ECONOMICS AND AGEING

VOLUME II: POLICY AND APPLIED

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Volume II: Policy and Applied

palgrave
macmillan

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ISBN 978-3-319-93356-6 ISBN 978-3-319-93357-3 (eBook)
https://doi.org/10.1007/978-3-319-93357-3

Library of Congress Control Number: 2018950472

Cover illustration: Darren Nakata / EyeEm

This Palgrave Macmillan imprint is published by the registered company Springer Nature Switzerland AG
The registered company address is: Gewerbestrasse 11, 6330 Cham, Switzerland

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1.1 Introduction

The US economist and Nobel Prize winner James Tobin once stated: 'The most difficult issues of political economy are those where goals of efficiency, freedom of choice, and equality conflict' (Tobin 1970, p. 263). Fiscal policy is one of these issues. It comprises public spending and taxation. In his classic textbook on public finances, Richard Musgrave identified three functions of fiscal policy: allocation, distribution, and stabilisation (Musgrave and Musgrave 1989). Through their spending and revenue, governments influence the state of an economy, its long-run evolution, and the distribution of resources. As we will see in this chapter, population and individual ageing are linked to these three functions, so much so that Lee et al. (2010, p. 80) stated: 'The projection of population under girds most long term economic projections and certainly all fiscal ones'. For example, the evolution of population ageing is projected to be one of the main drivers of public spending via age-related items, such as health, and to put pressure on long-term fiscal stability and sustainability; in addition, given the age profiles of—especially—labour-related income, economists have studied the case for age-dependent (or age-conditioned) taxes for allocative and distributive reasons.

Public budgets reflect priorities between areas of government and public goods and—in democratic systems—the public opinion and the electorate's preferences, usually mediating between private economic agents and interest groups. Public budgets also reflect how government spending will be funded, which means that they define a large proportion of the transfers of resources

J. L. Iparraguirre, *Economics and Ageing*,
https://doi.org/10.1007/978-3-319-93357-3_1

that will take place between the different economic sectors and actors during a given period.

The structure and size of governmental spending as a proportion of gross domestic product (GDP) have numerous macroeconomic effects, but how the spending is financed and whether the budget is balanced or the government needs to incur in debt to fund part of its spending also matter. In introductory macroeconomic courses, students are taught that switching from raising taxes to incurring in, or increasing, public debt as a means to financing a fiscal deficit increases interest rates, which negatively affects investment and therefore growth prospects, as well as appreciates the local currency, which reduces net exports—though students in courses based on, or including heterodox economic perspectives, may be taught otherwise—see, for example, Wray (2012). Hence, it will not be surprising that fiscal deficits are one of the most hotly debated topics in economic policy. Who pays by how much and when is another topic of dispute among economists—a topic, of course, closely related to the wider discussion about the merits and de-merits of fiscal deficits and public debt. A 2003 report about Germany includes the following caution: 'The most direct impact of Germany's aging will be the staggering fiscal cost -the equivalent of an extra 25 percent of payroll in old age benefits on top payroll tax rates that already exceed 40 percent' (Jackson 2003, p. 3). In 2016, the financial information and analytics firm S&P Global projected that total age-related public expenditures in Germany will increase by 22 per cent in 2050 to over 24 per cent of GDP in contrast to a projected 20.1 per cent for other advanced economies and that its net debt will grow to 149 per cent of GDP in 2050, up from 66 per cent in 2015 if the government does not implement any countervailing reforms (Winnekens 2016).

Two key concerns are the impact of population ageing on the sustainability of public finances and whether the costs of public projects can be passed onto future birth cohorts. There have been more discordant views in the economic profession on this topic than on almost any other issue. For example, regarding public debt, some economists would say that domestic debt (i.e. the portion of total public debt owed to lenders residing in the country) is 'neutral' in that taxpayers owe the stock of domestic debt ultimately to themselves, so servicing and cancelling the domestic debt should have no other economic effect than an internal redistribution of resources between economic agents. Other economists beg to differ and predict adverse effects on incentives to invest and work, falling consumer confidence, increasing costs of finance in international financial markets, and so on. Even others endorse the 'fiscal illusion' hypothesis, which posits that economic agents systematically underestimate the costs in terms of future taxes that current public debt imposes on them. For some economists and commentators, high levels of domestic indebtedness would pose a worrying threat for the welfare of current and future birth cohorts a menacing nature all the more perilous in the context of population ageing: 'The growing imbalance between the population of working people and those who are retired threatens to cause a future fiscal crisis in virtually every nation in the industrial world' (England 2002, p. 9).

Concerning economics and ageing, one potential economic impact of fiscal deficits stands out: whether future birth cohorts will be affected. As Atkinson (2014, p. 12) noted: 'Much of the rhetoric of fiscal consolidation is concerned with the national debt as a burden on future generations'. Atkinson added that we pass onto those who come after us not only the stock of the national debt but also pension liabilities, public financial assets, the public infrastructure and real wealth, private wealth, and the state of the environment and the stocks of natural resources. Apart from pension liabilities, the rest of the list is hardly included in discussions on ageing and fiscal matters. For example, generational accounting sets about to measure whether current fiscal policies impose a burden upon future birth cohorts and, if so, by how much and the implications for future cohorts of policy alternatives they could implement to reduce the deficits. In the words of Cardarelli et al. (2000, pp. F547–F548):

> First, how large a fiscal burden does current policy imply for future generations? Second, is fiscal policy sustainable without major additional sacrifices on the part of current or future generations or major cutbacks in government purchases? Third, what alternative policies would suffice to produce generational balance ś a situation in which future generations face the same fiscal burden, as do current generations when adjusted for growth (when measured as a proportion of their lifetime earnings)? Fourth, how would different methods of achieving such balance affect the remaining lifetime fiscal burdens -the generational accounts- of those now alive?

Before we present the generational accounting framework—and hopefully to whet your appetite—it is worth reviewing two related attempts: Laurence Kotlikoff's fiscal balance rule and the fiscal and generational imbalance measures by Jagadeesh Gokhale and Kent Smetters.

Kotlikoff's Fiscal Balance Rule Governments can incur in either productive or non-productive expenditures and can raise distortionary or non-distortionary taxes (Kneller et al. 1999). Kotlikoff (1992, 1993) argued that even if the public budget is balanced and even if it does not introduce any distortions in economic incentives, a policy that takes a given amount of money or resources away from younger age cohorts and transfers it integrally to the older age cohorts will crowd out private investments, reducing the capital stock and thus affecting economic growth and welfare in the long run. The argument is as follows.

Assume there are two age cohorts, the younger and the older, and that only the former earns an income, w. First, we consider the case in which the government does not introduce any transfers. The consumption possibilities of the younger age cohort in period t can be represented by

$$C_{y,t} + \frac{C_{(o,t+1)}}{(1 + r_{t+1})} \tag{1.1}$$

And the lifetime utility function is assumed to be log-linear[1]:

$$U_t = \beta \cdot \log[C_{y,t}] + (1 - \beta) \cdot \log[C_{(o,t+1)}] \tag{1.2}$$

where $0 < \beta < 1$ represents the contribution of consumption while young to lifetime utility. We form a Lagrangian with Eq. (1.2) subject to Eq. (1.1) which we maximise with respect to $C_{y,t}$ and $C_{(o,t+1)}$; we obtain:

$$\begin{aligned} C_{y,t} &= \beta \cdot w_t \\ C_{(o,t+1)} &= (1 - \beta) \cdot w_t \cdot (1 + r_{t+1}) \end{aligned} \tag{1.3}$$

Assume also that the capital stock, K, is not subject to depreciation. In each period, the capital stock per worker, k, is equal to the savings of the young cohort in the previous period:

$$k_{t+1} = w_t - c_t = (1 - \beta) \cdot w_t \tag{1.4}$$

and production per capita is a function of the stock of capital per worker, $y_t = k_t^{\alpha}$, where $\alpha < 1$ is the output elasticity of capital. Kotlikoff assumes that the markets are perfect so that the factors of production (workers and capital) earn according to their respective marginal productivity: for labour, wages are given by $w_t = (1 - \alpha) \cdot k_t^{\alpha}$, and for capital, the interest rate corresponds to $r_t = \alpha \cdot k_t^{(\alpha-1)}$. The equation of motion of the stock of capital becomes

$$k_{t+1} = (1 - \beta) \cdot (1 - \alpha) \cdot k_t^{\alpha} \tag{1.5}$$

Equation (1.5) is a difference equation with a solution (if, as it has been assumed, $\alpha < 1$ and $\beta < 1$) given by

$$k^* = [(1-\beta)\cdot(1-\alpha)]^{\left(\frac{1}{1-\alpha}\right)} \tag{1.6}$$

k^* is the level of the capital stock in the stationary state—that is, the level at which it remains constant provided the rate of population growth and the other parameters in the model stay unchanged. So, $k_{t+1} = k_t = k_{t-1} = k^*$. It is important to establish the stationary state level of the capital stock—in practice, the debt-to-GDP ratio[2]—because a gap or imbalance cannot remain unpaid forever, so a non-increasing debt-to-GDP ratio is a commonly used indicator of fiscal sustainability.[3]

Now let's study the case in which the government decides in period t to impose a transfer policy so that an amount τ is passed from the younger age cohort onto the older age cohort. The income constraint that the younger cohort faces in t is given by

$$w_t - \tau + \frac{\tau}{(1+r_{t+1})} \tag{1.7}$$

We form the following Lagrangian to solve the optimisation problem of the younger cohort:

$$\begin{aligned}\mathcal{L} = {} & \beta\cdot\log[C_{y,t}] + (1-\beta)\cdot\log[C_{(o,t+1)}] \\ & +\lambda\left[w_t - \tau + \frac{\tau}{(1+r_{t+1})} - C_{y,t} - \frac{C_{(o,t+1)}}{(1+r_{t+1})}\right]\end{aligned} \tag{1.8}$$

By solving the first derivatives with respect to $C_{y,t}$ and $C_{(o,t+1)}$, and considering that

$C_{o,t} = (1-\beta)\cdot w_t - \tau + \frac{\tau}{(a+r_{t+1})}$,

the optimal level of consumption for the younger cohort in period t is

$$C_{y,t} = \beta\cdot\left[w_t - \tau\cdot\left(\frac{r_{t+1}}{1+r_{t+1}}\right)\right] \tag{1.9}$$

and the equation of motion of the capital stock is

$$k_{t+1} = (1-\beta)\cdot(1-\alpha)\cdot k_t^{\alpha} - \tau\cdot\left[1 - \frac{\beta\cdot\alpha\cdot k_{t+1}^{\alpha-1}}{1+\alpha\cdot k_{t+1}^{\alpha-1}}\right] \tag{1.10}$$

The new level of the capital stock in the stationary state—$k^{*'}$—is also the level at which $k_{t+1} = k_t = k_{t-1} = k^{*'}$. We can investigate the effect that the implementation of the intergenerational transfer policy has on this level—that is, whether $k^{*'}$ is equal to, greater, or smaller than k^*. Kotlikoff calculates the first derivative of the stationary level with respect to τ:

$$\frac{\partial k^{*'}}{\partial \tau} = -\frac{\left[1 - \frac{\beta \cdot r}{1+r}\right]}{(1-\alpha)} \tag{1.11}$$

where r is the interest rate in the stationary state.

Equation (1.11) is lower than zero, because both the numerator and the denominator on the right-hand side are positive. This implies that the transfer policy reduces the stock of capital per worker in the economy over time; in other words, it crowds out investment. Why? Because this policy is implemented in the first period, the older age cohort receives a transfer without having made any contribution or paid any taxes in the previous period when they were young. This initial transfer increased the consumption of the older age cohort who benefited from the policy, thus reducing aggregate savings and consequently investment. Successive age cohorts see their consumption possibilities reduced, but such reduction will never offset the negative impact on savings and investment of the initial transfer.

This way, Kotlikoff asserts that even under a balanced budget, intergenerational transfers may have deleterious effects on the prospects of economic growth, thus placing a burden on future age cohorts. It does not matter whether the transfer is financed with a tax or a compulsory contribution, or by borrowing: the result is the same. It does not matter, either, whether the older age cohorts receive a transfer payment as above or interests plus repayment of a loan: the result is also the same. Finally, it does not matter whether the budget is balanced or not: the result is, once again, the same. However, this is not all: Kotlikoff proposed a rule, which he termed 'the fiscal balance rule', that would measure the impact of current fiscal policies upon future cohorts. Kotlikoff (1993) described the rule thus:

> [T]ake in net present value from each new young generation an amount equal to the flow of government consumption less interest on the difference between a) the value of the economy's capital stock and b) the present value difference between the future consumption and labor earnings of existing older generations. [p. 19]

…set the net lifetime payment of each successive generation equal to the flow of government consumption less the interest on the economy's capital stock left over after the current elderly consume. [p. 26]

According to Bonin (2010, p. 12), Kotlikoff's fiscal balance rule 'provides a theoretical justification for the normative claim of equal net tax burdens for present and future generations, prerequisite to achieve an equilibrium'. And it also provides a theoretical justification for one interpretation of intergenerational fairness—that the benefit derived from public spending net of any taxes and other transfers from individuals to the government is the same across persons of different birth cohorts (Peeters and Groot 2015). For example, Woods (2006, p. 1102) explains that intergenerational fairness is 'achieved when current policy treats current newborns and future newborns equally on a growth adjusted basis, such that each future cohort faces the same lifetime net tax rate as current newborns'.

Fiscal and Generational Imbalance With 'an eye toward simplicity and policy relevance' (Gokhale 2007, p. 64), Gokhale and Smetters (2003) proposed two measures closely related to GA: the **fiscal imbalance** (FI) and the **generational imbalance** (GI). FI does not distinguish between age cohorts and estimates the present value of lifetime payments and transfers from households of all age cohorts (i.e. including all future cohorts yet to be born) to the government net of all the public spending over time minus net public assets (i.e. public assets net of public liabilities). If a fiscal policy is not sustainable, it is not economically meaningful to project it forward into the future because, sooner or later—and if we assume that agents act rationally and have perfect foresight and information, not even 'sooner' but instantly—the agents will stop buying government bonds and other public debt instruments and will repudiate the debt. However, this is precisely the point of FI: to provide an estimate of the total imbalance built in current fiscal policies (Gokhale 2007). FI is, therefore, an indicator of temporal sustainability of the current fiscal policy: current fiscal policy is sustainable if FI is equal to zero.[4] If positive, FI indicates the size of future fiscal adjustment (increases in tax receipts or reductions in public spending) needed to turn the current fiscal policy sustainable. The FI in developed countries has been estimated to be equivalent to 10 per cent of the gross domestic product—and as high as 18.7 per cent for the Republic of Ireland (Nishiyama and Smetters 2014). Note that even though these are the present value[5] of streams of funds projected in perpetuity, they represent the level of fiscal imbalance provided the measures to eliminate it (a tax hike, a reduction in public spending, or a combination of both) are implemented in the current period; otherwise, the imbalance will increase.

A government may introduce changes to the transfer system between age cohorts without varying the temporal budget constraint and, consequently, without affecting the level of FI. However, these changes will impact on how different age cohorts face the burdens and reap the benefits of the modified policies. Hence, Gokhale and Smetters proposed the GI indicator, which measures the extent to which a fiscal imbalance originates as a consequence of changing the relative burden of current fiscal policy falling upon different age cohorts—in particular, upon currently younger cohorts and those yet unborn.

1.2 Generational Accounting

Now we can dwell upon generational accounting (henceforth, GA). A **generational account** is the present value of the differences between the taxes individuals of different age cohorts are expected to pay over their remaining lifetimes and the transfer payments they are expected to receive over their remaining lifetimes. It is an estimate of public services and transfers living age cohorts are projected to receive for the rest of their expected lifetimes above and beyond their past contributions and tax payments. GA measures, then, the portion of FI that the living age cohorts are accountable for. According to Gokhale and Smetters (2003), GA incorporates any hypothetical reform towards the restoration of the fiscal gap. For the USA, Gokhale (2013) estimated that the GA arising from social insurance programmes alone (i.e. Social Security and Medicaid) amounted to 5.3 per cent of the gross domestic product in 2012. If the generational accounts of the age cohorts who are currently alive are negative, then the present value of the transfer payments exceed that of the tax revenue: some payments will be left for unborn age cohorts to make. It measures 'directly the amount current and future generations can, under existing public policies, be expected to pay over time in net taxes (taxes paid less transfer payments received) to the government' (Kotlikoff 1992, p. 22). The focus of generational accounting is the intergenerational redistribution that 'occurs whenever a government policy expands the consumption opportunities of one generation at the expense of another' (Kotlikoff 1993, p. 18).

The starting point of GA is the inter-temporal budget constraint of the public sector—this constraint is the 'basic building block of modern dynamic analyses of fiscal policy' according to Cardarelli et al. (2000, p. F548) and 'the

Archimedean point on which the whole generational accounting approach rests', in the opinion of Watts (2012, p. 98).[6] Equation (9.12) in Volume I is one example. In a nutshell, this constraint posits that the present value of all current and future public spending must be equal to the present value of all current and future taxes plus the current stock of public assets net of any public debt (Gokhale 2007). Though the budget constraint is algebraically straightforward, there are no internationally accepted methods to *measure* the public deficit or the public debt, and even to *define* the public sector,[7] so from a public accounting point of view, a GA exercise is riddled with practical difficulties. However, even if the accounting standards and procedures were unanimously agreed upon, the economic question regarding the possibility of burdening future birth cohorts would remain; hence the importance of the inter-temporal budget constraint in delineating what is and what is not feasible concerning fiscal policy over time: the sum of public wealth and the present value of all the taxes paid by the current and future age cohorts must be equal to the present value of current and future public expenditure. The crux of the GA argument is that even if on a period-by-period basis the public sector budget remains in balance, current fiscal policies, including intergenerational transfers, may impinge on the welfare of living and unborn age cohorts if there are unfunded obligations that are left for future age cohorts to cancel. The net effect will depend on the rate of productivity growth, as well as on the difference between the interest rate and the rate of population growth. Let's look at this more formally.

Imagine that the population grows at a constant rate, n, and that there are two overlapping cohorts, the young (P_y) and the old (P_o). In any period t, $P_{y,t} = (1+n) \cdot P_{(y,t-1)}$, which is equivalent to $P_{y,t} = (1+n) \cdot P_{(o,t)}$. The government has only one role: to impose a lump-sum tax (i.e. a tax of a fixed amount) or a fixed compulsory contribution, τ, on the young cohort and to then transfer the amount it has raised completely and evenly to the older cohort. In symbols, $\tau \cdot P_{y,t} = \tau \cdot (1+n) \cdot P_{(o,t)}$. The public budget is balanced in every period. So far, so good …apparently. Let's see the situation from the young cohort's perspective: we need to estimate the present value of the taxes or contributions they will pay and the present value of the transfers they will receive over their lifetime. With only two periods and with r denoting the interest rate, we have:

$$\tau \cdot P_{y,t} = \tau \cdot (1+n) \cdot \frac{P_{(o,t+1)}}{(1+r)} \tag{1.12}$$

Because $P_{(o,t+1)} = P_{(y,t)}$, Eq. (1.12) becomes

$$\tau \cdot P_{y,t} = \tau \cdot (1+n) \cdot \frac{P_{(y,t)}}{(1+r)} \tag{1.13}$$

from where we obtain

$$\tau \cdot P_{y,t} = \tau \cdot P_{(y,t)} \cdot \frac{(r-n)}{(1+r)} \tag{1.14}$$

Remember that in an economy with no uncertainty and the other assumptions of a basic OLG model,[8] the interest rate is equal to the marginal product of capital. If the marginal product of capital does not exceed the population growth rate, the economy is said to be 'dynamically inefficient'—that is, in the long run there will be an unsustainable over-accumulation of capital to finance consumption levels in later life (Abel et al. 1989). Equation (1.14) shows then that in an economy that is dynamically efficient—that is, where the interest rate exceeds the rate of population growth—such a transfer policy, though *fiscally balanced*, generates a lifetime burden on the younger generation in the implementation period and on every single younger generation thereafter (Bonin 2010, ch. 1). Equation (1.14) presents the net tax payments the currently younger generation will face over their lifetime, which corresponds to the definition of generational accounts given above.

Under GA, the current fiscal policy is deemed to be sustainable over time only if the lifetime net tax rate for the future age cohorts is the same as that for the currently living age cohorts.

1.2.1 Computation

There are two procedures to estimate the generational accounts for a country or region: the residual approach and the sustainability approach. I present GA in a different way to facilitate the exposition of both methods. The generational accounts at any year for any member of a currently living generation are equal to the amount of taxes she will pay over her lifetime net of the amount of all the transfers she will receive. We now introduce two additional variables: the maximum lifespan—see Volume I, Chap. 1—and the probability of survival between any one period and the following one (see Volume I, Chap. 2).

The GA in base year t for a representative member of age cohort k with maximum lifespan D and survival probability S is

$$\mathrm{GA}_k = \sum_{i=t}^{i=k+D} \tau_{(i,i-k)} \cdot S_{(i,i-k)} \cdot (1+r)^{t-i} \tag{1.15}$$

where τ denotes net taxes and r is the discount rate (which we assume constant). The survival probabilities are not only cohort-specific but also gender-specific, so it is customary to estimate GA for men and women separately.[9] Other variables that influence survival probabilities, such as socio-economic status or geographical area of residence, are not considered as GA exercises are based on standard life tables prepared by central or regional statistical offices. Equation (1.15) is applicable to the members of currently living cohorts that is insofar as $k \leq t$. To estimate the GA for the members of future (i.e. yet to be born) cohorts, the formula is the same as above except that we need to start from the year of each cohort's birth (i.e. beginning in $i = k$ rather than $i = t$) and a productivity growth adjustment factor is added to account for economic progress over time[10]:

$$\mathrm{GA}_k^f = \sum_{i=k}^{i=k+D} \tau_{(i,i-k)} \cdot S_{(i,i-k)} \cdot \left[\frac{(1+r)}{(1+g)}\right]^{t-i} \tag{1.16}$$

With so many subscripts, it may pay to consider the formula in some detail. To illustrate, we assume that the maximum human lifespan is 120 years and that we want to estimate the GA of two living age cohorts—the individuals who were born in 1970 and in 1971—in 2010 (the base year). In 2010, these agents were 40 and 39 years old, respectively. The idea is to sum the net taxes between 2010 and 2090 for the older cohort and between 2010 and 2091 for the younger cohort. In 2010, for the older cohort, we have

$$\tau_{(2010,2010-1970)} \cdot S_{(2010,2010-1970)} \cdot (1+r)^{2010-2010} = \tau_{(2010,40)} \cdot S_{(2010,40)}$$

And for the same cohort, in 2011, we get

$$\tau_{(2011,2011-1970)} \cdot S_{(2011,2011-1970)} \cdot (1+r)^{2010-2011} = \tau_{(2011,41)} \cdot S_{(2011,41)} \cdot (1+r)^{-1}$$

With regard to the younger cohort, in 2010 we obtain

$$\tau_{(2010,2010-1971)} \cdot S_{(2010,2010-1971)} \cdot (1+r)^{2010-2010} = \tau_{(2010,39)} \cdot S_{(2010,39)}$$

and in 2011,

$$\tau_{(2011,2011-1971)} \cdot S_{(2011,2011-1971)} \cdot (1+r)^{2010-2011} = \tau_{(2011,40)} \cdot S_{(2011,40)} \cdot (1+r)^{-1}$$

To obtain the GA, we would sum all the terms until $k + D$, that is, until $1970 + 120 = 2090$ for the older cohort and until 2091 for the cohort born in 1971. We can see that GA is a forward-looking instrument, as the GA of any cohort is its remaining lifetime net taxes per capita. Therefore, sometimes GA are called 'prospective generational accounts'. However, there have been some attempts at estimating backward-looking GA (known also as 'lifetime' generational accounts). For example,

- Auerbach et al. (1995) for the USA for cohorts born between 1900 and 1993;
- Shimasawa et al. (2014) for cohorts born since 1916 in Japan;
- Ter Rele and Labanca (2012) for the Netherlands for the cohorts born since 1946;
- Wolfson et al. (1998) for Canada for ten-year birth cohorts born between the 1890s and 1990s;
- Gál and Tarcali (2003) for cohorts born since 1880 in Hungary; and
- Ablett and Tseggai-Bocurezion (2000) for cohorts born since 1901 in Australia.

GA for different living cohorts are not comparable, given the forward-looking nature of the indicator—agents from different co-existing birth cohorts are *perforce* at disparate stages in their life cycles and also their expected remaining lifetimes are not the same; consequently, their future net taxes are computed from dissimilar points of departure, economically speaking, and extend over different horizons. Only GA for future cohorts yet to be born can be compared between each other and also with the newborn cohort (i.e. the birth cohort born in the base year) because in these cases the GA are computed over full life cycles.

GA is focused on the possible burden imposed on future cohorts by current policy. The residual method for computing GA is based on the relative changes in the lifetime net tax rates between the baseline birth cohort (usually the newborn in the base year) and a representative future, yet unborn, agent. The main assumption underlying this approach is that the living generations will not see any changes in the current policies: if the fiscal policies in place are not sustainable, it will rest upon future cohorts to curb down public spending and/or increase taxes. The inter-temporal budget constraint of the public sector imposes that the GA of all future cohorts *ad infinitum*—that is, the present value of the sum of the net taxes of future cohorts—must equal the present value of net public spending (i.e. public expenditure minus revenue) plus public debt, B, *net of the GA of currently living cohorts*. Instead of looking into a representative member of a cohort, let's look at all its members so that the size of each birth cohort, P, is included in the computations. The GA of future cohorts is

$$\mathrm{GA}_k^f = \frac{\sum_{i=k}^{i=\infty} G_{(i,i-k)} + B_k - \sum_{i=t-D}^{t} \left(\mathrm{GA}_k \cdot P_{i,(i-k)}\right)}{\sum_{i=t+1}^{t} P_{i,0} \left(\frac{1+g}{1+r}\right)^{(i-t-1)}}; \text{ for } k > t \tag{1.17}$$

Equation (1.17) gives the residual indicator of GA. The ratio between the GA for the future cohorts (adjusted by productivity growth) and the living cohorts provides an indicator of fiscal sustainability, usually denoted by π:

$$\pi = \frac{\mathrm{GA}_{(t+1,t+1)}}{(1+g) \cdot \mathrm{GA}_{t,t}} \tag{1.18}$$

The estimation procedure projects the GA of current generations with the imputation of the public expenditure and revenue for the base year by age (and usually gender, as mentioned above) and the future net public spending under the assumptions of no policy change and no behavioural change. Any gaps between future net spending plus debt and the GA of current generations—that is, the nominator on the right-hand side of Eq. (1.17)—are distributed equally among all individuals yet to be born taking into account the future growth of the economy (which is assumed to be constant) discounted by a constant rate to the base year (i.e. the denominator).

One implication of this approach is that if the GA for future cohorts exceed the GA for living cohorts, the fiscal policy is unsustainable. However, the same would apply if the GA for current cohorts exceeded the GA for those yet unborn—that is, if the fiscal policy were imbalanced to the detriment of current cohorts. In each case, the fiscal policy would render an intergenerational distribution of public resources, because current and future cohorts would be treated differently with regard to taxes and transfers. Consequently, the residual approach defines *any* fiscal policy that shifts resources between living and future cohorts as unsustainable. As Bonin (2010, p. 53) remarked,

> In the static framework of generational accounting, gambling against time, or more precisely between distinct birth cohorts, is always a zero-sum game. Hence the observation of non-sustainability prevails, irrespective how fiscal burdens are distributed among future generations.

Note the word 'irrespective'. Here lies the main drawback of the residual approach: the fiscal policy options for future cohorts are not spelled out. Another important limitation is the omission of the fiscal implications of migration after the base year. According to Bonin (2010), this oversight leads to either an understatement of the burden imposed on future cohorts of any fiscal imbalance if emigration exceeds immigration or otherwise to its overstatement.

The residual approach falls short of providing a template for net public spending for future cohorts to restore fiscal sustainability if the inter-temporal budget is not balanced. The sustainability approach treats the net tax payments by living and future cohorts alike, irrespective of the restrictions imposed by the inter-temporal budget constraint. The focus becomes the extent to which public revenue has to increase to close the fiscal sustainability gap without reducing public spending. If we go back to Eq. (1.17), its nominator contains the difference between the sum of future net spending plus debt and the GA of current generations—the kernel of the residual approach. If to this residual we subtract the present value of the net public spending on future cohorts, we obtain the sustainability gap:

$$\mathrm{GA}_k^f = \frac{\sum_{i=k}^{i=\infty} G_{(i,i-k)} + B_k - \sum_{i=t-D}^{t} \left(\mathrm{GA}_k \cdot P_{i,(i-k)}\right)}{\sum_{i=t+1}^{t} P_{i,0} \left(\frac{1+g}{1+r}\right)^{(i-t-1)}}; \text{ for } k > t \tag{1.19}$$

The sustainability gap reveals how much of the current commitments to public spending remains unfunded given the expected future public revenue (Bonin 2010, p. 79). If the gap is positive, it will have to be filled either by increased taxes or reduced public expenditure, thus causing an intergenerational distribution of resources. If it is negative, intergenerational distribution will also take place. One way to measure the extent of the sustainability gap is to divide it by the gross domestic product, although the ratio would oddly combine the present value of an inter-temporal indicator and a measure of one year's worth of economic activity. To overcome this limitation, Boll (1996) proposed dividing the sustainability gap by an estimate of the present value of all future gross domestic product. This ratio would indicate the cost of putting off the fiscal measures required to eradicate the gap.

Other indicators have been suggested—for example, the burden ratio, an indicator of the relative intergenerational burden imposed by current fiscal policy arrangements, which is calculated by dividing the GA of the future cohorts and the GA of the cohort born in the base year. If instead of the GA we calculate the ratio between the lifetime tax rates of the newly born and those of the yet unborn cohorts, we obtain the lifetime tax rate, an indicator of the magnitude of the liabilities and consequently the tax hikes that, like a fiscal sword of Damocles, would be looming ominously above the earnings and wealth of the members of future cohorts. Another methodological innovation is the use of cyclically adjusted budget balances in the forward-looking budget projections to discriminate between pure policy, debt, and demographic effects (Bonin et al. 2014). The 'no policy change' assumption perpetuates the particular conditions the economy may be in along the business cycle in the base year. The technique developed by Bonin et al. (2014) corrects this by filtering the budget balance (i.e. by removing the cyclical component of the time series by means of a filter[11]) and estimating forward-looking generational accounts with filtered, cyclically adjusted data, which can then be decomposed into pure demographic, debt, and policy effects.

1.2.2 Limitations

Various authors have criticised the GA approach from theoretical economic perspectives. Moot theoretical points have been raised by orthodox economists—for example, Cutler (1993), Haveman (1994), Diamond (1996), and Buiter (1997)—and heterodox economists (Watts 2012; Watts and Sharpe 2013) alike. Furthermore, practical concerns about the computation of GA have also been highlighted—Productivity Commission (2005, Box 13.2, p. 328) presents a good summary of the various practical challenges that economists who want to compute GA would face.

The most substantial drawback of GA is the absence of general equilibrium effects (Bach and Wiegard 2002), that is, of endogenous behavioural changes by households (e.g. bequests) and firms (e.g. investments) resulting from the fiscal situation and the expectations about future fiscal policy measures. To illustrate, consider the following comment by Diamond (1996, p. 603):

> Insofar as generational accounting is meant to highlight the unsustainability of continuing current policies, it is not a good instrument for estimating individual responses. Individuals will focus on what they think will happen, not what would happen if current unsustainable policies were unchanged.

Another example are bequest decisions—transfers which are, obviously, germane to the well-being of future generations—which depend, among other things, on fiscal policy parameters though GA exclude these links (Haveman 1994). The size and role of bequests to counterpoise the fiscal pressures of ageing should not be underestimated. For example, using a dynamic overlapping generations simulation model with realistic demographics for Australia, Khan (2010) estimated that if bequests levels reached one per cent of gross domestic product, approximately one-third of the future fiscal burden of ageing would be offset when measured in terms of labour income.

Additional strong criticisms have been dished out to GA. First, the differing treatment of current and future generations. Haveman (1994, p. 100) starkly put it thus:

> The cohort of one-year-olds is assumed to operate under current laws, with no need for the government to satisfy a budget constraint; however, the members of future generations -for example, those born tomorrow- are subject to a different set of rules. Indeed, the primary message of the generational accounts-the excessive shifting of fiscal burdens to future generations-is largely an artifact of this rather special convention.

Second, the focus of GA is on intergenerational distribution, but fails to incorporate intergenerational mobility, intra-generational equity, and inter-dependence among generations. Considerations of intra-generational equity are also absent: GA computations are oblivious to the fact that within cohorts, tax burdens and public benefits vary substantially by age and race and income and wealth (Williamson and Rhodes 2011); gender is the only dimension usually accounted for. Besides, GA is blind to the inter-dependence among generations (Biggs and Lowenstein 2011; Daatland et al. 2011, 2012). Generational inter-dependence is one key gerontological concept, akin to the principle of 'linked lives', that points to the interconnection of the lives of individuals to each other (Elder 1998) and between society, family dynamics, and individual life trajectories (Hagestad 2003).

Third, from a heterodox perspective, the whole edifice of GA would be flawed as it rests upon the notion of intergenerational budget constraint, which the economists from this school of thought take issue with claiming it is not binding at all—see Lawm (2014), Mitchell and Mosler (2005), Watts and Sharpe (2013), and Watts (2012).

Finally, tax allocation is not the same as tax incidence—that is, who 'ultimately' pays, as the burden of a tax may not be borne by the agents upon whom it is levied (Fullerton and Metcalf 2002; Fullerton and Rogers 1993; Kotlikoff and Summers 1987). Incidence is mostly absent from GA studies.

Other limitations have to do with practical computational issues, which is to be expected given the formidable objective of projecting a number of economic aggregates infinitely. Of course, GA is based on the 'no policy change' assumption, which on the one hand simplifies enormously the task, but risks of rendering the instrument futile for policy evaluation. In the words of Bonin (2010, p. 47):

> While the generational accounts of the present living are based on the unlikely scenario of an unchanged status quo, the accounts for future generations do not take into consideration intergenerational fiscal policy constraints that in practice restrict fiscal policy over considerable periods of time.

Conesa and Garriga (2016) used GA to evaluate the future implications of two hypothetical intergenerational policy reforms: a partial replacement of labour income taxes with consumption taxes and the elimination of restrictions on labour market participation for retirees aged 65 or over (the model assumption was that retirees kept working until age 70). The authors calibrated their model to data from the USA prior to 2008, and found that GA works well in capturing the effects of a policy reform that introduces intergenerational redistribution causing improved consumption age profiles for some cohorts and reduced consumption age profiles for other cohorts. However, GA does not capture the effects of a policy reform that modifies efficiency, which not only changes the age profiles of consumption but also the age profile of hours worked.

Some problems flagged up in the earlier literature[12] are of lesser importance as various authors have attempted to resolve them. First, the application of constant rates of economic growth and discount—though some authors run sensitivity analyses showing the effects of alternative growth and discount rates on the results. Second, that the GA approach did not deal with intra-generational distribution and assume away the existing income and wealth inequality within cohorts; again, some authors have attempted to embed intra-generational distributive issues within a GA framework. Third, originally, only transfers in cash were computed, whereas current studies include in-kind benefits in the calculations. However, a delicate problem remains: how to apportion in-kind benefits and non-transfer public goods (i.e. anything from the protection of the environment to defence spending) to different cohorts. Some heroic assumptions are incorporated into the computations to account for these items of public spending, which leave the exercises open to criticism.

1.3 National Transfer Accounts

All countries have adopted the Systems of National Accounts (SNA)—a set of recommendations by the United Nations, the International Monetary Fund, the Organisation for Economic Co-operation and Development, and the European Commission 'on how to compile measures of economic activity in accordance with strict accounting conventions based on economic principles' (European Commission and International Monetary Fund and Organisation for Economic Co-operation and Development and United Nations and World Bank 2008, p. 1). The SNA is an accounting framework that allows the compilation of economic data in a comprehensive, consistent, and integrated way useful for policy-making and economic analysis. Familiar economic magnitudes such as the gross domestic product or the balance of payments are computed following these recommendations. The National Transfer Accounts (NTA) decompose these economic aggregate magnitudes by the age of the economic agents. Whilst following the SNA principles a country produces an estimate of public expenditure, the NTA dissect this figure into how much the public sector spends on, say, children or older people. And not just public spending, of course, but all the national accounts. Economics is the study of the allocation of resources; NTA computes the allocation of resources across age groups. In the words of two of its main proponents (Lee and Mason 2014, p. 4),

> [NTA] provide a valuable description of the economic roles of people at different ages, and of the relations among generations. They provide inputs for analytic studies of the effects of changing population age distributions on the macroeconomy as fertility and mortality decline and as populations age, and for studies of generational equity and the sustainability of economic support systems. They inform the efforts of policymakers to raise the living standards of people of all ages, from children to the elderly.

Or, as Mason et al. (2009, p. 90) explained:

> [NTA] provide estimates with sufficient historical depth to study the evolution of intergenerational transfer systems; the consequences of alternative approaches to age reallocations embodied in public policy with respect to pensions, health care, education, and social institutions (e.g., the extended family); and the social, political, and economic implications of population aging.

NTA also go beyond SNA in another way, by measuring intergenerational transfers at the aggregate level within households in an economy and looking into economic activities that are not computed in the national accounts, such as volunteering and household chores (usually by means of time surveys). NTA compute both cross-sectional transfers and longitudinal transfers. The former comprise intergenerational flows, as from parents to their children, whilst longitudinal transfers include accumulation and de-cumulation of capital over a life cycle.

According to the life-cycle framework—see Volume I, Chap. 4—economic agents earn an income during a period of their lives to fund their consumption when they retire and also to raise children so that during the first years of their life economic agents rely on transfers from adults responsible for their upbringing and, during the last years of their life, they rely on the wealth they accumulated during their income-generating years. NTA present aggregate estimates of those transfers—the cross-sectional transfers to children and the longitudinal transfers in later life. The language that economists who compile NTA tend to use is by and large infelicitous, with its emphasis on 'dependency' in childhood and later life.[13]

The starting point is an accounting identity of economic flows that must be satisfied in any period and for any household, age group, region, or economy: that income and credit must be equal to consumption and savings and net transfers. In symbols (Mason and Lee 2011, p. 56):

$$\left(C_a - W_a\right) = \left(\tau_a^+ - \tau_a^-\right) + \left(r \cdot K_a - S_a\right) \tag{1.20}$$

where a denotes the age of an agent and C and W stand for consumption and labour income, respectively. τ represents transfers, which can be positive—that is, to the agent—or negative, that is, from the agent. Finally, $r.A$ is the income (i.e. interest) derived from the capital stock or assets and S denotes savings.

Equation (1.20) can be broken down into a number of identities for each different sector. In aggregate terms, the **life-cycle deficit** corresponds to the difference between consumption (both public and private) and earnings. Public sector age reallocations are the difference between public transfer inflows and outflows (both cash and in kind) plus the difference between public asset income (both from public capital and property) and public savings. Private sector age reallocations are the difference between net private transfers and net private asset-based reallocations, which in turn are equal to the difference between private income (both from capital and property) and private savings. Age reallocations (private and public) are the difference between net transfer inflows and savings. Therefore, they are equal to the life-cycle deficit.

The data for most indicators are not available at an individual level or by age, so the estimations rely on regression analyses on aggregate data from which age profiles can be constructed—age profile of individual utilisation of primary healthcare or of private education expenditure, for example.

The Center on the Economics and Demography of Aging at the University of California at Berkeley and the Population and Health Studies Program of the East-West Center in Honolulu, Hawaii—both in the USA—are the lead institutions for the NTA project which measures, analyses, and interprets macroeconomic aspects of age and population ageing around the world and is a depository of NTA data for many countries.[14] The charts below illustrate the NTA for three countries, Costa Rica (Rosero-Bixby et al. 2011), Spain (Patxot et al. 2011b), and Taiwan (Tung and Lai 2011). The data, available on the NTA's website, are presented as a proportion of the average production for individuals aged 30–49. The life-cycle deficit is positive in childhood and adolescence and negative by the late 50s in the three countries, which shows the downward and upward transfers of resources by people between their early 20s to their late 50s. Private and public consumption is broken down into three items: consumption on education, health, and other items. In Spain, for example, all age consumption has been estimated to amount to €13,966 per person (health represents €1495; education, €1068; and all other consumption items make up the rest), and income from labour, including self-employment, is estimated at €12,105, which rends a life-cycle deficit of €1831 per person. Regarding reallocations, public transfer inflows amount to €4740 and outflows to €6249—private transfer inflows and outflows are basically the same, at €4709 and €4730, respectively.

The age profiles for income and consumption look very similar across these three countries, although the life-cycle deficit for Spain differs in later life from that of Costa Rica and Taiwan, reaching a plateau rather than gradually increasing during retirement years. It is also worth noting that in Costa Rica consumption is smoothed at a higher proportion of the average of labour income for individuals 30–49 years old. There are also some differences in the relative importance of private and public consumption in childhood and, particularly, later life: whilst in the three countries, public consumption bulges during childhood and grows monotonically (i.e. consistently) with advanced years. Private consumption in Costa Rica and Taiwan reaches a plateau in the mid-20s and increases slightly in later life, but in Spain, it continually diminishes with age after economic agents reach their mid-20s. Another difference is that in Spain, private transfers remain negative in later life after the middle-age trough, whereas they become positive in the other two countries—though much earlier in the life cycle in Taiwan than in Costa Rica. The data on private and public transfers for Spain shows, then, that older people are—on average—net payers of private transfers. Patxot et al. (2011a) conjecture that this could be explained by high levels of co-residence and intergenerational families. Another national characteristic reflected in the charts is the traditional importance of informal family support to older people in Taiwan, which can be seen in that private transfers overtake public transfers in later life—although there is evidence that suggests that the importance of family support in later life is on the wane in Taiwan (Fu and Lu 2009; Tung and Lai 2015). Finally, asset-based age reallocations do not show signs of reducing in Spain until much later in the life cycle compared to both Costa Rica and Taiwan.

These differences and similarities are the consequence of the particular institutional settings, levels of economic development, dynamics of population ageing, and social conventions and mandates in each country. Therefore, NTA allows for a more profound understanding not only of how consumption in later life is financed but also of the interactions between intergenerational flows and public transfers with life-cycle wealth accumulation within different economic, institutional, and demographic contexts (Figs. 1.1, 1.2, 1.3, and 1.4).

Based on NTA projections, the United Nations Economic Commission for Latin America and the Caribbean (ECLAC) defines an 'aged economy' as a country where people aged 60 years or over consume a higher proportion of overall aggregate consumption (private and public) than people under 20 years of age. Under this definition, in 2015 there were 19 'aged' economies and the ECLAC projects that there will be 73 'aged' economies by 2040. The projections also identify the year by when a currently 'non-aged' economy will become an 'aged' one: for example, Brazil (2022), Costa Rica (2024), Colombia (2034), Mexico (2035), and Argentina (2038).[15]

1.3.1 Limitations

The NTA are based on age profiles, but age profiles are cross-sectional in nature—that is, they relate to figures corresponding to individuals in one particular period (usually, a year). Consequently, they are not longitudinal: they do not track people over time. Techniques to produce pseudo-panels of cohort averages (Deaton 1985; Verbeek 1992, 2008) can be applied, but still a pseudo-cohort is not the same as using actual longitudinal data for individual histories cannot be retrieved.

Due to data limitations, NTA exercises assume households share consumption decisions, which is far from realistic as preferences on the one hand and bargaining power inside the household on the other vary substantially

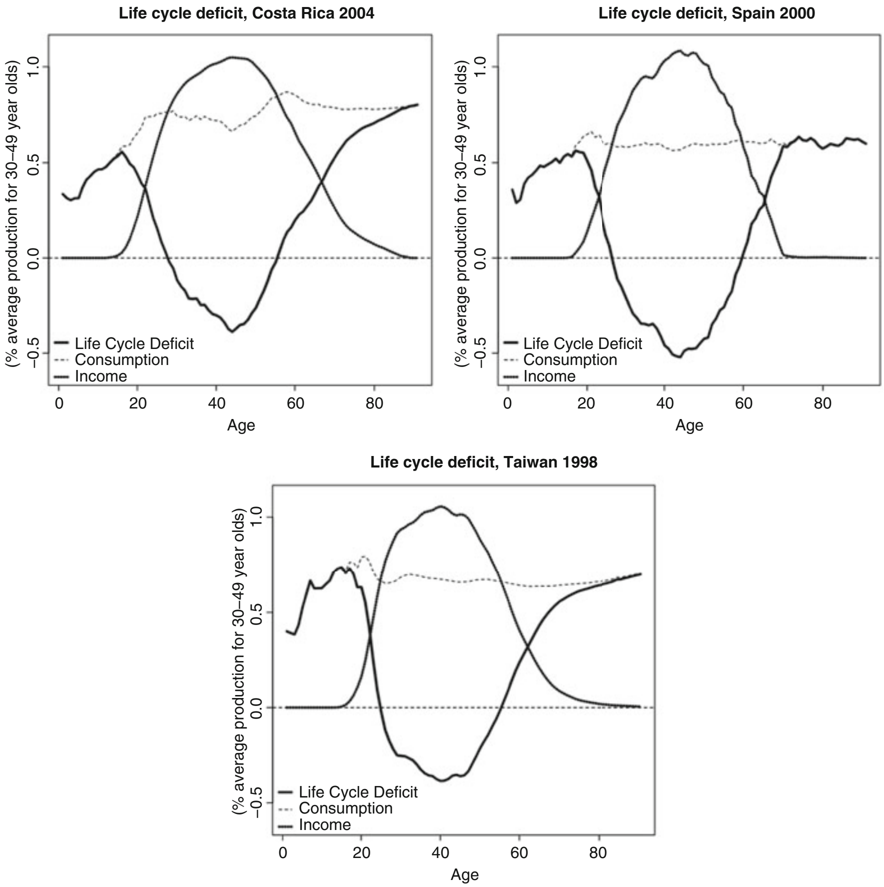

Fig. 1.1 Life-cycle deficits per capita. Costa Rica, Spain, and Taiwan. Values normalised by dividing by the simple average of labour income for individuals 30–49 years old. *Source: http://www.ntaccounts.com*

depending on the country, structure, and development of the welfare state, labour market and credit opportunities, social norms, and social class.

Incorporating bequests into NTA estimations is technically challenging and, given the scarcity of available data, empirically fraught with difficulties.

There are also some advanced technical points regarding the smoothing and re-scaling methods used to obtain the age profiles which the interested readers can learn about in United Nations (2013).

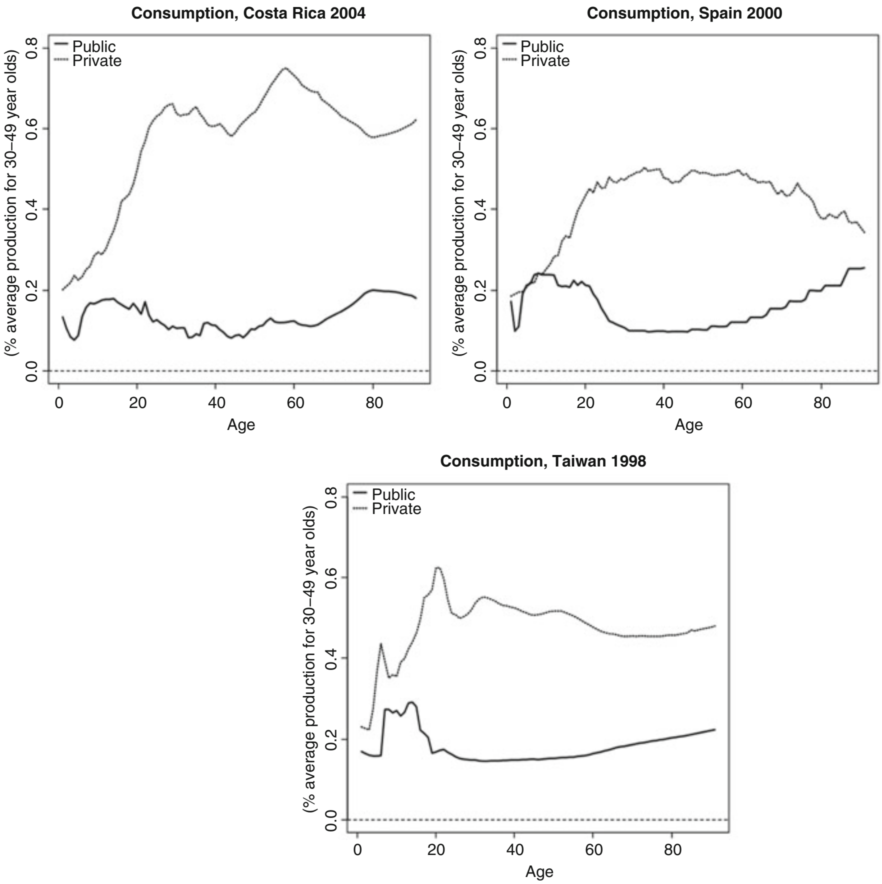

Fig. 1.2 Private and public consumption per capita. Costa Rica, Spain, and Taiwan. Values normalised by dividing by the simple average of labour income for individuals 30–49 years old. *Source:* *http://www.ntaccounts.com*

Finally, NTA estimations need be complemented with other macroeconomic approaches—a point that is usually forgotten:

> Like national accounts, national transfer accounts merely describe an economic situation, and do not recommend any policy change. The fact that current contributions to pension schemes do not suffice to pay pensions of future generations is an important finding. This finding however does not prescribe any particular policy response. It does not provide information on whether older persons will need to accept a cut in pensions and health care, or whether employees or employers should increase contributions to pension and health care systems. It also does not show how available policy options are circumscribed by

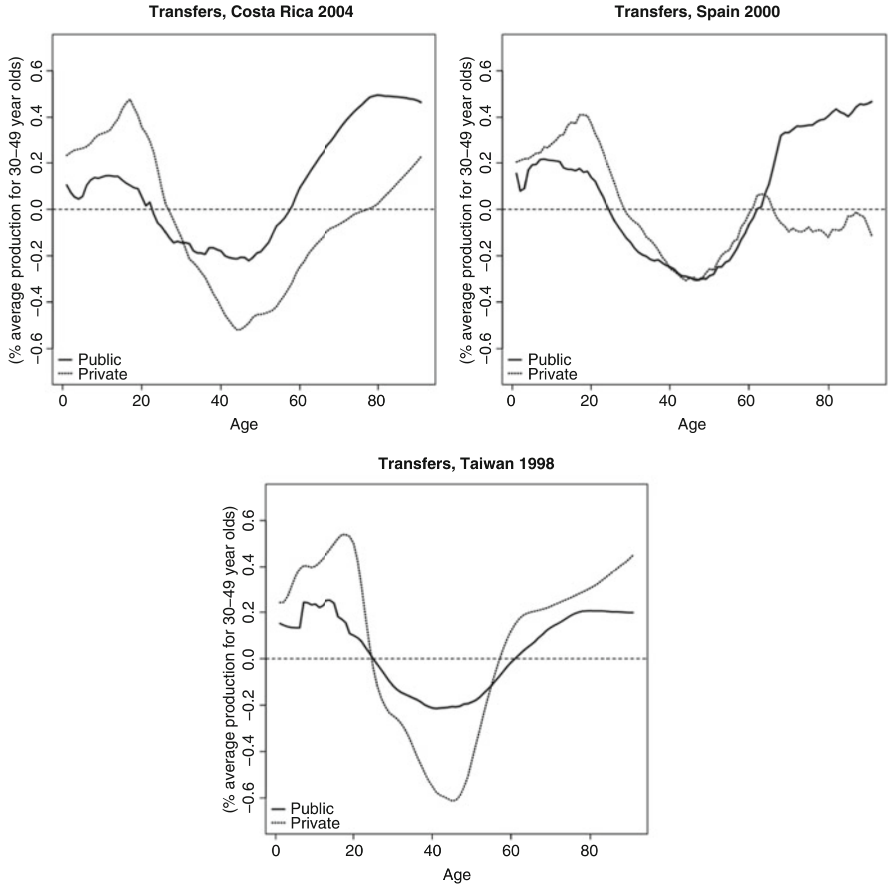

Fig. 1.3 Private and public transfers per capita. Costa Rica, Spain, and Taiwan. Values normalised by dividing by the simple average of labour income for individuals 30–49 years old. *Source: http://www.ntaccounts.com*

economic development, including the growth of output and labor productivity, as well as changes in labor force participation. It is therefore important that the analysis of the economic implications of population aging based on national transfer accounts be complemented by a more traditional analysis of economic development.

(Herrmann 2012, p. 39)

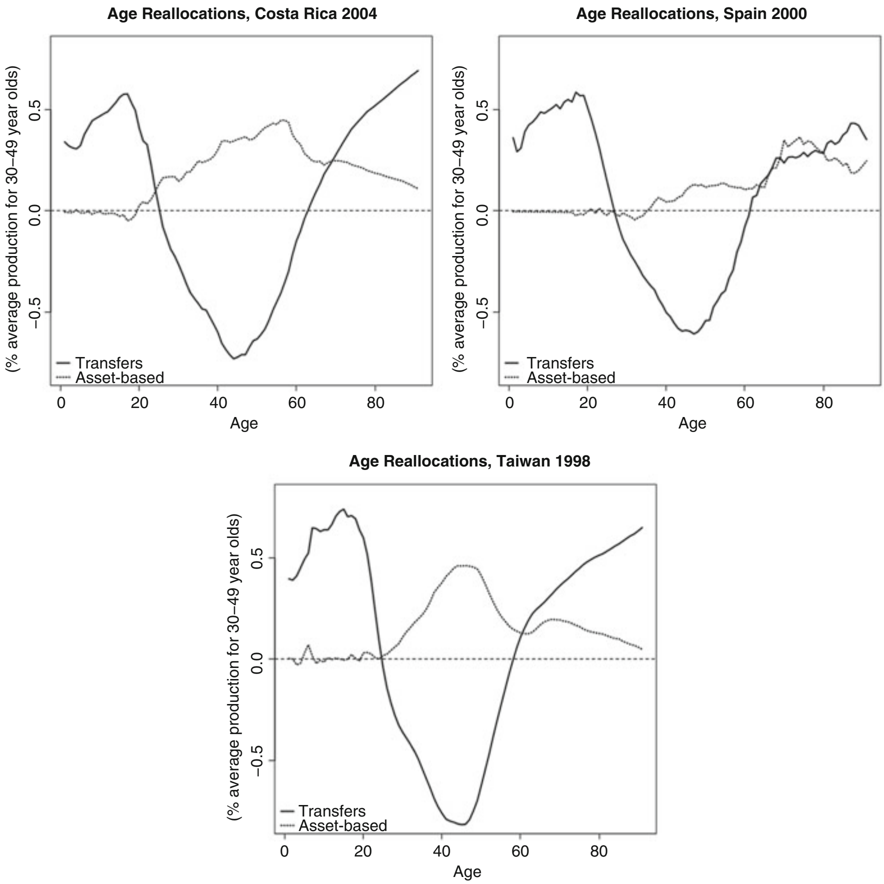

Fig. 1.4 Age reallocations per capita. Costa Rica, Spain, and Taiwan. Values normalised by dividing by the simple average of labour income for individuals 30–49 years old. *Source:* *http://www.ntaccounts.com*

Review and Reflect

1. Do you agree with the following quotation from one of the first reviews of generational accounting?

   While the authors claim that their estimates are consistent with "economic theory"—meaning the idea of rational, foresighted people—they have made numerous assumptions that seem at variance with such rationality and foresight.

   (Haveman 1994, p. 98)

(continued)

Would this criticism be applicable to other theoretical frameworks and models considered in this book so far?

2. Bonin (2010, p. 47) points out that in practice fiscal policy imposes more constraints on its effects on future cohorts and that policies directed at younger cohorts tend to favour cohorts to be born in the not so distant future, whereas policies that favour older cohorts 'are much less a pre-commitment for future fiscal policy'.

   Can you suggest an explanation for these policy biases based upon costs and benefits of politicians that seek to be re-elected in a democratic system? After preparing your response, see Volume IV, Chap. 4.
3. Discuss the following comment:

   > *…since generational balance is a comparison of newborns with the future, there are policies that are clear changes in generational distribution that would not show up as a change in generational balance. For example, a program of increased taxes used for education would affect newborns and future generations the same and so would not contribute to generational balance even though current older generations are paying higher taxes for the benefit of future generations.*
   >
   > *(Diamond 1996, p. 605)*

4. Comment on the following statement:

   > *…when GA models are used to support calls for retrenchment of public spending on pensions and other social programs that target the older population, it makes sense to recognize that the potential benefits with respect to government debt and deficit reduction and reduced inequality in net tax burdens across age cohorts may come at the cost of increased intragenerational inequality for many workers and retirees.*
   >
   > *(Williamson and Rhodes 2011, p. 33)*

5. Have you identified an ideological or political underpinning to GA? This is what Williamson and Rhodes (2011, p. 48) wrote in this regard:

   > *The generational equity debate is largely an ideological contest between those on the right, who suggest that we should focus on the pursuit of greater equity between age cohorts (intergenerational equity), and those on the left, who oppose policies designed to privilege this one form of equity relative to other forms, specifically intragenerational equity based on factors such as class, race, and gender.*

   Do you agree?

   Do you think that GA is compatible with the idea of generational interdependence or not?

(continued)

6. The findings from NTA regarding public and private intergenerational transfers have been summarised; thus:

   > *Private transfers flow strongly downward in every society, whereas the net direction of public transfers is downward (old to young) in some societies and upward in others (mostly rich)…Total transfers, the sum of public and private, flow downward in almost all countries, implying that modestly older age structures would be economically advantageous. However, the low fertility that prevails in many rich countries today will lead to much older age structures and a reversal in the direction of total transfers. For them, higher fertility and younger age structures will be advantageous.*
   > *(Lee and Mason 2011, p. 80)*

   In which sense would older age structures be economically advantageous? Why would they be so? And why would increasing population ageing imply a reversal in the flow of total transfers?

Notes

1. Here the functional form is of secondary importance, provided the utility function complies with the properties of a 'well-behaved' neoclassical utility function. I am following Kotlikoff (1993), who used a log-linear representation, which simplifies the exposition.
2. 'The evolution of government debt is the bottom line reference for the sustainability of fiscal policy' (Ballabriga and Martínez-Mongay 2007, p. 21).
3. For example, most countries have passed legislation or are subject to supranational legislation that requires that the government maintains a debt-to-gross domestic product ratio at or below 60 per cent (Lledó et al. 2017).
4. A government can incur in debts in a period, even in a rather long series of periods, but not indefinitely—these exercises rule out the possibility of a sovereign default. (Not for want of historical experiences, from Denmark in 1813 to Argentina in 2001.)
5. 2012 figures.
6. The government's inter-temporal budget constraint is criticised by heterodox economists. See the subsection on the limitations of GA below.
7. For example, the online appendix accompanying Dippelsman et al. (2012) shows that, in 2010, Canada's public sector gross debt amounted to anything between 38.2 per cent and 104.2 per cent of GDP, depending on the definition of public sector adopted and the assets and liabilities included!
8. The OLG model is based on the life-cycle model and according to Buiter (1997, p. 606), '…the usefulness of generational accounts as a summary of the budget's impact on the intergenerational distribution of private consumption

and on aggregate consumption lives or dies with the validity of the life-cycle model'.

9. Although Bonin (2010, p. 59) asserts that distinguishing between genders is only necessary for the evaluation of inter-vivos fiscal redistribution.
10. Given that this formula refers to future cohorts, it would be applicable insofar as $k > t$.
11. See Iparraguirre (2012) for a comprehensive description of existing filters to extract the cyclical element from a time series applied to economics.
12. See, for example, Congressional Budget Office (1995).
13. 'Classifying older people as "dependent" in the same manner as children is inappropriate and reductionist' (Martin et al. 2009, p. 1).
14. See the NTA project's website for further information: http://www.ntaccounts.com.
15. See the ECLAC's Ageing Future' series at http://repositorio.cepal.org/handle/11362/37540.

References

Abel, Andrew B et al. "Assessing dynamic efficiency: Theory and evidence." *Review of Economic Studies* 56 (1989): 1–20.

Ablett, John, and Zaid Tseggai-Bocurezion. "Lifetime net average tax rates in Australia since federation a generational accounting study." *Economic Record* 76, no. 233 (2000): 139–151.

Atkinson, Anthony B. *Public Economics in an Age of Austerity The Graz Schumpeter Lectures*. Abingdon: Routledge, 2014.

Auerbach, Alan J., Jagadeesh Gokhale, and Laurence J. Kotlikoff. "Restoring generational balance in U.S. fiscal policy: What will it take?" *Economic Review Federal Reserve Bank of Cleveland* 31, no. 1 (1995): 2–12.

Bach, Stefan, and Wolfgang Wiegard. "Public economics". In *Frontiers in Economics*. Edited by Klaus F. Zimmermann, 37–94. Berlin: Springer, 2002.

Ballabriga, Fernando, and Carlos Martínez-Mongay. "A further inquire about the sustainability of fiscal policy in the EU." In *Fiscal Indicators. Proceedings from the Directorate-General for Economic and Financial Affairs Workshop. Brussels, 22 September 2006*. Edited by Martin Larch and João Nogueira Martins, 17–55. European Economy Economic Papers 297. Brussels: European Commission, 2007.

Biggs, Simon, and Ariela Lowenstein. *Generational Intelligence: A Critical Approach to Age Relations*. Abingdon: Routledge, 2011.

Boll, Stephan. *Intergenerational Redistribution Through the Public Sector Methodology of Generational Accounting and Its Empirical Application to Germany*. Discussion paper 6/96. Frankfurt am Main, 1996.

Bonin, Holger. *Generational Accounting Theory and Application*. Berlin: Springer, 2010.

Bonin, Holger, Concepció Patxot, and Guadalupe Souto. "Cyclically-neutral generational accounting." *Fiscal Studies* 35, no. 2 (2014): 117–137.

Buiter, Willem H. "Generational accounts, aggregate saving, and intergenerational distribution". *Economica* 64, no. 256 (1997): 605–626.

Cardarelli, Roberto, James Sefton, and Laurence J. Kotlikoff. "Generational accounting in the UK." *Economic Journal* 110 (2000): F547–F574.

Conesa, Juan Carlos, and Carlos Garriga. "Intergenerational policy and the measurement of tax incidence." *European Economic Review* 83 (2016): 1–18.

Congressional Budget Office. *Who Pays and When? An Assessment of Generational Accounting*. Washington, DC: A CBO Study, 1995.

Cutler, David M. *Book Review 'Generational Accounting: Knowing Who Pays, and When, for What we Spend' by Laurence J Kotlikoff*, 1993.

Daatland, Svein Olav, Katharina Herlofson, and Ivar A. Lima. "Balancing generations: On the strength and character of family norms in the West and East of Europe." *Ageing & Society* 31, no. 7 (2011): 1159–1179.

Daatland, Svein Olav, Marijke Veenstra, and Katharina Herlofson. "Age and intergenerational attitudes in the family and the welfare state." *Advances in Life Course Research* 17, no. 3 (2012): 133–144.

Deaton, Angus. "Panel data from time series of cross sections." *Journal of Econometrics* 30 (1985): 109–126.

Diamond, Peter. "Generational accounts and generational balance: An assessment." *National Tax Journal* 49, no. 4 (1996): 597–607.

Dippelsman, Robert, Claudia Helene Dziobek, and Carlos Gutierrez Mangas. *What Lies Beneath: The Statistical Definition of Public Sector Debt. An Overview of the Coverage of Public Sector Debt for 61 Countries*. IMF Staff Discussion Note SDN/12/09, 2012.

Elder, Glen. "The life course as developmental theory." *Child Development* 69, no. 1 (1998): 1–12.

England, Robert Stowe. *The Fiscal Challenge of an Aging Industrial World*. Washington, DC: Center for Strategic and International Studies Press, 2002.

European Commission and International Monetary Fund and Organisation for Economic Co- operation and Development and United Nations and World Bank. *System of National Accounts 2008*. New York, NY: European Commission et al., 2008

Fu, Tsung-Hsi, and Pau-Ching Lu. "Population ageing and social policy in Taiwan." In *Ageing in East Asia: Challenges and Policies for the Twenty-First Century*. Edited by Tsung- Hsi Fu and Rhidian Hughes. Comparative Development and Policy in Asia, 89–104. Abingdon: Routledge, 2009.

Fullerton, Don, and Gilbert E. Metcalf. "Tax incidence." In *Handbook of Public Economics*. Edited by Alan J. Auerbach and Martin Feldstein. Vol. 4, 1878–1872. Amsterdam: Elsevier, 2002.

Fullerton, Don, and Diane Lim Rogers. *Who Bears the Lifetime Tax Burden?* Washington, DC: The Brookings Institution, 1993.
Gál, Róbert, and Géza Tarcali. "Pension reform and intergenerational redistribution in Hungary." *The Economic Review Keizai Kenkyuu* 54 (2003): 237–247.
Gokhale, Jagadeesh. " Unfunded obligation measures for EU countries." In *Fiscal Indicators. Proceedings from the Directorate-General for Economic and Financial Affairs Workshop. Brussels, 22 September 2006*. Edited by Martin Larch and João Nogueira Martins. European Economy Economic Papers 297, 59–94. Brussels: European Commission, 2007.
—. *Spending Beyond Our Means. How We Are Bankrupting Future Generations*. Technical report. Washington, DC: Cato Institute, 2013.
Gokhale, Jagadeesh, and Kent Smetters. *Fiscal and Generational Imbalances. New Budget Measures for New Budget Priorities*. Washington, DC: The AEI Press, 2003.
Hagestad, Gunhild O. "Interdependent lives and relationships in changing times: A life-course view of families and aging." In *Invitation to the Life Course: Toward New Understandings of Later Life*. Edited by Richard A. Settersten. Architects in the Third World, 135–160. Amityville, NY: Baywood Publishing Company, 2003.
Haveman, Robert. "Should generational accounts replace public budgets and deficits?" *Journal of Economic Perspectives* 8, no. 1 (1994): 95–111.
Herrmann, Michael. "Population aging and economic development: Anxieties and policy responses." *Population Ageing* 5 (2012): 23–46.
Iparraguirre, José. *Fluctuaciones del ciclo económico, raíces unitarias y memoria larga: Colombia 1905 2010*. Saarbrücken: Editorial Académica Española, 2012.
Jackson, Richard. *Germany and the Challenge of Global Aging*. Report. Washington, DC: Center for Strategic and International Studies Nationwide, 2003.
Khan, Hayat. "Private intergenerational transfers and their ability to offset the fiscal burden of ageing." *Pacific Economic Review* 15, no. 1 (2010): 116–151.
Kneller, Richard, Michael F. Bleaney, and Norman Gemmell. "Fiscal policy and growth: Evidence from OECD countries." *Journal of Public Economics* 74 (1999): 171–190.
Kotlikoff, Laurence J. *Generational Accounting Knowing Who Pays, and When, for What We Spend*. New York, NY: The Free Press, 1992.
—. "From deficit delusion to the fiscal balance rule: Looking for an economically meaningful way to assess fiscal policy." *Journal of Economics* 7 (1993): 17–41.
Kotlikoff, Laurence J., and Lawrence H. Summers. "Tax incidence." In *Handbook of Public Economics*. Edited by Alan J. Auerbach and Martin Feldstein, vol. II, 1043–1092. Amsterdam: Elsevier, 1987.
Lawm, Philip. *Wake Up Economists! Currencyissuing Central Governments Have No Budget Constraint*. MPRA Paper 28224. Adelaide: Faculty of Social and Behavioural Sciences, Flinders University, 2014.
Lee, Ronald D., and Andrew Mason. *Population Aging and the Generational Economy: A Global Perspective*. Cheltenham: Edward Elgar Publishing, 2011.

Lee, Ronald, and Andrew Mason. "National transfer accounts: An overview." *Policy in Focus* 30 (2014): 4–9.

Lee, Ronald, Shripad Tuljapurkar, and Ryan D. Edwards. "Uncertain demographic futures and government budgets in the US." In *Ageing in Advanced Industrial States. Riding the Age Waves Volume 3*. Edited by Shripad Tuljapurkar, Naohiro Ogawa, and Anne H. Gauthier. International Studies in Population. Vol. 8, 79–100. London: Springer, 2010.

Lledó, Víctor et al. *Fiscal Rules at a Glance.*. Background Note. New York, NY: International Monetary Fund, 2017.

Martin, Ruth, Caroline Williams, and Desmond O'Neill. "Retrospective analysis of attitudes to ageing in the economist: Apocalyptic demography for opinion formers?" *British Medical Journal* 339 (2009): b4914. https://doi.org/10.1136/bmj.b4914.

Mason, Andrew, and Ronald Lee. "Introducing age into national accounts." In *Population Aging and the Generational Economy A Global Perspective*. Edited by Ronald Lee and Andrew Mason, 55–78. Cheltenham: Edward Elgar, 2011.

Mason, Andrew et al. "Population aging and intergenerational transfers: Introducing age into national accounts." *Developments in the Economics of Ageing*. Edited by David A. Wise, 89–122. Chicago, IL: The University of Chicago Press, 2009.

Mitchell, William, and Warren Mosler. *Essential Elements of a Modern Monetary Economy with Applications to Social Security Privatisation and the Intergenerational Debate*. Working Paper 05-01. Callaghan, NSW: Centre of Full Employment and Equity, The University of Newcastle, 2005.

Musgrave, Richard A., and Peggy B. Musgrave. *Public Finance in Theory and Practice*, 5th edn. New York, NY: McGraw-Hill, 1989.

Nishiyama, Shinichi, and Kent Smetters. "Financing old age dependency." *Annual Review of Economics* 6, no. 1 (2014): 53–76.

Patxot, Concepció et al. "How intergenerational transfers finance the lifecycle deficit in Spain". In *Population Aging and the Generational Economy: A Global Perspective*. Edited by Ronald Lee and Andrew Mason, 241–255. Cheltenham: Edward Elgar, 2011a.

—. *NTA Country Report, Spain, 2000*. Technical report, 2011b. http://www.ntaccounts.org.

Peeters, Marga and Loek Groot. "Ageing and fiscal sustainability in the European Union." In *Population Change in Europe, the Middle-East and North Africa: Beyond the Demographic Divide*. Edited by Koenraad Matthijs et al., 227–252. Abingdon: Routledge, 2015.

Productivity Commission. *Economic Implications of an Ageing Australia*. Research Report. Canberra: Productivity Commission, 2005.

Rosero-Bixby Luis, Paola Zúñiga-Brenes, and Andrea Collado. *NTA Country Report, Costa Rica, 2004*. Technical report, 2011. http://www.ntaccounts.org.

Shimasawa, Manabu, Kazumasa Oguro, and Minoru Masujima. *Population Aging Policy Reforms, and Lifetime Net Tax Rate in Japan: A Generational Accounting Approach*. Technical Report 05. Tokyo, 2014.

Ter Rele, Harry, and Claudio Labanca. "Lifetime generational accounts for the Netherlands." *Fiscal Studies* 33, no. 3 (2012): 399–427.

Tobin, James. 1970. On limiting the domain of inequality. *The Journal of Law and Economics* 13: 263–277.

Tung, An-Chi, and Mun-Sim Lai. *NTA Country Report, Taiwan, 1998*. Technical report, 2011. http://www.ntaccounts.org.

—. "Who supports the elderly? The changing economic lifecycle reallocation in Taiwan, 1985 and 2005." *The Journal of the Economics of Ageing* 5 (2015): 63–68.

United Nations. *National Transfer Accounts Manual: Measuring and Analysing the Generational Economy*. New York, NY: United Nations, 2013.

Verbeek, Marno. "Pseudo panel data". In *The Econometrics of Panel Data: Handbook of Theory and Applications*. Edited by László Mátyás and Patrick Sevestre. Advanced Studies in Theoretical and Applied Econometrics, 303–315. Dordrecht: Springer, 1992.

—. "Pseudo-panels and repeated cross-sections." In *The Econometrics of Panel Data. Fundamentals and Recent Developments in Theory and Practice*. Edited by László Mátyás and Patrick Sevestre. Advanced Studies in Theoretical and Applied Econometrics. Vol. 46, 369–382. Heidelberg: Springer, 2008.

Watts, Rob. "The intergenerational accounting project and the myth of a looming fiscal crisis." *Journal of Australian Political Economy* 69 (2012): 86–102.

Watts, Martin J., and Timothy P. Sharpe. "Immutable laws of debt dynamics". *Journal of Post Keynesian Economics* 36, no. 1 (2013): 59–84.

Williamson, John B., and Anna Rhodes. "A critical assessment of generational accounting and its contribution to the generational equity debate." *International Journal of Ageing and Later Life* 6, no. 1 (2011): 33–57.

Winnekens, Felix. *Global Aging 2016: German Reforms Start to Tackle the Cost of Aging*. Technical report. New York, NY: S&P Global, 2016. https://www.spglobalcom/cn/ourinsights/GlobalAging2016GermanReformsStartToTackle-The-Cost-Of-Aging.html.

Wolfson, Michael et al. "Historical generational accounting with heterogeneous populations." In *Government Finances and Generational Equity*. edited by Miles Corak, 107–126. Ottawa: Statistics Canada, 1998.

Woods, Robert. The role of fiscal indicators in setting fiscal policy in the UK. In *Fiscal Indicators. Papers Presented at the Banca d'Italia Workshop Held in Perugia, 30 March–1 April, 2006*, 1071–1107. Rome, 2006.

Wray L. Randall. *Modern Money Theory: A Primer on Macroeconomics for Sovereign Monetary Systems*. New York, NY: Palgrave Macmillan, 2012.

2

Public Spending, Taxation, and Ageing

We mentioned in the introduction to the previous chapter that one of the most important topics in the current discussions on fiscal policy and ageing is the sustainability of public finances in the face of population ageing. However, before jumping to conclusions, a closer link between individual and population ageing and public spending has to be established: to what extent is ageing actually a driver of government expenditure? This chapter considers this point as well as two mechanisms governments resort to in order to rein in spending: targeting and means-testing.

2.1 Age-Driven and Age-Related Public Spending

In Sect. 3.3 (this volume), we state that the commonsensical notion that because older people consume more health services per head than any other age group population ageing is leading to greater healthcare spending is too simplistic. For example, Christiansen et al. (2006) noted that institutional characteristics and capacity, technology, and behavioural variables mediate in the relationship between ageing and healthcare spending. The same applies to other areas of expenditure. Social care, housing, transport, safety, and training are other public policy areas with direct impact on the older population's welfare and quality of life (Iparraguirre 2009).

Some documents by governmental and international organisations as well as media commentators and academics refer to either age-driven or age-related public spending, using these two expressions as synonymous and the European

J. L. Iparraguirre, *Economics and Ageing*,
https://doi.org/10.1007/978-3-319-93357-3_2

Commission coined the distinction between 'total age-related spending' and 'strictly-age-related spending', where the latter is composed of public spending on healthcare, long-term care, adult education, and pensions and the former includes outlays in unemployment benefits as well.[1]

You may think that semantic nuances apart, they are one and the same thing. Mark Twain is reported to have quipped that 'the difference between the right word and the almost right word is the difference between lightning and the lightning bug'—and there is also a world of difference between public expenditure that is driven by population ageing and public expenditure that is related to population ageing. Public spending that to a large proportion goes to older people (e.g. pensions and healthcare) tends to be classified as 'age-related'—see, for example, IMF (2012).

The problem is that, implicitly at least, the culprit seems to be the demographic trends. 'Culprit', in one of its denotations, corresponds to the cause of a problem. However, not all age-related spending is driven—that is, 'caused' or part of a causal model of explanation[2]—by population ageing. Therefore the distinction between 'age-related' and 'age-driven' public spending needs be emphasised, for the latter is explained by population ageing, whereas the former may be related to other factors than changes in the demographic structure of a country. Think of a sunrise. It takes place due to the motion of the Earth and not because roosters crow—although there is a clear association between the timing of sunrises and crowing. Likewise, there is a clear association between population ageing and age-related spending, but not all age-related spending is due to demographic change. Instead, all age-driven spending is.

Let me illustrate the difference with three examples, two closer to our interests and one from completely different areas of study: ecology and botany.

- 'Age-driven declines in fluid intelligence, by age-related increases in crystallized experience' (Agarwal et al. 2009, p. 57)—see Volume III, Part I, for the distinction between fluid and crystallised intelligence. These authors are explaining that cognitive decline is driven, that is, 'caused', by chronological age, whilst accumulated experience is associated with increasing chronological age but is not driven—'caused'—by it.
- '…we are vulnerable to seeing ourselves and those we study entirely in terms of age: as ageing rather than living individuals: ageful rather than ageless. Once persuaded that ageing is worthy of serious study, we are tempted to interpret all change and all differences as age related, if not age driven' (Bytheway 2000, pp. 785–786)—paraphrasing, 'associated with, if not caused by, age'.

- Wandering into the territory of ecology and botany, we find the following in a paper on self-thinning (i.e. '…the natural process whereby numbers of trees per unit area decrease as average tree size increases over time'[3]): '…the internal, age-related (but not necessarily age-driven) processes such as senescence, decreasing shade tolerance, and impediments associated with increasing tree size'. Again, according to these authors, any of these processes are associated with, but not a necessary result of, the age of the tree.

Figure 2.1 presents projections of changes in age-driven and age-related public spending for a number of developed countries between 2011 and 2030.

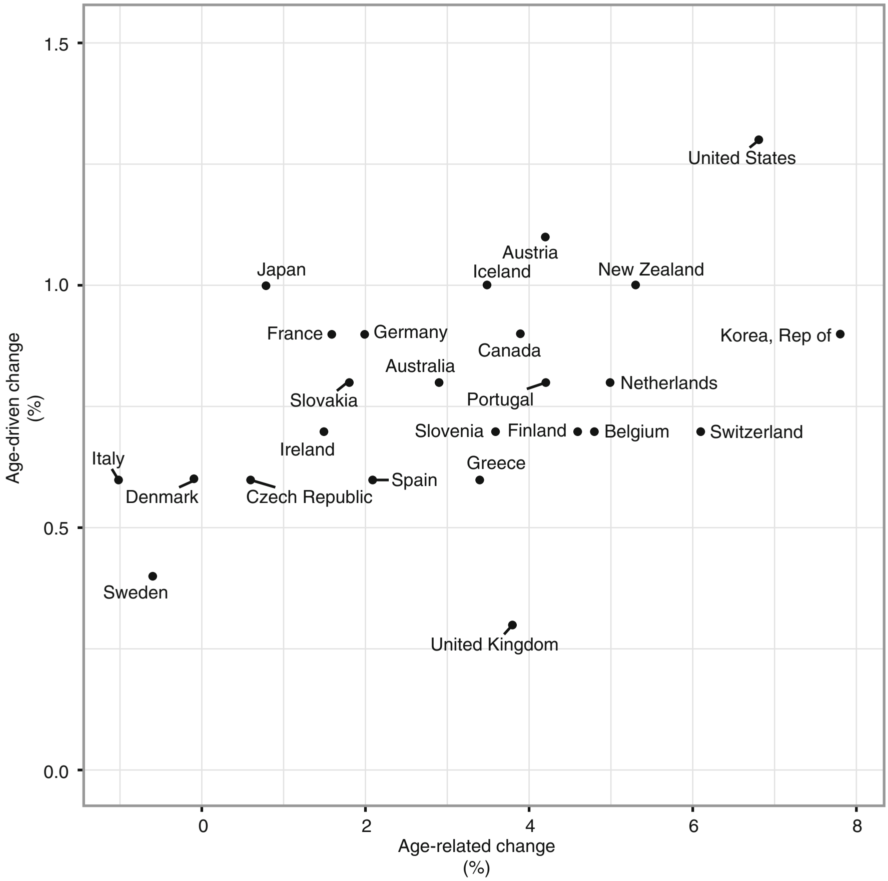

Fig. 2.1 Change in age-related and age-driven public expenditure selected countries 2011–2030 *(Source: Iparraguirre, José (2012). Age UK Chief Economist's Report. Spring 2012. Age UK. London.)*

Age-related changes in spending are, on average, much higher than age-driven changes, though for some countries they are expected to fall over the period. Moreover, countries like the UK or Greece, whose age-related public spending is projected to grow close to the average for all the countries considered, exhibit two of the lowest growth rates in age-driven public spending.

One crucial policy point is that part of 'age-related' expenditure is modifiable: prevention and other pro-active measures can be implemented to curb down public expenditure related to, but not driven by, ageing, irrespective of demographic trends. Cottarelli (2012, p. v) stated: 'Moderating the growth of age-related spending, including on health, will have to be a major element of the fiscal consolidation strategy in the advanced economies over the coming years'. I agree, but—depending on the country—not a large proportion of this growth is due to population ageing. Not all age-related spending on health is driven by chronological age. Gupta et al. (2012) listed several drivers of growth in health expenditure apart from population ageing (although they are related to ageing): changes in income levels, technology, health insurance coverage, disease profiles, lifestyle risk factors and in unit labour costs in the healthcare sector as well as health policies, inefficiencies, and market imperfections, and as they explained (p. 9):

> The growth of spending attributed to …nondemographics has been coined "excess cost growth (ECG)." Assumptions regarding ECG are the most important factor behind health care projections, given that the effect of aging on spending increases is believed to be moderate.

For example, looking into data for 27 advanced and 23 emerging economies between 1970 and 2010, Coady and Kashiwase (2012) found that roughly 25 per cent of the projected increase in the share of GDP spent by the public sector is explained by population ageing and three-thirds by ECG. Similarly, Soto et al. (2012) projected that around one-third of increases in public health spending in advanced economies between 2010 and 2030 (estimated to be in the order of three percentage points of GDP) would result from population ageing; for emerging countries, half of the projected increase would be attributable to population ageing, but total change is to be much lower (at one percentage point of GDP).

Many economists are careful to make the distinction between age-related and age-driven (or, using Clements and Coady's terminology, age-related and non-demographic) spending. And all those who probe the data find that non-demographic forces are more important than population ageing—the literature citing similar findings is copious; to restrict the case to health spending, see, for example, Denton et al. (1986) for Canada; Dormont et al. (2006a) for France; Reinhardt (2003) for the USA; Dittrich and Stara (2013) for the Czech Republic; Richardson and Robertson (1999) for Australia; and so on.

Failing to distinguish between age-related and age-driven forces, which is regrettably not uncommon, leads to portraying all 'age-related' spending as 'age-driven', and therefore to inflating the figures that are attributed to population ageing and hence to drawing wrong conclusions, all of which contributes to the cultural trope of ageing as a 'burden' or 'crisis' that seems to have taken pre-eminence over more positive views on the economic consequences of population ageing (Dabbs Sciubba 2012; McDaniel 1987). These negative portrayals of population ageing would predispose public opinion to accept otherwise unpalatable policy options (Northcott 1994). According to Barer et al. (1995), the popularity of the unsubstantiated dictum that population ageing will exert extraordinary pressure on public budgets can be explained by three factors:

- that demographic trends do have substantial effects though more akin to glaciers than avalanches in their dynamics;
- that on some sub-sectors such as long-term care, age-driven forces are substantial and analysts and observers wrongly extrapolate these trends to other sectors; and
- that in the healthcare sector in particular, the increasing demand for services by older people would be misleadingly suggestive that population ageing is driving spending.

Evans et al. (2001) add a fourth explanation: notwithstanding its lack of empirical support, this apocalyptic view would be in vogue because it serves particular economic interests—see also Gee (2002), Lundgren and Ljuslinder (2012), and Shaw (2002) and Part IV in Volume IV.

2.1.1 Targeting, Means-Testing, Rationing, and Other Related Concepts

Some policies directed at older people are universal in nature, whilst others are conditional to additional requisites than a minimum chronological age. In general parlance, 'universal' policies are not selective. When the additional conditions have to do with levels of income or wealth, the policies are termed 'means-tested'. However, as Reddin remarked:

> the presence of a "means-test" does little to demonstrate the selective nature of a policy, and the absence of such a test by no means ensures universality of cover or impact.
>
> (Reddin 1978, p. 22)

The report further explained that apart from means-testing there are three additional key elements to determine whether a policy is universal or selective: how it is funded, its time dimension, and the actual beneficiaries. For example, we could have a universal benefit for older people funded by a selective payment system (e.g. a tax on social security pension income from abroad): some older people would obtain a higher 'rate of return' on the benefit than other recipients. Timing is also crucial: for how long the benefits or services are to be received and for how long the taxes or fees to fund those benefits or services will be levied. The definition of beneficiary may restrict access or eligibility or use to even universal policies. Universal (as well as means-tested) policies for older people can be seen as ageist: some authors, particularly critical gerontologists, see conditionality on chronological age to access services or benefits as a new form of ageism (Angus and Reeve 2006; Hastings and Rogowski 2015; Macnicol 2015; Milton et al. 2015; Walker 2012). Furthermore, Green et al. (2017) reported negative impacts of targeted welfare benefits on material, psychosocial, and structural determinants of health in older adults, mediated by how 'welfare' and 'entitlement' are framed and understood by potential beneficiaries.

Spicker (2005) distinguishes conceptually between selectivity, means-testing, targeting, and rationing. Selectivity is a mode of operation (i.e. 'a pattern of policy-making or approach to policy'—op. cit., p. 345) that categorises between eligible and non-eligible individuals based on an assessment exercise. Means-testing is a technique for identifying and therefore restricting the eligibility to benefits or services based on income or wealth. It is, therefore, one form of selectivity—but selectivity includes, for example, need-based eligibility which is not based on means. Targeting, in turn, is primarily to do with delivery: the services or benefits can be administered on particular geographical areas (spatial targeting) or groups—for example, chronological age bands, such as concessionary bus passes in the UK for people who reached pensionable age.

Klein et al. (1996, pp. 11–12)[4] provide the following classification of forms of rationing, which was developed to account for rationing in a healthcare context but can be applied to the provision of any other public goods and services:

- Rationing by denial, by which services are denied to specific individuals, or client groups
- Rationing by selection, by which staff responsible for the allocation of services choose whom to provide them to on the basis of likely net gains or deservedness
- Rationing by deterrence, by which barriers to access are erected by unhelpful information and advice
- Rationing by dilution, by which the quantity and quality of services are reduced
- Rationing by delay, by which through waiting lists and other devices, access is discouraged
- Rationing by deflection, by which prospective beneficiaries and recipients of services are channelled to different programmes or providers
- Rationing by substitution, by which individuals are offered cheaper alternative services
- Rationing by termination, by which services are withdrawn, programmes terminated, and so on[5]
- Rationing by charges, by which fees and other charges are levied

Targeted universalism, far from an oxymoron, is quite common. It consists of the combination of universal goals and targeted means (Reece et al. 2010). Targeted universalism provides benefits or services to all units within a targeted group; it introduces sensitivity to particular needs without compromising the universal goals of a policy. As with any other form of targeting, it is 'as much about who is excluded from welfare provision as it is about who is included' (Kemshall 2002, p. 27).

Rationing is a mode of operation by which the demand or the supply of services is restricted. Demand may be restricted by deterrence, the levying of charges, establishment of quotas, or prohibition. Supply may be restricted by means to eligibility criteria, filtering, delays, and so on.

In Volume II, Part III, I will present the main elements of the economics of long-term care, and in Part IV in Volume IV, we will discuss alternative explanations for the age orientation of welfare states.

2.2 Taxation and Ageing

Taxes are not only a lesser evil when it comes to disposable income but also to economic efficiency: they introduce distortions which reduce welfare.[6] Using a simple supply and demand diagram—see Fig. 2.2—we can see that in the absence of a tax, a market reaches an equilibrium level E_0 where q_0 units of a good are demanded and supplied at price p_0. Suppliers are content with selling that quantity at that price; they would accept to sell any quantities lower than q_0 at that price, which in the diagram is marked as area PS. In that sense, the area shows a *producer surplus* that goes to the suppliers, as they are in fact selling all the quantities below q_0 at p_0, a price higher than at which they were prepared to sell those quantities. Likewise, the consumers would accept to pay higher prices for the quantities below q_0—imagine to which lengths a famishing person would go to get that first roll of bread in days[7]—but they are getting those quantities at a lower price, p_0, so the area CS denotes the *consumer surplus*. The sum of the consumer surplus and the producer surplus is known as the *economic welfare*.

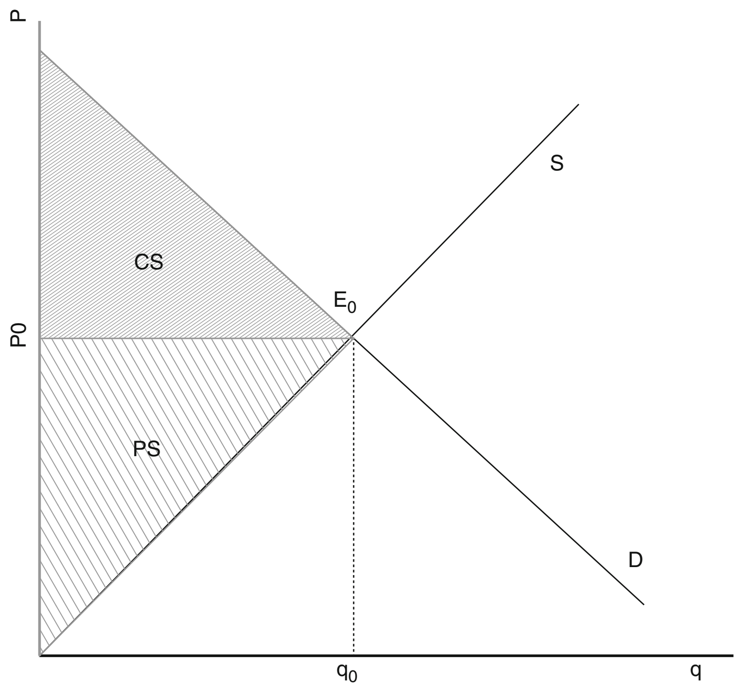

Fig. 2.2 Welfare effects of a tax. *Source: Figure is illustrative, prepared with mock data*

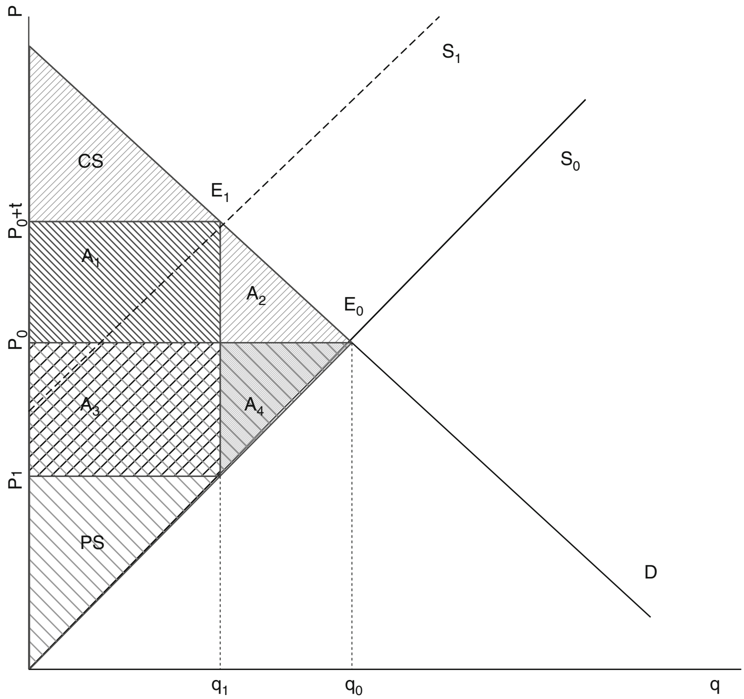

Fig. 2.3 Welfare effects of a tax. *Source: Figure is illustrative, prepared with mock data*

Now comes the government, and to keep things simple, let's assume it levies a per unit (or specific) tax t that raises the price to p_0+t, reducing the quantity demanded to q_1 (Fig. 2.3). This shifts the supply from S to $S_1(= S+t)$ until a new equilibrium level is reached (E_1).

The government revenue equals the shaded areas A_1 and A_3. Compared to the situation before the introduction of the tax, the consumer and producer surpluses were reduced. But if we sum the new economic welfare and the government revenue, we see that the total is smaller than the economic welfare before the tax: this reduction in economic welfare resulting from the tax is known as a *deadweight loss* and represents the distortion caused by the tax. The deadweight loss is a measure of the allocative inefficiency or excess burden introduced by the tax (Hines 1999, 2008).

2.2.1 Optimal Taxation

Ramsey (1927) showed that under certain assumptions, it is optimal for a government seeking to maximise the welfare of the society to relate the *ad*

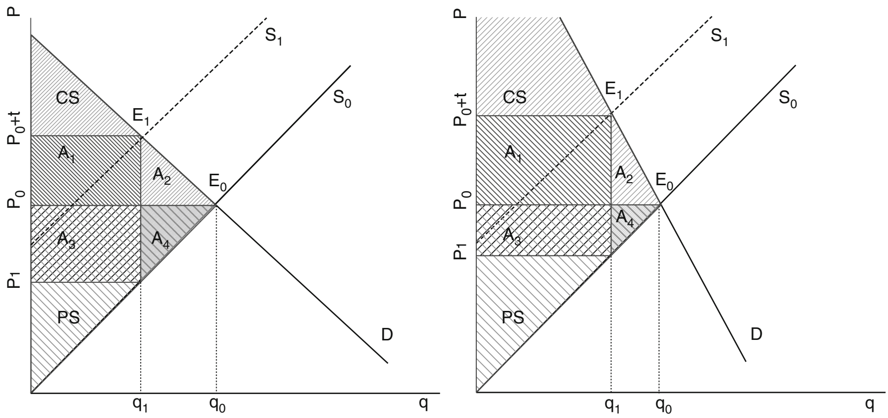

Fig. 2.4 Welfare effects of a tax. *Source: Figure is illustrative, prepared with mock data*

valorem tax[8] rates it levies in inverse proportion to the elasticity of demand of the goods and services on which the tax is levied. The result applies to a per unit tax, so continuing with our example, consider two different goods only differing in their price elasticity of demand, on which a per unit tax t is levied.

The left panel in Fig. 2.4 shows the previous situation. The panel on the right-hand side shows the same tax rate applied to a good with a more inelastic demand schedule. We can estimate the deadweight loss caused by the tax in each case, applying the formula DWL $= 0.5 \cdot t \cdot \delta \cdot Q$, where t is the tax rate and $\delta \cdot Q$ stands for the difference in the equilibrium quantity before and after the tax (i.e. $q_1 - q_0$).[9] The tax is equal to the difference in the price paid by the consumers before and after and the price received by the suppliers, also before and after, so it corresponds to the difference between the gross price (i.e. including tax) paid by the consumers and the net price (i.e. minus tax) received by the suppliers. The price elasticity of demand and supply at the equilibrium points E_0 are:

$$E_D = \frac{\frac{\Delta Q}{Q_0}}{\frac{\Delta P}{P_0}} = \frac{\Delta Q}{Q_0} \cdot \frac{P_0}{P_{0+t} - P_0}$$

$$E_S = \frac{\frac{\Delta Q}{Q_0}}{\frac{\Delta P}{P_0}} = \frac{\Delta Q}{Q_0} \cdot \frac{P_0}{P_1 - P_0}$$

from where the following expression can be obtained[10]:

$$\mathrm{DWL} = 0.5 \cdot t^2 \cdot \frac{q_0}{p_0} \cdot \frac{\left[\frac{\Delta Q}{Q_0} \cdot \frac{P_0}{P_1 - P_0}\right] \cdot \left[\frac{\Delta Q}{Q_0} \cdot \frac{P_0}{P_{0+t} - P_0}\right]}{\left[\frac{\Delta Q}{Q_0} \cdot \frac{P_0}{P_1 - P_0}\right] - \left[\frac{\Delta Q}{Q_0} \cdot \frac{P_0}{P_{0+t} - P_0}\right]} = 0.5 \cdot t^2 \cdot \frac{q_0}{p_0} \cdot \frac{E_S \cdot E_D}{E_S - E_D}$$

For a given supply, the more inelastic the demand for a good, the smaller is the deadweight loss of imposing a tax. The 'Ramsey rule' states that more necessary goods should be taxed more heavily than goods with greater demand elasticities.[11] This way the total excess burden caused by the introduction of the tax will be minimised: this tax structure would be economically efficient. 'And extremely regressive!', you may decry because the price-demand elasticity of a good is higher the more necessary the good, and it is the poor who tend to allocate a higher proportion of their income to 'basic necessities'. Well, I said 'under certain assumptions', one of which is that the economic actor being model is a representative agent: all agents are assumed to be identical, so there are no distributional problems. If we assume there are, say, two groups of individuals—namely, the poor and the rich—and that the former have more inelastic demands because they tend to allocate a higher proportion of their lower income on necessities compared to the other group, Ramsey's model highlights the tension between efficiency and equity that runs through much of the discussions in public finance and economic policy in general. As Mirrlees et al. (2011, p. 36) put it: 'Optimal tax theory is all about the choice of a system of taxation that balances efficiency losses against the government's desire for redistribution and the need to raise revenue.'

When it comes to efficient tax structures, a tailor-made tax on consumption that were able to distinguish between agents would be theoretically optimal: any two agents with different demand elasticities would be taxed differently. But why restrict the analysis to the consumption of goods and services? Ramsey did not concentrate only on the demand side—after all, demand and supply are but the two blades of the same pair of scissors (Marshall 2013, V.III.7, p. 164). In fact, his basic insight was that—assuming linear and separable demand and supply schedules and the absence of income effects—the ratio between the unit tax on a good and its unit price must be equal to the sum of the inverse of the elasticity of demand and the inverse of the elasticity of supply; see Stiglitz (2015).

One key service is labour, so a tax on labour income could also be structured along Ramsey's rule. Labour income is the product of the number of hours worked and the hourly wages, so the tax rate would be higher for agents with higher labour supply elasticity. Another important source of income, particularly for well-off individuals, is capital income; hence, in theory a tax on interest income could follow similar guidelines. Here we come to one intersection between ageing and taxation: age-adjusted optimal taxes.

2.2.2 Age-Adjusted Optimal Taxation

Ramsey was concerned about efficiency. The levying of taxes (other than lump-sum) introduces deadweight losses or inefficiencies. If the governments could observe things closely associated with efficiency such as effort or skills, they could estimate the elasticities of effort or skills and consequently levy taxes optimally. However, effort or skills cannot be observed directly—this is a key assumption: that the government (or social planner) cannot observe each individual's labour ability or effort; hence taxes cannot be based on this characteristic, which is assumed to remain 'private' information.

We further assume that the government cannot even observe unit wages. Instead, only total income is observable, which conditions the fiscal instruments the government can use. More generally, time is assumed to be available solely either for labour or leisure.[12] And leisure cannot be taxed directly, which, according to Erosa and Gervais (2002, p. 339), constitutes the 'fundamental problem in setting optimal fiscal policy'. If we agree that labour income is positively and closely related to effort and skills, or inversely associated with leisure, then it could constitute an acceptable base for Ramsey-type taxation. Therefore, we need to look into the wage elasticity of labour supply.

Crucially, the elasticity of labour supply varies with age (Peterman 2016; Whalen and Reichling 2017), and the age profiles of capital income show a positive gradient, as the life-cycle hypothesis suggests—see, for example, Brugiavini and Padula (2003), Burtless (2005), and Garbinti et al. (2017). Consequently, the Ramsey model would recommend that income taxes should be adjusted by age. As we mentioned above—see also Chap. 1 in Volume III—older workers tend to exhibit a higher elasticity of labour supply with respect to changes in labour income, particularly along the extensive margin.

In labour economics, there is a distinction between the extensive and the intensive margin of labour supply: the **extensive margin** refers to the decision of whether to work in paid employment or not; the **intensive margin** refers to the decision of how many hours to allocate to paid employment, having already decided to work. For men and women the elasticity of labour supply, both at the extensive and the intensive margins, varies along their life cycle

(Blundell et al. 2013). As Hemel (2010, p. 1888) explained:

> If individual workers cannot make marginal adjustments to their hours, then we would expect the price elasticity of labor supply to be greater for individuals who are considering exit from the workforce than for individuals who might desire an incremental reduction in hours. In other words, we would expect the disincentive effects of taxation to be greater around the retirement decision than at midcareer.

This changing elasticity over the life cycle constitutes the main theoretical pillar of the position that proposes the adoption of age-dependent taxation: 'The need for age-dependent taxes is a natural implication of life-cycle behavior' (Erosa and Gervais 2002, p. 341).

Akerlof (1978) advanced the idea that if poorer groups of the population could be identified or 'tagged' costlessly according to relevant characteristics they could not modify, transferring subsidies to them would increase social welfare. Chronological age is an observable and non-manipulable trait and, given its association with income, a good candidate for tagging (Bastani et al. 2013).

Furthermore, unlike other observable traits which are also associated with earnings and economic behaviour in general, such as height or gender, tagging based on chronological age may be more acceptable politically given that most people are expected to reach a given chronological age at some time during their lifetimes (Banks and Diamond 2010). For example, in a US context, Hemel (2010, p. 1896) noted that the endorsement by interest groups representing older people of age-dependent tax rates, which made the policy recommendations stemming from optimal taxation theory easier to implement, was 'a rare (and perhaps unique) congruence' between economic theory and interest group politics.

Given that labour supply elasticity increases with chronological age, the fiscal policy conclusion (based upon a number of simplifying assumptions) is that marginal tax rates should decline with advancing chronological age (Hemel 2010). The literature on this topic, as on any other in economics, has developed from relatively simple models[13] to more complex specifications, where initial assumptions are gradually relaxed.

We are going to use Weinzierl (2011a,b) as a guide to reflect on the relationship between taxation and individual ageing, without going into the mathematical details. Weinzierl discussed there alternative tax policies: a labour income tax that is a function of the income but unrelated to the chronological age of the taxpayer; a labour income tax that depends on the income and the chronological age of the taxpayer; and a labour income tax that depends on the income, the chronological age, and the lifetime path of incomes of the taxpayer—termed, respectively, 'Static Mirrlees', 'Partial Reform', and 'Full Optimum' policies.

The starting point is an individual's utility function, which is generally assumed to depend on consumption and leisure. Instead of leisure, what in this case enters the utility function is the disutility of the labour effort. Labour effort is equal to the ratio between the labour income and the wage per unit of labour. Labour income, in turn, is the product of the wage and the labour effort. Ability or effort is not readily observable and is assumed to be distributed among the population. Economic life starts in period 1 when an individual enters the labour market and finishes in period T, when she retires. Each individual lives and works for the same number of periods: in this model there is no retirement and chronological age and period coincide. The utility of an individual of ability i and age t results from the difference between the utility derived from consumption and the disutility from labour:

$$U_t^i(c, y) = u(c) - v\left(\frac{y}{w_t^i}\right) \tag{2.1}$$

Each individual maximises her utility subject to the budget constraint after the taxes whose specification depends on the policy. For example, under a Static Mirrlees regime where income tax only depends on income, we have $T = T(y)$, whereas under a Partial Reform policy, we have $T = T(y, t)$ as the income tax depends on income and age; finally, in the Full Optimum case, the tax becomes $T\left(y(.)_{t=1}^{T}, t\right)$ because it depends on the lifetime path of income and the current chronological age of the taxpayer. Finally, the model assumes the existence of a social welfare function that a benevolent policy maker or social planner seeks to maximise.

The standard assumption, adopted by Weinzierl, is that this social welfare function can be represented by a weighted utilitarian function of the individual utilities—that is, as the weighted sum of the individual utilities, where the weights, known as Pareto weights (Saez and Stantcheva 2016), reflect social preferences (d'Aspremont and Gevers 2002; Sen 1986). Weinzierl (2011b) calibrated the model with data for over 10,000 people in paid employment aged 25–55 in the USA between 1968 and 2001 and obtained that age-dependent taxes generated efficiency (i.e. welfare) gains equivalent to between 0.6 per cent and 1.5 per cent of aggregate annual consumption. These efficiency gains resulted from a reduction in the marginal taxes on high-income young workers (because higher taxes on these individuals would introduce substantial the deadweight costs with much lower tax revenue from this same group of people) and from a reduction, on average, on younger workers relative to older workers under the assumption of imperfections in the capital markets such that private saving and borrowing were restricted. The conclusion was that the welfare gains under age dependence would exceed those under an age-independent tax regime. Similarly, based on US data between 1982 and 2008, Bastani et al. (2013) estimated that switching from a non-linear age-independent income tax to a non-linear age-dependent income tax would generate welfare gains equalling about four per cent of total output.

The same approach has been extended to taxes on consumption and interest income: if elasticities vary with chronological age, under the same assumptions as above—particularly, the separability of the utility function—it would be optimal to levy these age-dependent taxes. However, would it be optimal to introduce age-dependent taxes on wages, consumption, and interest income at the same time? By means of a similar model as the one described above, Alvarez et al. (1992) showed that it would not. Under the separability assumption between consumption and leisure, these authors presented the following ranking of tax (or subsidy) configurations in terms of the decreasing distortions or deadweight losses each configuration would create (Alvarez et al. 1992, Table 1, p. 119):

1. Age-conditioned wage taxes (or subsidies) and age-conditioned consumption taxes (or subsidies), or a uniform, non-aged-conditioned consumption tax (or subsidy) and age-conditioned wage taxes (or subsidies), or age-conditioned wage taxes (or subsidies)
2. Age-conditioned consumption taxes (or subsidies) and a non-aged-conditioned interest income tax (or subsidy)
3. Uniform, non-aged-conditioned consumption tax (or subsidy) and a non-aged-conditioned interest income tax (or subsidy)
4. Age-conditioned consumption taxes (or subsidies) or uniform, non-aged-conditioned consumption taxes (or subsidies)

This ranking is not based on redistributive arguments or on consideration of the social insurance repercussions of imposing age-dependent taxes, but purely on efficiency grounds. Nevertheless, Gervais (2012) showed that age-dependent tax rates on labour income and on capital income would be progressive: under age-dependent labour income tax, the tax rates would increase with labour supply and vice versa, whilst the tax rates on capital income would be negative when labour supply increased (and vice versa).

The models in the optimal taxation literature have become more and more complex as authors have relaxed assumptions and explored particular conditions and situations. Different specifications have included the interplay between labour decisions and retirement—for example, the elasticity of labour supply to changes in the pension system, which we will touch upon in Volume III, Part II—or between investment in human capital and wages and productivity along the life cycle; see Volume III, Part I.

Lehmann et al. (2013), using data for France between 2003 and 2006, presented the interesting finding that the elasticity of labour supply (at the extensive margin) with respect to the marginal net-of-income-tax rate would be higher than that with respect to the marginal net-of-payroll (or social security contribution) tax rates (which would not be significantly different from zero) despite both taxes affect after-tax income in exactly the same amount. Furthermore, these authors also reported that for workers aged 50 or over, the elasticity was negative, whilst it was positive for younger workers, which adds empirical clout to the recommendations that marginal income tax rates should be lower for older workers.

A study looking into Swedish data for 2007 (Laun 2017) concluded that the introduction of two income tax credits—an earned income tax credit which increases for workers aged 65 or over and a reduction in social security contributions (a payroll tax credit) for workers aged 65 or above—had positive short-term effects at the extensive margin: the elasticity of labour supply to these age-related tax credits was 0.22, meaning workers aged 65 years old extended their labour market participation as a result of these tax credits, which contributed to a gain in welfare per dollar spent of about 1.15.

Other extensions have considered the effects on capital accumulation, the uncertainty around the extension of the lifespan, decisions about planned bequests, and the stochasticity of the relationship between labour productivity and chronological age.

Woodland (2016, p. 742) surveyed the literature and concluded that there seems to be an agreement that age-dependent taxes produce net welfare gains, which could 'partially relieve' the pressure that population ageing creates on government budgets.

Average and Marginal Taxes

Taxes are levied on goods or services, transactions or transfers, or on income or wealth. For example, a tax on personal income or on profits made by private corporations, on the transfers of value by an inheritance, on the supply of goods and services (and therefore on consumption), on the transfer of shares, or on the occupation of non-domestic property like shops, guest houses, factories, or offices. The amount to which a tax rate is applied and on which the tax liability is determined is known as the *tax base*.

If we divide the total amount of tax collected by its tax base, we obtain the *average tax rate* or *effective tax rate*. At the individual taxpayer level, the average income tax rate—that is, the amount she pays in income taxes divided by her income (I)—is also known as the *tax burden*. However, certain taxes (e.g. personal income tax) have graded rates, depending on the level or amount of its base. For example, in Austria, personal income tax is not levied on incomes below €11,000, whilst for incomes between €11,000 and €18,000, a 25 per cent rate is applied, and a 35 per cent rate is applicable for incomes above €18,000 but up to €31,000. The table below shows the complete tax schedule:

Average and marginal tax rates—Austria (amounts in euros)

Income brackets	Rate (%)	Tax liability
0–≤ 11,000	0	0
>11,000–≤18,000	25	[(I – 11,000)*0.25]
>18,000–≤31,000	35	[(I – 18,000)*0.35 + (18,000 – 11,000)*0.25]
>31,000–≤60,000	42	[(I – 31,000)*0.42 + (31,000 – 18,000)*0.35]
>60,000–≤90,000	48	[(I – 60,000)*0.48 + (60,000 – 31,000)*0.42]
>90,000–≤1m	50	[(1m – 60,000)*0.50 + (90,000 – 60,000)*0.48]
>1m	55	[(I –1m)*0.55 + (90,000 – 60,000)*0.50]

Source: OECD (2011)

Let's compute the tax liability for taxpayers earning exactly the maximum income level in each bracket (i.e. €11,000, €18,000, etc.). We get: €0, €1750, €6300, €18,480, €32,880, €487,880, and €1,037,880. If we divide these amounts by the total income (i.e. €0/11,000, €1750/18,000, etc.), we obtain the average tax rates for these taxpayers: 0.0%, 9.7%, 20.3%, 30.8%, 36.5%, 48.8%, and 51.9%.

We can see in Fig. 2.5 how the marginal and average tax rates differ. It is the former which are more relevant to compute deadweight loss and estimate behavioural effects.

Marginal and Infra-Marginal Amounts

Let's continue with the example of Austria and imagine that the tax rate for incomes between €11,000 and €18,000 goes up from 25 per cent to 28 per cent. Anyone in that bracket would face a marginal rate of 28 per cent, which may have implications for their decisions—in other words, this policy decision may introduce distortionary effects. In turn, anyone in any of the higher-income brackets would see their income reduced, but their decisions as to whether to

(continued)

work or not (extensive margin) or the number of hours to work (intensive margin) would not be affected: the marginal tax rates of these agents would not change; they would only face an infra-marginal rate hike. Therefore, higher tax rates should be applied to infra-marginal income and lower rates on marginal income; more revenue should be raised on taxes on infra-marginal income and less at the margins, as the former would be non-distortionary. Looking at chronological ages within income brackets, some ages or age categories may be more likely to feature in certain levels of income than in others: given a change in a tax rate for a certain level of income, some stages of the life cycle concentrate a higher proportion of marginal taxpayers, whereas other stages concentrate a higher proportion of infra-marginal taxpayers. It would be less distortionary to lower the tax rates that age groups with a higher grouping of marginal taxpayers face and to increase the tax rates of age groups with an over-representation of infra-marginal taxpayers (Kremer 2002). Kanbur and Tuomala (2016) present a simple framework to decide on the optimal number of categories (e.g. two, three, or more age brackets?) and on the optimal cut-off for the tagging categories (imagine we determined that three categories are optimal, should the brackets be, say, between ages 19–29, 30–40, and 41+ or 19–45, 46–68, 69+?) based on the population shares of each category and the within-cohort income distribution.

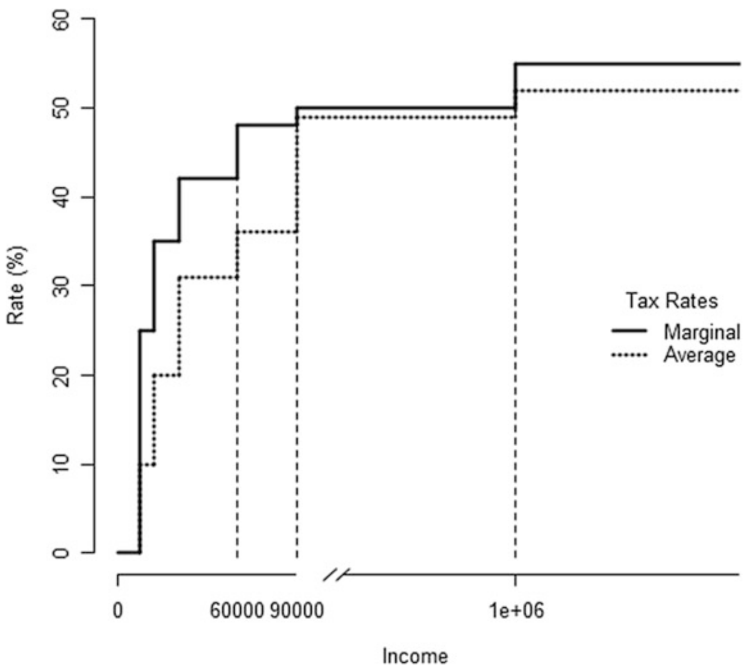

Fig. 2.5 Average and marginal income tax rates—Austria, 2016. *Source: Based on OECD (2011)*

2.2.3 Taxation in Dynastic Models

With infinitely lived agents, life-cycle considerations cease to exist.[14] However, the timing of saving decisions does matter because of the repercussions on capital accumulation, economic growth, and welfare. These distortions in inter-temporal choices lead to the conclusion that the optimal tax rate on capital or inheritance is zero (Chamley 1986; Judd 1985). Alas, it only takes the introduction of additional assumptions to, or the relaxation of, some assumptions in the most basic dynastic models to reach the conclusion that the optimal tax rate on wealth or assets is positive. Among other extensions that lead to tax rates on inheritance and capital income greater than zero, we can list: idiosyncratic labour income shocks—that is, shocks that affect individuals or their households rather than whole economic aggregates; accidental bequests; and the lack of government commitment over time (infinitely, in fact) to the fiscal policy (Piketty and Saez 2013). Furthermore, in their influential survey of direct taxation, Banks and Diamond concluded:

> The empirical evidence on the consumption patterns of parents and adult children alive at the same time is strongly contradictory of the idea that people typically behave as if there were a single dynastic utility function being jointly maximized. Moreover, taking this literally and recognizing marriage (which links dynasties to each other) leads to absurdities.
>
> (Banks and Diamond 2010, p. 575)

2.2.4 Taxation on Lifetime Income

Basing the income tax on lifetime income constitutes ‘an entirely different approach to the problem of taxation over time’ compared to age-dependent taxation (Fennell and Stark 2005, p. 36).

Bradford (1977) recommended the application of a cash-flow tax (i.e. an income tax but excluding savings) based on lifetime cash flows and their time along the individual taxpayer’s life cycle. However, Zelenak (2008) discusses the limitations of such an approach from the perspective of the ‘multiple self’ framework—see Volume I, Chap. 8.

2.3 Population Ageing and Fiscal Space

Fiscal space has been defined as

> the availability of budgetary room that allows a government to provide resources for a desired purpose without any prejudice to the sustainability of a government's financial position.
>
> (Heller 2005, p. 3)

and as

> the financing that is available to government as a result of concrete policy actions for enhancing resource mobilization, and the reforms necessary to secure the enabling governance, institutional and economic environment for these policy actions to be effective, for a specified set of development objectives.
>
> (Roy et al. 2009, p. 33)

Ostry et al. (2010, p. 17) proposed a different definition of fiscal space focused on fiscal sustainability: 'the difference between the current level of public debt and the debt limit implied by the country's historical record of fiscal adjustment'. These authors estimated, using data from 2015, that many developed countries needed to implement fiscal adjustment efforts that far exceeded their historical records.

The concept of fiscal space is not without critics: according to Perotti (2007), it is nothing new as it merely re-states the notion of the inter-temporal government budget constraint. However, other analysts see it as a useful conceptual tool to look beyond budgetary straitjackets in the sense that fiscal space can be created and expanded. For instance, Ortiz et al. (2015, p. 1) listed eight policy options available even in the poorest countries to 'make budgetary room':

- increasing tax revenues
- expanding social security coverage and contributory revenues
- lobbying for increased aid and transfers
- eliminating illicit financial flows
- borrowing or restructuring debt
- adopting a more accommodative macroeconomic framework
- reallocating public expenditures
- tapping into fiscal and foreign exchange reserves

Park (2012) looked into the impact of population ageing on fiscal space using yet another definition: '[the] distance between the current tax revenue level and the peak of Laffer curve' (p. 3).[15] Using data from 1995 to 2009 for the G-7 countries,[16] this author estimated a Laffer curve under the then existing population structure and calibrated the Laffer curve for each of these countries up to 2050 using demographic projections. The idea behind the exercise was that population ageing would shrink labour supply and hence reduce revenue capacity (i.e. the tax base) and the fiscal space, but if a country was on the 'right' side of the Laffer curve (i.e. if the average tax rate was below its maximum revenue-generating level), the pressure from the change in the demographic structure could be offset, at least in part, by the excess room for fiscal manoeuvre. The results pointed to a smaller fiscal space for Germany, France, and Italy—the three countries in the G-7 with a relatively larger share of the public sector in the economy. These countries would be 'more susceptible to aging shock' (op. cit., p. 14).

Bogetic et al. (2015) also looked into population ageing and fiscal space, but operationally defined the latter as debt per dependent person 'as a measure of fiscal space to finance the aging related commitments that are no longer feasible to be financed by the contributions from the active population' (p. 20). They defined a maximum threshold for the debt-to-GDP ratio and then estimated the policy adjustments needed to avoid exceeding that target. The authors explained that this cap showed 'the extent to which the government can implement a transfer and expenditure system if it cannot be financed by the aging work force' and elaborated:

> Typically, any age-related expenditures are financed by higher taxes or borrowing beyond a certain threshold. Because the threshold is determined by the relative size of the dependent population and the characteristics of the tax and transfer systems and of public spending, the extent to which a government can issue debt per dependent person without breaching a specified debt ceiling shows how much fiscal space it has available to accommodate the fiscal pressures of an aging society. A cap on the growth rate of debt per dependent person -a "speed rule" defined by the fiscal target- will be tighter if the dependent population grows faster than the working-age population. Similarly, an increase in the initial debt-to-GDP ratio or a tightening in the fiscal target will suggest need for a downward adjustment to the speed rule.
>
> (Bogetic et al. 2015, p. 20)

The authors analysed long-term fiscal policy options in 40 countries in Europe and Asia by means of one population ageing indicator—the old-age dependency ratio (see Volume I, Chap. 2)—and several fiscal variables as a percentage of gross domestic product, such as gross public expenditure, revenue, and debt, social contribution revenues, social benefit expenditure, and so on. From these simple bivariate relationships and the threshold defined as explained above, they concluded that the fiscal space in most of these countries is limited 'for discretionary and growth-oriented public spending' and 'to accommodate increases in aging-related spending' (Bogetic et al. 2015, p. 7).

Fiscal space is a useful concept for macroeconomic analysis, but economists should be wary of the danger that lies within: an over-mechanistic numerical approach that does not take into account that:

> …decisions on financing and spending usually respond to the specific interests of stakeholders that have sufficient power to influence them. No intervention on financing or public spending is neutral in terms of which groups in society are winners or losers. Thus, the creation of fiscal space, whatever its purpose, unfolds in a context dominated by the relationships between the power groups in society.
>
> (Durán-Valverde and Pacheco 2012, p. 1)

Or, in the words of (Estes et al. 2003, p. 19):

> …portrayals of the threatened bankruptcy of public treasuries to support the retirement of the elderly and the 'appropriate' policy response (such as the proposed privatisation of social security) are crisis constructions embedded in intense power struggles that are momentous in their social, political and economic consequences, including the sacrifices that are demanded.

The financial situation of the public sector in a country is a relevant variable to assess its fiscal space. However, its growth prospects, debt reduction and consolidation policies, the political commitment by policy-makers, the relative clout and effectiveness of the different interest groups, institutional characteristics and dynamics, and—for developing countries—the use of development assistance from abroad are of equal importance.

Finally, economists should be wary of the prevalent mode of political competition (Roemer 2009) in the jurisdiction under study or where they work and provide their advice or make decisions, because as Lynch (2006, pp. 67–68) correctly asserted '…the dominant mode of political competition is crucial for the eventual age orientation of social spending'.

2.3.1 The Global Aging Preparedness Index

The Global Aging Preparedness Index (or GAP Index), compiled by the Global Aging Initiative of the Center for Strategic and International Studies in Washington, D.C., USA, is an index that seeks to assess how countries are getting ready for 'particularly the "old-age dependency" dimension of the challenge' (Jackson et al. 2013, p. iii) posed by population ageing (the authors of the index define old age as 60 years or over). In part, it includes the notion of fiscal space, but it extends the concept as it brings together two sub-indices: a Fiscal Sustainability Index and an Income Adequacy Index.

The Fiscal Sustainability Index is composed of three 'categories':

- the Public Burden category, which measures the level of and projected (all projections for the 2013 edition were run until 2040) growth in total public benefits to older people and is composed of two indicators:
  - the Benefit Level (the projected public benefits to older people as a proportion of GDP)
  - the Benefit Growth (the projected growth in public benefits to older people as a proportion of GDP)
- the Fiscal Room category, which measures the fiscal space of a country by combining three indicators:
  - the Tax Room (projected government revenue as a percent of GDP if all growth in benefits to older people are paid by taxes)
  - the Budget Room (projected proportion of benefits as a percentage of total public spending assuming cuts in all other items finance the projected growth in benefits to older people)
  - the Borrowing Room (the projected net debt as a percent of GDP assuming all projected growth in benefits to older people is funded by borrowing)
- the Benefit Dependency category, which measures the degree of dependence of older people on public benefits and is composed of two indicators:
  - the Benefit Share (average of projected benefits to older people as a per cent of the cash income of the median-income older person)
  - the Benefit Cut (the percentage of older people that would fall into poverty—measured as earning an income below 50 per cent of the median income of the whole population—if public benefits were cut by 10 per cent)

The indicators in the first two categories of the Fiscal Sustainability Index are weighted equally, but in the Benefit Dependency category, the share indicator receives two-thirds and the cut indicator receives one-third. The Public Burden category receives a weighting factor of 40 per cent, whilst the Fiscal Room and the Benefit Dependency categories are assigned 30 per cent each.

The Income Adequacy Index is also composed of three 'categories':

- the Total Income category, which measures the ratio between the level of income of older people and younger people, and the trends, and is composed of two indicators:
  - the Income Level (the projected ratio of average after-tax total income per capita of older people to younger people)
  - the Income Trend (the projected change in the ratio of average after-tax total income per capita of older people to younger people)
- the Income Vulnerability category, which measures income adequacy for middle-income older people and the extent of poverty in old age, and is composed of three indicators:
  - the Median Income Level (the projected ratio of median after-tax cash income per capita of older people to younger people)
  - the Median Income Trend (the projected change in the ratio of median after-tax cash income per capita of older people to younger people)
  - the Poverty Level (the percentage of older people with incomes below 50 per cent of the median income for the whole population)
- the Family Support category, which measures family support networks, and is composed of two indicators:
  - the Family Ties (the percentage of older people living with adult children)
  - the Family Size (the projected change in the number of surviving children of older people)

The indicators in the first two categories of the Income Adequacy Index are weighted equally, but in the Family Support category, the Family Ties indicator receives two-thirds and the Family Size indicator receives one-third. The Total Income and the Income Vulnerability categories receive a weighting factor of 40 per cent each, whilst the Family Support category is assigned 20 per cent. Finally, the Global Preparedness Index is calculated by assigning the Fiscal Sustainability and the Income Adequacy indices the same weights.

The latest (2013) GAP index report found that fiscal sustainability would not be an important policy concern: India, Mexico, and Chile, but that countries such as Brazil, Japan, France, the Netherlands, Germany, Italy, and above all Spain would be highly vulnerable. Looking into income adequacy, Netherlands, the United States, Brazil, Australia, and Germany stand out as highly prepared; amongst the most vulnerable countries are Mexico, Russia, South Korea, and Poland.

2.4 The Fiscal Implications of Risk

Population ageing is one of the socially amplified risks (Kasperson et al. 1988, 2003) in contemporary societies, and what Taylor-Gooby (2004) identified as one of the four processes of 'social risk' in post-industrial societies. In fact, Taylor-Gooby understands that population ageing exerts the most important pressure on welfare states, which emerges as 'new social risks'. These new risks translate, from the perspectives of citizens, into changes in employment relations, family life, social care, career, and so on. From the perspective of governments, the new social risks are manifested in changes in policy-making, institutional structures, power dynamics, and legitimisation.

We saw in Volume I, Chap. 1, examples of apocalyptic demography, with concerns that population ageing would bring about a 'crisis', a 'time bomb', an 'agequake', or a 'silver tsunami' and authors warning of the seismic consequences of 'gray dawn' and the 'coming generational storm'. Some go even beyond this. For example, Richard Jackson, President of the Global Aging Institute based in Virginia, USA, suggested that global population ageing threatens to 'overturn' (Jackson 2006) or 'shape' (Howe and Jackson 2011) the world order. In the same vein, Heller (2003a,b) asserted that a number of major long-term risks and challenges beset almost every country and pose mounting threats to fiscal stability, including population ageing—which Heller[17] placed on the same level with climate change, rapid technological change, the intensification of globalisation, increasing inequality, and bio-terrorism and the proliferation of weapons of mass destruction. Such a statement may look hyperbolic, but it mirrors what Peterson (1999a,b) had previously written:

> The list of major global hazards in the next century has grown long and familiar. It includes the proliferation of nuclear, biological, and chemical weapons, other types of high-tech terrorism, deadly super viruses, extreme climate change, the financial, economic, and political aftershocks of globalization, and the violent

> ethnic explosions waiting to be detonated in today's unsteady new democracies. Yet there is a less-understood challenge -the graying of the developed world's population- that may actually do more to reshape our collective future than any of the above.
>
> (Peterson 1999b, p. 42)

Ageing (especially population ageing) portends risk, and risk is lexically close to danger and the unknown (Atkins 1995)—to be precise, semantics teaches that we should be talking of danger, endangering, and so on, rather than risk, but the latter word (or lexeme) is generically used (e.g. risk assessment, risk analysis, etc.) (Boholm 2012). In economics, risk is generally given a statistical interpretation: a measure of inaccuracy or dispersion of an estimation of a parameter—of the probability of occurrence of an event. (In Sect. 3.2, this volume, we will consider the distinction between risk and uncertainty that is based on statistical concepts.) We have mentioned so far in this textbook several types or modalities of risk: systematic and unsystematic mortality risk, longevity risk, health risk, financial risk, poverty risk, and so on. They all have a notion of chance and harm attached to them, as decision theory explains—see, for example, Raiffa (1970). However, it is interesting to note that the perils of population ageing are presented by the prophets of demographic apocalypse in deterministic terms: as certain. To illustrate with one example: 'The coming transformation is both certain and lasting; there is almost no chance that it will not happen—or that it will be reversed in our lifetime' (Jackson and Howe 2008, p. 155). The element and connotation of chance has been removed from the risk; all it remains is the harm.

Sociologists—most prominently Anthony Giddens and Ulrich Beck—have theorised that a proliferation of risks and risk discourse is a central tenet of 'late modern' societies. This theoretical approach to risk has been incorporated in the analytical armoury of social policy analysts (Kemshall 2002) and social gerontologists (Phillipson and Powell 2004; Powell 2014) but hardly at all among mainstream economists.[18] By a 'late modern' society, Giddens (1991, p. 3) means a society in which 'the concept of risk becomes fundamental to the way both lay actors and technical specialists organise the social world'—a state of social affairs that is 'apocalyptic—not because it is inevitably heading towards calamity, but because it introduces risks which previous generations had not have to face' (Giddens 1991, p. 4).

Beck defines risk as 'a systematic way of dealing with hazards and insecurities induced and introduced by modernization itself' (Beck 1992, p. 21) and opines that the process of targeted individualisation of rights and welfare entitlements is not new but that a distinguishing feature of contemporary, late-modern societies is that this targeting is explicit and that people are expected (and told so) to 'live their lives with the most diverse and contradictory transnational and personal identities and risks' (Beck and Beck-Gernsheim 2001, p. 26). Social policies increasingly shift onto individuals the responsibility for the management of risks. The counterparts of such displacement of risks on the individuals are, on the one hand, a retrenchment of governments from responsibilities that used to be part and parcel of most welfare states with its corollary of fiscal containment and a de-legitimation of particular needs, on the other. For example, Iparraguirre (2015) estimated that in 2014 in England meeting the needs of people aged 65 or over with substantial social care needs (i.e. people who could not perform three or more of the following daily activities without help: having a bath or a shower, dressing or undressing, getting in and out of bed, using the toilet, or eating, including cutting up food) who went *without* sufficient help or at all would have cost as much as the reductions in social care budgets over the previous four years. As Kemshall (2002, p. 22) contended, social policy in a risk society

> is no longer about the alleviation of the needs of the individual or the pursuit of the collective good. Instead, it is about the prevention of risk and the displacement of risk management responsibilities on to the "entrepreneurial self" who must exercise informed choice and self-care to avoid risks.

Cognitive decline, loneliness, bereavement, disease and physical impairment, income reduction or deprivation, loss of independence—these are some of the negative experiences more prevalent, worldwide, among older people than any other age group. Therefore, in a probabilistic sense, we can say that later life brings in *heightened* risks (Wynne-Harley 1991). However, besides such an objective measure of statistical risk, we need to factor in a subjective perception of risk, that is, whether (older) people consider themselves more or less exposed to risks. The evidence on risk perception suggests that older people tend to exhibit higher risk perception for some risk factors than younger people and lower for other factors (Greenberg 2012; Slovic 2016). For example, whereas Otani et al. (1992) found that the older the individuals who took part in an experiment the higher the risk they indicated in ignoring warning signs and the less willing they were to disregard those signs, Bouyer et al. (2001) reported that older people showed lower risk perception for some factors (e.g. medical care, energy production, public transport) whilst they perceived other factors such as psychotropic drugs, addictions, sexual activity to be of higher risk than younger people. When it comes to risks 'associated with' later life, older people exhibit a higher perception. Consequently, in times when living with and being responsible for avoiding or minimising risks have become the 'new normal', we must bear in mind that older people, especially if living in precarity (Phillipson 2017), face heightened vulnerability and that new vulnerabilities (Hendricks and Powell 2009) are being added in this context of reorientation of policies where the notion of social citizenship[19] is shifted 'away from freedom from want toward freedom to act' (Hemerijck 2009, p. 88).

Furthermore, the situation is worse in developing countries. Higo and Khan (2015) pointed to four risks in later life which are unequally distributed and would challenge developing countries to a larger extent than developed countries: the risk of the burden of disease in epidemiological transition, the risk of financial insecurity in retirement, the risk of not enough familial resources for elderly care, and the risk of an insufficient workforce for elderly care.

Economists, as part of the group of experts who influence policy—many of whom with prominent roles in governmental and international organisations responsible for designing, approving, and implementing policies and budgets—should engage critically and self-reflectively with this literature, surmise whether the diagnosis therein has any merit, and, if so, think upon the possibility of redefining the objectives of fiscal policy in modern societies.

Review and Reflect

1. Mason et al. (2009, p. 93) state:

   ...population aging causes a large increase in the demand for lifecycle wealth relative to GDP. Population aging interacts with the transfer systems either to generate a major increase in the proportional implicit debt and transfer burden on the working population, or to generate a large deepening of the capital stock. Third World countries are at a crucial juncture, and depending on their policy choices, population aging will have one or the other effect.

   Which economic, demographic, and institutional variables would tip the balance towards either an increase in transfers from the 'working population' or a deepening of the capital stock? And which policy choices would?
2. Atkinson (2014, p. 12) criticises the sole or overriding focus on the intergenerational impact of national debt on future generations. He points out:

   In addition to the national debt, we also pass on to our children:

   - *Pension liabilities*
   - *Public financial assets*
   - *Public infrastructure and real wealth*
   - *Private wealth*
   - *The state of environment and stocks of natural resources*

(continued)

Pension liabilities have been included in extended versions of generational accounting, national transfer accounts, and fiscal sustainability exercises. In which way and to what extend would the incorporation of the other assets and liabilities would modify some of their findings? Do you agree with Atkinson? Would you add or take out any items from his list?

3. Consider the following:

> *The commodification of welfare and the attendant economic framing of provision recasts the service user as a consumer, both entitled to and required to make choices. While such choice may in reality be heavily constrained by economic resource and social capital…rationally informed…are expected of the individual.*
>
> *(Kemshall 2002, p. 44)*

Give examples of 'commodification' of welfare. What are the main differences from a microeconomic point of view between a service user and a consumer? If choices are not to be expected of individuals, who would be responsible for choosing on their behalf? Discuss the implications of assuming agency and responsibility by different actors.

4. Continuing with the topic of choice, risk, and responsibility, discuss the following quotation:

> *Governmental programmes are mainly developed against the background of the model of a self-responsible actor, and increasingly address people with significant lack of cultural and economic resources as self-reflective and rational actors…Although this concept might be generally helpful in order to formulate political programmes they regularly fail because of this assumption.*
>
> *(Powell 2014, p. 139)*

5. McKinnon (2004, p. 311) puts forth the case for cash benefits for older people in developing countries in the following terms:

> *The prioritization of the provision of cash benefits for the elderly is not a policy choice based upon sentimentality. The significance of providing for the elderly in developing countries should be seen as being of strategic importance within social and economic development programmes. It is increasingly recognized that older people have an important role to play within extended family groups in helping to reduce the destabilizing outcomes of increasing urbanization, labour-force migration and, in southern Africa in particular, the debilitating impacts of HIV+/AIDS. This observation is not unimportant because the family has traditionally been the most important, and sometimes only, social protection mechanism available to many people in the developing world.*
> *…targeting the old not only offers the possibility of wider welfare sharing impacts for extended family groupings but also provides a policy mechanism which is supportive of the retention of traditional family*

(continued)

> *structures....Simply stated, providing older people with 'assets' in the form of cash benefits will guarantee that they have a continuing value as providers and as carers in the eyes of family and community members.*

However, McKinnon comments that the World Bank has rejected tax-financed schemes delivered on a universal basis in the world's poorest countries because they would be beyond their fiscal capacity. Articulate a defence of cash benefits for older people (a) using the notion of fiscal space and (b) framing the argument in the context and terms (though without formalisation!) of a general equilibrium model as opposed to a partial equilibrium model.

6. Rudman (2006, p. 181) identifies four ideal types associated with neo-liberal political rationality which are transforming the subjectivity of modern retirees. These types can be classified along two dimensions: consumer-based and producer-based subjectivities, on the one hand, and age-defying and prudentially minimising age-related risks subjectivities, on the other. For example, consuming leisure and body optimisation are consumer-based, age-defying subjectivities, whilst entrepreneurial work and skills training are producer-based prudential subjectivities. The author then contends:

> *...the ways in which certain subjectivities, and their associated technologies and practices of the self that are consistent with neo-liberal political rationality, are being shaped as ideal for "retirees". ...the personal "freedom" promised with the idealised life practices is ultimately illusory, because they oblige older people to resist or defy ageing through relentless projects of self-reflection and improvement, self-marketing, risk management, lifestyle maximisation and body optimisation.*

Discuss if there are economic implications stemming from the 'relentless projects of self-reflection and improvement, self-marketing, risk management, lifestyle maximisation and body optimisation'. Would these implications offset the potential benefits of shifting risks and responsibilities for self-management onto older people?

7. Banks and Diamond (2010) recommended the introduction of age-dependent taxes on the following two grounds:

> *Support for age-dependent tax rates comes from two separate arguments: differences in the distributions of circumstances across different ages and individual forward-looking calculations when making decisions. Both arguments matter, but the former may be more persuasive than the latter because of ease of measurement and the substantial diversity in individual decision-making. Because age-dependent taxes can address both of these arguments, we think it is useful for governments to contemplate introducing them in some form...*
>
> *(Banks and Diamond 2010, p. 636)*

(continued)

Can you think of any qualifications to this statement? Changes in which assumptions of the model presented in the text could make the introduction of age-dependent taxes less useful or even not advisable at all?

8. In 2014, the government in Sweden introduced age differentiation of the payroll tax deduction (Anxo 2014). Regarding minimum wage, the Organisation for Economic Co-operation and Development (OECD) recommended the introduction of a sub-minimum wage for younger workers (OECD 2011), but by 2015, it qualified this argument; thus:

    > *Targeting the minimum wage on age rather than on recent experience would create an unlevelled playing field with other workers, in particular more mature long-term unemployed for whom finding a job would become even more difficult.*
    >
    > *(OECD 2015, p. 69)*

    Is this proviso applicable to tagging taxes by age in general, or is it only relevant to setting minimum wage levels?

9. Lee and Skinner (1999) discussed alternative scenarios of fiscal impact stemming from projections of demographic change, health, and retirement decisions in the USA between 2000 and 2070. They explained that from an intergenerational perspective, whether to cut benefits to older people or raising taxes to the working-age population would depend on the causes of the fiscal pressures brought about by an ageing population.

    In each of these alternative causes mentioned by Lee and Skinner, discuss if either an increase in taxes levied on the population of working age or a reduction in benefits targeted to older people would be a better policy from an intergenerational point of view:

    - low growth in real wage rates
    - poor asset returns
    - low fertility rates but reasonable economic growth
    - higher-than-expected frailty in the older population
    - an outbreak of a disease that strikes younger and older people alike
    - higher-than-expected lifespans
    - higher-than-expected technological innovations that improve the quality and efficiency of healthcare services

10. The Mirrlees Review (Mirrlees et al. 2010, 2011) is a comprehensive study of the tax system in the UK. In his commentary on the review, US economist Martin Feldstein underlines the sentence, which he finds 'quite amazing', '…if society places some positive value on the welfare of those with income in the top tax bracket, then a lower rate -and less revenue- will be preferred' (Mirrlees et al. 2011, p. 65), and wonders:

    > *Who speaks for this society? What kind of nation places no value on the welfare of those with income in the top tax bracket, treating them only as the revenue producing property of the state? Many noneconomists would*

(continued)

find the Reviews suggestion that a society could disregard the welfare of any group of taxpayers repugnant.

(Feldstein 2012, p. 783)

Would many economists find the suggestion repugnant as well? Dwell upon Feldstein's first question 'who speaks for this society?'. Who do you think economists speak for in general?

11. Guillemar (1991, p. 173) posited:

…social policies are impossible to conduct as soon as they become only auxiliary to the economy without any particular plans for the sectors of the population they are intended for.

Discuss, in the context of targeting, means-testing, and rationing.

12. The vast majority of models of optimal taxation assume that individuals have time-consistent preferences. However, we could adopt the assumption that the utility functions of economic agents would exhibit hyperbolic discounting—Volume I, Chap. 8, and Volume IV, Chap. 9. Here's a quotation discussing some of the implications of introducing myopia:

The larger a tax liability, the more a present-self-focused taxpayer can gain by exporting tax consequences to the taxpayer's future selves and the more tempting it may be for a taxpayer to succumb to self-control problems. Also, optimism biases may have greater impact if taxpayers mispredict that they will be in a better position to deal with tax liabilities in the future. Hence, when taxpayers cannot limit the discretion of their future selves, increasing the size of a tax liability can potentially exacerbate time-inconsistency problems.

(Gamage 2013, p. 194)

What would the implications of introducing myopia and hyperbolic discounting be for age-dependent taxation?

13. Discuss the following argumentation:

The choice of the indicator for measuring the impact of demographic ageing on social spending is of key importance. If we choose a structural indicator based on demographic structure (e.g. the demographic dependence ratio and the economic dependence ratio), the effect of ageing is direct: the weight of seniors increases sharply. If we use an indicator of the burden of social spending based on the working population, again the effect is significant, since the working population is taken from the central age group whose proportion is decreasing slightly in the population as a whole and above all because social spending is directly influenced by the growing proportion of seniors. But if we use a tax burden indicator which takes account of the contribution to government revenue of all contributors, the picture is less discouraging since old people, whose proportion is increasing, also pay taxes. By providing more and more

(continued)

> *income for governments, seniors are no longer simply a burden as is the case for the two previous indicators, but contribute to solving the problem. So the viability of public solidarity must be viewed in the light of 3 key criteria: demographics, labour and finance.*
>
> *(Gauthier 2007, p. 290)*

14. 'We are seldom aware how easily and frequently our beliefs about causes and consequences are created and changed by subtle or unconscious cues …classification schemes are central to political manoeuver and persuasion', affirmed Edelman (1993, pp. 231–232). Plenty of evidence has amassed in political science that how a policy is labelled (i.e. the 'contestable metaphor' chosen by policy-makers) or framed (Entman 1993) affects the extent to which it is accepted by the public.

    With this theoretical (extremely short!) preamble, discuss the following quote:

    > *Given their greater marginal propensity to consume, the elderly may be viewed …as a vehicle to stimulate the economy through creating increased demand for consumer goods. Unfortunately, this expedient tends to be interpreted as charity, whereas subsidy to industry is defined as a valuable investment in the economy. The labelling is crucial: support for the aged should be recognised as healthy for the economy and a return on the earlier work investment by the old.*
    >
    > *(Eisdorfer 1981, pp. xvi–xvii)*

Notes

1. Economic, Affairs, and the Economic Policy Committee (2012).
2. See Pearl (2000) for a classic exposition of causality and causal models; see also Pearl (2009).
3. Johnson et al. (2009, p. 250).
4. See also Arksey (2002, Box 1).
5. An extreme form of rationing down to zero!
6. For a good introduction to the economics of taxation, see Salanié (2003).
7. The literature on development economics has studied this point at length; see, for example, Teklu et al. (1991) and Akhter (2000).
8. An 'ad valorem tax' is a tax based on, and whose payable amount varies with, the price of a good or service or the value of a transaction, such as the sales and the value-added taxes.
9. See Hyman (2011, Appendix 11) and Sandmo (1976).
10. Chetty (2009) argues that once we factor in tax evasion and tax avoidance, the income elasticity of a tax—that is, 'the sensitivity of taxable income to changes in tax rates' (Feldstein 1995, p. 551)—is not enough to calculate the

deadweight loss of income taxation: we need to estimate the weighted average of the taxable income and total earned income elasticities. In what follows, as in most of the literature, we assume away tax non-compliance.

11. Ramsey looked into *ad valorem* taxes, which are linear by definition. Denoting the price and quantity consumed of a good by p and c, respectively, an *ad valorem* tax τ levied on this good would require the consumer to spend $p.c.(1+\tau)$.
12. See Volume I, Chap. 8.
13. The seminal paper—Mirrlees (1971)—is far from simple, but the re-examination by Diamond (1998), which is the starting point of many a theoretical extension, presents a more accessible framework.
14. Lacan.
15. By the 'Laffer curve', economists refer to a relationship between tax rates and tax revenues in which revenue is a concave function of tax rates and equal to zero if the rate is set at either 0 per cent or 100 per cent. Assuming mathematical continuity, there is a maximum tax revenue at a positive rate lower than 100 per cent; outside this optimal tax rate level, there are always two tax rates at which one same amount of revenue can be collected: a higher tax rate on a smaller tax base and a lower tax rate on a bigger tax base (Laffer 2004).
16. The G-7 countries are Canada, France, Germany, Italy, Japan, the UK, and the USA.
17. The then Deputy Director of the Fiscal Affairs Department of the International Monetary Fund.
18. The famed British anthropologist Mary Douglas noted first-hand a similar epistemological phenomenon when her novel views on risk were not welcome by risk analysis academics and practitioners in the early 1980s; she elaborates: 'The explanation has to do with concerns for the purity of the risk analysis profession and the danger of moving out of the favoured paradigm of individual rational choice' (Douglas 1992).
19. Social citizenship (or the social element of citizenship) has been defined as:

> The whole range from the right to a modicum of economic welfare and security to the right to share to the full in the social heritage and to live the life of a civilised being according to the standard prevailing in the society.
>
> (Marshall 1950, p. 11)

References

Agarwal, Sumit et al. "The age of reason: Financial decisions over the life cycle and implications for regulation." *Brookings Papers on Economic Activity* 2009, no. 2 (2009): 51–117.

Akerlof, George A. "The economics of "tagging" as applied to the optimal income tax, welfare programs, and manpower planning." *The American Economic Review* 68, no. 1 (1978): 8–19.

Akhter, U. Ahmed. "Trends in consumption, nutrition and poverty." In *Out of the Shadow of Famine: Evolving Food Markets and Food Policy in Bangladesh*. Edited by R. Ahmed, S. Haggblade, and T. Chowdhury. International Food Policy Research Institute Series. International Food Policy Research Institute, 2000.

Alvarez, Yvette et al. "Optimal taxation in a life-cycle model." *Canadian Journal of Economics/Revue Canadienne d'Economique* 25, no. 1 (1992): 111–122.

Angus, Jocelyn, and Patricia Reeve. "Ageism: A threat to "aging well" in the 21st century." *Journal of Applied Gerontology* 25, no. 2 (2006): 137–152.

Anxo, Dominique. *Stimulating Job Demand: The Design of Effective Hiring Subsidies in Europe*. EEPO Review Luxembourg. Luxembourg: Employment Policy Observatory, 2014.

Arksey, Hilary. "Rationed care: Assessing the support needs of informal carers in English social services authorities." *Journal of Social Policy* 31, no. 1 (2002): 81–101.

Atkins, Beryl T.S. "The role of the example in a frame semantics dictionary". In *Essays in Semantics and Pragmatics: In Honor of Charles J Fillmore*. Edited by M. Shibatani and S.A. Thompson, 5–42. Amsterdam: John Benjamins Publishing Co., 1995.

Atkinson, Anthony B. *Public Economics in an Age of Austerity The Graz Schumpeter Lectures*. Abingdon: Routledge, 2014.

Banks, James, and Peter Diamond. "The base for direct taxation." In *Dimensions of Tax Design: The Mirrlees Review*. Edited by James A Mirrlees et al., 548–648. Oxford: Oxford University Press, 2010.

Barer, Morris L., Robert G. Evans, and Clyde Hertzman. "Avalanche or glacier? Health care and the demographic rhetoric." *Canadian Journal on Aging/La Revue Canadienne du Vieillissement* 14, no. 2 (1995): 193–224.

Bastani, Spencer Sören Blomquist, and Luca Micheletto. "The welfare gains of age-related optimal income taxation." *International Economic Review* 54, no. 4 (2013): 1219–1249.

Beck, Ulrich. *Risk Society Towards a New Modernity*. London: Sage Publications, 1992.

Beck, Ulrich and Elisabeth Beck-Gernsheim. *Individualization: Institutionalized Individualism and Its Social and Political Consequences*. Published in association with Theory Culture & Society. London: SAGE Publications, 2001.

Blundell, Richard, Antoine Bozio, and Guy Laroque. "Extensive and intensive margins of labour supply: Work and working hours in the US, the UK and France." *Fiscal Studies* 34, 1 (2013): 1–29.

Bogetic, Zeljko et al. *Fiscal Policy Issues in the Aging Societies*. MFM Discussion Paper 1. New York, NY, 2015.

Boholm, Max. "The semantic distinction between "risk" and "danger": A linguistic analysis." *Risk Analysis* 32, no. 2 (2012): 281–293.

Bouyer Muriel et al. "Personality correlates of risk perception." *Risk Analysis* 21, no. 3 (2001): 457–466.

Bradford, David F. *Blueprints for Basic Tax Reform*. Washington, DC: Department of the Treasury, 1977.

Brugiavini, Agar, and Mario Padula. "Household saving behavior and pension policies in Italy." In *Life-Cycle Savings and Public Policy: A Cross-National Study of Six Countries*, 101–148. San Diego, CA: Academic Press, 2003.

Burtless, Gary. *The Age Profile of Income and the Burden of Unfunded Transfers in Four Countries: Evidence from the Luxembourg Income Study*. Working Paper wp2004-33. Chestnut Hill, MA: Center for Retirement Research Boston College, 2005.

Bytheway, Bill. "Youthfulness and agelessness: A comment." *Ageing and Society* 20, no. 6 (2000): 781–789.

Chamley, Christophe. Optimal taxation of capital income in general equilibrium with infinite lives. *Econometrica* 54, no. 3 (1986), 607–622.

Chetty, Raj. "Is the taxable income elasticity sufficient to calculate deadweight loss? The implications of evasion and avoidance." *American Economic Journal: Economic Policy* 1, no. 2 (2009): 31–52.

Christiansen, Terkel et al. *Demographic Changes and Aggregate Health-Care Expenditure in Europe*. ENEPRI Research Report 32. Brussels: Belgium, 2006.

Coady, David, and Kenichiro Kashiwase. "Public health care spending: Past trends." In *The Economics of Public Health Care Reform in Advanced and Emerging Economies*. Edited by Benedict Clements, David Coady, and Sanjeev Gupta, v–vi. New York, NY: International Monetary Fund, 2012.

Cottarelli, Carlo. "Foreword". In *The Economics of Public Health Care Reform in Advanced and Emerging Economies*. Edited by Benedict Clements, David Coady, and Sanjeev Gupta, v–vi. New York, NY: International Monetary Fund, 2012.

d'Aspremont, Claude, and Louis Gevers. "Social welfare functionals and interpersonal comparability." In *Handbook of Social Choice and Welfare*. Edited by Kenneth J. Arrow, Amartya K. Sen, and Kotaro Suzumura. Vol. 1, Chap. 10, 459–541. Elsevier: New York, 2002.

Dabbs, Sciubba, Jennifer. "A new framework for aging and security lessons from power transition theory." In *Political Demography: How Population Changes are Reshaping International Security and National Politics*. Edited by Jack Goldstone, Monica Duffy Toft, and Eric Kaufmann, 63–79. Oxford: Oxford University Press, 2012.

Denton, Frank T., Christine H. Feaver, and Byron G. Spencer. "Prospective aging of the population and its implications for the labour force and government expenditures." *Canadian Journal on Aging/La revue canadienne du vieillissement* 5, no. 2 (1986): 75–98.

Diamond, Peter A. "Optimal income taxation: An example with a U-shaped pattern of optimal marginal tax rates." *American Economic Review* 88, no. 1 (1998): 83–95.

Dittrich, Ludwig, and Dana Stara. "The impact of aging population on the rise of the health care cost in the Czech Republic." *International Advances in Economic Research* 19, no. 1 (2013): 11–17.

Dormont, Brigitte, Michel Grignon, and Hélène Huber . "Health expenditure growth: Reassessing the threat of ageing." *Health Economics* 15, no. 9 (2006a): 947–963.

Douglas, Mary. *Risk and Blame Essays in Cultural Theory*. London: Routledge, 1992.

Durán-Valverde, Fabio, and José Francisco Pacheco. *Fiscal Space and the Extension of Social Protection: Lessons Learnt from Developing Countries. Bolivia, Botswana, Brazil, Costa Rica, Lesotho, Namibia, Thailand and South Africa*. ESS (Extension of Social Security) Paper 33. Geneva, 2012.

Economic, Directorate-General for Financial Affairs, and the Economic Policy Committee. *The 2012 Ageing Report: Economic and Budgetary Projections for the EU27 Member States (2010–2060)*. European Economy Series Report 2. Luxembourg: European Com-mission, 2012.

Edelman, Murray. "Contestable categories and public opinion." *Political Communication* 10 (1993): 231–242.

Eisdorfer, Carl. "Foreword." In: *Other Ways of Growing Old: Anthropological Perspectives*. Edited by Pamela Amoss and Steven Harrell, xiii– xxi. Dordrecht: Springer, 1981.

Entman, Robert M. "Framing: Toward clarification of a fractured paradigm." *Journal of Communication* 43, no. 4 (1993): 51–58.

Erosa, Andres, and Martin Gervais. "Optimal taxation in life-cycle economies." *Journal of Economic Theory* 105, no. 2 (2002): 338–369.

Estes, Carroll L., Simon Biggs, and Chris Phillipson. *Social Theory, Social Policy and Ageing A Critical Introduction*. Maidenhead: Open University Press, 2003.

Evans, Robert G. et al. "Apocalypse no: Population aging and the future of health care systems." *Canadian Journal on Aging/La Revue Canadienne du Vieillissement* 20, S1 (2001): 160–191.

Feldstein, Martin. "The effect of marginal tax rates on taxable income: A panel study of the 1986 Tax Reform Act." *Journal of Political Economy* 103, no. 3 (1995): 551–572.

—. "The mirrlees review." *Journal of Economic Literature* 50, no. 3 (2012): 781–790.

Fennell, Lee Anne, and Kirk J. Stark. "Taxation over time." *Tax Law Review* 59 (2005): 1–64.

Gamage, David. "On the future of tax salience scholarship: Operative mechanisms and limiting factors." *Florida State University Law Review* 41 (2013): 173–203.

Garbinti, Bertrand, Jonathan Goupille-Lebret, and Thomas Piketty. *Income Inequality in France 1900-2014: Evidence from Distributional National Accounts (DINA)*. Working Paper 2017/4. World Wealth & Income Database, 2017. http://wid.world/.

Gauthier, Hervé. "Social spending: Recent changes and conditions for its long-term viability." In *Ages, Generations and the Social Contract: The Demographic Challenges Facing the Welfare State*, 279–299. Dordrecht: Springer, 2007.

Gee, Ellen M. "Misconceptions and misapprehensions about population ageing." *International Journal of Epidemiology* 31, 4 (2002): 750–753.

Gervais, Martin. "On the optimality of age-dependent taxes and the progressive US tax system." *Journal of Economic Dynamics and Control* 36, no. 4 (2012): 682–691.

Giddens, Anthony. *Modernity and Self-identity: Self and Society in the Late Modern Age*. Cambridge: Polity Press, 1991.

Green, Judith et al. "A model of how targeted and universal welfare entitlements impact on material, psycho-social and structural determinants of health in older adults." *Social Science and Medicine* 187 (2017): 20–28.

Greenberg, Michael R. "The senior elderly environmental risks, and generation gaps." *Human Ecology Review* 19, no. 1 (2012): 37–49.

Guillemar, Anne-Marie. "The decline of the social status? Evolution of the welfdare state for the elderly in Europe: The past situation and future prospects." In *The Economics of Care of the Elderly*. Edited by Jozef Pacolet and Celeste Wilderom, 166–190. Avebury Academic Publishing Group, 1991.

Gupta, Sanjeev Benedict Clements, and David Coady. "The challenge of health care reform in advanced and emerging economies." In *The Economics of Public Health Care Reform in Advanced and Emerging Economies*. Edited by Benedict Clements, David Coady, and Sanjeev Gupta, 3–21. New York, NY: International Monetary Fund, 2012.

Hastings, Sandra J., and Steve Rogowski. "Critical social work with older people in Neo- liberal times: Challenges and critical possibilities. *Practice* 27, no. 1 (2015): 21–33.

Heller, Peter. *Understanding Fiscal Space*. IMF Policy Discussion Paper PDP/05/4. New York, NY, 2005.

Heller, Peter S. "Who will pay?" *Finance Development* 09 (2003a): 36–39.

—. *Who Will Pay? Coping with Aging Societies, Climate Change and Other Long-Term Fiscal Challenges*. New York, NY: International Monetary Fund, 2003b.

Hemel, Daniel. "Should tax rates decline with age. " *The Yale Law Journal* 120 (2010): 1885–1897.

Hemerijck, Anton. "In search of a new welfare state in Europe: An international perspective." In *The Welfare State in Post-Industrial Society A Global Perspective*. Edited by Jason Powell and Jon Hendricks, 71–98. New York, NY: Springer, 2009.

Hendricks, Jon, and Jason Powell. "The welfare state in post-industrial society: The lay of the land." In *The Welfare State in Post-industrial Society A Global Perspective*. Edited by Jason Powell and Jon Hendricks, 3–18. New York, NY: Springer, 2009.

Higo, Masa, and Hafiz Khan. "Global population aging: Unequal distribution of risks in later life between developed and developing countries." *Global Social Policy* 5, no. 2 (2015): 146–166.

Hines, James R. "Three sides of Harberger triangles." *Journal of Economic Perspectives* 13 (1999): 167–188.

—. "Excess burden of taxation." In *The New Palgrave Dictionary of Economics Vol. 3*. Edited by Steven N. Durlauf and Lawrence E. Blume. 2nd ed., 75–77. Basingstoke: Palgrave Macmillan, 2008.

Howe, Neil, and Richard Jackson. "How ready for pensioners?" *Finance Development* 48 (2011): 16–18.

Hyman, David N. *Public Finance: A Contemporary Application of Theory to Policy*. Tenth. Mason, OH: South-Western, Cengage Learning, 2011.

IMF. *Fiscal Monitor World Economic and Financial Surveys. Balancing Fiscal Policy Risks*. Technical report. New York, NY, 2012.

Iparraguirre, José. *Public Expenditure on Older People in Northern Ireland. A Report for Changing Ageing Partnership*. Monograph 43. Belfast: Economic Research Institute of Northern Ireland, 2009.

—. *How Much Would It Cost to Meet the Unmet Social Care Needs of Older People in England*? Report. London: Age UK, 2015.

Jackson, Richard. *The Challenge of Global Aging How Demography Will Reshape the World of the 21st Century*. Conference Presentation, 2006. https://oakbay.public.sd61.bc.ca/ wpcontent/uploads/sites/37/2013/6/the_challenge_of_global_agingpdf.

Jackson, Richard, and Neil Howe. *The Graying of the Great Powers. Demography and Geopolitics in the 21st Century*. Washington, DC: Center for Strategic and International Studies, 2008.

Jackson, Richard, Neil Howe, and Tobias Peter. *The Global Aging Preparedness Index*. Washington, DC: Center for Strategic & International Studies, 2013.

Johnson, Paul S., Stephen R. Shifley, and Robert Rogers. *The Ecology and Silviculture of Oaks*. Wallingford: CABI CAB International, 2009.

Judd, Kenneth L. "Redistributive taxation in a simple perfect foresight model." *Journal of Public Economics* 28, no. 1 (1985): 59–83.

Kanbur, Ravi, and Matti Tuomala. "Groupings and the gains from tagging." *Research in Economics* 70, no. 1 (2016): 53–63.

Kasperson, Roger E. et al. "The social amplification of risk: A conceptual framework." *Risk Analysis* 8, no. 2 (1988): 177–187.

Kasperson, Jeanne X. et al. "The social amplification of risk: Assessing fifteen years of research and theory." In *The Social Amplification of Risk*. edited by Nick Pidgeon, Roger E. Kasperson, and Paul Slovic, 13–46. Cambridge: Cambridge University Press, 2003.

Kemshall, Hazel. *Risk, Social Policy and Welfare*. Introducing Social Policy. Buckingham: Open University Press, 2002.

Klein, Rudolph, Patricia Day, and Sharon Redmayne. *Managing Scarcity: Priority Setting and Rationing in the National Health Service*. State of Health Series. Buckingham: Open University Press, 1996.

Kremer, Michael. *Should Taxes be Independent of Age?*.Technical report, 2002.

Laffer, Arthur. The Laffer Curve: Past, Present, and Future. *The Backgrounder* 1765 (2004).

Laun, Lisa. "The effect of age-targeted tax credits on labor force participation of older workers." *Journal of Public Economics* 152 (2017): 102–118.

Lee, Ronald, and Jonathan Skinner. "Will aging baby boomers bust the federal budget?" *Journal of Economic Perspectives* 13, no. 1 (1999): 117–140.

Lehmann, Etienne, François Marical, and Laurence Rioux. "Labor income responds differently to income-tax and payroll-tax reforms." *Journal of Public Economics* 99 (2013): 66–84.

Lundgren, Anna Sofia, and Karin Ljuslinder. "The baby-boom is over and the ageing shock awaits: Populist media imagery in news-press representations of population ageing." *International Journal of Ageing and Later Life* 6, no. 2 (2012): 39–71.

Lynch, Julia. *Age in the Welfare State The Origins of Social Spending on Pensioners, Workers, and Children*. Cambridge: Cambridge University Press, 2006.

Macnicol, John. *Neoliberalising Old Age*. Cambridge: Cambridge University Press, 2015.

Marshall, Thomas. *Citizenship and Social Class, and Other Essays*. Cambridge: Cambridge University Press, 1950.

Marshall, Alfred. *Principles of Economics*. Palgrave Classics in Economics. Basingstoke: Palgrave Macmillan, 2013.

Mason, Andrew et al. "Population aging and intergenerational transfers: Introducing age into national accounts." In *Developments in the Economics of Ageing*. edited by David A. Wise, 89–122. Chicago, IL: The University of Chicago Press, 2009.

McDaniel, Susan. "Demographic aging as a guiding paradigm in Canada's welfare state." In *Canadian Public Policy/Analyse de Politiques* XIII.3 (1987): 330–336.

McKinnon, Roddy. "Social risk management and the World Bank: Resetting the 'standards' for social security?" *Journal of Risk Research* 7, no. 3 (2004): 297–314.

Milton, Sarah et al. "Understanding welfare conditionality in the context of a generational habitus: A qualitative study of older citizens in England." *Journal of Aging Studies* 34 (2015): 113–122.

Mirrlees, James A. "An exploration in the theory of optimum income taxation." *The Review of Economic Studies* 38, no. 2 (1971): 175–208.

Mirrlees, James A. et al., eds. *Dimensions of Tax Design: The Mirrlees Review*. Oxford: Oxford University Press, 2010.

Mirrlees, James A. et al. *Tax by Design*. Oxford: Oxford University Press, 2011.

Northcott, Herbert. Public perceptions of the population aging crisis. *Canadian Public Policy/Analyse de Politiques* XX, no. 1 (1994): 66–77.

OECD. *Economic Policy Reforms 2011. Going for Growth*. Paris: Organisation for Economic Co-operation and Development, 2011.

—. *Economic Policy Reforms 2015. Going for Growth*. Paris: Organisation for Economic Co-operation and Development, 2015.

Ortiz, Isabel, Matthew Cummins, and Kalaivani Karunanethy. *Fiscal Space for Social Protection. Options to Expand Social Investments in 187 Countries*. ESS (Extension of Social Security) Paper 48. Geneva, 2015.

Ostry, Jonathan et al. *Fiscal Space*. IMF Staff Position Note SPN/10/11. New York, NY, 2010.

Otani, Hajime et al. "Age differences in perception of risk." *Perceptual and Motor Skills* 74, no. 2 (1992): 587–594.

Park, Seok Gil. *Quantifying Impact of Aging Population on Fiscal Space*. IMF Working Paper WP/12/164. New York, NY, 2012.

Pearl, Judea. *Causality: Models, Reasoning and Inference*. Cambridge: Cambridge University Press, 2000.

—. "Causal inference in statistics: An overview." *Statistics Surveys* 3 (2009): 96–146.

Perotti, Roberto. *Fiscal Policy in Developing Countries: A Framework and Some Questions*. Policy Research Working Paper 4365. New York, NY, 2007.

Peterman, William B. "Reconciling micro and macro estimates of the Frisch labor supply elasticity." *Economic Inquiry* 54, no. 1 (2016): 100–120.

Peterson, Peter G. *Gray Dawn: How the Coming Age Wave Will Transform America-and the World*. New York: Times Books, 1999a.

Peterson, Peter G. "Gray dawn: The global aging crisis." *Foreign Affairs* 78 (1999b): 42–55.

Phillipson, Chris. "Precarity in late life: Understanding new forms of risk and insecurity." *Journal of Aging Studies* 43 (2017): 9–14.

Phillipson, Chris, and Jason L. Powell. "Risk, social welfare and old age." In *Old Age and Agency*. edited by Emmanuelle Tulle, 17–26. New York, NY: Nova Science, 2004.

Piketty, Thomas, and Emmanuel Saez. "A theory of optimal inheritance taxation." *Econometrica* 81, no. 5 (2013): 1851–1886.

Powell, Jason. "Ageing, risk and the EU." *International Letters of Social and Humanistic Sciences* 16, no. 2 (2014): 132–143.

Raiffa, Howard. *Decision Analysis. Introductory Lectures on Choices Under Uncertainty*. Reading, MA: Addison Wesley, 1970.

Ramsey, Frank Plumpton. "A contribution to the theory of taxation." *The Economic Journal* 37, no. 145 (1927): 47–61.

Reddin, M. *Universality and Selectivity: Strategies in Social Policy*. Report 36. Dublin: Republic of Ireland, 1978.

Reece, Jason et al. *Targeted Universalism and the Jobs Bill. Helping Communities in Crisis Through Targeted Investments*. Report. Columbus, OH, 2010.

Reinhardt, Uwe E. "Does the aging of the population really drive the demand for health care?" *Health Affairs* 22, no. 6 (2003): 27–39.

Richardson, Jeff, and Iain Robertson. *Ageing and the Cost of Health Services* Canberra, 1999.

Roemer, John E. *Political Competition: Theory and Applications*. Cambridge, MA: Harvard University Press, 2009.
Roy, Rathin, Antoine Heuty, and Emmanuel Letouzé. "Fiscal space for what? Towards a human development approach." In *Fiscal Space: Policy Options for Financing Human Development*. Edited by Rathin Roy and Antoine Heuty. Abingdon: Routledge, 2009.
Rudman, Debbie Laliberte. "Shaping the active, autonomous and responsible modern retiree: An analysis of discursive technologies and their links with neo-liberal political rationality." *Ageing Society* 26, no. 2 (2006): 181–201.
Saez, Emmanuel, and Stefanie Stantcheva. "Generalized social marginal welfare weights for optimal tax theory." *The American Economic Review* 106, no. 1 (2016): 24–45.
Salanié, Barnard. *The Economics of Taxation*. Cambridge, MA: The MIT Press, 2003.
Sandmo, Agnar. "Optimal taxation an introduction to the literature." *Journal of Public Economics* 6 (1976): 37–54.
Sen, Amartya K. *Social Choice Theory*. Edited by Kenneth J. Arrow and Michael D Intrilligator, vol. 3, 1073–1181. New York: Elsevier, 1986. Chapter 22.
Shaw, Frank. "Is the ageing population the problem it is made out to be?" *Foresight* 4, no. 3 (2002): 4–11.
Slovic, Paul. *The Perception of Risk*. Earthscan Risk in Society. Abingdon: Taylor & Francis, 2016.
Soto, Mauricio, Baoping Shang, and David Coady. "New projections of public health spending, 2010-50." In *The Economics of Public Health Care Reform in Advanced and Emerging Economies*. Edited by Benedict Clements, David Coady, and Sanjeev Gupta, v–vi. New York, NY: International Monetary Fund, 2012.
Spicker, Paul. "Targeting, residual welfare and related concepts: Modes of operation in public policy." *Public Administration* 83, no. 2 (2005): 345–365.
Stiglitz, Joseph E. "In praise of frank Ramsey's contribution to the theory of taxation." *The Economic Journal* 125, no. 583 (2015): 235–268.
Taylor-Gooby, Peter. "New risks and social change." In: *New Risks, New Welfare: The Transformation of the European Welfare State*. Edited by Taylor-Gooby Peter. Oxford: Oxford University Press, 2004.
—. *Drought and Famine Relationships in Sudan: Policy Implications*. Edited by Tesfaye Teklu, Joachim von Braun, and Elsayed Zaki. International Food Policy Research Institute. International Food Policy Research Institute, 1991.
Walker, Alan. "The new ageism." *The Political Quarterly* 83, no. 4 (2012): 812–819.
Weinzierl, Matthew. "Technical appendix: The surprising power of age-dependent taxes." *The Review of Economic Studies* 78, no. 4 (2011a). https://academicoupcom/restud/article/78/4/149/1591716/TheSurprisingPowerofAgeDependentTaxes#supplementary-data.
—. "The surprising power of age-dependent taxes." *The Review of Economic Studies* 78, no. 4 (2011b): 1490–1518.

Whalen, Charles, and Felix Reichling. "Estimates of the Frisch elasticity of labor supply: A review." *Eastern Economic Journal* 43, no. 1 (2017): 37–42.

Woodland, A. "Taxation, pensions, and demographic change." In *Handbook of the Economics of Population Aging*. Edited by J. Piggott and A. Woodland. Handbooks in Economics, 714–780. Amsterdam: Elsevier, 2016. Chapter 12.

Wynne-Harley, Deidre. *Living Dangerously: Risk-Taking Safety and Older People*. CPA Report 16. London, 1991.

Zelenak, Lawrence. "Tax policy and personal identity over time." *Tax Law Review* 62 (2008): 333–375.

Part II

Health Economics

3

Health of the Individual and the Society

3.1 Introduction

The 'nature vs nurture' debate—that is, whether certain positive and negative traits are inherited (and inheritable) or result from upbringing and social determinants—is long-running. The Oxford English Dictionary identifies William Shakespeare as the earliest source in written English, dating from 1611.[1] This debate is held at many levels, including health. For example, let's take schizophrenia. Around 7 people per 1000 total population are affected in the USA (mostly under the chronological age of 40), and its related costs have been estimated to be US$62.7 billion.[2] Is schizophrenia the result of increasing income inequality, which would negatively affect social cohesion and social capital placing individuals under chronic stress as Burns et al. (2014) suggest? Is it enforced by capitalism, as Deleuze and Guattari (2004) argued? Or is it caused by a genetic variant such as the intronic single nucleotide polymorphism (SNP) rs2312147 near the VRK2 gene (Chang et al. 2016)? This section looks into the 'nurture' side of the health inequalities debate—that is, the socio-economic determinants of health.

The World Health Organization (WHO) defined health as 'a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity' (World Health Organization 1948). This definition has been endorsed and criticised almost in equal measure, which should not concern us here. What is closer to our interests is that the health of an individual affects their economic decisions in many ways—from whether to retire or not and when, the level of disposable income, their saving decisions, and so on. Economics also affects health. Some consumer decisions (e.g.

J. L. Iparraguirre, *Economics and Ageing*,
https://doi.org/10.1007/978-3-319-93357-3_3

joining a gym or curbing down the ingest of saturated fats, etc.) are, to some extent, driven by a need to prevent health deterioration. Economic conditions are germane to mortality levels and trends (Cutler et al. 2016). At a macro level, health spending represents a sizeable proportion of the economy of a country: in 2014, it constituted about 17 per cent of the US GDP, for example.[3] Besides, as an industry, the healthcare and social assistance sectors make up a sizeable portion of productive activities—to continue with the USA, around 7.4 per cent of its economy.[4]

Of course, ageing and health are also connected, hence the importance of looking into the confluence of health, economics, and ageing. Heads and representatives of states and governments who assembled at the United Nations from 19 to 20 September 2011 had this relationship in mind when they acknowledged (in a rather apocalyptic overtone) 'that the global burden and threat of non-communicable diseases constitutes one of the major challenges for development in the twenty-first century, which undermines social and economic development throughout the world, and threatens the achievement of internationally agreed development goals' (United Nations 2011, p. 1). Given this close interplay between economics and health, economists developed a branch of economics—health economics—which has evolved as either the economics of health in itself or of healthcare systems. Unfortunately, these two strands have developed, by and large, independently of each other (Cardozo 2008). One reason for the lack of integration is that they apply different paradigms (Grossman 2000). In reviewing the paradigms and research programmes in health economics, Edwards (2001) noted an excessive emphasis on the economics of healthcare in detriment to the economics of health[5] and advocated for a deeper focus on health and its determinants, rather than on one of its intermediate inputs, healthcare.[6] Attempts have been made at bridging 'economics of health' and 'economics of healthcare'. Conrad and Sullivan (2005) stated that health economics 'addresses the allocation of resources directed to health improvement and the organization, delivery, and financing of health services'. The first part of this statement—that is, the allocation of resources directed to health improvement—corresponds to the study of the demand and supply and determinants of health, whilst the latter part, that is, the organisation, delivery, and financing of health services, deals with the study of healthcare, including the provision of medical and hospital services and pharmaceuticals (Cardozo 2008; Zweifel et al. 2009).

According to Fuchs (1998, p. xvii), 'health is the outcome of a process that involves patients and health professional working together'. Lifestyle choices are part of this process: diet, smoking, and exercise influence the health status of an individual. Moreover, an individual's health also depends on public goods such as the provision of safe drinking water, the implementation of food safety regulations, and the reduction in air pollution levels, and therefore an economic approach to health would incorporate these public health goods. This approach is mirrored by the systemic conceptualisation of the health sector as a combination of 'preventative services, primary care, community services, local clinics, long-term care, secondary and tertiary hospital services, and palliative care' (Smith and Yip 2016, p. 25).

The relationship between health and healthcare can be understood if we consider their demand. In economics, a *derived demand* is a demand for inputs needed for the supply of a good which is needed.[7] The demand for healthcare services is derived from the demand for health.[8] Because people value their health, they demand healthcare services—that is, those inputs that make them healthy and/or prevent them from being unhealthy. However, this demand would not cover all health-related consumer behaviour, as the demand for anything from indoor exercise bicycles to housing in greener or cleaner areas could be deemed to have a health component or driver and therefore could be construed as instances of demand for health.

Williams (1987) presented a scheme to describe the main topics in health economics with demand and supply for health*care* at its core, but which incorporated considerations about the value of health, the external influences of health (such as occupational hazards, income levels, or consumption patterns), cost-effectiveness and cost-benefit aspects, and macro-level elements (e.g. budgeting and regulation). Edwards expanded Williams's scheme by adding and placing at the centre the 'health of the individual'[9] and 'health of society'. (In a similar vein, Zweifel et al. (2009) talked of a microeconomic and a macroeconomic view of health.) Edwards's distinction seeks to reflect that it is 'health' rather than 'healthcare' that is the relevant public good or social want (Edwards 2001, p. 45) and mirrors the dichotomy between individual ageing and population ageing. Focusing on the interaction between economics and individual health on the one hand, and the interaction between economics and population health on the other, is more informative for the study of health issues related to economics and ageing and more integrative of the two main strands along which the academic literature on health economics has developed. As always in economics, the micro and macro (and meso) dimensions of analysis are inter-related: for example, individual decisions may affect the amount spent by the government in a publicly funded health system, whereas the introduction of or changes in a publicly funded health insurance system may affect an individual's health-related behaviour.

This Part, of course, cannot survey the whole field of health economics.[10] Notwithstanding, ageing is so prominent in contemporary academic and political discussion on health economic issues[11] that deciding what to leave out has been more difficult than in other Parts of this textbook. Moreover, life course approaches to health, economics, and ageing underline the crucial implications for the health of individuals in later life of interventions and decisions made at younger chronological ages: for example, even a reduction in infant mortality is directly related to population ageing given that, mathematically, it increases the modal length of life in a population (Kannisto 2001), and also because, according to the demographic transition theory, it initiates the second stage of a transition that brings about population ageing—see Volume I, Chap. 2. In other words, a strong case could be presented for not leaving any aspect of health economics out of this part. I adopted a pragmatic approach (you may be pleased to know) and concentrated the exposition on the main models and issues concerning health and economics in which ageing is salient.

3.2 Health of the Individual

3.2.1 The Demand for Health

Michael Grossman's Model of Health as Human Capital We start this section with an influential model of an individual's demand for health introduced by Grossman (1972). Grossman proposed that health is a durable good, part of human capital, like education. Remember the WHO's definition of health as a state of physical, mental, and social well-being? Grossman's approach is different: in his model, health is not a state but a durable capital good (Santerre and Neun 2010, p. 38). Health capital 'consists of currency in terms of fitness, strength, immune status, inherited characteristics, resistance to physical damage, protection against vulnerability, psychological strength and stability, and all the other components of health' (Blaxter 2010, pp. 25–26). This notion of health as durable capital is related to the concept of 'reserve of health'—that is, the endowment which individuals can draw upon to react or resist illness or injury (Herzlich 1969). Under this conceptualisation, healthy individuals are not *in* good health but *have* good health.[12]

Considered as a capital good, health is a stock; changes in a stock variable are known as flows, so a health flow is a deterioration or amelioration of health over time. As any other form of capital, its stock can be augmented by investments. Health capital can be increased by investments such as healthcare services and health-promoting behaviours. Also as any other form of capital, health is subject to depletion by use (well, by living!) as well as to depreciation through health-damaging circumstances, events, and behaviours including smoking, drug abuse, and unhealthy eating, stress, childbearing, epidemics, economic depressions, accidents, and the passing of time (Blaxter 2010). Muurinen and Le Grand (1985, p. 1029) summed this up in the following equation:

$$\text{Change in stock of health capital over time} = \text{Effects of health-promoting activities} - \text{Use of health stock}$$

A capital good has a precise definition in economics: it is a commodity used to produce goods and services. If Grossman defined health as a capital good, it was because he thought that health could produce something. What? 'Healthy time', he posited. Please, don't snigger. Consider a self-employed tradesperson, an independent shopkeeper with no employees, an informal worker, or a poor farmer and their small plot of land. If they become unwell or get injured, they will certainly lose one or more days from work during which they will not be able to generate an income. Healthy time is the complement of this working time lost due to illness or injury—the more time spent in good health, the less working time lost. In fact, according to Grossman, the difference between health and other forms of human capital like education is that whereas investments in education increase productivity or income, investments in the health stock increase the time a person can spend in income-generating activities (or, as Mushkin (1962, p. 132) explained, health investments increase the working force as well as its quality whilst education chiefly influences the latter). We can see here that the main focus of the model is economically active individuals (i.e. those either in paid employment or looking for a job—see Volume III, Part I.

The model contends that individuals, as much as any other investor, will invest the optimal amount in which the marginal or additional gains from adding to the capital stock and the marginal or additional costs of such investment are equal. More briefly, people invest in their health up to the point in which the marginal utility of such investment equals its marginal cost. In the context of Grossman's demand for health model, there are two sources of utility: gains measured by the income from work as a result of being healthy and the utility that being healthy (not being sick) generates directly, or as Cropper (1977, p. 1274) describes:

> Since individuals are not fully able to enjoy life when they are ill, illness is assumed temporarily to interrupt the individual's utility stream; that is, if the

> state "ill" occurs the individual receives the same utility he would receive if he consumed nothing. Thus psychically, if not literally, illness is equivalent to zero consumption.

The marginal cost of investing in health depends on two things: (a) the consumption goods that the individual has to forego as a result of spending in healthcare or healthy behaviours and (b) the effectiveness of the investment in improving the health stock. So individuals would invest in their health up to the point in which the marginal gains of health investments from both sources equal the marginal costs of remaining healthy or recuperating. If we only consider the indirect health effects via increased income, we use a 'pure investment' model of the demand for health. If we only focus on the direct effects on utility of not being sick, we have the 'pure consumption' model. The full model incorporates both elements: an investment component and a consumption component.

We need to delve into some maths to better understand this model, its implications, and limitations. Some versions treat time as a discrete variable and others as a continuous variable. The treatment of time as either discrete or continuous has some mathematical implications, particularly regarding the optimisation process. Here a basic version of Grossman's model with time as a continuous variable is described. We will mostly follow a simplified version of the presentations in Laporte and Ferguson (2007) and Laporte (2015).

We start with the variable time. As we are going to treat time as a continuous variable, we need to resort to 'integrals' (see box).

In this model, the lifetime of an individual spans between year 0, when she is born or when she starts in paid employment (depending on the variant of the model specification, but it is secondary to our purposes here), and year T, when she dies—for the moment, we don't know whether T is fixed or not (we indicated above that in the model individuals are assumed to choose the length of their lives, but we keep how T is set open for the moment). Each individual spends each period of their lives in an income-generating activity (T^w), in leisure activities including consumption (T^c), in ill health or sick (T^s), or in health-promoting or illness-preventing activities (T^h). So, the total time available in each period t—which we call Ω—is spent in any of these uses or states:

$$\Omega = T_t^w + T_t^c + T_t^s + T_t^h \tag{3.1}$$

The model also assumes that each individual has a certain level of health capital stock, H_t. This health stock produces a given level of health, which translates into 'healthy time' according to this formula:

$$h_t = \phi . H_t \tag{3.2}$$

As mentioned, Grossman presented two models, which can be combined into one or kept separate—the pure investment and the pure consumption models. In Eq. (3.2), the coefficient ϕ denotes the efficiency at which the health stock yields healthy time and therefore utility, either directly (pure consumption model) or indirectly (pure investment model). The efficiency of the health stock in producing healthy time depends, for example, on advances in medical knowledge and technology so that for a same level of investment in health, the higher the health outcomes are, the better the advances in medicine and healthcare (Cutler and McClellan 2001). We need to introduce two additional assumptions: (a) ϕ is greater than zero, so that investment in health yields healthy time, and (b) Eq. (3.2) is continuous and twice differentiable,[13] with a negative second derivative—that is, we assume that the generation of healthy time from investments in health diminishes with increasing health stock:

$$\frac{dh_t}{dH_t} > 0; \frac{\partial^2 h_t}{\partial H_t^2} < 0 \tag{3.3}$$

Some versions of the model assume that ϕ varies over time—that is, ϕ_t; in Eq. (3.2), we assume that it is constant. Whichever the assumption regarding the evolution of the efficiency parameter, the model assumes that the amount of healthy time decreases with increasing levels of health stock: if you are very healthy already, there is only very little improvement you can make to your health. As mentioned, like any other capital good, health capital is subject to depreciation. Also like any other capital good, its accumulation dynamics could, in principle, be described by the following equation:

$$\frac{dH}{dt} = \dot{H} = I_t - \delta . H_t , \tag{3.4}$$

where I_t stands for any investment in health an individual makes in a given period—from statins to vitamin supplements, an angioplasty, or anaerobic exercises. Goods and services that negatively affect health (cigarettes, illegal drugs, etc.) are also encompassed in I_t as 'negative health investments'. In what follows we can either assume away these damaging products or define I_t as health investment net of these adverse consumption goods and services. The d in $\frac{dH}{dt}$ stands for change, and the dot above a variable is a simplified way of denoting its change—that is, its first derivative—over time; $\delta > 0$ represents the depreciation rate. In macroeconomics and industrial studies, replacement investment—that is, investment spending to replace a stock of capital that depreciates over time—is usually assumed, as a first approximation, to be proportional to the capital stock and is seen as a recurrent event over time (Jorgenson 1963). However, such assumption and therefore the equation above would introduce an unpleasant difficulty in the context of health: given a constant depreciation rate, Eq. (3.4) implies that the higher the investment for replacement is, the higher the amount of stock. This makes sense for most capital goods: replacing, say, train coaches or some of their parts due to depreciation in a fleet of 100 coaches requires less investment than in a fleet of 10,000 coaches. However, if we applied this equation to health capital, we would reach the conclusion that the higher the health depreciation would be—and consequently more investment in health would be required or, in other words, more healthcare resources would be demanded—the higher the stock of health (note that the second term, where the stock of health H_t appears, is preceded by a minus sign and given that δ is positive, a higher stock of health requires a higher level of investment to prevent from any reductions in the health stock). Therefore, Eq. (3.4) posits that the healthier a person (e.g. the younger they are), the more they will invest in their health, which makes less sense than in the case of train coaches and is at variance with the empirical evidence. To avoid this potential pitfall, Grossman assumed that the rate of depreciation of an individual's health stock depends on their chronological age:

$$\begin{gathered} \frac{dH}{dt} = \dot{H} = I_t - \delta_t . H_t \\ \text{with} \quad \dot{\delta} > 0 \end{gathered} \tag{3.5}$$

Under this revised specification, we obtain that the older the person, the more their health stock depreciates with the passing of time, whence it follows that an individual would invest increasingly more in their health (i.e. demand more healthcare services) with advancing chronological age. Though Eq. (3.5) overcomes the previous objection, it poses another problem, particularly in relation to ageing: it assumes that chronological age determines the rate of health stock depreciation and hence the investment in health (Dalgaard and

Strulik 2014). As we shall discuss below, some authors contend that proximity to death, health status, or frailty is more relevant to the demand for healthcare services than chronological age. Furthermore, as you may recall from Volume I, Chap. 1, there is plenty of evidence that suggests that chronological age is not an adequate proxy for physiological processes of ageing. For the moment we continue with the specification in Eq. (3.4), so we keep the depreciation rate of health capital stock, δ, as constant over an individual's lifetime. Following Case and Deaton (2005), we can re-write Eq. (3.5) (with δ constant over time, remember) thus:

$$\frac{dH/dt}{H_t} = \frac{I_t}{H_t} - \delta \tag{3.6}$$

This re-specification distinguishes between the rate at which the stock of health varies $\frac{dH/dt}{H(t)}$ and the rate at which it deteriorates, δ. Investment in health can offset any depreciation in the health stock over time. In other words, the equation suggests that individuals could live forever, should they wish, by investing more in their health—that is, by demanding more health services (including medication, etc.) or spending more time visiting a doctor or the emergency department at their local hospital, and so on. To rule this possibility out, Grossman assumed that there is a minimum level of health capital—exogenously defined below—which further investments in health do not increase its stock, life ceases to be feasible, and the individual dies. This assumption circumvents the case of infinite lifetimes but introduces yet another conundrum: that individuals somehow choose when to die or, to put it differently, that they choose for how long to live and therefore the length of their lives. You may think this is a model's limitation, but Grossman thought it was 'one of the novel features of the model' (Grossman 2000, p. 350).

The complete model assumes that health is directly and indirectly associated with utility; the other goods and services consumed by an individual affect utility directly. Let's call C_t all the other consumption goods and services consumed in a given period. We can then represent an individual's lifetime utility (LU) function by this integral:

$$LU = \int_0^T e^{-\rho.t}.U[C_t, \phi.H_t].dt \tag{3.7}$$

The integral in Eq. (3.7) implies that we assume that each individual's lifetime utility function is separable and additive over time—an assumption we encountered in Volume I, Chap. 8. The equation includes the term $e^{-\rho.t}$. Here ρ corresponds to the subjective discount rate or rate of time preference—see Volume I, Chap. 8—which we assume to be positive: $\rho \geq 0$. The assumption is that the contribution to utility of a given level of consumption of healthcare or any other goods and services diminishes the more distant in time the consumption takes place. (There is another assumption that ρ is a constant, which implies that the individual applies only one fixed rate of discount over their lifetime.)

We introduce two additional assumptions:

- More healthy time contributes positively to utility. Analytically, the first derivative of utility with respect to H is positive,[14] that is, greater than zero or, *in extremis*, equal to zero: $\frac{\partial Ut}{\partial Ht} \geqslant 0$ and similarly for higher levels of consumption of all the other goods and services: $\frac{\partial Ut}{\partial Ct} \geqslant 0$.
- Utility is subject to diminishing returns on both consumption goods and health, so, even though more units demanded of C or H increases U, utility augments less and less with each additional unit of consumption goods and services or each additional improvement in health. Mathematically, this is denoted with a second derivative lower than or at most equal to zero: $\frac{\partial^2 Ut}{\partial Ht^2} \leqslant 0$.

Note in Eq. (3.4) that if the individual does not investment in their health in a given period $I_t = 0$, the stock of health capital declines as defined at a rate defined by the depreciation rate, δ. In turn, I_t depends on the prices and amounts of the different healthcare products and health-promoting/health-preventing activities demanded—denoted as p_t^h and q_t^h, respectively—as well as on the time devoted to these activities, T_t^h. Of course, investment in health is negatively related to prices of healthcare and positively related to the quantity of products or activities and the time dedicated to healthcare. It is also usually assumed to depend on educational levels, E_t, which has been very widely defined to include information and intelligence.[15] Thus, we can define I_t:

$$I_t = f(p_t^h.q_t^h, T_t^h; E_t) \tag{3.8}$$

The flow of consumption goods and services, C_t, is assumed to be a function of the prices of these goods and services, p_t^c, and the time available for consumption, T^c: $C_t = C(p_t^c; T^c)$. We assume that the prices of the consumption goods and services do not change over time and are equal to 1 (i.e. $p_t^c = 1$). We also assume that the individual spends all her income in either consumption or healthcare goods and services.[16] So, we get:

$$w_t.T_t^w = p_t^h.q_t^h + q_t^c \tag{3.9}$$

The equation of motion that shows how health capital evolves over time—that is, Eq. (3.4)—is a restriction subject to which the individual seeks to maximise their lifetime utility.

The individual seeks to maximise her lifetime utility—Eq. (3.7)—subject to Eq. (3.6), along with the other assumptions regarding the rest of the first and second derivatives.

The model requires an initial condition for income, which we assume is fixed: $w\_0.T\_0^w = Y\_0$. This initial condition can be also understood as an exogenous level of income.

We form the following Hamiltonian:

$$\mathcal{H} = U[Y_0 + w_t.T_t^w - p_t^h.I_t, \phi.H_t] + \varphi_H[I_t - \delta.H_t] \tag{3.10}$$

where φ_H is the 'costate' or auxiliary variable, which represents the shadow price of health.

The necessary conditions are:

$$\begin{aligned} \frac{\partial \mathcal{H}}{\partial I_t} &= -p_t^h \frac{\partial \mathcal{U}}{\partial C_t}.(Y_0 + w_t.T_t^w - p_t^h.I_t, \phi.H_t) + \varphi_H = 0; \\ \frac{\partial \varphi_H}{\partial t} &= \dot{\varphi_H} = \rho.\varphi_H - \left[\frac{\partial U_t}{\partial C_t}.\frac{\partial Y_t}{\partial H_t} - \rho.\varphi_H\right] = 0 \end{aligned} \tag{3.11}$$

The most important trajectory to analyse is that of the investment in health—that is, the demand for healthcare over time—with respect to the stock of health in each period. So, we need to obtain an expression for how the investment changes with respect to the stock, as well as the rate of change of investment in health over time. The key values correspond to those for which both the investment and the stock do not change over time—that is, for which $\frac{\mathrm{d}I\_t}{\mathrm{d}t} = 0$ and $\frac{\mathrm{d}H\_t}{\mathrm{d}t} = 0$. The analytical details are too cumbersome to present here, but the solution can be shown in a phase diagram. A phase diagram is a plot of the derivative of a variable over time against the levels of the same variable over time—for example, a plot of $\frac{\mathrm{d}y\_t}{\mathrm{d}t}$ against y_t (Chiang 1984). The following phase diagram graphically depicts the solution to this simple version of the Grossman's model (Fig. 3.1).

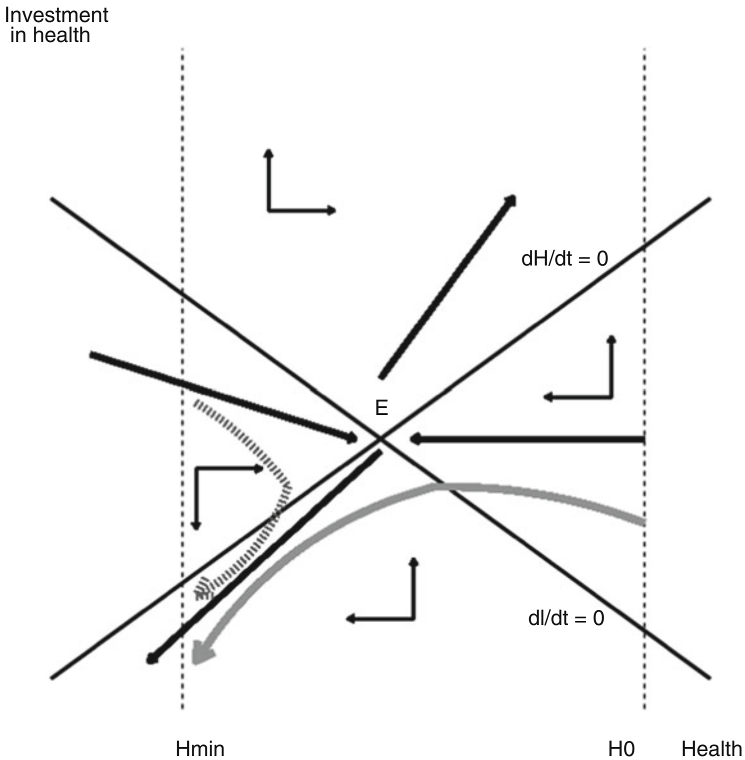

Fig. 3.1 Optimal path of health investments and stock. *Source: Figure is illustrative, prepared with mock data*

The phase diagram shows that there are two regions that converge to an equilibrium point (E) and two regions that diverge away from equilibrium. However, we can also see that the equilibrium point is not achieved, for life inexorably ends in death, that is, beyond the minimum health stock (H_{min}). The diagram tells two stories, one starting with good levels of health stock—(H_0)—and the other one with initial low levels of health stock. If we start from a good level of health and an investment in health between the $\frac{dI_t}{dt} = 0$ and $\frac{dH_t}{dt} = 0$ lines, with the passing of time, health starts deteriorating but the individual makes increasing investments. After a while, these investments cannot keep pace with the deterioration of health, and the stock depletes all the way to its minimum (H_{min}); below this point, the individual dies.

This model has been widely used and many refinements have been attempted. I am not going to review them all, but only mention one extension and modification: the introduction of uncertainty. A preliminary word is due about the distinction in economics between uncertainty and risk. When in Volume I, Chap. 8, we considered stochastic elements in the life-cycle framework such as the length of our own lives, we introduced 'uncertainty' in the models. We used that term because that is how randomness is almost always presented in a LC context. However, and more generally, some economists, following Knight (1921), distinguish between risk and uncertainty. Risk is present when the objective probability that an event may occur is measurable; if the likelihood of occurrence of an event is incalculable, we face uncertainty, not risk. The distinction has to do, then, with the possibility of knowing or not the probability distribution of an outcome in a group of instances. It does not depend, for example, on how slim a chance of occurrence may be: if the probability can be known, we talk of risk; otherwise, we talk of uncertainty.[17]

In general, taking risks can be either positive (e.g. think of an investor or the thrill experienced by extreme sports enthusiasts) or negative. Titterton (2004, p. 25) explains that '[r]isk taking is a course of purposeful action based on informed decisions concerning the possibility of positive and negative outcomes of types and levels of risk appropriate in certain situations'. However, in health studies, it is almost exclusively associated with the notion of *risk factor*—that is, 'a pattern of behavior or physical characteristic of a group of individuals that increases the probability of the future occurrence of one or more diseases in that group relative to comparable groups without or with different levels of the behavior or characteristic' (Rothstein 2003, p. 2)—and hence it is ascribed a negative connotation. This is reflected in the following definitions of risk taken from health-related literature:

- 'the probability that a particular adverse event occurs during a stated period of time, or results from a particular challenge' (The Royal Society 1992, p. 2), or
- a 'characteristic of a situation or action wherein two or more outcomes are possible, the particular outcome that will occur is unknown, and at least one of the possibilities is undesired' (Covello and Merkhofer 1993, p. 2)

In most of the health economic literature, when it is not associated with behavioural, biological, and environmental health risk factors, the Knightian distinction is lost and risk and uncertainty are used interchangeably. Consequently, unless we refer to factors, we will not distinguish between the two concepts and refer generally to uncertainty.

Going back to the Grossman's model, uncertainty can be introduced in many ways to extend the original specification (Dardanoni and Wagstaff 1990). For example, we can assume that the rate of depreciation of the health stock is stochastic (Cropper 1977; Dardanoni and Wagstaff 1987) or that what is uncertain is the effectiveness or productivity of health investments in augmenting the health stock (Arrow 1963).[18]

To illustrate one of the consequences of introducing uncertainty in a Grossman's model, we will follow Dardanoni and Wagstaff (1987, 1990). Let's simplify the model considering a pure investment version with time as a discrete variable and a life course that only lasts for two periods. Lifetime utility is the sum of the utility in each period:

$$LU = U_1(C_1) + U_2(C_2) \tag{3.12}$$

The representative agent seeks to maximise LU subject to the budget constraints she faces in each period. In period 1, we have

$$C_1 = A + Y_1 - P^m.M_1 - S_1 \tag{3.13}$$

where A is the initial wealth or financial assets, P^m is the price of healthcare, M_1 is the quantity of healthcare services demanded, and S denotes savings. So, Eq. (3.13) indicates that in the first period the individual finances the consumption of healthcare and of the other goods and services (whose price is assumed to be equal to 1 for simplicity) out of her initial stock of assets and the income she earns in the period. Any difference represents her savings. In the second period, the budget constraint looks thus:

$$C_2 = (1 + r).S_1 + Y_2 \tag{3.14}$$

where r is the interest rate. So, in the second period, we assume the agent does not invest in her health and finances her consumption level out of the interest on the savings from the first period and the income she earns in the second period. Replacing Eq. (3.13) in Eq. (3.14), we obtain

$$C_2 = (1 + r).[A + Y_1 - C_1 - P^m.M_1] + Y_2 \tag{3.15}$$

We need to define the health stock in each period. We assume that in period 1 it is given: the agent 'is born' with a certain level of health stock, $H_1 = H_o$. In period 2, it depends on the health status in the previous period net of the depreciation of the health stock with the passing of time plus any investments in health the individual carried out in the previous period: $H_2 = (1-\delta)(H_1)+ I(M_1)$.

The income earned in each period is assumed to depend on the stock of health in each period:

$$\begin{aligned} Y_1 &= Y_o + \varphi_H(H_1) \\ Y_2 &= Y_o + \varphi_H[(1-\delta)(H_1)] + I(M_1) \end{aligned} \tag{3.16}$$

The Lagrangian (remember we are working with time as a discrete variable) for this problem is

$$\begin{aligned} \mathcal{L} = U_1(C_1) + U_2\left((1+r).[A + Y_1 - C_1 - P^m.M_1] + Y_2\right) \\ + \varphi_H[(1-\delta)(H_1) + I(M_1)] \end{aligned} \tag{3.17}$$

We maximize $\mathcal{L}$ with respect to M_1 and to C_1, that is, with respect to healthcare and other goods and services: the agent seeks to maximise utility over her life course subject to her lifetime budget constraint. Remember that this is a pure investment version of the Grossman's model, so utility in each period depends on the consumption of goods and services other than healthcare but the health stock does influence utility via its impact on the generation of income. Hence the maximisation has to be done with respect of both C and M. We obtain

$$\begin{aligned} \frac{\partial \mathcal{L}}{\partial M_1} &= \frac{\partial U_2}{\partial M_1}.\left[(1+r)(-P^m) + \frac{\partial \varphi_H}{\partial M_1}.\frac{\partial I}{\partial M_1}\right] = 0 \\ \frac{\partial \mathcal{L}}{\partial C_1} &= \frac{\partial U_1}{\partial C_1} - \frac{\partial U_2}{\partial C_1}.(1+r) = 0 \end{aligned} \tag{3.18}$$

The derivative of $\mathcal{L}$ with respect to M_1 is equal to zero if the term between brackets is equal to zero. For this term to be equal to zero, we need

$$\frac{P^m}{\frac{\partial I}{\partial M_1}} = \frac{\frac{\partial \varphi_H}{\partial M_1}}{(1+r)} \tag{3.19}$$

The term on the left-hand side in Eq. (3.19) is the marginal cost of investing in health, and the term on the right-hand side corresponds to the present value of the marginal benefit of investing in health. The agent will invest in her health up to the point where the marginal cost of such investment equals its marginal benefit.

The point that Dardanoni and Wagstaff (1987, 1990) highlighted is that in Grossman's original model, the level of health investment does not depend on the level of financial assets or wealth, A. In other words, the model concludes that inequalities in wealth cannot explain why two individuals may differ in their health stock. However, empirical evidence suggests otherwise: the wealthier an agent, the better their health status on average, the longer their life expectancy, and so on. These authors show that by simply incorporating uncertainty over the function that translates levels of health stock into income—that is, over the productivity of the health stock, φ_H—and assuming that the agents exhibit risk aversion, the model predicts that the wealthier agents are, the more they will invest in their health and therefore their health stock will be higher. Let's see. All we need to do is assume that $\varphi_H = k.H_t$ where k is a stochastic variable, which we assume is defined over a certain interval $[\underline{k}, \bar{k}]$ and has a cumulative distribution defined by $F(k)$. With this seemingly minor modification, the Lagrangian—Eq. (3.17)—becomes

$$\mathcal{L} = \int_{\underline{k}}^{\bar{k}} [U_1(C_1) + U_2(1+r).[A + Y_1 - C_1 - P^m.M_1] + Y_2 \\ + k.[(1-\delta)H_1 + I(M_1)]].dF(k) \tag{3.20}$$

The maximisation with respect to M and C equals

$$\frac{\partial \mathcal{L}}{\partial M_1} = E\left\{\frac{\partial U_2}{\partial M_1}.\left[(1+r)(-P^m) + k.\frac{\partial I}{\partial M_1}\right]\right\} = 0 \\ \frac{\partial \mathcal{L}}{\partial C_1} = \frac{\partial U_1}{\partial C_1} - E\left\{\frac{\partial U_2}{\partial C_1}\right\}.(1+r) = 0 \tag{3.21}$$

where E is the mathematical expectation. Again we need to find out where the derivative of the Lagrangian with respect to M equals zero. Because k varies within the interval $[\underline{k}, \bar{k}]$, the derivative can be re-expressed thus:

$$E\left\{\frac{\partial U_2}{\partial M_1}.\left[\bar{k}.\frac{\partial I}{\partial M_1} - (1+r)(-P^m)\right]\right\} + E\left\{\frac{\partial U_2}{\partial M_1}.\left[(k-\bar{k}).\frac{\partial I}{\partial M_1}\right]\right\} = 0 \tag{3.22}$$

The covariance between two variables x_1 and x_2—that is, $cov(x_1, x_2)$ —is equal to $E(x_1 x_2) - E(x_1).E(x_2)$. With this definition, we can re-arrange Eq. (3.22) and obtain

$$\bar{k}.\frac{\partial I}{\partial M_1} - (1 + r).P^m + cov\left(\frac{\partial U_2}{\partial M_1}, k\right).\frac{\frac{\partial I}{\partial M_1}}{\frac{\partial U_2}{\partial M_1}} = 0 \tag{3.23}$$

The main difference between Eqs. (3.23) and (3.19) is the covariance term. But because C_2 depends on A—see Eq. (3.15)—so does $\frac{\partial U_2}{\partial M_1}$ and consequently the covariance term. Therefore, by introducing uncertainty over the effect of health investments on income, under the assumption of risk aversion, individuals with greater wealth or financial assets will invest more in their health. With uncertainty over φ_H, investing in health becomes 'risky', and it is wealthier agents who can afford to invest more than poorer agents assuming both groups exhibit the same attitude towards risk—that is, aversion.

Instead of revisiting the whole literature of Grossman's models under uncertainty,[19] it is worth considering uncertainty in health and healthcare in more detail. According to Eddy (1984, p. 75), '[u]ncertainty creeps into medical practice through every pore'. It is no wonder, then, that scholars in health-related disciplines devoted much thinking about this. Han et al. (2011) introduced a useful taxonomy which incorporates the notions of sources of uncertainty, uncertainty around substantive issues, and the locus of uncertainty. Sources of uncertainty include risk (defined here as a known probability of a future outcome, but with no certainty), ambiguity (when experts do not agree on the probability), and complexity (the 'it's not so easy' situation where there are multiple causal factors in play affecting the probability). Apart from these sources, there are scientific, system-centred, and patient-centred substantive issues. Examples of scientific issues include uncertainty about diagnosis, prognosis, treatments, or outcomes. System-centred issues include the competence and experience of the healthcare professionals and the process and pathways including timings of the care system to treat a particular condition or patient-condition dyad. Issues of uncertainty around the patients themselves include, for example, their psychological reactions to an illness or a treatment. Finally, the locus of uncertainty refers to where uncertainty 'resides': is it in the minds of physicians? In the minds of the patients? Both?

Sources, issues, and loci of uncertainty are particularly pertinent in studies of older people. Some scientific issues, for example, are made more complex with advanced chronological age (e.g. co-morbidity and polypharmacy); some individual issues appear to be more salient among older patients (e.g. denial of need or refusal to treatment); systemic issues including waiting lists, early or delayed discharges, or attendance to emergency departments are more prevalent among older patients. Other sources can be included to the list—for example, uncertainty around the price of healthcare services, or the development or occurrence of adverse events and side effects (Elliott and Payne 2005, pp. 139–140); ambiguity and vagueness in the recommendations in clinical practice guidelines (Codish and Shiffman 2005); the differences in individual interpretations of qualitative expressions of probability ('likely', 'almost never', etc.) among physicians (Kong et al. 1986); the management of uncertainty (Danczak and Lea 2016); and so on.

The Supplier-Induced Demand for and the Demand-Induced Supply of Healthcare

Supplier-Induced Demand In Grossman's model, a usual assumption in mainstream economics is adopted: that the production of healthcare services is defined by how consumers decide to allocate their incomes on the basis of their individual tastes and preferences. In other words, the consumer decides how much she demands for healthcare services: the consumer is sovereign—**consumer sovereignty** has been defined as 'the controlling power exercised by free individuals, in choosing between ends, over the custodians of the community's resources, when the resources by which those ends can be served are scarce' (Hutt 1940, p. 66); see also Persky (1993). In contrast, the framework of the **supplier-induced** (also known as provider- or physician-induced) healthcare demand introduced by Zweifel (1981) starts from the premise that once the initial contact between a patient and a physician is made, it is the latter who determines the allocation of healthcare services on behalf of the former: which and how many goods and services will the patient consume depend upon the physician. A key assumption is that there is asymmetry—that is, an unbalance—in the information that the patient and the physician hold,[20] and also there is a principal-agent relationship[21] between insurers and physicians, and between insurers and patients, but the bulk of the literature focuses on the patient-physician relationship. This informational inequality conducts a patient to 'delegate to the physician much of his freedom of choice' (Arrow 1963, p. 965). The patient-physician relationship is described as a principal-agent relationship (Buchanan 1988; McGuire 2000), in which the principal (the physician) takes decisions on behalf of the agent (the patient) given the greater medical knowledge of the former. In this sense, the demand for healthcare services is *induced* by the agents—the physicians—as custodians, gatekeepers, advisers, and providers of the services. In this framework, then, the assumption that the utility functions of consumers and producers are independent is dropped with the consequence that a free market solution would not achieve a socially optimal equilibrium or allocation of resources and maximisation of utility (of patients) (Barer et al. 1987).

In this agency relationship, physicians would have an advantage given their greater information—a position they could use to provide excessive healthcare services to their patients. The literature focuses on three situations under which this market failure could arise (Fabbri and Monfardini 2003):

- if the density of physicians per inhabitant in an area increases, the income of the physicians working in the area would decrease which would lead to greater demand for medical care
- if the demand for healthcare increases exogenously as a result of, for example, an epidemics or changes in tastes
- if the fees paid to physicians vary

We present now a summary analytical version of this model—for a complete exposition, see Zweifel et al. (2009, ch. 8). Imagine there are n older people and a physicians in a country. The density of physicians δ is equal to the number of physicians per person, $\delta = a/n$. Assume that all older people access to healthcare free of charge at point of delivery or, similarly, that they are fully insured due to their age. Assume, also, that physicians earn a fee, p, per unit of medical services they provide, which is regulated. As older people are fully insured or do not pay at point of delivery, their demand for healthcare does not depend on the level of the fee earned by physicians. Each older person demands an amount M of healthcare services, so the total demand for healthcare by older people is $M.a$ and the demand per physician is $M.a/n = M/\delta$. And that would be it, except that now we assume that physicians can induce older people to demand more services. Each physician induces a demand for s units of additional services so that total induced demand is $s.a$. Therefore, the total demand for healthcare by older people corresponds to $n.M + a.s$, that is, the amount of services they would demand if there were no inducement plus the induced services generated by physicians. The total demand for healthcare per physician is $n.M/a + a.s/a = M/\delta + s$. Of course, this demand per physician determines the amount of hours each physician will work. If we do working time by t, we obtain $t = min[M/\delta + s, 1]$, where 1 is an upper limit of the number of hours a physician can work. The number of hours of work, t, is given, then, by the demand for healthcare services up to this upper limit. The income a physician earns is simply a function of the regulated fee and the number of hours she works: $y = y(p.t)$. The physician's utility function is given by $u = u(y, t, s)$. We assume that utility increases with income and that it decreases with working time—nothing new there. But the model assumes that a physician's utility decreases with increasing inducement, because such behaviour would go against professional ethical commitments and would involve greater reputational risks. We need to maximise a physician's utility subject to the demand for healthcare services and the time she can allocate to the provision of the services. The utility function can be expressed thus:

$$U = \left\{ y(p.t), \frac{M}{\delta} + s, s \right\} \tag{3.24}$$

which, after replacing t, becomes

$$U = \left\{ y \left[p. \left(\frac{M}{\delta} + s \right) \right], \frac{M}{\delta} + s, s \right\} \tag{3.25}$$

The Lagrangian[22] corresponds to the sum of the utility function and the constraint multiplied by λ. The constraint in this case is the working time, which cannot exceed the upper limit set equal to 1, so the constraint is $1 - \left(\frac{M}{\delta} + s\right) = 1 - \frac{M}{\delta} - s$. The Lagrangian becomes

$$\mathcal{L} = \left\{ y \left[p. \left(\frac{M}{\delta} + s \right) \right], \frac{M}{\delta} + s, s \right\} + \lambda. \left[1 - \frac{M}{\delta} - s \right] \tag{3.26}$$

We maximise this expression with respect to s and to λ. We obtain:

$$\frac{\partial \mathcal{L}}{\partial s} = p.\frac{\partial y}{\partial s}.\frac{\partial U}{\partial y} + \frac{\partial U}{\partial t} + \frac{\partial U}{\partial s} - \lambda \leq 0 \tag{3.27}$$

and

$$\frac{\partial \mathcal{L}}{\partial \lambda} = 1 - \frac{M}{\delta} - s \geq 0 \tag{3.28}$$

These are the conditions that determine the optimal behaviour by physicians. There are four situations, considering whether physicians are working at full capacity (e.g. $t = 1$) or not (i.e. $t < 1$), and whether they induce additional demand (e.g. $s > 0$) or not (i.e. $s = 0$). Let's consider one of these four situations only, where physicians induce demand and they are not working at full capacity (i.e. $s > 0$ and $t < 1$). As $t < 1$, the constraint about working time is not binding, so λ in Eq. (3.27) becomes equal to zero. We get:

$$\frac{\partial U}{\partial s} = p.\frac{\partial y}{\partial s}.\frac{\partial U}{\partial y} + \frac{\partial U}{\partial t} + \frac{\partial U}{\partial s} = 0 \tag{3.29}$$

This expression defines the optimal amount of inducement—that is, the amount of s that maximises a physician's utility. The amount of healthcare services each physician will provide is, recall, the amount demanded by older people without any inducement plus the induced services: $n.M/a + s$, which can be equivalently defined as $M + a.s/n$ or as $M + s.\delta$. The amount of inducement depends on the density of physicians, the non-induced demand from older people, and the regulated fee. Therefore, the amount of healthcare provided per older person is given by $q = M + s(\delta, p, M).\delta$. From here we can estimate how the supply of healthcare services changes if the density of physicians increases:

$$\frac{\partial q}{\partial \delta} = s + \delta.\frac{\partial s}{\partial \delta} \tag{3.30}$$

So, there is a direct effect of an increase in the ratio of physicians per older person—the inducement s that increases demand—and an indirect effect that is given by how much physician density affects inducement, $\frac{\partial s}{\partial \delta}$. If this effect is positive, the amount of healthcare services increases as a result of an increase in the density of physicians per person. Zweifel et al. (2009) show that under certain usual assumptions this is the case: when the number of physicians per person is high, the demand for healthcare services increases as a result of supplier-induced (here, physician-induced) demand. This is one testable hypothesis derived from the supplier-induced demand framework, and there has been a lot of empirical research activity around it.

We can think that the patient's demand function for healthcare is 'set' or 'shifted' by her physician. There is a key normative element in this setting or shifting: is the decision taken in the best interests of the patient? Or, to put it differently, if a patient had the same knowledge as her physician about the alternative procedures, interventions, treatments, and so on, would she have chosen the same as the physician did? As the amount of services consumed exceed that which patients would demand if there were no inducement, the result is that there would be overconsumption of healthcare services. If considerations other than the patient's health come into play and influence the principal's behaviour—especially the economic incentives embedded in the national or local health system and the physicians' preference for leisure—then normative aspects are salient. In 2005, just 55 per cent of 359 US health economists believed these normative elements were not relevant, that is, that physicians did not generate substantial demand for their healthcare services (Morrisey and Cawley 2008). We said that the normative element is *key* because if the inducement does not lead to a departure from what a physician considers to be the best decision for the patient's health, then the patient's welfare is not affected. For this reason, McGuire (2000) defines supplier-induced demand as an influence on a patient's demand for healthcare by a physician which goes against the latter's belief of what is best for the patient. It is worth noting that normative issues can only be addressed once positive aspects cannot be rejected empirically (Hurley 2000).

There is another economic aspect of the health sector that we need to consider: health insurance. In the model above, we assume that p—the cost of healthcare services—does not affect the demand for healthcare, M. This would be the case in a healthcare system where services were free at point of delivery, including medication. For countries where older people have to spend out-of-pocket to procure all or part of their healthcare, the model can be modified by introducing p as a determinant of M.[23] In Europe, for example, there is almost a universal health coverage for older people through tax-funded national health systems (e.g. Denmark, Italy, Sweden, or the UK) or social health insurance schemes (e.g. Austria, Belgium, France, Germany, or the Netherlands). In spite of this, people aged 50 years or over incur, on average, out-of-pocket expenditure on healthcare services equivalent to between 1 per cent and 5 per cent of their household gross income—and in most European countries, over 70 per cent of people aged 50 years or over spend something out of their own pockets on healthcare (Scheil-Adlung and Bonan 2012). Moreover, even though the richer the household the higher the out-of-pocket expenditure on healthcare, it is the poorer older people who spend more as a proportion of their household income (as much as 13 per cent in Greece) (Scheil-Adlung and Bonan 2012). Similarly, in the USA, despite the Medicare programme (a federal health insurance programme for people aged 65 or older as well as for younger people with certain disabilities and medical conditions), about 17 per cent of total personal healthcare spending by people aged 85 or over corresponds to out-of-pocket outlays (U.S. Centers for Medicare & Medicaid Services 2016, Tables 1 and 5). Furthermore, Baird (2016, Table 3) estimated that 23.2 per cent of people aged 75 or over in the USA spend over 10 per cent of their disposable income on healthcare—the proportions for other countries in this study are 43.2 per cent (Switzerland), 33.8 per cent (Poland), 33.2 per cent (Israel), 25.6 per cent (Russia), 25.5 per cent (Australia), 13.1

per cent (Slovenia), 12.1 per cent (Japan), and 5.4 per cent (France). On the other hand, in India—a country with almost non-existent health coverage for older people—around 13 per cent of household consumption spending goes into healthcare (Mohanty et al. 2014), and in South Korea, where there is a national health insurance scheme (Medical Aid), due to a combination of co-insurance payments and low income after retirement, 10 per cent of household income of people 65 years of age or older is spent in medication costs alone (Park et al. 2015).

Concerning the supply of physicians per capita, the consensus in the literature is that supplier-induced demand exists so that a greater supply is associated with a greater utilisation of healthcare, which leads to overconsumption of services (Léonard et al. 2009).[24] To cite but a few studies:

- Gruber and Kiesel (2010) found supplier-induced demand for medical specialist services among German men aged 50 or over with either full health insurance or supplementary health insurance (an upgrade of the statutory insurance scheme).
- Sekimoto and Ii (2015) found supplier-induced demand for hypertension and diabetes care among older people in Japan.
- Jacobson et al. (2013) found elements of agency in the behaviour of US oncologists treating older cancer patients, including changes in the mix of drugs based on profitability rather than clinical response and increases in chemotherapy care—which, nevertheless, were associated with extended survival.[25] The authors also found that an over-generous payment scheme could lead to under-provision of care given, again, agency effects.
- Nguyen et al. (2017) found variation in the odds of undergoing surgical intervention for carotid stenosis among people enrolled in a healthcare programme serving active members of the US uniformed services, retirees, and their families (TRICARE) depending on the clinician reimbursement scheme.
- Jiménez-Martín et al. (2004) found, in a study of 12 European countries, that physicians who are paid on the basis of the healthcare services provided (i.e. a fees-for-service scheme) exhibit a longer duration of treatments compared to colleagues who are salaried employees of the state or under a capitation scheme where they are paid a fee for each patient in their books irrespective of the services provided.
- Maeda et al. (2016) found higher odds of having a gastrostomy feeding tube placed among people older people in Japan in prefectures (i.e. regions) with greater hospital physician density.

Demand-Induced Supply Apart from supplier-induced demand, some authors contend that there is also **demand-induced supply**: medical information would be increasing, and patients would be becoming more empowered so that they would be enforcing their tastes and requirements regarding the healthcare services they would like. The demand curve would also 'shift', as in a supplier-induced scenario, but now this shift would not depend on the physicians' behaviour but on the patients' behaviour. As a consequence of this shift in demand, the supply would also shift: now the physicians' response would be induced by the patients—the supply of healthcare services would be induced by their demand (Fang and Rizzo 2009; Shih and Tai-Seale 2012).

Demand-induced supply is relevant for studies on economics and ageing (Wagner and Wagner 2003). Retired people, for example, are thought to be able to spend more time seeking health-related information than people in employment (as the opportunity cost of time for people in retirement is lower), so they would be able to induce supply more effectively. Also, as older people are more at risk of needing care, they would also have an additional incentive for such health-oriented behaviour. In essence, this becomes an empirical issue. Meyer (2016), for example, found that better informed patients did not exhibit a higher demand for outpatient care compared to uninformed patients in Swiss cantons where doctors were allowed to sell the drugs they prescribe, though, among uninformed patients, the authors did find supplier-induced demand for outpatient care.

Dalgaard and Strulik's Model of Accumulation of Health Deficits Chapter 4 in Volume I introduced the notion of 'deficit accumulation' and frailty. Carl-Johan Dalgaard and Holger Strulik presented a model of health demand based on this concept (Dalgaard and Strulik 2014).[26] This model—henceforth, DS—is an excellent example of a formalisation within a mainstream economic model of ideas borrowed from other disciplines (in this case, human biology) to present an alternative theoretical framework to a canonical model such as Grossman's, which disregards any insights from outside economics.

DS treats time as a continuous variable. The starting point of departure is the realisation that Grossman's model of demand for health conceptualises the life course as a process of accumulation of health capital, whilst Dalgaard and Strulik understand that over the life course, people accumulate health *deficits*—a view that we covered as 'redundancy and deficit accumulation' in Volume I, Chap. 4.

We saw that in a simplified version of Grossman's model, the health capital stock accumulates as the difference between investments and depreciation—

see, for example, Eq. (3.4) or (3.6). In DS, it is health deficits which accumulate over time. In symbols:

$$\frac{\partial D}{\partial t} = \dot{D} = \mu[D_t - f(I_t)] \tag{3.31}$$

where D are the health deficits; μ, which is greater than zero, is the rate at which the homeostatic or physiologic reserve depletes—see Volume I, Chap. 4; and I is health investment. μ is the rate at which deficits accumulate, which can be seen if we calculate the first derivative of $\dot{D}$ with respect to D:

$$\frac{\partial \dot{D}}{\partial D} = \mu \tag{3.32}$$

Given that this model and the biological framework in which it is inscribed adopt the definition of ageing as deficit accumulation, μ is variously known as the force of mortality, the failure rate, the instantaneous risk of failure, the hazard rate, the force of ageing, or the rate of ageing (Gavrilov and Gavrilova 2006; Kowald 2002; Strulik and Vollmer 2013; Thatcher et al. 1998). As we assume that $\mu > 0$, Eq. (3.32) indicates that unhealthier people (i.e. people with more health deficits) become even unhealthier over time.

In Grossman's model, death took place when the health stock reached a minimum level. In DS model, it occurs when health deficits accumulate up to a given maximum level. Here μ does not depend on chronological age, so the accumulation of deficits does not depend on chronological age either.

As in Grossman's model, individuals have identical utility functions which depend on consumption and health, though now it is the health deficits rather than the stock of capital which enter in the equation. Also as in Grossman's model, DS has a pure consumption and a pure investment specification.

In the pure consumption version, individuals seek to maximise lifetime utility:

$$\int_0^T U(C_t, D_t).e^{-\rho.t} \tag{3.33}$$

In the pure investment model, health deficits do not influence lifetime utility directly, so we have

$$\int_0^T U(C_t).e^{-\rho.t} \tag{3.34}$$

In both versions of the model, ρ corresponds to the time preference rate, and lifetime utility is subject to the budget constraint:

$$Y_t = C_t + p.f(I_t) \tag{3.35}$$

where p is the price of healthcare goods and services, I_t is the expenditure in healthcare (investments in health), and $f()$ is the function that translates investments in health into health. We can further assume that this function follows a linear relationship at a fixed rate, A: $f(I_t) = A.I_t$, so that the budget constraint becomes

$$Y_t = C_t + p.A.I_t \tag{3.36}$$

We will look in some detail to the pure consumption version, which is slightly more complex. To maintain the exposition manageable, Dalgaard and Strulik assume an iso-elastic or constant relative risk aversion utility function of consumption and health deficits:

$$U[C_t, D_t] = \frac{[C_t^{\alpha}.(\bar{H} - D_t)^{1-\alpha}]^{(1-\sigma)} - 1}{(1-\sigma)} \tag{3.37}$$

where α denotes the relative importance of consumption goods in utility, σ corresponds to the inverse of the elasticity of inter-temporal substitution, and $\bar{H}$ represents the best health status the individual can enjoy if there are no health deficits. It is clear that in Eq. (3.37), the accumulation of health deficits reduces utility.

This maximisation problem is solved by forming the Hamiltonian and obtaining the first-order conditions plus the transversality condition. The Hamiltonian is

$$\mathcal{H} = \frac{[C_t^{\alpha}.(\bar{H} - D_t)^{1-\alpha}]^{(1-\sigma)} - 1}{(1-\sigma)} + \lambda.[\mu.D_t - \mu.(A.I_t)] \tag{3.38}$$

The first-order conditions are obtained by estimating the first derivative of $\mathcal{H}$ with respect to I_t and D_t:

$$\frac{\partial \mathcal{H}}{\partial I} = \frac{\alpha.[C_t^{\alpha}.(\bar{H} - D_t)^{1-\alpha}]^{(1-\sigma)} - 1}{C_t}.(-p) - \lambda.\mu.A = 0;$$

$$\frac{\partial \mathcal{H}}{\partial D} = \frac{(1-\alpha).[C_t^{\alpha}.(\bar{H} - D_t)^{1-\alpha}]^{(1-\sigma)} - 1}{D_t}.(-1) + \lambda.\mu = 0 \tag{3.39}$$

The transversality condition can be expressed as a boundary requirement that the Hamiltonian tends to zero as T tends to infinite. We are going to omit the derivation of the equations of motion of consumption and health deficits with which the phase diagrams to investigate the predictions of this model can be drawn. The key difference between the DS and the Grossman models lies in the changes of health deficits over time. From Eq. (3.31) and the budget constraint—Eq. (3.36)—we get

$$\begin{gathered}\frac{\partial D}{\partial t} = \dot{D} = \mu D_t - \mu . \left[A . \left(\frac{Y_t - C_t}{p} \right) \right] ; \\ \frac{\partial \dot{D}}{\partial D_t} > 0\end{gathered} \tag{3.40}$$

As we mentioned earlier, we find that the less healthier the individual is in one period of time, the worse her health becomes (the more deficits she accumulates) with advancing chronological age.

The results from both versions of the DS model depend on whether we assume that the time preference rate σ is greater or smaller than the force of mortality μ. If $\sigma < \mu$, biological deterioration exceeds the subjective preference for the present, so individuals invest in their health earlier in life and consume relatively more in later life: healthcare expenditure would go down with increasing chronological age (and frailty). If $\sigma > \mu$, healthcare expenditure increases with advancing chronological age and therefore declining health (increasing deficits)—which is what the empirical evidence shows: people delay spending in health until later in life when health becomes 'an issue'.

Remember that in Grossman's model, individuals can live forever—unless additional assumptions are incorporated such as the existence of a fixed terminal state, that the rate at which health depreciates is increasing with chronological age, or that lifetimes are defined as finite so that the minimum level of health stock is always reached at some point. Can 'eternal life' be achieved in the DS model? Is there a fixed point that veers the motion of deficit accumulation over time away from the health deficit threshold beyond which death awaits? Yes, but it requires high medical technology and efficiency—much higher than available nowadays. Some biogerontologists opine that agelessness is round the corner (Zhavoronkov 2013); other scientists, it almost goes without saying, disagree (Olshanksy 2014; Olshansky et al. 2002a,b). This leaves the DS as a promising alternative framework; and as with the simplified Grossman's model, many refinements and extensions can be introduced to the basic version.

3.2.2 Health Insurance

The economics of insurance in general and of health insurance in particular are beyond the remit of this textbook.[27] However, the basic concepts of health insurance economics are worth mentioning; they include:

- Individual healthcare needs and therefore spending are unpredictable both in terms of timing and amount.
- The distribution of individual healthcare spending is very skewed with a long right-hand tail: the top 1 per cent of spenders in healthcare account for over 20 per cent of all personal healthcare spending (NIHCM 2012).[28]
- The unpredictability of needs means that *you* could be among those high spenders.
- Economic agents, on average, exhibit positive risk aversion, so they prefer to cover themselves against such eventuality.
- Given the huge amounts involved in the most serious or long-standing instances, borrowing and saving are not feasible options.
- Health insurance is a financial product created as a means to mitigate health-related financial risk.
- An insurance product pools risks across a population (or subgroup) so that a potentially insurmountable financial burden for one individual becomes a relatively insignificant amount for all contributors (i.e. the risk is 'spread').

Health insurance has been defined as 'a contract between the client and the insurer to the effect that, in the event of specified events occurring, the insurer will pay certain sums of money either to the insured person or to the health service agency' (Culyer 2005, pp. 176–177). Even if the probability of incurring catastrophic costs is extremely low, mainstream microeconomic theory assumes that choosing to insure is a rational decision under the assumption of diminishing marginal utility of income: increasing amounts of income do increase utility but at a diminishing rate due to risk aversion.

Let's depart from the tail of the distribution where catastrophic spending lurks and imagine that an older person is consuming \$1000 on average per month and is obtaining a level of utility of U_1. Imagine also that there is a 50 per cent probability that she may fall ill, in which case she will have to spend \$800 in medical care and medications. Left with \$200, her utility level would go down to U_2—we are not including the disutility of pain, discomfort, and so on, brought about by the illness. The expected consumption before purchasing the insurance is $EC_b = 0.50 \times \$1000 + 0.50 \times \$200 = \$600$, which renders an expected utility of $EU_b = 0.50 \times U_1 + 0.50 \times U_2$. Would she buy a health insurance for up to \$400? You may think that it would be indistinct, for in both cases the utility level will be the same. You may go one step further and think that it would not be a good idea, for the \$400 that the insurance costs is a certain disbursement, whereas the \$800 that the healthcare services may cost are only 50 per cent probable to materialise. Nonetheless, mainstream economic theory, through the assumption of diminishing marginal utility of income, concludes that this agent would act rationally by buying the insurance product. How come? After buying the insurance, income disposable for consumption is also \$400, and the corresponding utility is U_a. With diminishing marginal utility of income resulting from risk aversion, $U_a > U_b$—a risk averse agent prefers a given amount of income or consumption with certainty than a scenario in which the probability distribution of income or consumption has a weighted average of exactly that same amount.[29] Figure 3.2 depicts the situation.

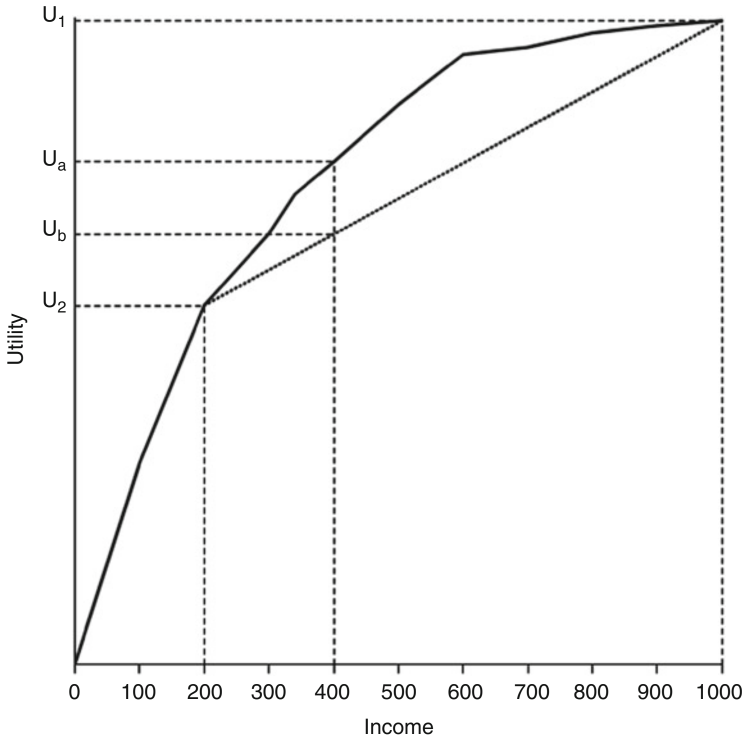

Fig. 3.2 Utility before and after insurance under diminishing marginal utility of income. *Source: Figure is illustrative, prepared with mock data*

Without an insurance, the expected utility is equal to U_b, a weighted average of the utility in good and bad health where the weights are the respective probabilities (in our example, the same, 50 per cent). With an insurance, the expected utility is equal to U_a, which is higher than U_b given the concavity in the utility function that reflects that utility increases less and less as income increases as a result of risk aversion. The more risk averse the agent, the lower U_b will be with respect to U_a.

One key aspect of health insurance is whether its provision changes the demand for healthcare services—that is, whether it affects incentives. Contracting an insurance creates four types of effects:

- Risk reduction (De Meza 1983). The main purpose of an insurance product is to reduce risk. As a consequence, it increases financial certainty, which creates a wealth effect. This wealth effect may increase the desired level of utilisation of healthcare services as well as savings and the demand for other goods, some of which—though not necessarily all—may be beneficial to health of the older person who bought the insurance. This risk reduction effect depends on the magnitude of the individual's risk aversion: the more risk averse the older person, the greater the gain in avoiding risk and, consequently, the wealth effect of health insurance and the demand for healthcare and other goods.
- Income transfer (Nyman 1999, 2001, 2006). The pooling of risk introduced by an insurance product creates a transfer of income from healthy participants to ill participants *a posteriori*—that is, *ex post*, which may increase the demand for healthcare services.
- Access effect. Health insurance reduces the financial burden of incurring out-of-pocket outlays for consultations, medications, or treatments. This may provide access to healthcare services to older people who would have not been able to afford the costs or who would have faced catastrophic costs without the insurance. Even in systems with publicly funded universal coverage, the existence of private health insurance may allow older people who purchase these products to access healthcare services of higher quality—for example, with reduced waiting times (Jofre-Bonet 2000a,b).
- Moral hazard. The event against which an agent takes out an insurance is never completely out of her control: people may set their house or car on fire to claim payment as set out in the insurance policy, or she could become more relaxed or inattentive about checking for fire hazards or fire alarms compared to before buying the fire insurance. These are examples of what in economics is known as a **moral hazard**—that is, a mis-allocation of resources as a result of changes in incentives by insurance and other risk

spreading products given some degree of discretionary power by the insured agent to influence the occurrence of the eventuality she is insured against (Arrow 1963; Marshall 1976; Prescott 1999).

Of these four effects, economists have focused principally on moral hazard. Plenty of evidence has been found of moral hazard effects of health insurance in the demand for healthcare services by older people (Coulson et al. 1995; Curtis et al. 2004; Saleh et al. 2007). In order to limit or reduce potential moral hazard effects of health insurance, many countries have introduced cost-sharing schemes such as user charges, deductibles, co-insurance, co-payment, and so on, which would incorporate price signals in the respective healthcare systems. These mechanisms could price low-income older people away from necessary medication or treatments. The detrimental effect in the quantity of healthcare services demanded as a result of cost-sharing depends on the price elasticity of the demand for medical care of older people. For example, Tamblyn et al. (2001) studied the introduction of prescription cost sharing in Quebec, Canada, in 1996 among older patients: visits to emergency departments as a direct result of the reduction in essential drugs increased by 14.2 per 10,000 person-months. Moreover, Bíró (2013) found that co-payments reduced the probability of visiting general practitioners in a number of European countries, and Yang et al. (2017) report that cost-sharing has negatively affected the demand for outpatient visits by older people in Taiwan. Demand-price elasticity of medical services depends on the severity of the illness, the type of service, and the income level: in a study of Japanese people aged 70 or older, Fukushima et al. (2016) found that reducing co-insurance from 30 per cent to 10 per cent increased personal medical expenditure by 11 per cent, but the effect was greater for branded drugs compared to generic drugs, among relatively healthier individuals compared to sicker older people, and for certain medical specialities (e.g. orthopaedics and ophthalmology) than for others (e.g. internal medicine or mental health).

Cost-sharing is also controversial because it may reduce adherence, a concept to which we now turn.

3.2.3 Adherence

Adherence is 'the extent to which a person's behavior – taking medication, following a diet, and/or executing lifestyle changes – corresponds with agreed recommendations from a health-care provider' (Bosworth 2010, p. 2). Adherence to medication—which includes adherence to 'timing, dosage, frequency and duration of medication' (Lau et al. 2017, p. 113)—is the most widely researched aspect of compliance, but, as the definition indicates, adherence to health-related behaviours (screening, diet, treatments and therapy, vaccination, physical activity, etc.) is also relevant for attaining better health outcomes and also for health costs: in the USA, the annual cost of non-adherence has been estimated at $290 billion (about 13 per cent of total health spending), of which $100 billion correspond to hospitalisations resulting from non-adherence (NEHI 2009). Between 33 and 69 per cent of all medication-related hospital admissions are due to non-adherence (Healthcare Intelligence Network 2010).

The World Health Organization determined five dimensions that affect adherence:

- Socio-economic factors
- Healthcare system factors
- Condition-related factors
- Therapy-related factors
- Patient-related factors

Socio-economic factors feature prominently among the determinants for non-adherence, and among the patient-related factors, age and old-age-related conditions are also very important. Among the socio-economic factors that affect adherence, the incidence of healthcare costs on household disposable income is one of the most salient. Non-adherence can be intentional or non-intentional. Unwillingness to pay is one economic aspect that influences intentional non-adherence, but affordability (a combination of the cost of medication, living on low incomes, and out-of-pocket disbursements) is a more prevalent barrier. Some patient-related factors such as the ability to follow prescription instructions and the level of health literacy as well as some healthcare system factors (e.g. co-payment schemes, competition, and regulation) also have underlying economic drivers.

A study based on US data found that the high cost of drugs, particularly among older people without coverage, on low incomes, and with multiple chronic illnesses, was the most important driver of non-adherence to medication (Safran et al. 2005). In another study, household income level was found to be positively associated, and out-of-pocket costs were negatively associated with adherence to diabetes medication (Kirkman et al. 2015; Piette et al. 2004). Similar results were reported for non-compliance with drugs for cardiovascular disease (Alexa et al. 2006), chronic health conditions (Hennessy et al. 2016), osteoporosis (Chodick et al. 2016), oral chemotherapy (Doyle et al. 2016), and so on. Furthermore, around five per cent of older people in Europe forgo a visit to their doctor due to its cost (Tur-Sinai and Litwin 2015). da Costa et al. (2017) report that around 30 per cent of people aged 65 or over in Portugal had to resort to some form of non-adherence due to financial reasons during the Great Recession.

Low adherence rates among older people are especially problematic given the high prevalence of co-morbidities and polypharmacy. Worldwide, the adherence rate to medication among older people is, on average, less than 45 per cent (Giardini et al. 2016). Depending on the definition of polypharmacy[30] and the chronological age groups under study, prevalence rates among people aged 55 years or over have been estimated at 46 per cent of people in Malaysia (Lim et al. 2017), at 57 per cent in France (among people aged 70 years or more) (Herr et al. 2015), and, among people aged 65 years or older, at 37 per cent in Spain (Martín-Pérez et al. 2017), 29.5 per cent in New Zealand (Nishtala and Salahudeen 2015), and 39 per cent in the USA (Charlesworth et al. 2015). These prevalence rates correspond to non-institutionalised older people living in their communities; the prevalence of polypharmacy in long-term care nursing and residential institutions is much higher, with about 91 per cent of residents taking five or more medications according to a review of US studies (Jokanovic et al. 2015).

3.3 Health of the Society

According to Wang et al. (2015, p. 1531), 'A key goal, if not the fundamental goal, of a health system is to prolong life, especially healthy life, into old age.' However, health systems do not operate in isolation and health outcomes are the result of layers of socio-economic, cultural, and environmental determinants (Dahlgren and Whitehead 1991). For example, in the study of the determinants of morbidity and mortality in later life by Lima et al. (2014), lifestyle and behavioural determinants such as smoking and individual determinants such as marital status and gender were assumed to be influenced by a first layer of social and community networks, where factors such as perceived age discrimination and social engagement and participation would come into play (Lima et al. 2014). These networks would be affected by a second layer composed of the living conditions of individuals, including education, tenure, and so on, all influenced by macro variables such as urban or rural environment, country of origin and of residence, ethnicity, and financial hardship. Solar and Irwin (2007) developed another conceptual scheme, which was adopted by the Commission on Social Determinants of Health set up by the World Health Organization.[31] Here two types of determinants of health inequalities are identified: structural and intermediate. Structural determinants comprise two mutually influencing categories, the socio-economic and political context and the socio-economic position of the individual. The intermediate determinants include material circumstances and psychological and behavioural factors. Social cohesion and social capital (especially, linking social capital[32]) mediate between the effects of the socio-economic and political context upon individual socio-economic positions, whilst the final impact on health inequalities is mediated by the characteristics of the health system. Yet a third scheme comes from Elkeles and Mielck (1997),[33] which distinguishes at a macro-level disparities in knowledge, power, money, and prestige that would lead to differences in exposure to risks, resources, access to health services, and health-related behaviours, all of which would redound to socio-economic inequalities in morbidity and mortality.

3.3.1 Population Ageing and Public Spending in Health

We mentioned in the introduction to this chapter that the healthcare sector and public spending in health represent a large chunk of the economy and public sector budgets of most countries, respectively. We also noted that the demand for healthcare products and services increases with chronological age. It would seem a logical step, then, considering the demographic trends that indicate that population ageing is happening throughout the developed world as well as in most developing countries, to join these two dots and get a picture in which demographic ageing increasingly drives public spending on health to unsustainable levels: in the words of Longman (1987, p. 88) 'Older people, on average, inevitably require much more health care than do the young…and so, as the elderly share of the population increases, so too will the demand for health care'. This is the conclusion emerging from a 2013 report by the rating agency Standard & Poor's, in which healthcare costs are deemed to become the 'biggest driver of higher age-related spending in coming decades' globally (Standard & Poor's 2013, p.12). The authors of the report forecast that public spending in healthcare in terms of GDP will increase by 2.1 per cent among advanced economies and by 2.5 among emerging economies (and as much as by 8.4 per cent in Korea and 7.4 per cent in Iceland) (Standard & Poor's 2013, Table 4). It is the same conclusion to which academics Ronald Lee and Shripad Tuljapurkar arrived back in 1997 in their analysis of data from the USA: 'The long run outlook for the federal budget is for large and increasing deficits, mainly due to projections of steeply rising per capita health care expenditures and of increases in the relative size of the elderly population' (Lee and Tuljapurkar 1997, p. 67). However, years later, in another study of US data, Lee concluded that health expenditure per older person and the number of older people would contribute equally to the rising share of health spending as a proportion of GDP (Lee and Miller 2002). More recently, Colombier (2017) cautions against inferring that population ageing is of secondary importance to healthcare spending—in his study of time series for Switzerland, Colombier shows that advances in medical technology are a fundamental driver, but that if long-term care expenditure is omitted, population ageing becomes the most important factor behind the trends in healthcare spending even after controlling for proximity to death.

Rising health spending per capita does not necessarily translates into increasing proportions of GDP if labour productivity grows at the same rate as health outlays and demographic change is equal to zero (Lee et al. 2010). Let's denote 'Health spending on older people' by 'HSOP'; we can demonstrate this algebraically,

$$\text{HSOP} = \text{HSOP} \times \text{ Older population}$$

and

$$\text{GDP} = \text{GDP per capita in employment } \times \text{ Labour productivity}$$

Therefore,

$$\text{HSOP as \% of GDP} = \frac{\text{HSOP} \times \text{Older population}}{\text{GDP per employed person} \times \text{Labour productivity}}$$

If we express these equations as growth rates, we obtain that the change in health spending as a percentage of GDP is equal to the difference between changes in the number of older people and changes in the size of the workforce plus the difference between changes in health spending per older person and changes in labour productivity. With no demographic change, the number of older people varies at the same rate as the size of the workforce; hence the first term on the right hand becomes zero. Under this assumption, then, if health spending per capita grows at the same rate as labour productivity, health spending as a proportion of GDP does not vary.

That's all academic, you might say, for ageing is a topic of utmost urgency and salience precisely because the number of older people is growing almost worldwide; consequently, if we go back to the last equation and draw upon our previous discussion, it would not be too far-fetched to expect that the share of public health spending in the economies of advanced and emerging countries should be outgrowing and will keep outgrowing labour productivity. Right? Far-fetched it may not be, but wrong it certainly would, according to many reports and academic studies. As Barer et al. (1987, p. 851) wrote:

> By now, everybody knows that the rapid growth in elderly populations threatens to bankrupt the healthcare systems of every industrialized country. Unfortunately the rhetoric supporting this belief is much stronger than the evidence.

Or, as Gee (2002, pp. 752–753) concluded:

> …while it makes 'sense' that an ageing population leads to increased health care costs, the evidence -at least in terms of hospital use, physician use, and pharmaceuticals- strongly negates the importance of age structure in affecting health care costs.

To mention but three studies which, despite using different statistical techniques and focusing on different countries, contradict this commonsensical[34] view:

- Dormont et al. (2006) presented a microsimulation of health expenditure growth in France and concluded that changes in the age structure would contribute to 3.4 per cent of health spending growth but that changes in patients' and physicians' behaviour, preferences, and expectations jointly with technological progress and more costly drugs would have an impact 3.8 times higher—and, incidentally, reduction in morbidity[35] would more than offset the 'pure ageing' effect: changes in morbidity would reduce projected expenditure on health by 9.7 per cent.
- Using panel data econometrics with a multifactor error structure and Bayesian model averaging, Hauck and Zhang (2016) looked into determinants of healthcare expenditure growth in 34 developed countries between 1980 and 2012. They reported that a one standard deviation increase in the proportion of people aged 65 or over in total population contributed with a 0.40 increase in the rate of healthcare expenditure growth. In turn, a one standard deviation increase in the growth rate of the gross domestic product was associated with a 0.77 increase in healthcare expenditure growth rate and that a similar increase in pharmaceutical sales per capita was associated with a 0.83 per cent in the growth rate of healthcare spending.

- Younsi et al. (2016) applied dynamic panel econometrics to investigate the determinants of healthcare expenditure growth in 167 countries between 1993 and 2013. They found that population ageing had but a limited impact on public healthcare spending, mostly concentrated in low- and middle-income countries.

In their review of the literature on the effects of population ageing on health expenditure growth, de Meijer et al. (2013) concluded that the ageing of the population only moderately increases spending on (acute) healthcare and that medical technology is its most important driver. However, given that chronological age and population ageing strongly interact with some of the other determinants of healthcare spending, age becomes, indirectly, associated: there is a steepening of the age-spending profile. In their words, [p. 359]:

> …age is a predisposing determinant that is not directly responsible for utilization of health care. Instead, it is the relationship between age and need determinants such as health and disability that explain the age pattern of health expenditures.

But before we delve into this discussion, we must spell out three concepts that link together chronological age and consumption of healthcare goods and services: individual-age, period-age, and cohort-age profiles of healthcare expenditure. In Volume I, Chap. 8, we introduced age-earning and age-wealth profiles—that is, charts or data tables that show average earnings or wealth by age. Similarly, age profiles of healthcare spending depict average expenditure on healthcare goods and services by chronological age.

Individual-Age Profiles of Healthcare Expenditure The link between chronological age and consumption of healthcare goods and services can be measured as a longitudinal relationship where the focus is on how consumption changes over the life course of an individual. The theories about the demand for health in the previous section attempt to explain these profiles.

Period-Age Profiles of Healthcare Spending The relationship between age and healthcare consumption can also be studied as a cross-sectional relationship, where the focus is on aggregate consumption of healthcare at one point in time by a population broken down into chronological age groups. At different points in time, different people would populate each age group: these are period-age profiles. The picture we tend to obtain when we classify a given population by age groups and estimate the average expenditure on healthcare

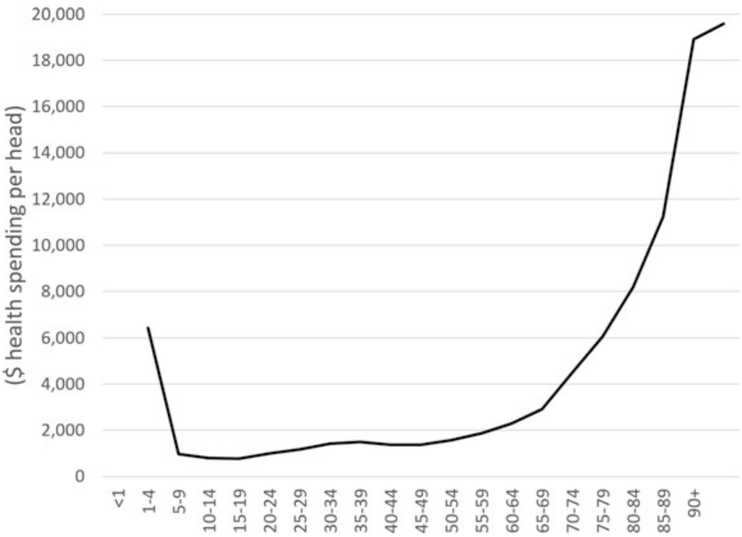

Fig. 3.3 Age profile of health expenditure, Canada 2002. *Source:* Canadian Institute for Health Information (2016) National Health Expenditure Trends, 1975–2015. Table 'Total'. Available on https://www.cihi.ca/en/spending-and-health-workforce/spending/national-health-expenditure-trends. Accessed on 17 January 2017

goods and services by each group in one point in time shows that average health spending goes down after the first year of life and remains fairly constant until the early to mid-60s; thereafter it grows exponentially up to very advanced ages when there is (usually) a contraction. The following profile, for Canada in 2002,[36] is typical (Fig. 3.3).

Cohort-Age Profiles of Healthcare Spending We can study healthcare consumption of one particular birth cohort over time—that is, as it ages. At different points in time, we would have data on healthcare spending for the same group of people: the cohort-age profiles.

3.3.2 Projections of Health Expenditure

How come that if individual age profiles tend to show increasing average consumption of healthcare goods and services with chronological age, most macro-level studies do not find that age is a major driving factor of healthcare spending? Usually, forecasts of health spending are based on cross-sectional, period-age profiles. Projecting into the future healthcare consumption by age group based solely on one or more years of cross-sectional age profiles by necessity requires assuming that several other factors will not change over the forecasting period. The following is a *short* list of such factors that would be captured under the *ceteris paribus* clause:

> …the incidence and character of sickness and injury; standards of diagnosis; quantity and quality of treatment; the provision of resources in goods and services; the present level of unsatisfied demand; and the present proportionate distribution of consumer use of the service by age, sex…
>
> (Abel-Smith and Titmuss 1956, p. 154)

Przywara (2010) presented a useful classification of the factors and variables that have to be taken into account for projecting healthcare spending. It comprises demographic, health, public policy, and economic and social factors. Public policy and economic and social factors can be additionally classified into demand-side and supply-side factors. Population structure, for example, is a demographic factor which along with any other demographic factors that may affect spending of healthcare goods and services does so via changes or pressures in the demand for these goods and services. The same is true of a health factor such as the improvement over time in the average health status of a given age group (e.g. people aged 85 or over) due to intervening cohort effects. However, there are public policy factors that influence spending due to their impact on the demand of healthcare, whilst other public policy factors affect the supply of healthcare. For example, health promotion initiatives influence demand, whereas funding or regulatory measures modify the supply of healthcare services. Likewise, an economic factor such as disposable income is related to demand for health, whereas changes in relative costs have repercussions on the supply of health services.

In summary, there is a myriad of elements that may affect future health spending other than changes in the age structure of a population, which should be taken into consideration when projecting health expenditure levels. Furthermore, these elements are interconnected to one another, and these relationships should also be considered in the forecasting exercises. One variable whose importance in spending on health has been actively researched and hotly contested is the costs near the end of life. In 1999, Zweifel et al. conjectured that the growth in public healthcare expenditure per person is *independent* of population ageing and that it depends on remaining time to death, not on chronological age: the ageing of a population would have no impact on changes in healthcare spending per head. The authors concluded:

'Exclusive emphasis on population ageing as a cause of growth in per capita [healthcare expenditure] runs the risk of creating a red herring by distracting from the choices that ought to be made' (Zweifel et al. 1999, p. 494). The **red herring hypothesis** was born.

3.3.3 The Red Herring Hypothesis

According to Polder et al. (2006, p. 1729), the 'red herring hypothesis' tries 'to demonstrate that standard projection methods that use fixed costs per age-gender group will overestimate the effects of ageing on future health expenditure'; hence its importance for the study of health, economics, and ageing—see also (Mason et al. 2015). Zweifel et al. came to this conjecture by analysing two datasets from Swiss sick funds between 1983 and 1992/94 and focusing on the last year of life; the paper gave origin to a vast literature.

The hypothesis was validated with English data for the period 1998/99–2012/13:

> it is proximity to death rather than age per se that seems the more important influence on [inpatient hospital care] costs…So when it comes to hospital expenditure, policy-makers may need to pay more attention to the rate at which the population is dying than to the rate at which it is ageing.
>
> (Aragón et al. 2016, p. 430)

The hypothesis was also validated for France (Gastaldi-Ménager et al. 2016) and Germany (Karlsson et al. 2016), where the last year of life accounts for about eight per cent of an individual's lifetime healthcare spending. Other definitions of 'proximity' were applied, and studies that looked into the last four years of life tend to confirm the 'red herring' hypothesis (Felder et al. 2010; Werblow et al. 2007; Zweifel et al. 2004).

Another way to assess the importance of proximity to death for healthcare expenditure is to estimate how much spending in the last year (or last three years) of life represents in terms of total healthcare expenditure in a country. Data from the USA shows that the last year of life is responsible for 6.7 per cent of total medical spending and for 16.8 per cent of all healthcare expenditure for the population aged 65 and over (Nardi et al. 2016). Polder et al. (2006) found that healthcare costs in the last year of life were 13.5 times higher than average lifetime costs in the Netherlands, and that the last year of life took up 10 per cent of all healthcare spending. In Israel, the cost of medical care during the last year of life is 20 times the average annual cost for survivors (Shmueli et al. 2010).

Apart from acute care and long-term healthcare services, proximity to death is also a key determinant of expenditure on prescriptions. A study of data from the Republic of Ireland concluded:

> …age is not a driver of prescription expenditure in the population age 70 years or more…Regardless of what age is a proxy for, failure to account for the large number of individuals who die in any year leads to an over estimation of the true expenditure and perpetuates the theory of ageing alone driving costs.
>
> (Moore et al. 2017, p. 6)

However, costs associated to proximity to death may also vary by the chronological age of the patient. For example, Baal and Wong (2012) reported that in the Netherlands, healthcare expenditure in the last 12 months of life at age 65 was about 20 times higher than in other years but that the proportion went down to 2.5 times at age 90. Similar results were reported for Scotland (Geue et al. 2014), Finland (Forma et al. 2009), and Japan (Fukawa 2016).

A related consideration is the **Eubie Blake effect**: that more healthcare is spent on patients who are more likely to profit from the services for a longer time period (Breyer et al. 2015).

A word of caution: despite this wealth of evidence, it is worth considering the following recommendation:

> …while we can confirm that simulations on the basis of the population age structure alone are misleading, the same applies when only age-specific mortality rates are added. The effect of rising longevity cannot be ignored, either.
>
> (Breyer et al. 2015, p. 107)[37]

3.3.4 Adding Years to Life, but Life to Years as Well?

The United Nations projected that by 2050 there will be 379 million people aged 80 or over in the world, of whom 3.2 million are centenarians, [38] and 944 million by 2100, up from around 125 million in 2015 (United Nations 2015). In the UK, it has been projected that one-third of all babies born in 2012 will be alive by 2112 (ONS 2010). In the USA, death rates among centenarians have been *decreasing* since 2008: even centenarians are getting older (Xu 2016).

With increasing numbers of people reaching and expected to reach very old age whether these added years are lived in good health or not is of paramount importance in so many aspects including the repercussions for public and private healthcare and social care spending. There are three hypotheses to account for the changes in healthy years as mortality rates fall—that is, as the saying goes, whether the addition of 'years to life' is mirrored by added 'life to years': compression of morbidity, failures of success, and dynamic equilibrium (Siegel 2012).

- The **expansion of morbidity** hypothesis—also known as 'failures of success' (Gruenberg 1977)—proposes that medical advancements increase survival rates from previously incurable diseases but, as an unintended consequence, expand morbidity in later life: people are living longer as more and more people survive cardiovascular disease, stroke, or cancer, but these gains in survival are accompanied by an increasing prevalence of age-related diseases and conditions including dementia or frailty. This increase in age-specific disability rates results in an expansion of morbidity: lower mortality would come at the expense of worsening health (Olshansky et al. 1991).
- **Compression of morbidity** (Fries 1980). Improvements in medical science and in health-related behaviours would postpone morbidity but not mortality if life expectancy is close to or at the maximum lifespan, or if life expectancy increases by less than the time morbidity is delayed. In each case, the chronological age at onset of morbidity, disability, frailty, or infirmity would increase faster than life expectancy. According to the proponents of this hypothesis, the key to healthier old age is health promotion conducive to pro-health behavioural changes and chronic disease prevention.[39] Compression of morbidity onto the end of life can co-exist with fixed or rising human lifespan, and with falling and increasing life expectancy: its occurrence depends on the relative changes in morbidity against those in mortality or life expectancy (Fries et al. 2011). As said, compression may be achieved if the delay in years exceeds the gains in life expectancy or, *in extremis*, under a fixed life expectancy scenario; the latter would render survival curves of increasingly rectangular shape—see Volume I, Chap. 2. But mortality compression is not the same as, and is not even necessary for, morbidity (and healthy life expectancy). If mortality improves but morbidity rates remain unchanged, lifetime morbidity would increase as the prevalence rates of disability would go up with advancing chronological age. On the other hand, mortality can improve without being compressed; if morbidity is delayed in these circumstances, then lifetime morbidity would decrease (Stallard 2016). Moreover, compression can also result from regaining functioning or good health more quickly through shorter recovery periods.

- **Dynamic equilibrium** (Manton 1982). According to Manton, authors that support the compression of morbidity hypothesis view age-related chronic illness as a loss of organ reserve as a consequence of physiological processes for which delay in onset would be more effective than 'cure'. In contrast, expounders of the expansion of morbidity hypothesis consider age-related chronic illness as pathologies for which prevention would be more effective. The dynamic equilibrium hypothesis proposes that increasing survival is offset by a reduction in prevalence rates of age-related diseases, which maintains the proportion of years of life spent in good health more or less constant. Both mortality and morbidity fall, so the question whether the years lived free from disability and illness expand or compress is left unanswered and subject to empirical scrutiny. The focus is on the management of chronic diseases, irrespective of the efforts to reduce prevalence via prevention. The concept of dynamic equilibrium requires that morbidity and mortality are related: changes in severity and prevalence of chronic diseases would be correlated with falling mortality and with falling morbidity as the deterioration in vital organs with increasing chronological age is reduced.

The Hypotheses at Disease Level The evidence regarding these hypotheses based on macro or aggregate health indicators is mixed, though it tends to favour the compression hypothesis except for chronic diseases where there seems to be an expansion in morbidity (Chatterji et al. 2015).

Health is a multifaceted concept, so there may be compression of morbidity for certain conditions and expansion for others: disability may be postponed, whilst the years suffering from chronic disease may be on the rise as a result of extending life expectancy. It is important, then, to consider individual diseases or groups of diseases apart from macro-health indicators—Parker and Thorslund (2007) proposed to extend the indicators of functional limitation or disability which are generally used to validate the compression/expansion hypotheses from a macro-health perspective (as opposed to a focus on individual conditions) with an indicator for the burden of chronic diseases that combines conditions such as hypertension, diabetes, obesity, and mental and behavioural disorders; the authors argued that the prevalence of these conditions is positively associated with medication costs, healthcare visits, and opportunity costs of lifelong treatment. Studies on the prevalence of disability (measured as number of daily life activities which an individual has difficulty to perform) show declining morbidity among older people at a faster rate than the improvement in age-specific mortality, thus favouring the compression hypothesis (Payne et al. 2007). Focusing on various health conditions is relevant, because some diseases show development and trends in opposing directions: for example, the onset age of type 2 diabetes is decreasing (NCD Risk Factor Collaboration 2016) but that of myocardial infarction is decreasing (Gaziano and Gaziano 2016).[40] It should come as no surprise, then, that the literature has reported conflicting findings:

- In a study on health expectancy at age 65 years or older in England, Jagger et al. (2016) found support for the compression of morbidity hypothesis for cognitive impairment and self-perceived health, and reported that disability would be better explained by the dynamic equilibrium hypothesis.
- Support for the expansion of morbidity hypothesis was found in Walter et al. (2016), a study that looked into the gap between age-specific onset of a list of individual diseases including myocardial infarction, heart failure, cerebrovascular disease, and some cancers and life expectancy between 1997 and 2010 in Spain.
- In turn, a study in Germany of people aged between 65 and 89 years old looked into the three hypotheses using self-reported health and functional health as indicators (measured as needing help to perform daily life activities) and found evidence in support for both the compression of morbidity and the dynamic equilibrium hypotheses (Trachte et al. 2015).
- However, another paper, also looking into German data, but focusing on type 2 diabetes, found partial support for the expansion of morbidity (Muschik et al. 2016).

The Hypotheses in Case of Co-morbidities Another consideration is the joint presence of co-morbidities and the disability resulting from certain diseases, such as diabetes. For example, Bardenheier et al. (2016), in a study of over 20,000 people aged 50 or over in the USA, reported the people who suffered from diabetes died 4.6 years earlier and developed disability 6–7 years earlier than adults without diabetes—which implies longer years with disability despite shorter life expectancy for diabetes patients. Co-morbidity is 'a very common and important dimension of disease…that is often neglected in scientific papers, especially by economists' (Banks et al. 2016, p. 368).

The Hypotheses in Population Subgroups It is also important—as we will also discuss below at greater length with regard to health inequality—to define whether we consider a population as a whole or if we focus on the compression or expansion of morbidity for particular groups, for example, defined by chronological age. Even if we use life expectancy and disability-free life expectancy, findings based on LE at birth may differ from those at, say, 65 years of age. Salomon et al. (2013) compared life expectancy and healthy life expectancy at birth and at 50 years of age in 187 countries between 1990 and 2010. The authors concluded that because gains in healthy life expectancy across the world resulted from reductions in mortality rather than in morbidity, the gap between life expectancy and healthy life expectancy has increased with gains in life expectancy: the number of healthy years lost to non-fatal disability is positively associated with life expectancy at 50.[41] These findings support the expansion of morbidity hypothesis.

The Hypotheses at Disaggregated Geographical Areas Most studies focus at national level. However, using data at lower geographical levels may derive in different results. For example, Steensma et al. (2017) tested whether there had been relative compression and expansion of morbidity between 1994 and 2010 in Canada using life expectancy and disability-free life expectancy as measures. They reported that at the national level no trend was statistically significant but that for two provinces the evidence suggested an expansion of morbidity.

The Hypotheses and Relative Indicators Another point is that we can define compression or expansion not in absolute terms (i.e. number of years with a disability or illness) but in relative terms, as a proportion of expected number of years of life. However we define them, it may lead to different conclusions. *Ceteris paribus*, the elimination of non-fatal diseases, such as osteoarthritis, and eyesight and hearing problems would result in an increase in healthy years of life, while total life expectancy would remain fairly unchanged; this would lead to an absolute compression of morbidity. At the other extreme, *ceteris paribus* improvements in survival rates for currently highly fatal diseases such as pancreatic cancer can result not only in an increase in healthy years but in an even larger increase in years with disability, resulting in a relative or absolute expansion of morbidity. Absolute and relative compression and expansion of morbidity reflect four different scenarios (Nusselder et al. 1996; Robine and Mathers 1993)[42]:

- If life expectancy increases more than the gain in disability-free years, the expected number of years of life with disability declines, and we obtain an absolute compression of morbidity.
- If both life expectancy and disability-free years increase but the proportion of years expected to be lived free of disability declines, there is a relative expansion of morbidity.
- If both life expectancy and disability-free years increase but the proportion of years expected to be lived free of disability increases, there is a relative expansion of morbidity.

- If disability-free life expectancy declines at the same time as life expectancy increases, we obtain an absolute expansion of morbidity.

The Hypotheses and Health Spending Finally, we need to ascertain the impact of whichever hypothesis may be validated on spending. As Payne et al. (2007, pp. 222–223) warn:

> It is tempting to conclude that the compression of morbidity evident in the estimations of increasing disability-free life expectancy should translate into less money spent on health care…Apparent improvements in population morbidity may be due to one or a combination of the following factors: the increased usage of the health care system, more effective health care, and healthier lifestyles. Different combinations of these variables carry different implications for expenditures.

The impact of population ageing on healthcare costs would depend on whether there is a compression or expansion of morbidity for individual illnesses or groups of disease and on the relative costs of treating these various conditions (Parker and Thorslund 2007).

Morbidity exerts direct impact on utilisation of healthcare services and on costs. In a study among people aged 72 or over in Germany, Nagl et al. (2012) found that each additional co-morbidity increased healthcare costs by 17 per cent and that older people with 10 or more co-morbidities caused average annual costs 5.5 times higher than people without any disease. Similarly, Glynn et al. (2011) found among people aged 50 or over in the Republic of Ireland that having 4 or more co-morbidities is associated with total healthcare costs 5.4 times higher than not having any condition—although the authors reported that the ratio for the USA was 15 times higher. However, projecting future healthcare costs using population projections only could be greatly misleading as there would be no account for compression or expansion of morbidity. If there is compression of morbidity, the projections overestimate future healthcare costs. If expansion of morbidity is a more accurate depiction of future trends, projections that do not take this into account underestimate future healthcare costs. Caley and Sidhu (2011) presented projections of healthcare costs for a region in England based on different morbidity scenarios using the same underlying demographic projections: healthcare costs due to population ageing were projected to increase between 0.48 per cent and 1.12 per cent each year (between 2006 and 2031) depending on whether morbidity was compressed or expanded over the period. A similar exercise, using data for people aged 65 or over in Australia, projected that health expenditure per person would increase 3.33 per cent on average between 2015 and 2035 on the basis of population ageing only, but once changes in morbidity were factored in, the annual growth in health expenditure per person was estimated at 1.87 per cent (Harris and Sharma 2016).

Review and Reflect

1. Discuss the following critiques to the theoretical approach introduced by Michael Grossman:

> *A reading of Grossman produces some interesting explanations. For instance, the average life expectancy for males in some parts of Glasgow, Scotland is declining and is now in the region of 68 years: similar to levels recorded in the 1940s. Following Grossman, a plausible explanation (requiring empirical testing) would be along the following lines: income constraints are becoming more binding for certain groups, or their tastes have changed, in this particular locale and accordingly rational individuals reduce their demand for health, implying that their health stock depreciates more quickly. Like Becker, instrumental rationality is at the centre of Grossman's explanation. Here the association between poverty and poor health status is recognised as a constraint: the individual trades-off health stock for other utility yielding commodities subject to a more binding constraint. The individual is socially disembedded in an institutional vacuum.*
>
> *(McMaster 2007, p. 14)*

> *…it is frequently assumed that individuals are born with a specific amount of health capital that depreciates over time. It is also assumed that the rate of depreciation depends on gross investments in health and on the level of health technology (which is assumed to be both exogenous to the individual and independent of the date of birth -i.e., neglects cohort effects)…While these assumptions greatly simplify estimating procedures, they are inconsistent with accumulating evidence that successive birth cohorts are experiencing later onset of chronic diseases and disabilities, lower age-specific prevalence rates, and less severe conditions…*
>
> *(Fogel 2003, p. 22)*

2. Discuss the following paragraph in the light of the 'red herring' hypothesis:

> *Grossman's (1972) highly influential model of health care as an investment in human capital indicated that for a given health status, the decreasing value of healthy time and the decreasing expected length of life could reduce the equilibrium level of desired health as age rises. If this is so, any model that includes both time-to-death and age should estimate a negligible, or even negative, effect for age.*
>
> *(Payne et al. 2007, p. 245)*

(continued)

3. Consider the following passage:

   …clearly we can't study everything, can we? Unfortunately this is exactly what we must do if we wish to deal with the behaviour of human beings living in an uncertain world and to avoid the misleading and ultimately dehumanising fragmentation that results from the unthinking application of the 'scientific method' to the social world. 'Treat the patient rather than the disease' is the familiar, everyday, protest against such a tendency in the health area but apart from its lack of practical success it is in itself an inadequate response. Treating the patient as a patient is better than treating him as a bundle of diseases, but it is inferior to treating him as a person. The maxim ought to be 'treat the person not the patient'.

   (Dowie 1975, p. 620, italics in the original)

4. On arguing about some of the economic implications of the 'dynamic equilibrium' hypothesis, Manton (1982, p. 228) states:

   Health care costs will be incurred in reducing the severity of the chronic disease, or slowing its rate of progression, in order to reduce mortality risks. In return, it is expected that these costs will accelerate as life expectancy (and disease prevalence) increase. However, since life-span extensions are produced by reductions in the rate of progression of the disease, productive life span will also increase and potentially lead to greater economic productivity. Increases in health care costs will thus have to be balanced against greater economic productivity. Thus, equilibrium leads us naturally to a dynamic "cost/benefit" ratio.

   Discuss this quote and present the cases against it from the 'compression of morbidity' and the 'failures of success' hypotheses.
5. Consider the following statement:

   Conventional wisdom and media discourse emphasises that population ageing is the main driver of increases in particular morbidities. Our analysis shows this is a gross over-simplification. Population growth and changing ethnic composition also have important roles. But the most important driver is the progress or lack of progress in driving down the prevalence rates by gender, age and ethnicity.

   (Clark and Rees 2017, p. 38)

   Assume for a moment it is correct. Why would contemporary media discourse reflect such a grossly over-simplified view?

   In their study, Clark and Rees focused specifically on diabetes. Can you think of any economic levers that could help bring down prevalence rates of chronic diseases such as diabetes?
6. Reflecting upon the intensity of the healthcare services delivered to older people within the context of population ageing, Barer et al. (1987, p. 859) wrote:

(continued)

> *…the crucial question, which cannot be answered without additional data and analysis, is whether this increased intensity of servicing is an appropriate response to levels of morbidity among the elderly. It would be appropriate either if specific types of morbidity for which the health care system has effective interventions were increasing, or if existing morbidity from previously untreatable disorders could now be treated effectively. It would be an inappropriate response if it were based either on misguided perceptions of the effectiveness of the extra services, on income aspirations of providers, or on demands from patients unrelated to underlying health care needs. Even without an answer to this question, it is important to note that the focus of the policy debate is shifted significantly when the 'crisis' of the elderly is framed in this fashion.*

Prepare two policy statements framing in two opposite ways—one in favour of and the other one against—the need for increasing healthcare services resulting from an ageing population. Which of the hypotheses and theoretical frameworks reviewed in this chapter would provide an analytical basis for each statement? To what extent does existing evidence support them?

7. On focusing on individual and population ageing, there is a risk of distracting from other structural considerations such as race or gender that also present socio-economic gradients. With this in mind, discuss the following quote:

> *A major socioeconomic barrier, the high rate of poverty among older women …, is most problematic among minority older women …. Lifelong health risks that accumulate over the life cycle, with increasing chronic and acute health episodes causing significant health crises, are not easily remedied by access to Medicare in late life.*
> *Although Medicare helps to minimize the erosion of health access for many older women, it does not provide services to noncitizen older adults, and access to Medicaid services varies by state. Sexism, racism, and ageism put older, minority females at greater risk for not receiving preventive care and gold standard treatment for their health conditions.*
> *(Yee and Chiriboga 2007, p. 302)*

Notes

1. *A devil, a born devil, on whose nature*
   Nurture can never stick; on whom my pains,
   Humanely taken, all, all lost, quite lost;
   And as with age his body uglier grows,
   So his mind cankers. I will plague them all,
   Even to roaring. Shakespeare (1958, Act IV, Scene 1).
2. Source: http://www.schizophrenia.com/. Accessed on 15 May 2017.
3. Source: *World Development Indicators - World Bank*.

4. Source: *US Department of Commerce. Bureau of Economic Analysis*.
5. For example, according to Ludbrook and Cohen (2003, p. 223), economics of healthcare studies 'the contribution that the formal healthcare sector makes to the production of health'.
6. See also Ludbrook and Cohen (2003) for a similar position.
7. In Alfred Marshall's words: 'the direct demand for the finished product is in effect split up into many derived demands for the things used in producing it' (Marshall 2013, Book V, Ch VI, para. 3; p. 316).
8. Similarly, the demand for health insurance is derived from the demand for health.
9. Or 'citizen' as in Edwards's paper, though given that it has little to do with issues around citizenship and healthcare (Bergman et al. 2011; Dwyer 2001, on this topic, see, for example,), I prefer to talk about the 'individual'.
10. There are several introductory textbooks to economics and health, including Cullis and West (1979), Henderson et al. (2005), McPake et al. (2013), Morris et al. (2007), Sloan and Hsieh (2012), Folland et al. (2016), Santerre and Neun (2010) and Zweifel et al. (2009).
11. Especially in developed countries, albeit not much so in studies of low- and middle-income countries. O'Neill (2017) notes that less than one per cent of studies on MEDLINE (an online academic search tool for the biosciences) look into the relationship between global health and population ageing.
12. On the difference between health as a state and health as capital, see Blaxter (2010).
13. The precise definition of a continuous function and continuity in calculus is beyond the level of this textbook, but for our purposes we can think of a continuous function as a function with no 'breaks' (Sydsæter et al. 2012, section 7.8); in other words, there exists a value for h_t at every period t. A function is differentiable at a particular point (e.g. $t = t_o$) if there exists a value when we move *infinitesimally* to another point—more technically, if this limit exists. A function is twice differentiable if there exists a value for the 'variation of the variation' or a further infinitesimal increase applied to the infinitesimal increase. For more precise definitions, see Sydsæter et al. (2012, sections 6.6 and 6.9).
14. Technically, we assume the first derivative is positive, not *strictly* positive.
15. See Muurinen (1982) for an in-depth analysis of theoretical aspects of the relationship between health demand and education. However, whether there exists a positive association is an empirical matter. Grossman himself, on reviewing the literature on the links between health education, concluded that the evidence is conflicting enough to assert whether the assumption is valid (Grossman 2015).
16. More complex specifications introduce a stock of financial assets and other wealth, which yields income and accumulates or depletes over time.

17. There are statistical approaches to deal with uncertainty, including Bayesian updating of posterior probabilities and multi-prior probability distributions, which should not concern us here.
18. The uncertainty around how much health is improved by investments in healthcare goods and services can be interpreted as either imperfect diagnostic information about precise health stock or as the impact of stochastic exogenous determinants of health (Dardanoni and Wagstaff 1990).
19. See Hugonnier et al. (2013) and Pelgrin and St-Amour (2016) for recent extensions.
20. Other healthcare providers such as dentists and physiotherapists as well.
21. For a complete treatment of the principal-agent model in economics, see Laffont (2002), and for a description of principal-agent relationships in the healthcare sector, see Jones and Zanola (2001), Liu and Mills (2007), Schneider and Mathios (2006), and Schwartz (1997) and Folland et al. (2016, ch. 10).
22. See Volume I, Chap. 8.
23. Needless to say, more complex models can be, and have been, designed. See McGuire and Pauly (1991) for a seminal paper.
24. For a survey of overconsumption of medical services around the world, see Brownlee et al. (2017).
25. Jacobson et al. (2017) also reported a positive effect on survival.
26. See also Dalgaard and Strulik (2015).
27. Zweifel and Eisen (2012) provide a thorough introduction. See also Zweifel (2007) for public or social health insurance.
28. 'Skewed data is the main issue in statistical models in healthcare costs' (Malehi et al. 2015, p. 1).
29. Known as the Bernoulli's theorem, it was first presented by the Swiss mathematician Daniel Bernoulli; see Bernoulli (1954).
30. Usually at least four or five drugs.
31. See also Mackenbach (2015) and Commission on Social Determinants of Health (2008).
32. Social capital has a horizontal and a vertical dimension. At a horizontal level, social capital bonds and bridges across individuals and communities—that is, bonding and bridging social capital. The vertical dimension refers to its capacity for linking people from different economic, social, or political backgrounds.
33. See also Hoffmann (2008).
34. 'Whatever everyone knows, is usually wrong, and common sense is either not common, or not sense' (Barer et al. 1987, p. 851).
35. That is, the 'compression of morbidity'—see below.
36. *Source:* Canadian Institute for Health Information (2016). National Health Expenditure Trends, 1975–2015. Table 'Total'. Available on https://

www.cihi.ca/en/spending-and-health-workforce/spending/national-health-expenditure-trends. Accessed on 17 January 2017.

37. See also Karlsson and Klohn (2014).
38. United Nations (2002).
39. On health promotion and older people, see Arsenijevic et al. (2016), Delgado (2008), Haber (2013), and Wilson and Palha (2007).
40. See also Geyer (2015).
41. Also at birth.
42. See also Beltrán-Sánchez et al. (2014).

References

Abel-Smith, Brian, and Richard Titmuss. *The Cost of the National Health Service in England and Wales*. Cambridge: Cambridge University Press, 1956.

Alexa, Ioana Dana et al. "Non-compliance in a large population of elderly patients with cardiovascular disease." *Medica: A Journal of Clinical Medicine* 1, no. 3 (2006): 4–18.

Aragón, Maria José, Martin Chalkley and Nigel Rice. "Medical spending and hospital inpatient care in England: An analysis over time." *Fiscal Studies* 37, no. 3–4 (2016): 405–432.

Arrow, Kenneth J. "Uncertainty and the welfare economics of medical care." *American Economic Review* 13, no. 5 (1963): 941–973.

Arsenijevic, Jelena et al. "A review of health promotion funding for older adults in Europe: A cross-country comparison." *BMC Health Services Research* 16, no. 5 (2016): 288. https://doi.org/10.1186/s12913-016-1515-2

Baal, Pieter H. van, and Albert Wong. "Time to death and the forecasting of macro-level health care expenditures: Some further considerations." *Journal of Health Economics* 31, no. 6 (2012): 876–887.

Baird, Katherine. "High out-of-pocket medical spending among the poor and elderly in nine developed countries." *Health Services Research* 51, no. 4 (2016): 1467–1488.

Banks, James, Soumaya Keynes, and James P. Smith. "Health, disability and mortality differences at older ages between the US and England." *Fiscal Studies* 37, no. 3–4 (2016): 345–369.

Bardenheier, Barbara H. et al. "Disability-free life-years lost among adults aged ≥50 years with and without diabetes." *Diabetes Care* 39, no. 7 (2016): 1222–1229.

Barer, M. et al. "Aging and health care utilization: new evidence on old fallacies." *Social Science & Medicine* 24, no. 10 (1987): 851–862.

Beltrán-Sánchez, Hiram, Fahad Razak, and S.V. Subramanian. "Going beyond the disability- based morbidity definition in the compression of morbidity framework." *Global Health Action* 7 (2014). http://dx.doi.org/10.3402/gha.v7.24766

Bergman, Bo, Duncan Neuhauser, and Lloyd Provost. "Five main processes in healthcare: A citizen perspective." *BMJ Quality & Safety Supplement 1* 20 (2011): i41–i42.

Bernoulli, Daniel. "Exposition of a new theory on the measurement of risk." *Econometrica* 22, no. 1 (1954): 23–36.

Bíró, Anikó. "Copayments, gatekeeping, and the utilization of outpatient public and private care at age 50 and above in Europe." *Health Policy* 111, no. 1 (2013): 24–33.

Blaxter, Mildred. *Health Key Concepts*. Cambridge: Polity Press, 2010.

Bosworth, Hayden. "Introduction." In: *Improving Patient Treatment Adherence A Clinician's Guide*. Edited by Hayden Bosworth, 1–8. New York, NY: Springer, 2010.

Breyer, Friedrich, Normann Lorenz, and Thomas Niebel. "Health care expenditures and longevity: Is there a Eubie Blake effect?" *The European Journal of Health Economics* 16, no. 1 (2015): 95–112.

Brownlee, Shannon et al. "Evidence for overuse of medical services around the world." *The Lancet* (2017). https://doi.org/10.1016/S0140-6736(16)32585-5

Buchanan, Allen. "Principal/agent theory and decisionmaking in health care." *Bioethics* 2, no. 4 (1988): 317–333.

Burns, Jonathan K., Andrew Tomita, and Amy S. Kapadia. "Income inequality and schizophrenia: Increased schizophrenia incidence in countries with high levels of income inequality." *International Journal of Social Psychiatry* 60, no. 2 (2014): 185–196.

Caley, Michael, and Khesh Sidhu. "Estimating the future healthcare costs of an aging population in the UK: Expansion of morbidity and the need for preventative care." *Journal of Public Health* 33, no. 1 (2011): 117–122.

Cardozo, Cláudia. "Health economics or health care economics?" *Revista de Estudios Politécnicos Polytechnical Studies Review* VI, no. 10 (2008): 189–198.

Case, Anne, and Angus, Deaton. "Broken down by work and sex: How our health declines." In *Analyses in the Economics of Aging NBER Conference Report*. Edited by David A. Wise, 185–212. Chicago, IL: University of Chicago Press. 2005.

Chang, Hong et al. "Further evidence of VRK2 rs2312147 associated with schizophrenia." *The World Journal of Biological Psychiatry* 17, no. 6 (2016): 457–466.

Charlesworth, Christina J. et al. "Polypharmacy among adults aged 65 years and older in the United States: 1988–2010." *The Journals of Gerontology Series A: Biological Sciences and Medical Sciences* 70 (2015): 989–995.

Chatterji, Somnath et al. "Health, functioning, and disability in older adults-present status and future implications." *The Lancet* 385, no. 9967 (2015): 563–575.

Chiang, Alpha C. *Fundamental Methods of Mathematical Economics*. New York, NY: McGraw-Hill. 1984.

Chodick, Gabriel, Sarah Sharman Moser, and Inbal Goldshtein. "Non-adherence with biphosphonates among patients with osteoporosis: Impact on fracture risk and healthcare cost." *Expert Review of Pharmacoeconomics & Outcomes Research* 16, no. 3 (2016): 359–370.

Clark, Stephen D., and Philip H. Rees. "The drivers of health trends: A decomposition of projected health for local areas in England." In *The Frontiers of Applied Demography*. Edited by David A. Swanson. Applied Demography Series, vol. 9, 21–40. Cham: Springer. 2017.

Codish, Shlomi, and Richard N. Shiffman. "A model of ambiguity and vagueness in clinical practice guideline recommendations." In *AMIA Annual Symposium Proceedings*, vol. 2005, 146–150. Bethesda, MD: American Medical Informatics Association. 2005.

Colombier, Carsten. "Population ageing in healthcare a minor issue? Evidence from Switzerland." *Applied Economics* (2017) 1–15. https://doi.org/10.1080/00036846.2017.1374538

Commission on Social Determinants of Health. *Closing the Gap in a Generation: Health Equity Through Action on the Social Determinants of Health*. Geneva: World Health Organization. 2008.

Conrad, Douglas A., and Sean D. Sullivan. "Health economics." In *Encyclopedia of Biostatistics*. Edited by Peter Armitage and Theodore Colton. 2nd ed. Hoboken, NJ: Wiley. 2005.

Costa, Filipa Alves da et al. "Effects of economic recession on elderly patients' perceptions of access to health care and medicines in Portugal." *International Journal of Clinical Pharmacy* 39, no. 1 (2017): 104–112.

Coulson, N. Edward et al. Estimating the moral-hazard effect of supplemental medical insurance in the demand for prescription drugs by the elderly. *The American Economic Review* 85, no. 2 (1995): 122–126.

Covello, Vincent T., and Miley W. Merkhofer. *Risk Assessment Methods: Approaches for Assessing Health and Environmental*. New York, NY: Springer. 1993.

Cropper, Maureen L. "Health, investment in health, and occupational choice." *The Journal of Political Economy* 85, no. 6 (1977): 1273–1294.

Cullis, John G., and Peter A. West. *The Economics of Health: An Introduction*. New York, NY: New York University Press. 1979.

Culyer, Anthony J. *The Dictionary of Health Economics.* Cheltenham: Edward Elgar Publishing. 2005.

Curtis, Lesley H. et al. "The insurance effect on prescription drug expenditures among the elderly: Findings from the 1997 medical expenditure panel survey." *Medical Care* 42, no. 5 (2004): 439–446.

Cutler, David M., and Mark McClellan. "Is technological change in medicine worth it?" *Health Affairs* 20, no. 5 (2001): 11–29.

Cutler, David M., Wei Huang, and Adriana Lleras-Muney. *Economic Conditions and Mortality: Evidence from 200 Years of Data*. NBER Working Paper 22690. Cambridge, MA: National Bureau of Economic Research. 2016.

Dahlgren, Göran, and Margaret Whitehead. *Policies and Strategies to Promote Social Equity in Health. Background Document to WHO Strategy Paper for Europe*. Stockholm: Sweden. 1991.

Dalgaard, Carl-Johan, and Holger Strulik. "Optimal aging and death: Understanding the Preston curve." *Journal of the European Economic Association* 12, no. 3 (2014): 672–701.

—. "The economics of health demand and human aging: Health capital vs health deficits." 2015. http://holger-strulik.org/my_papers/health_capital_deficits.pdf

Danczak, A., and A. Lea. *Mapping Uncertainty in Medicine: What to Do When You Don't Know What to Do?* London: Royal College of General Practitioners. 2016.

Dardanoni, Valentino, and Adam Wagstaff. "Uncertainty inequalities in health and the demand for health." *Journal of Health Economics* 6, no. 4 (1987): 283–290.

—. "Uncertainty and the demand for medical care." *Journal of Health Economics* 9, no. 1 (1990): 23–38.

Deleuze, Giles, and Félix Guattari. *Anti-Oedipus. Capitalism and Schizophrenia*. London: Bloomsbury Academic. 2004.

Delgado, Melvin. *Older Adult-led Health Promotion in Urban Communities: Models and Interventions*. Plymouth: Rowman & Littlefield Publishers. 2008.

De Meza, David. "Health insurance and the demand for medical care." *Journal of Health Economics* 2, no. 1 (1983): 47–54.

Dormont, Brigitte, Michel Grignon, and Hélène Huber. "Health expenditure growth: Reassessing the threat of ageing." *Health Economics* 15, no. 9 (2006): 947–963.

Dowie, Jack. "The portfolio approach to health behavior." *Social Science & Medicine* 9 (1975): 619–631.

Doyle, Conor Simon White, and Lizzie Mills. "Adherence with oral chemotherapy in a cancer unit in Northern Ireland." *Journal of Medicines Optimisation* 2, no. 2 (2016): 28–33.

Dwyer, Peter. "Retired EU migrants, healthcare rights and European social citizenship." *The Journal of Social Welfare & Family Law* 23, no. 3 (2001): 311–327.

Eddy, David, M. "Variations in physician practice: The role of uncertainty." *Health Affairs* 3, no. 2 (1984): 74–89.

Edwards, R.T. "Paradigms and research programmes: Is it time to move from health care economics to health economics?" *Health Economics* 10, no. 7 (2001), 635–650.

Elkeles, Thomas, and Andreas Mielck. "Entwicklung Eines Modells Zur Erklärung Gesund- heitlicher Ungleichheit." *Gesundheitswesen* 59, no. 3 (1997): 137–143.

Elliott, R., and K. Payne. *Essentials of Economic Evaluation in Healthcare*. London: Pharmaceutical Press. 2005.

Fabbri, Daniele, and Chiara Monfardini. "Public vs. private health care services demand in Italy." *Giornale Degli Economisti e Annali di Economia* 62, no. 1 (2003): 93–123.

Fang, Hai, and John A. Rizzo. "Competition and physician-enabled demand: The role of managed care." *Journal of Economic Behavior & Organization* 72, no. 1 (2009): 463–474.

Felder Stefan, Andreas Werblow, and Peter Zweifel. "Do red herrings swim in circles? Controlling for the endogeneity of time to death." *Journal of Health Economics* 29, no. 2 (2010): 205–212.

Fogel, Robert W. *Changes in the Process of Aging During the Twentieth Century: Findings and Procedures of the Early Indicators Project*. NBER Working Paper 9941. Cambridge, MA: National Bureau of Economic Research. 2003.

Folland, Sherman, Allen C. Goodman, and Miron Stano. *The Economics of Health and Health Care.* Pearson International Edition. New Jersey, NJ: Prentice Hall. 2016.

Forma, Leena et al. "Age and closeness of death as determinants of health and social care utilization: A case-control study." *The European Journal of Public Health* 19, no. 3 (2009): 313–318.

Fries, James F. "Aging, natural death, and the compression of morbidity." *The New England Journal of Medicine* 303, no. 3 (1980): 130–135.

Fries, James F., Bonnie Bruce, and Eliza Chakravarty. "Compression of morbidity 1980–2011: A focused review of paradigms and progress." *Journal of Aging Research* 2011 (2011): Article ID 261702.

Fuchs, Victor R. *Who Shall Live? Health, Economics, and Social Choice*. Economic Ideas Leading to the 21st Century Singapore, vol. 3. Singapore: World Scientific. 1998.

Fukawa, Tetsuo. "Inpatient expenditure of the decedent elderly in Japan." *British Journal of Medicine & Medical Research* 15, no. 10 (2016): 1–10.

Fukushima, Kazuya et al. "Patient cost sharing and medical expenditures for the elderly." *Journal of Health Economics* 45 (2016): 115–130.

Gastaldi-Ménager Christelle, Pierre-Yves Geoffard, and Grégoire de Lagasnerie. "Medical spending in France: Concentration, persistence and evolution before death." *Fiscal Studies* 37, no. 3–4 (2016): 499–526.

Gavrilov, Leonid A., and Natalia S. Gavrilova. "Models of systems failure in aging." In *Handbook of Models for Human Aging*. Edited by P. Michael Conn, 45–68. Burlington, MA: Elsevier Academic Press. 2006.

Gaziano, Thomas A., and J. Michael Gaziano. "Global evolving epidemiology natural history and treatment trends of myocardial infarction." In *Myocardial Infarction: A Companion to Braunwald's Heart Disease*. Edited by David A. Morrow, 11. St Louis, MO: Elsevier. 2016.

Gee, Ellen M. "Misconceptions and misapprehensions about population ageing." *International Journal of Epidemiology* 31, no. 4 (2002): 750–753.

General Assembly of the United Nations. *Political Declaration of the High-Level Meeting of the General Assembly on the Prevention and Control of Non-communicable Diseases*. New York, NY: United Nations. 2011.

Geue, Claudia et al. "Population ageing and healthcare expenditure projections: New evidence from a time to death approach." *The European Journal of Health Economics* 15, no. 8 (2014): 885–896.

Geyer, S. "Die Morbiditätskompressionsthese und ihre Alternativen." *Das Gesundheitswesen* 77, no. 06 (2015): 442–446.

Giardini, Anna et al. "Toward appropriate criteria in medication adherence assessment in older persons: Position paper." *Aging Clinical and Experimental Research* 28, no. 3 (2016): 371– 381.

Glynn, Liam G. et al. "The prevalence of multimorbidity in primary care and its effect on health care utilization and cost." *Family Practice* 28, no. 5 (2011): 516–523.
Grossman, Michael. "On the concept of health capital and the demand for health." *Journal of Political Economy* 80, no. 2 (1972): 223–255.
—. "The human capital model." In *Handbook of Health Economics*. Edited by Anthony J. Culyer and Joseph P Newhouse, vol. 1A, 347– 408. Amsterdam: Elsevier. 2000.
—. "The relationship between health and schooling: What's new?" *Nordic Journal of Health Economics* 3, no. 1 (2015): 7–17.
Gruber, Stefan, and Markus Kiesel. "Inequality in health care utilization in Germany? Theoretical and empirical evidence for specialist consultation." *Journal of Public Health* 18 (2010): 351–365.
Gruenberg, Ernest M. "The failures of success." *The Milbank Memorial Fund Quarterly Health and Society* 55 (1977): 3–24.
Haber, David. *Health Promotion and Aging Practical Applications for Health Professionals*. New York, NY: Springer. 2013.
Han, Paul K., William M. Klein, and Neeraj K. Arora. "Varieties of uncertainty in health care: A conceptual taxonomy." *Medical Decision Making* 31, no. 6 (2011): 828–838.
Harris, Anthony, and Anurag Sharma. *The Future of Health and Aged Care Expenditure in Australia*. CSIRO-Monash Working Paper 2016-05. 2016.
Hauck, Katharina, and Xiaohui Zhang. "Heterogeneity in the effect of common shocks on healthcare expenditure growth." *Health Economics* 25 (2016): 1090–1103.
Healthcare Intelligence Network. *2010 Benchmarks in Improving Medication Adherence*. Sea Girt, NJ: Healthcare Intelligence Network. 2010.
Henderson, John, Alistair Mcguire, and Gavin Mooney. *Economics of Health Care*. New York, NY: Taylor & Francis. 2005.
Hennessy, Deirdre et al. "Out-of-pocket spending on drugs and pharmaceutical products and cost-related prescription non-adherence among Canadians with chronic disease." *Health Reports* 27, no. 6 (2016): 3–8.
Herr, M. et al. "Polypharmacy and frailty: Prevalence, relationship, and impact on mortality in a French sample of 2350 old people." *Pharmaco Epidemiology and Drug Safety* 24, no. 6 (2015): 637–646.
Herzlich, Claudine. *Santé et Maladie: Analyse d'une Representation Sociale*. Paris: Éditions Mouton. 1969.
Hoffmann, Rasmus. *Socioeconomic Differences in Old Age Mortality*. The Springer Series on Demographic Methods and Population Analysis. Dordrecht: Springer. 2008.
Hugonnier, Julien, Florian Pelgrin, and Pascal St-Amour. "Health and (other) asset holdings." *The Review of Economic Studies* 80, no. 2 (2013): 663–710.
Hurley, Jeremiah. "An overview of the normative economics of the health sector." In *Handbook of Health Economics*. Edited by Anthony J. Culyer and Joseph P. Newhouse. Handbook of Health Economics, 55–118. Amsterdam: Elsevier. 2000.

Hutt, William H. "The concept of consumers' sovereignty." *The Economic Journal* 50, no. 197 (1940): 66–77.
Jacobson, Mireille et al. *Physician Agency and Competition: Evidence from a Major Change to Medicare Chemotherapy Reimbursement Policy.*" Working Paper No 19247. National Bureau of Economic Research. 2013.
Jacobson, Mireille G. et al. "Physician agency and patient survival." *Journal of Economic Behavior & Organization* 134 (2017): 27–47.
Jagger, Carol et al. "A comparison of health expectancies over two decades in England: Results of the cognitive function and ageing study I and II." *The Lancet* 387, no. 10020 (2016): 779–786.
Jiménez-Martín, Sergi, José M Labeaga, and Maite Martínez-Granado. "An empirical analysis of the demand for physician services across the European Union." *The European Journal of Health Economics* 5, no. 2 (2004): 150–165.
Jofre-Bonet, Mireia. "Health care: Private and/or public provision." *European Journal of Political Economy* 16, no. 3 (2000a): 469–489.
—. "Public health care and private insurance demand: The waiting time as a link." *Health Care Management Science* 3, no. 1 (2000b): 51–71.
Jokanovic, Natali et al. "Prevalence and factors associated with polypharmacy in long-term care facilities: A systematic review." *Journal of the American Medical Directors Association* 16, no. 6 (2015): 535:e1–535:e12.
Jones, Andrew, and Roberto Zanola. "Agency and health care." In *Public Decision-Making Processes and Asymmetry of Information*. Edited by Massimo Marrelli and Giacomo Pignataro, 165–188. Norwell, MA: Kluwer. 2001.
Jorgenson, Dale W. "Capital theory and investment behavior." *The American Economic Review* 53, no. 2 (1963): 247–259.
Kannisto, Vaino. "Mode and dispersion of the length of life." *Population: An English Selection Biodemographic Perspectives on Human Longevity* 13 (2001): 159–171.
Karlsson, Martin, and Florian Klohn. "Testing the red herring hypothesis on an aggregated level: Ageing, time-to-death and care costs for older people in Sweden." *The European Journal of Health Economics* 15, no. 5 (2014): 533–551.
Karlsson, Martin, Tobias J. Klein, and Nicolas R. Ziebarth. "Skewed, persistent and high before death: Medical spending in Germany." *Fiscal Studies* 37, no. 3–4 (2016): 527–559.
Kirkman, M. Sue et al. "Determinants of adherence to diabetes medications: Findings from a large pharmacy claims database." *Diabetes Care* 38, no. 4 (2015): 604–609.
Knight, Frank H. *Risk, Uncertainty and Profit*. Boston: MA: Houghton Mifflin Co. 1921.
Kong, Augustine et al. "How medical professionals evaluate expressions of probability." *New England Journal of Medicine* 315, no. 12 (1986): 740–744.
Kowald, Axel. "Lifespan does not measure ageing." *Biogerontology* 3, no. 3 (2002): 187–190.
Laffont, Jean Jacques. *The Principal Agent Model: The Economic Theory of Incentives*. Princeton, NJ: Princeton University Press. 2002.

Laporte, Audrey. *Should the Grossman Model of Investment in Health Capital Retain its Iconic Status?* Working Paper 04. Canadian Centre for Health Economics Centre Canadien en Économie de la Santé. 2015.

Laporte, Audrey, and Brian S. Ferguson. "Investment in health when health is stochastic." *Journal of Population Economics* 20, no. 2 (2007): 423–444.

Lau, Ying et al. "Multidimensional factors affecting medication adherence among community-dwelling older adults: A structural-equation-modeling approach." *Journal of Public Health* 25, no. 1 (2017): 113–122.

Lee, Ronald, and Timothy Miller. "An approach to forecasting health expenditures, with application to the US medicare system." *Health Services Research* 37, no. 5 (2002): 1365–1386.

Lee, Ronald, and Shripad Tuljapurkar. "Death and Taxes: Longer life, consumption, and social security." *Demography* 34, no. 1 (1997): 67–81.

Lee, Ronald, Andrew Mason, and Daniel Cotlear. *Some Economic Consequences of Global Aging: A Discussion Note for the World Bank*. Health, Nutrition and Population (HNP) Discussion Paper. Washington, DC: The World Bank. 2010.

Léonard, Christian, Sabine Stordeur, and Dominique Roberfroid. "Association between physician density and health care consumption: A systematic review of the evidence." *Health Policy* 91, no. 2 (2009): 121–134.

Lim, Li Min et al. "Prevalence, risk factors and health outcomes associated with polypharmacy among urban community-dwelling older adults in multi-ethnic Malaysia." *PLoS One* 12, no. 3 (2017). https://doi.org/10.1371/journal.pone.0173466

Lima, de et al. "Social determinants of death among the elderly: A systematic literature review." *Revista Brasileira de Epidemiologia* 17 (2014): 178–193.

Liu, Xingzhu, and Anne Mills. "Agency theory and its applications in health care." In *Public Ends, Private Means. Strategic Purchasing of Health Services*. Edited by Alexander S. Preker et al., 151–178. Washington, DC: The World Bank. 2007.

Longman, Philip. *Born to Pay: The New Politics of Aging in America*. Boston: Houghton Mifflin. 1987.

Ludbrook, Anne, and David Cohen. "Economics of health and health improvement." In *Advances in Health Economics*. Edited by Alan Maynard Anthony Scott and Robert Elliott, 223–240. Chichester: Wiley. 2003.

Mackenbach, Johan P. "Socioeconomic inequalities in health in high income countries: The facts and the options." In *Oxford Textbook of Global Public Health*. Edited by Rogers Detels et al., vol. 1, 106–126. Oxford: Oxford University Press. 2015.

Maeda, Toshiki et al. "Investigation of the existence of supplier-induced demand in use of gastrostomy among older adults: A retrospective cohort study." *Medicine* 95, no. 5 (2016): 1–7.

Malehi, Amal Saki, Fatemeh Pourmotahari, and Kambiz Ahmadi Angali. "Statistical models for the analysis of skewed healthcare cost data: A simulation study." *Health Economics Review* 5, no. 1–16 (2015), 11.

Manton, Kenneth G. “Changing concepts of morbidity and mortality in the elderly population.” *The Milbank Memorial Fund Quarterly Health and Society* 60 (1982): 183–244.

Marshall, John M. “Moral hazard.” *The American Economic Review* 66, no. 5 (1976): 880– 890.

Marshall, Alfred. *Principles of Economics*. Palgrave Classics in Economics. Basingstoke: Palgrave Macmillan. 2013.

Martín-Pérez, M. et al. “Prevalence of polypharmacy among the population older than 65 years in Spain: Analysis of the 2006 and 2011/12 national health surveys.” *Revista Española de Geriatría y Gerontología* 52, no. 1 (2017): 2–8.

Mason, Thomas et al. “Exploring the limitations of age-based models for health care planning.” *Social Science & Medicine* 132 (2015): 11–19.

McGuire, Thomas G. “Physician agency.” In *Handbook of Health Economics*. Edited by Anthony J. Culyer and Joseph P Newhouse, vol. 1, 461–536. Amsterdam: Elsevier. 2000

McGuire, Thomas G., and Mark V. Pauly. “Physician response to fee changes with multiple payers.” *Journal of Health Economics* 10, no. 4 (1991): 385–410.

McMaster Robert. “On the need for a heterodox health economics.” *Post-autistic Economics Review* 41 (2007): 9–22.

McPake, Barbara, Charles Normand, and Samantha Smith. *Health Economics: An Interna-tional Perspective*. Durham Modern Middle East and Islamic World. New York, NY: Taylor & Francis. 2013.

Meijer, Claudine de et al. “The effect of population aging on health expenditure growth: A critical review.” *European Journal of Ageing* 10, no. 4 (2013): 353–361.

Meyer, Stefan. “Dispensing physicians, asymmetric information supplier-induced demand: Evidence from the Swiss Health Survey.” *International Journal of Health Economics and Management* 16, no. 3 (2016): 215–245.

Mohanty, Sanjay K. et al. “Out-of-pocket expenditure on health care among elderly and non-elderly households in India.” *Social Indicators Research* 115, no. 3 (2014): 1137–1157.

Moore, Patrick V., Kathleen Bennett, and Charles Normand. “Counting the time lived, the time left or illness? Age, proximity to death, morbidity and prescribing expenditures.” *Social Science & Medicine* 184 (2017): 1–14.

Morris, Stephen, Nancy Devlin, and David Parkin. *Economic Analysis in Health Care*. Chichester: Wiley. 2007.

Morrisey, Michael A., and John Cawley. “Health economists’ views of health policy.” *Journal of Health Politics, Policy and Law* 33, no. 4 (2008): 707–724.

Muschik, Denise et al. “Morbidity compression, morbidity expansion, or dynamic equilibrium? The time trend of AOK-insured patients with type 2 diabetes in lower Saxony Germany.” *Journal of Public Health* 25 (2016): 1–10.

Mushkin, Selma J. “Health as an Investment.” *The Journal of Political Economy* 70 (1962): 129–157.

Muurinen, Jaana-Marja. "Demand for health: A generalised Grossman model." *Journal of Health Economics* 1, no. 1 (1982): 5–28.
Muurinen, Jaana-Marja, and Julian Le Grand. "The economic analysis of inequalities in health." *Social Science & Medicine* 20, no. 10 (1985): 1029–1035.
Nagl, Alexander et al. "Relationship between multimorbidity and direct healthcare costs in an advanced elderly population." *Zeitschrift für Gerontologie und Geriatrie* 45, no. 2 (2012): 146–154.
Nardi, Mariacristina et al. "Medical spending of the US elderly." *Fiscal Studies* 37, no. 3–4 (2016): 717–747.
NCD Risk Factor Collaboration. "Worldwide trends in diabetes since 1980: A pooled analysis of 751 population-based studies with 4.4 million participants." *The Lancet* 387, no. 10027 (2016): 1513–1530.
NEHI. *Thinking Outside the Pillbox. A System-Wide Approach to Improving Patient Medication Adherence for Chronic Disease*. NEHI Research Brief. Cambridge, MA: New England Health Care Institute. 2009.
Nguyen, Louis et al. "Provider-induced demand in the treatment of carotid artery stenosis: Variation in treatment decisions between private sector fee-for-service vs salary-based military physicians." *JAMA Surgery* (2017). https://doi.org/10.1001/jamasurg.2017.0077
NIHCM. *The Concentration of Health Care Spending*. NIHCM Foundation Data Brief. Washington, DC: National Institute for Health Care Management Research and Educational Foundation. 2012.
Nishtala, Prasad S., and Mohammed Saji Salahudeen. "Temporal trends in polypharmacy and hyperpolypharmacy in older New Zealanders over a 9-year period: 2005–2013." *Gerontology* 61, no. 3 (2015): 195–202.
Nusselder, Wilma J. et al. "The elimination of selected chronic diseases in a population: The compression and expansion of morbidity." *American Journal of Public Health* 86, no. 2 (1996): 187–194.
Nyman, John A. "The economics of moral hazard revisited." *Journal of Health Economics* 18, no. 6 (1999): 811–824
—. "The income transfer effect, the access value of insurance and the Rand health insurance experiment." *Journal of Health Economics* 20, no. 2 (2001): 295–298.
—. "Evaluating health insurance: A review of the theoretical foundations." *The Geneva Papers on Risk and Insurance Issues and Practice* 31, no. 4 (2006): 720–738.
Olshanksy, S. Jay. "Big claims and bold characters." *Health Affairs* 33, no. 5 (2014): 901–903.
Olshansky, S. Jay et al. "Trading off longer life for worsening health the expansion of morbidity hypothesis." *Journal of Aging and Health* 3, no. 2 (1991): 194–216.
Olshansky, S. Jay, Leonard Hayflick, and Bruce A. Carnes. "Position statement on human aging." *The Journals of Gerontology Series A: Biological Sciences and Medical Sciences* 57, no. 8 (2002a): B292–B297.
Olshansky, S. Jay, Leonard Hayflick, and Bruce A. Carnes. "No truth to the fountain of youth." *Scientific American* 286, no. 6 (2002b): 92–95.

O'Neill, Desmond. "Protecting the global longevity dividend." *The Lancet. Global Health* 5, no. 2 (2017): e116–e117.

ONS. *What Are the Chances of Surviving to Age 100*. Newport, Wales. 2010.

Park, Eun-Ja et al. "Out-of-pocket medication expenditure burden of elderly Koreans with chronic conditions." *International Journal of Gerontology* 9, no. 3 (2015): 166–171.

Parker, Marti G., and Mats Thorslund. "Health trends in the elderly population: Getting better and getting worse." *The Gerontologist* 47, no. 2 (2007): 150–158.

Payne, Greg et al. "Counting backward to health care's future: Using time-to-death modeling to identify changes in end-of-life morbidity and the impact of aging on health care expenditures." *Milbank Quarterly* 85, no. 2 (2007): 213–257.

Pelgrin, Florian, and Pascal St-Amour. "Life cycle responses to health insurance status." *Journal of Health Economics* 49 (2016): 76–96.

Persky, Joseph. "Retrospectives: Consumer sovereignty." *The Journal of Economic Perspectives* 7, no. 1 (1993): 183–191.

Piette, John D., Michele Heisler, and Todd H. Wagner. "Problems paying out-of-pocket medication costs among older adults with diabetes." *Diabetes Care* 27, no. 2 (2004): 384–391.

Polder, Johan J., Jan J. Barendregt, and Hans van Oers. "Health care costs in the last year of life-the Dutch experience." *Social Science & Medicine* 63, no. 7 (2006): 1720–1731.

Prescott, Edward S. "A primer on moral-hazard models." *Federal Reserve Bank of Richmond Economic Quarterly* 85, no. 1 (1999): 47–78.

Przywara, Bartosz. *Projecting Future Health Care Expenditure at European Level: Drivers, Methodology and Main Results*. Economic Papers 417. Brussels: Directorate-General for Economic and Financial Affairs. European Commission. 2010.

Robine, Jean-Marie, and Colins D. Mathers. "Measuring the compression or expansion of morbidity through changes in health expectancy." In *Calculation of Health Expectancies: Harmonization, Consensus Achieved and Future Perspectives*. Edited by Jean-Marie Robine et al., 269–269. Montpellier: John Libbey Eurotext. 1993.

Rothstein, William G. *Public Health and the Risk Factor: A History of an Uneven Medical Revolution*. Rochester Studies in Medical History. Rochester NY: University of Rochester Press. 2003.

Safran, Dana Gelb et al. "Prescription drug coverage and seniors: Findings from a 2003 national survey." *Health Affairs* 24 (2005): W5:152–W5:166.

Saleh, Shadi S., Wendy Weller, and Edward Hannan. "The effect of insurance type on prescription drug use and expenditures among elderly Medicare beneficiaries." *Journal of Health and Human Services Administration* 30, no. 1 (2007): 50–74.

Salomon, Joshua A. et al. "Healthy life expectancy for 187 countries, 1990–2010: A systematic analysis for the global burden disease Study 2010." *The Lancet* 380, no. 9859 (2013): 2144– 2162.

Santerre, Rexford E., and Stephen P. Neun. *Health Economics: Theory Insights, and Industry Studies*. Mason, OH: South-Western Cengage Learning. 2010.

Scheil-Adlung, Xenia, and Jacopo Bonan. *Can the European Elderly Afford the Financial Burden of Health and Long-Term Care? Assessing Impacts and Policy Implications*. ESS (Extension of Social Security) Paper 31. Geneva: Switzerland. 2012.

Schneider, Helen, and Alan Mathios. "Principal agency theory and health care utilization." *Economic Inquiry* 44, no. 3 (2006): 429–441.

Schwartz, Andrea. *Informations- und Anreizprobleme im Krankenhaussektor: Eine institu- tionenökonomische Analyse*. Markt- und Unternehmensentwicklung Markets and Organisations. Wiesbaden: Springer. 1997.

Sekimoto, Miho, and Masako Ii. "Supplier-induced demand for chronic disease care in Japan: Multilevel analysis of the association between physician density and physician-patient encounter frequency." *Value in Health Regional Issues* 6 (2015): 103–110.

Shakespeare, William. "The Tempest." In *The Complete Works of William Shakespeare*. London: Spring Books. 1958.

Shih, Ya-Chen Tina, and Ming Tai-Seale. "Physicians' perception of demand-induced supply in the information age: A Latent class model analysis." *Health Economics* 21 (2012): 252–269.

Shmueli, Amir et al. "Health care costs during the last 12 months of life in Israel: Estimation and implications for risk-adjustment." *International Journal of Health Care Finance and Economics* 10, no. 3 (2010): 257–273.

Siegel, Jacob S. *The Demography and Epidemiology of Human Health and Aging*. New York, NY: Springer. 2012.

Sloan, Frank A., and Chee-Ruey Hsieh. *Health Economics*. Cambridge, MA: The MIT Press. 2012.

Smith, Peter C., and Winnie Yip. "The economics of health system design." *Oxford Review of Economic Policy* 32, no. 1 (2016): 21–40.

Solar, Orielle, and Alec Irwin. *A Conceptual Framework for Action on the Social Determinants of Health*. Geneva: World Health Organization. 2007.

Stallard, Eric. "Compression of morbidity and mortality: New perspectives." *North American Actuarial Journal* 20, no. 4 (2016): 341–354.

Standard & Poor's. *Global Aging 2013: Rising to the Challenge*. Global Credit Portal. Ratings Services. New York, NY: Standard & Poor's Financial Services LLC. 2013.

Steensma, Colin, Lidia Loukine, and Bernard C.K. Choi. "Evaluating compression or expansion of morbidity in Canada: Trends in life expectancy and health-adjusted life expectancy from 1994 to 2010." *Chronic Diseases and Injuries in Canada* 37, no. 3 (2017): 68–76.

Strulik, Holger, and Sebastian Vollmer. "Long-run trends of human aging and longevity." *Journal of Population Economics* 26, no. 4 (2013): 1303–1323.

Sydsæter, Knut, Peter Hammond, and Anne Strøm. *Essential Mathematics for Economic Analysis*. Harlow: Pearson. 2012.

Tamblyn, Robyn et al. "Adverse events associated with prescription drug cost-sharing among poor and elderly persons." *JAMA* 285, no. 4 (2001): 421–429.

Thatcher, A., Roger Väinö Kannisto, and James W. Vaupel. *The Force of Mortality at Ages 80 to 120* Monographs on Population Aging. Odense: Odense University Press. 1998.

The Royal Society. *Risk: Analysis, Perception and Management Report of a Royal Society Study Group*. London: The Royal Society. 1992.

Titterton, Mike. *Risk and Risk Taking in Health and Social Welfare*. Gateshead: Athenaeum Press. 2004.

Trachte, F., S. Sperlich, and S. Geyer. "Kompression oder Expansion der Morbidität?" *Zeitschrift für Gerontologie und Geriatrie* 48, no. 3 (2015): 255–262.

Tur-Sinai, Aviad, and Howard Litwin. "Forgone visits to the doctor due to cost or lengthy waiting time among older adults in Europe." In *Ageing in Europe Supporting Policies for an Inclusive Society*. Edited by Axel Börsch-Supan et al., 291–300. Berlin: De Gruyter. 2015.

United Nations. *World Population Ageing 1950–2050*. Population Studies, 207. New York: Department of Economic and Social Affairs. Population Division. 2002.

United Nations. *World Population Prospects. The 2015 Revision. Key Findings and Advance Tables*. New York, NY: United Nations. 2015.

U.S. Centers for Medicare & Medicaid Services. *National Health Expenditure Data. Age and Gender Tables*. 2016. https://www.cms.gov/Research-Statistics-Data-and-Systems/Statistics-Trends-and-Reports/NationalHealthExpendData/Downloads/2012GenderandAgeTables.zip

Wagner, Lisa Smith, and Todd H. Wagner. "The effect of age on the use of health and self-care information: Confronting the stereotype." *The Gerontologist* 43, no. 3 (2003): 318–324.

Walter, Stefan et al. "No evidence of morbidity compression in Spain: A time series study based on national hospitalization records." *International Journal of Public Health* 61, no. 7 (2016): 729–738.

Wang, Haidong and GBD 2015 Mortality and Causes of Death Collaborators. "Global, regional, and national life expectancy, all-cause mortality, and cause-specific mortality for 249 causes of death, 1980–2015: A systematic analysis for the Global Burden of Disease Study 2015". *The Lancet* 388, no. 10053 (2015): 1459–1544.

Werblow, Andreas, Stefan Felder, and Peter Zweifel. "Population ageing and health care expenditure: A school of 'red herrings'?" *Health Economics* 16, no. 10 (2007): 1109–1126.

Williams, Alan. "Health economics: The cheerful face of the dismal science?" In *Health and Economics. Proceedings of Section F (Economics) of the British Association for the Advancement of Science Bristol, 1986*. Edited by Alan Williams, 1–11. Basingstoke: Macmillan Press. 1987.

Wilson, Donna M., and Pedro Palha. "A systematic review of published research articles on health promotion at retirement." *Journal of Nursing Scholarship* 39, no. 4 (2007): 330–337.

World Health Organization. *Preamble to the Constitution of the World Health Organization as Adopted by the International Health Conference New York*, 19–22 June 1946; signed on 22 July 1946 by the representatives of 61 States (Official Records of the World Health Organization, no. 2, p. 100) and entered into force on 7 April 1948. 1948.

Xu, Jiaquan. *Mortality Among Centenarians in the United States, 2000–2014*. NCHS Data Brief 233. Hyattsville, MD. 2016.

Yang, Chung Jen, Ying Che Tsai, and Joseph J. Tien. "The impacts of persistent behaviour and cost-sharing policy on demand for outpatient visits by the elderly: Evidence from Taiwan's national health insurance." *The Geneva Papers on Risk and Insurance-Issues and Practice* 42, no. 1 (2017): 31–52.

Yee, Barbara W.K., and David A. Chiriboga. "Issues of diversity in health psychology and aging." In *Handbook of Health Psychology and Aging*. Edited by Carolyn Aldwin, Crystal L. Park, and Avron Spiro III, 286–312. New York, NY: Guilford Press. 2007.

Younsi, Moheddine, Mohamed Chakroun, and Amine Nafla. "Robust analysis of the de-terminants of healthcare expenditure growth: Evidence from panel data for low-, middle- and high-income countries." *The International Journal of Health Planning and Management* 31, no. 4 (2016): 580–601.

Zhavoronkov, Alex. *The Ageless Generation: How Advances in Biomedicine Will Transform the Global Economy*. New York, NY: St. Martin's Press. 2013.

Zweifel, Peter. "Supplier-induced demand in a model of physician behavior." In *Health, Economics, and Health Economics*. Edited by J. Van der Gaag and M. Perlman, 245–267. Amsterdam: North-Holland. 1981.

Zweifel, Peter. *The Theory of Social Health Insurance*. Foundations and Trends in Microeconomics. Hanover MA: Now Publishers Inc. 2007.

Zweifel, Peter, Friedrich Breyer, and Mathias Kifmann. *Health Economics*, 2nd ed. Heidelberg: Springer. 2009.

Zweifel, Peter, and Roland Eisen. *Insurance Economics*. Springer Texts in Business and Economics. Heidelberg: Springer. 2012.

Zweifel, Peter, Stefan Felder, and Markus Meiers. "Ageing of population and health care expenditure: A red herring?" *Health Economics* 8, no. 6 (1999): 485–496.

Zweifel, Peter, Stefan Felder, and Andreas Werblow. "Population ageing and health care expenditure: New evidence on the "red herring"." *The Geneva Papers on Risk and Insurance Issues and Practice* 29, no. 4 (2004): 652–666.

4

Macroeconomics and Health

4.1 Introduction

Macroeconomic conditions influence population health—and older people's health in particular. The literature has delved into three inter-related (though not always studied in conjunction) macroeconomic aspects: unemployment, business cycles, and (reductions in) public spending.

Whilst young adults have the largest share of the workforce anywhere, people aged 50 years or older—the usual demarcation for defining older workers; see Volume I, Chap. 1—are becoming more economically active and in certain countries constitute a sizeable proportion of the workforce. Consequently, whether there is a relationship between economic fluctuations, unemployment and health are germane to a study of economics and ageing.

Redundancies are more common during economic recessions, so we would expect that the unemployment-health relationship becomes particularly bad when an economy goes through a downturn phase. The evidence is mixed. In fact, the opposite finding was reported in a number of studies: the relationship between health and macroeconomic conditions would be pro-cyclical in that job losses during recessions would not be as strongly associated with negative health outcomes as job losses that take place during economic expansions. Several explanations have been given for the pro-cyclical nature of the relationship between mortality and health deterioration, on the one hand, and economic cycles on the other:

- A compositional effect (Martikainen et al. 2007). During times of economic buoyancy, if an older worker loses her job, it may be the result of being

J. L. Iparraguirre, *Economics and Ageing*,
https://doi.org/10.1007/978-3-319-93357-3_4

adversely selected due to her health: if any jobs are shed, it is the less healthy older workers who would be more badly affected. In turn, when the times are bad, both healthy and less healthy older workers would be equally affected. Therefore the finding that there is a weaker statistical association between unemployment and health during recessions compared to expansions may simply reflect the compositional effect resulting from the adverse selection of less healthy individuals during cyclical upturns: the proportion of relatively healthier individuals not in employment during recessions would be greater than during economic expansions.

- The risk of CVD is higher among older workers who lose their jobs during recessions compared to expansionary times: becoming redundant during a recession would give way to greater financial hardship and distress given the additional difficulty of finding a new job in contractionary times, which may increase the risk of CVD among older workers who lose their jobs. In contrast, older workers who are not laid off but see their working hours reduced as a result of temporary downturns in the economy would experience a reduction in the risk of CVD as they would have extra time for health-promoting activities and be less exposed to accidents and pollution (Noelke and Avendano 2015).
- Based on a Grossman's model framework, Ruhm (2000) surmised four additional reasons:
  - The rising opportunity cost of time during an expansion has a substitution effect from the consumption of healthcare services and investment in the health stock in favour of the consumption of other goods and services.
  - Some productive activities involve health risks, so increased output could be statistically associated with deteriorating health (although this could be the case for work-related accidents where the temporal link between health and economic cycle is immediate; it is less clear for work-related health conditions that tend to manifest in the longer run).
  - Some health risk behaviours may be in higher demand when incomes increase (goods and services that pose increased risk to health would be normal goods), so the increased indulgence in activities and goods that may negatively affect health could explain the association between economic upturns and health deterioration.
  - During economic expansions countries tend to experience net positive migration. Immigrants from countries with less developed healthcare systems or with lower average health status could deteriorate average health indicators in the country of destination. (Although this effect

is less related to older people, their propensity to move for job-related reasons is much lower than among younger people.)

However, other studies do find that recessions involve a health risk to older workers: mortality and health deterioration would be anti-cyclical.

- Iversen et al. (1987), Martikainen and Valkonen (1996), Morris et al. (1994), Stefansson (1991), and Vagero and Garcy (2016) found an association between job loss and mortality;
- Davalos et al. (2012) and Deb et al. (2011) found an association between economic contractions and increased alcohol consumption, whilst the latter also reported increased prevalence of excessive weight;
- Ardito et al. (2017), Lundin et al. (2014), and Montgomery et al. (2013) reported increased risks of CVD among older workers made redundant;
- Chu et al. (2016) reported adverse effects also on functional disability; and
- Chu et al. (2016) and Kim et al. (2017) on depression.

To some extent, studies that report positive findings between health and recessions may suffer from ecological fallacy, wrongly inferring individual-level associations out of aggregate-level associations. Unless they are based on individual-level data, statistical associations at area, state, or country level would not be valid to make inferences about individuals living in those areas, states, or countries. However, these studies could also be reflecting an underlying process: older workers who do not lose their jobs during a recession could become healthier. There is some evidence, in this regard, of an 'inhibition' effect: for example, during recessions, fears of job loss make some workers with at-risk levels of alcohol consumption moderate their drinking (Catalano et al. 1997). As Catalano and Bellows (2005) argued, once we introduce the 'inhibition' effect into the analysis, the anti-cyclical and pro-cyclical findings can be reconciled: recessions increase health risks and are deleterious to health, but for some workers they may curb down health-risky behaviours which improves their health. Furthermore, according to Bonamore and Carmigiani (2015), the relation between unemployment and mortality is non-linear and follows a U-shaped curve: starting from a low base, as unemployment rates increase, mortality decreases increasingly more though up to a point beyond which rising higher unemployment rates impact mortality less and less. Bonamore and Carmigiani proposed that the non-linearity is related to the different individual perceptions about the length of the unemployment spell and the different behavioural responses out of these perceptions.

A conclusive finding that highlights the importance of the intersection between labour market participation, ageing, and health is that job losses near retirement age are associated with an increased risk of developing cardiovascular diseases (CVD) such as stroke and myocardial infarction, and of dying (Dupre et al. 2012; Gallo 2012; Noelke and Beckfield 2014; Sullivan and Wachter 2009; Tapia Granados et al. 2014). In other words, the timing of the redundancy is important. Furthermore, even though the adverse health effects are most significant during the first 12 months following the job displacement, they are still evident even 20 years after. Job losses are damaging to the health of older workers particularly if they cannot find a job soon or cannot start up as self-employed and find themselves unemployed two or three months after being laid off (Ardito et al. 2017). But, does the effect vary according to the stock of financial resources of the individual? Perhaps, older workers who can draw upon accumulated financial wealth are more protected from health repercussions of job displacement than older workers with scant resources? In fact, there is some evidence supporting the *opposite* hypothesis, known as the *disappointment paradox*[1] (McKee and Stuckler 2013; Montgomery et al. 2013; Osika and Montgomery 2008): financial resources are protective of the deleterious health effects of unexpected job loss at earlier stages of an individual's life course, but they accentuate these effects if the displacement takes place in later life. The 'paradox' is that, on average, of two older workers who are made redundant and cannot find their way back into paid employment, the individual who is better-off in terms of financial resources is affected more deeply than the other individual. Montgomery et al. (2013) reported a similar paradoxical effect among older workers with higher education and with better cognitive functioning, two otherwise health protectors: better qualified and cognitive functioning older workers would suffer more health damage following unemployment than their counterparts with lower qualifications or cognitive functioning.

4.2 Health Inequality and Inequity

As we already mentioned—see Volume I, Chap. 1—one of the main characteristics of older human populations, readily identifiable and manifest in several domains, is their heterogeneity. Biological ageing is one such aspect, and hence it should come as no surprise that so is health: from immune responsiveness and deficiency (Barcellini et al. 1988) to neuropsychological or cognitive performance (Valdois et al. 1990), from osteoporotic fractures of the femoral neck (Karagas et al. 1996) to delirium among hospitalised older patients (Rudberg et al. 1997), most health conditions and responses to health interventions among older people tend to show great variability—and for many conditions, greater than among groups of younger individuals.

This heterogeneity implies, of course, that there is great inequality in health outcomes among older people. Insofar as the differences are due to biological factors, they are not deemed to be unfair or unjust. However, in cases in which the variability can be ascribed to economic factors (e.g. to income or wealth differentials), health discrepancies are seen more unfair than if they originate in biological factors. For this reason, some authors distinguish between health inequality and inequity (or disparity) (Braveman 2006; Braveman et al. 2011; Carter-Pokras and Baquet 2002; Whitehead 1992; WHO 2015).

According to Kawachi et al. (2002, p. 647), health inequality refers to 'the generic term used to designate differences, variations, and disparities in the health achievements of individuals and groups', whilst health inequity designates 'those inequalities in health that are deemed to be unfair or stemming from some form of injustice' or avoidable or unnecessary.[2]

Whitehead (1992, p. 5) listed seven types of determinants of health differentials—of which the first three would not be deemed to be unfair and hence would not be classified as inequities:

- Natural, biological variation
- Health-damaging behaviour if freely chosen, such as participation in certain sports and pastimes
- The transient health advantage of one group over another when that group is first to adopt a health-promoting behaviour (as long as other groups have the means to catch up fairly soon)
- Health-damaging behaviour where the degree of choice of lifestyles is severely restricted
- Exposure to unhealthy, stressful living and working conditions
- Inadequate access to essential health and other public services
- Natural selection or health-related social mobility involving the tendency for sick people to move down the social scale

The last four determinants—which would cause unfair differences in health—have, to some extent, economic drivers. Even so-called 'self-provoked' harm from unhealthy behaviours tends to be more prevalent the lower the socio-economic status of older individuals, such as smoking (Schaap et al. 2008; Sreeramareddy et al. 2016) or alcohol abuse (Mackenbach et al. 2015; Probst et al. 2014), although alcohol-related hazardous behaviour—but not to pathological or harmful consumption levels—has been found to be more prevalent among older people from higher socio-economic groups (Iparraguirre 2015b; Livingston 2014).

However, 70 years on, a currently 10-year-old person will likely benefit from medical advances that will routinely treat conditions affecting people aged 80 years old for which nowadays there is either no cure or not very efficacious treatment for octogenarians suffering from the same conditions; on the other hand, people currently aged 80 years old benefit from more efficient procedures and drugs than octogenarians 70 years ago. These period effects are another source of health inequality. Yet another source of differences across birth cohorts (or even within birth cohorts depending on the month of birth) is related to the exposure to major events such as epidemics, war, natural or technological disasters, and so on. For example, Almond (2006) found that men born in the USA between January and September of 1919 had 20 per cent higher disability rates by 1980—that is, at age 61—than men born either a few months earlier or later. What happened between January and September 1919 in the USA? The Spanish influenza pandemic.[3] We would probably be ready to accept that health disparities due to medical advances over time and epidemics (and to some extent at least, natural disasters) are a source of inequalities rather than inequities, but what about those arising from exposure to man-made events such as wars or technological disasters or to anthropogenic natural disasters (i.e. with attributable human elements)?

In what follows, we will not distinguish between health inequality, disparity, and inequity since most of the literature on socio-economic determinants of health tend to use these terms interchangeably (Kindig 2007)—although see Ward et al. (2013) for a call to distinguish between these concepts. Unless when quoting other authors, as I am writing this book in the UK, I will use 'inequality', which seems to be more common in the English-speaking countries outside the USA; US-based authors tend to use 'disparity' more frequently.

4.3 Socio-economic Determinants of Health

'With an ageing population, the question of whether socio-economic differences in health persist, increase, or decrease at older ages becomes increasingly salient', asserted Chandola et al. (2007, p. 1). This statement presupposes that there exist socio-economic differences in health at younger chronological ages. Health status, access, and outcomes vary across countries depending on their level of economic development and that there are economic gradients in health outcomes, access to healthcare, and health status within countries by socio-economic position.

Chapin (1924), using data from over 150 years ago (1865) from Providence, Rhode Island, USA, analysed differences in age-standardised mortality rates and the incidence of the different causes of death among income tax taxpayers and nontaxpayers (being a taxpayer or not was used as a proxy for social class). Chapin reported that death rates were higher among nontaxpayers for every group of diseases[4] and concluded that 'The mortality attributed to old age is more than four times as great among the nontaxpayers as among the taxpayers' [p. 650].

More recently, a study by the World Health Organization (WHO) on government policies to tackle inequalities in health in 13 developed countries concluded that all those countries recognised that health was 'largely determined by the social, economic, physical and cultural environment' (Crombie et al. 2005, p. 47) and that these countries set out interventions to reduce inequalities in health. The interventions tackle 'the macroenvironmental factors (income and education) and the physical and social environment, as well as adverse health behaviours and access to health care'. Furthermore, the study pointed out that '[i]nterventions which only tackle adverse health behaviours will have little success: they offer microenvironmental solutions to a macroenvironmental problem' [p. 52]. However, academics and practitioners are less unanimous about the mechanisms and the extent to which socio-economic variables are associated with inequalities in health. Some authors emphasise the role of poverty on health, whereas others contend that economic inequality is the main driver of health inequalities at least in developed countries. In addition, both parties recognise that reverse causality is in operation: health levels also influence upon economic performance, income-generating activities or potential, and so on.

The relationship between health outcomes and socio-economic variables is the focus of the extensive socio-economic determinants of health (SCD) literature—an area of study that, curiously, health economists have not shown great interest in (Mooney 2009) and whose output they have generally found wanting (Bergh et al. 2016). Most economists tend to agree that 'the stories about income inequality affecting health are stronger than the evidence' (Deaton 2003, p. 150). Regarding the link between economic inequality and health inequality, King (2016, p. 217) provided the following summary of the SCD approach, which the authors termed 'the argument':

> In order to reduce health inequalities and improve population health, we are morally compelled to address the social determinants of health, through interventions that redistribute social or economic resources in a more fair or just manner.

King (2016) expounded many of the criticisms to the SCD approach, and highlighted that 'the argument' is a normative claim that demands that accurately measured socio-economic inequalities are associated with equally accurately measured health inequalities in a unidirectional causal relationship: socio-economic inequalities cause health inequalities independently from other factors. Here lies the crux of the matter: how to measure both socio-economic and health inequalities and how to ascertain causality.

However, scholars of social epidemiology and social medicine as well as public and health policy experts vastly agree that there is a socio-economic gradient in most health-related variables in later life. For example, differences in educational attainment in later life were associated with differences in mortality (Baker et al. 2007; Huisman et al. 2004), mammography and dental care (Bennett et al. 2009), disability (Klijs et al. 2014), or aggregate indices of physical and mental health such as the 12-Item Short-Form Health Survey (SF-12)[5] (Howard et al. 2006).

Income inequality has also been associated with differences among older people in oral health (Pyle and Stoller 2003), dietary habits (Katsarou et al. 2010), mortality following myocardial infarction (Rao et al. 2004), sleep problems (Stamatakis et al. 2007), stroke (Cox et al. 2006), self-reported health (Grundy and Holt 2001), and tooth loss in countries as disparate as Germany (Buchwald et al. 2013), Korea (Han and Khang 2017), and Nigeria (Ibiyemi and Idiga 2017). Disadvantage according to housing tenure was also found to be associated with shorter disability-free life expectancy (Matthews et al. 2006). A study of German data found that impairments in daily activities such as climbing stairs or walking 100 yards, as well as subjective health, are associated with financial assets (Schöllgen et al. 2010), and a study among older people in Finland found a negative association between tiredness and material wealth (Avlund et al. 2007). Similar unequal health outcomes have been reported in relation to disparity in autonomy and social opportunities derived from different social statuses (Marmot 2007).

Surely, with such an overwhelming evidence, the case for socio-economic determinants of health can be laid to rest.[6] It's not that simple. To begin with, we mentioned education, income, wealth, housing tenure, and so on. Do we find the same gradients and associations irrespective of the socio-economic variable under consideration? Imagine we focus on income. Are we talking of a link between low levels of absolute income and health? Or is it with relative poverty, destitution, or deprivation? And even if we focus on absolute measures, are we considering the association between health and *chronic* absolute low income, poverty, destitution, or deprivation or do *transitory* adverse conditions also count? Or, the relationship may be operating at a macro level and the key variable is the level of income inequality in society. Or, perhaps income has little to do with health inequality and we need to consider another socio-economic variable, say education. Or, even if we accept that health inequalities have a socio-economic cause, the economic effects may wane with chronological age. Or, …

This section, which straddles between the individual and the macro-societal dimensions, presents an overview of the different hypotheses, methodological issues, and evidence around socio-economic determinants of health inequality.[7]

Here's one story. Non-communicable diseases (NCDs) are diseases of generally long duration and slow progression, which include cardiovascular diseases, cancers, chronic respiratory diseases, and diabetes. More than 36 million people died in 2016 from NCDs (equivalent to 63 per cent of global deaths) (Disease - Mortality and Death Collaborators 2016). Over 90 per cent of these deaths could have been prevented, as they are largely attributable to four behavioural risk factors such as tobacco use, physical inactivity, harmful use of alcohol, and salt/sodium intake and to two biological risk factors also related to behavioural patterns: diabetes/obesity and raised blood pressure. For this reason, in 2013, the World Health Organization set out the Global Action Plan for the Prevention and Control of Non-Communicable Diseases with the aim to reduce by 25 per cent the number of deaths from those four NCDs—relative to the 2010 levels—by 2025 (i.e. what is known as the '25 × 25 target'). Low socio-economic status is not included among the risk factors. In a multi-cohort study, Stringhini et al. (2017) compared the contribution of socio-economic status—measured by last known occupational title or position—to mortality and years of life lost (YLLs) with that of the risk factors identified by the WHO. They found that the association between socio-economic classification (SEC) and mortality is comparable to that of the risk factors and mortality. Moreover, low SEC was associated with higher number of YLLs among people aged between 40 and 85 years than high alcohol intake, obesity, diabetes, hypertension, and physical inactivity—only smoking had a greater associated risk. The authors concluded that 'socioeconomic circumstances, in addition to the 25 × 25 factors, should be treated as a target for local and global health strategies, health risk surveillance, interventions, and policy' (Stringhini et al. 2017, p. 1235).

Some economists take issue with stories such as this due to the lack of a theoretical model with behavioural foundations from which they may emanate. This uneasiness is echoed in the following quip (by a medical sociologist, not an economist): '[l]ike good servants, these epidemiological approaches and methods are always available, do whatever is asked of them, but seldom question the underlying reasons' (McKinlay 1998, p. 370).

Closely related is what yet another non-economist (in this case, an expert on biomedical ethics) contends is paramount in social epidemiology and policies inspired thereof: the 'counterfactual trap'—that is, conflating observational evidence of associations between socio-economic inequality and health inequality with claims about causal mechanisms from the former to the latter (King 2016). However, the SCD approach goes beyond the proposition that socio-economic *inequality* is associated with health inequality. As hinted at above, it may be destitution or relative economic position and not inequality what causes disparities in health outcomes.

Before expounding the hypotheses that try to explain the association between adverse health outcomes and socio-economic variables, let's take note of some expressions which have been coined by social epidemiologists and public health experts to convey the complexity of pathways mediating between socio-economic variables and health outcomes:

- the 'causes of causes' (Braveman and Gottlieb 2014; Marmot 2005; Marmot et al. 2007; Rose 2001)[8]
- the 'web of causes' (Australian Institute of Health and Welfare 2012)
- the 'patterns of determinants' (Kindig and Stoddart 2003)

Tellingly, by 'causes of causes', Rose (1993) wanted to distinguish between 'proximal' causes of a disease—the object of medical research—and the determinants of exposure to diseases, a matter for social and economic research. This complexity of the causal explanation of health inequalities is compounded by several methodological hurdles. We mentioned above that this section will encompass the micro and the macro aspects—the health of the individual and that of society. In fact, one challenging methodological point is whether the empirical studies are based on individual or aggregate data and, if the latter, the level of aggregation. Many scholars have dismissed some of the results of the SCD approach that stemmed from studies based on aggregate data due to purportedly statistical flaws such as the 'regression to the mean'[9] or omitted confounding variables (Bergh et al. 2016). Even carefully designed studies of SCD of health inequality that avoid such statistical pitfalls have to negotiate several other technical complications:

- the socio-economic variable or variables of interest, whether the culprit is a low absolute level of the socio-economic variable or inequality in the distribution of that variable and, if the latter, the inequality measures and the reference groups;

- studies with a focus on later life need to consider the chronological age cut-off and whether comparisons with other age groups are needed or not;
- the measure or measures of health outcomes and health inequality; and
- the evidence must be incorporated into a theoretical framework in which causality can be ascertained.

Let's see each of these aspects in turn.

4.3.1 Individual-Level or Aggregate-Level Data

Rose (2001) distinguishes between 'causes of cases', which refers to the reasons for an individual to develop or exhibit a certain medical condition, say dementia, and 'causes of incidence'—that is, why there is a higher incidence of dementia in one population or group compared to another population or group. Understanding the 'causes of cases' requires individual-level data; learning about the 'causes of incidence' demands aggregate-level data.

So far, so good …and here comes the 'but': results from individual-level and aggregate-level data may differ. Imagine that absolute income levels affect health—for example, that mortality risk is higher among people on lower incomes. Imagine also that income inequality is not related to differences in mortality risk. Gravelle (1998) contended that even if income inequality is unrelated to health outcomes, aggregate data could still show a significant association inasmuch as the health effect is smaller at higher levels of absolute income than at lower levels, irrespective of the shape of the income distribution or however income inequality is measured. All we need in order to find aggregate data that 'demonstrate' that relative income is significantly associated with mortality risk when in fact there is no such relationship is individual-level data that exhibit a particular non-linear relationship: that health risks decline with increasing income levels at a decreasing rate—Subramanian and Kawachi (2004) termed this relationship the 'concavity-induced income inequality effect'.[10] Moreover, provided such a non-linear relationship between absolute income and health exists at individual level, aggregate data would show smaller marginal health effects of income in more developed regions or countries than in less developed ones. However, in a study of data from 50 states in the USA, Wolfson et al. (1999)—though acknowledging this mathematical relationship and finding evidence for the concavity effect—concluded that income inequality affects health outcomes (measured by mortality of infants and men aged 25–59 years) at state level over and above the non-linear relationship at the individual level.

When econometricians first tried to deal with aggregation bias, they despaired: '…he who wants to use macromodels runs the risk of falling into three different traps. Should not we abolish these models altogether?' (Theil 1954, p. 180). Of course they haven't. Several econometric techniques were developed to correct the bias introduced by aggregation from micro to macro units of analysis. Linden and Ray (2017) applied some of these techniques to analyse three different models of the relationship between life expectancy at birth and GDP per capita between 1970 and 2010 for 148 countries. The authors found that levels of income had increasingly impacted on health outcomes since the year 1995 but that since the year 2000 income inequality had affected health in poorer, less developed countries but not in more affluent countries.

4.3.2 Health Indicators

We must decide upon the choice of health indicator. When studying health inequality in later life, is it differences in mortality rates we want to focus on? Healthy life expectancy? Pain? Self-reported health status? Tooth loss? Frailty? One particular condition or number of co-occurring illnesses or disorders (i.e. co-morbidities)? Access to healthcare?

We also need to define whether we are interested in analysing a favourable measure of health attainment (e.g. survival, surgical procedures, immunisation) or a negative measure of health shortfall (e.g. mortality, waiting lists, disease onset).

4.3.3 Socio-economic Variables

Apart from the chronological age cut-off (are we going to focus on the over 50s, the 75+, the centenarians?), we need to choose the socio-economic dimension. There are many ways to define and measure the socio-economic class, status, or position of individuals or groups (Galobardes et al. 2007).[11] Studies focusing on the association between health and SEC have looked into income, wealth, material deprivation, current or most recent occupational status, workplace stress, parental occupation or income, housing tenure, residential segregation, the built environment, educational attainment, and political empowerment, among other dimensions (Berkman and Macintyre 1997). Perhaps, health disparities along one socio-economic dimension (e.g. income) may disappear, reduce, or accentuate when seen along another socio-economic dimension.

There is some consensus in the literature that it is improper to study the relationship between health and, say, income in isolation of other socio-economic variables. Most authors present results for two or more alternative SEC indicators (Rahman et al. 2016) although another methodological tack is to consider the socio-economic realm as multidimensional. The latter approach requires the use of composite indicators, which introduces additional problems of interpretation of absolute and relative levels and inequality.

Whatever the variables and dimension, it is not enough to find a statistical association: a story about causality must accompany empirical findings. For example, we may find that education is protective of health—that is, that better educated individuals have, on average, better health. But why? Some authors, inspired by Grossman's approach, think that education increases the efficiency in the production of healthy time—that is, the productivity of the investment in the health stock. Other authors surmise that education is actually a proxy for other factors, such as the ability to delay gratification and self-efficacy. In addition, it has been suggested that better educated people have more access or are more responsive to health-related information. Finally, education is associated with income, so unless we control for the latter, the education-health association could be spurious.

4.3.4 Reverse Causality

People who enjoy better health earn, on average, higher incomes than individuals who suffer from bad health. If there is an income gradient of health, we will observe that people on higher incomes have, on average, better health than individuals on lower incomes. The causality goes in both directions—what is known as 'reverse causality'. Deaton (2002) laments that much of the SCD literature tends to minimise the importance of health on socio-economic variables such as income.

Some studies have used exogenous changes in income—akin to a natural experiment—to isolate the effect of income on health. Case (2004) studied if the presence of a pensioner in the household was associated with improved health status of all its adult members—a pensioner would add the old-age pension to the household's income. Iparraguirre (2014b) analysed if the introduction of a monetary benefit to pensioners in winter reduced excess winter mortality in England. Both studies found positive health effects, which does not mean that health does not affect income but that income does protect health even in later life.

Other studies using natural experiments focused on the health effects of exogenous changes in education, such as changes in compulsory years of schooling. For example, Spasojevi (2010) studied the effects of the education reform introduced in 1950 in Sweden which increased by one the number of compulsory years of schooling. So, two groups can be distinguished in the cohorts born between 1945 and 1955: those who stayed in school for one additional year and those who did not. The author found positive effects among those who remained in school for longer in a composite health index and in body mass index by 1981 and 1991, after controlling for a number of covariates including income and family background. Once again, this finding does not rule out reverse causality but shows that education has an impact on health.

4.3.5 Reference Groups

Whatever the measure of inequality, the study of health inequality across a population and within groups of that population captures different aspects of the distribution of health-related variables. Depending on the measure we use, we need to select a reference group. For older people, is the most suitable reference group the average older person? The whole population average? The healthiest subgroup? A fixed target rate?

Though far from unanimously agreed, the most widely accepted approach among scholars is to focus on and compare between groups. For example, Keppel et al. (2005, p. 2) defined health inequality as 'the quantity that separates a group from a reference point on a particular measure of health that is expressed in terms of a rate, proportion, mean, or some other quantitative measure'. The preference for group comparisons as opposed to individual comparisons is that the latter would not consider or control for the social positions and contexts people are embedded in.

4.3.6 Measures of Health Inequality

'…what matters in determining mortality and health in a society is less the overall wealth of that society and more how evenly wealth is distributed'. This is, according to an editorial note on the respected academic publication *British Medical Journal*, one of the 'big ideas' that politicians would seek and scientists would dream to unveil ('Editor's choice' 1996). This assertion takes for granted that there is inequity in the distribution of health outcomes or access—and that is a matter of political and academic concern. Even if we accept this, we have to bear in mind that conclusions regarding the distribution of health and trends over time may differ depending on the health and socio-economic inequality measures in use. This subsection presents an overview of the most common measures of health inequality in the literature.[12]

Broadly speaking, there are absolute and relative measures of inequality (in health or any other dimension). Absolute measures reflect the size of the differences between individuals or groups, whilst relative measures reflect proportional differences among individuals or groups. Concerning health inequality, the following indicators have been proposed:

- Absolute measures
  - the absolute concentration index. A population is ranked from the most disadvantaged individual or group to the most advantaged individual or group (ranked at N). The index is obtained thus:

$$\mathrm{ACI} = \frac{2}{N.\mu}\sum_{i=1}^{i=N} h_i.\left(\frac{i}{N}\right) - 1 - \frac{1}{N} \tag{4.1}$$

    where N is the best-off individual as ranked according to the socio-economic variable of choice, h is the value of the chosen health indicator and μ is its mean value, and $\frac{i}{N}$ denotes where individual i ranks along the distribution of the socio-economic variable in relation to the best-off individual.

    For population groups, the formula becomes

$$\mathrm{ACI} = 2.\left(\sum_{j=1}^{j=J} p_j.\mu_j.\sum_{j=1}^{j=J} p_y - 0.5p_j\right) - 1 \tag{4.2}$$

    where p is the share of the group in the total population, μ_j is the mean value of the health indicator for group j, and y is the cumulative share of the population up to group j.

    This index uses data from the level and distribution of the health variable, so apart from an indicator of inequality, it is also a measure of goal attainment (Ásgeirsdóttir and Ragnarsdóttir 2013).
  - the between-group variance. This indicator is only applicable to groups and is equal to the variance of the health variable under study weighted

by the size of the group. It is calculated as

$$\mathrm{BGV} = \sum_{j=1}^{j=J} p_j.(y_j - \mu)^2 \tag{4.3}$$

– the mean difference from the best-performing subgroup. This measure, only applicable to groups, corresponds to the weighted sum of the absolute differences between the subgroup estimate of the health indicator under study and that for the best-performing group in the population. Formally,

$$\mathrm{MDBP} = \sum_{j=1}^{j=J} p_j.|y_j - y_{bp}| \tag{4.4}$$

where y_{bp} is the value of the health indicator for the best-performing group.

– the mean difference from mean. This measure, only applicable to groups, corresponds to the weighted sum of the absolute differences between the subgroup estimate of the health indicator under study and the population average. It is calculated as

$$\mathrm{MDM} = \sum_{j=1}^{j=J} p_j.|y_j - \mu| \tag{4.5}$$

– the slope index of inequality (SII) (Pamuk 1985). Similar to the RII, the SII is constructed as the difference between the hazard or incidence rate for the best-performing group and the worst-performing group: $\mathrm{SII} = h_{bp} - h_0$. Talih (2015, p. 993) defined the SII as 'the slope of the (weighted) least-squares regression of health outcomes onto socioeconomic ranking …designed to summarize the association between health and socioeconomic status (SES)'.

- Relative measures

  – the index of dissimilarity (Mackenbach 1993; Preston et al. 1981). A population is classified according to a socio-economic variable or dimension, and for each category a ratio is calculated between a standardised rate of a chosen measure of health and the average rate for the whole population.

The index of dissimilarity is obtained by this formula:

$$ID = \frac{\sum_{j=1}^{j=J} p_j . \left| RR_j - 1 \right|}{2} \tag{4.6}$$

where the socio-economic variable is broken down into j categories or subgroups, RR_J represents the rate ratios for each socio-economic subgroup (i.e. the ratio between a subgroup's standardised rate and the average population rate), and p_J are the proportions of each subgroup in the total population and which act as weights. The index, then, is a weighted average of the deviations from the national average in each subgroup, equal to the absolute value of the rate ratio minus one, divided by two. According to Mackenbach (1993, p. 113), the index measures 'the proportion of the number of cases of ill-health in the whole population which has to be redistributed between sociodemographic subgroups in order to give each of them the same Rate Ratio'. Or, in the words of Regidor (2004a, p. 860), it measures 'the proportion of total health that would need to be transferred from individuals whose health is above average to those who health is belong average, to achieve a situation of total equality'.

– the relative index of inequality (RII) (Pamuk 1985). This measure is constructed by arranging a socio-economic dimension (usually, class) on a horizontal axis from the lowest ranked to the highest ranked and computing the range of each class in the cumulative proportionate ranking of the population from the lowest (equal to 0) to the highest (= 1). Then a health measure (e.g. mortality), standardised by age and by the chosen socio-economic dimension, is plotted at the mid-point of its range, and a regression between the health measure and the categories of the socio-economic dimension is fitted by a statistical technique known as weighted least squares, in which the proportions of the population in each socio-economic category operate as weights. For each group, then, the hazard rate or incidence rate of a health outcome, $h(x)$, is calculated. The RII is the ratio between the hazard or incidence rate for the best-performing group, h_{bp}, and the worst-performing group, h_0: RII $= h_{bp}/h_0$ (Moreno-Betancur et al. 2015).
– the population attributable to risk. This measure, only applicable to groups, measures the change in health outcomes that would result if every group in a population had the same health status as that ranked highest

in terms of a socio-economic variable. The formula uses the relative risk for the group in question:

$$\text{PAR} = \sum_{j=1}^{j=J} \frac{p_j(RR_j) - 1}{1 + p_j(RR_j) - 1} \tag{4.7}$$

– the mean log deviation or Theil L index. You have data on a given health indicator y for i individuals in a population, with mean $\bar{y}$. The mean log deviation (or Theil L) index is given by this formula, where N is the population size:

$$\text{Theil L} = \frac{1}{N}.\sum_{i=1}^{i=N} ln\left(\frac{y_i}{\bar{y}}\right) \tag{4.8}$$

For j groups of subgroups, the formula becomes

$$\text{Theil L} = \sum_{j=1}^{j=J} p_j.ln\left(\frac{y_j}{\bar{y}}\right) \tag{4.9}$$

– the Theil T index. Similar to the mean log deviation, the Theil T index is given, respectively, for individuals and groups by the following expressions:

$$\begin{aligned} \text{Theil T} &= \frac{1}{N}.\sum_{i=1}^{i=N} \frac{y_i}{\bar{y}}.ln\left(\frac{y_i}{\bar{y}}\right) \\ \text{Theil T} &= \sum_{j=1}^{j=J} p_j.\frac{y_j}{\bar{y}}.ln\left(\frac{y_j}{\bar{y}}\right) \end{aligned} \tag{4.10}$$

– the relative concentration index (Wagstaff et al. 1989, 1991). Individuals are ranked according to a socio-economic dimension (e.g. class) beginning with the most disadvantaged on the x-axis and plotted against cumulative proportions of a health indicator (e.g. mortality). The plot would render a diagonal if health were equally distributed along the categories of the chosen socio-economic dimension; unequal health would result in a curve below the diagonal—the higher the health inequality, the further the curve from the diagonal. The concentration index is twice the area between the diagonal and the curve. The formula is

$$\mathrm{C} = \frac{2}{N.\mu} . \sum_{i=1}^{i=N} h_i.(1 - R_i) \tag{4.11}$$

where μ is the mean value of the health indicator for the whole population and R_i is the fractional rank in the distribution of the socio-economic variable of choice of person i.

– the extended concentration index (Wagstaff et al. 1989, 1991). The relative concentration index can be extended by adding an inequality aversion parameter, ν, so that if $\nu = 1$ the health of each individual is weighted equally and health inequality does not matter; consequently, the index is equal to 0. Higher values of this parameter indicate that more weight is attached to the health of people in lower socio-economic conditions. With the addition of inequality aversion, the extended relative concentration index is calculated thus:

$$\mathrm{CE} = 1 - \frac{\nu}{N.\mu} . \sum_{i=1}^{i=N} h_i.(1 - R_i)^{\nu-1} \tag{4.12}$$

For grouped data, the formula of the extended concentration index is

$$\mathrm{CEg} = 1 - \frac{\nu}{\mu} . \sum_{j=1}^{j=J} p_j h_j.(1 - R_j)^{\nu-1} \tag{4.13}$$

– the health achievement index (O'Donnell et al. 2007; Wagstaff 2002). Associated with the extended relative concentration index, this measure reflects the average level of, and the inequality in, a health variable between the worst- and the best-off individuals or groups in a population. The formula is

$$\mathrm{HAI} = \frac{1}{N} . \sum_{i=1}^{i=N} h_i.\nu(1 - R_i)^{\nu-1} \tag{4.14}$$

– the entropy-based Rényi index (RI) (Talih 2013). This measure is also based on the ratio between a particular group of interest and a reference group. For j groups of subgroups, the formula is

$$\mathrm{RI} = \frac{1}{\alpha(1-\alpha)}.ln\left[\sum_{j=1}^{j=J} \bar{p}_j.r_j^{1-\alpha}\right] \tag{4.15}$$

where r_j is the ratio between the relative disease burden and the population share of the group: $r_j = h_j/p_j$, and $\bar{p}$ denotes the ratio between the relative population share of a particular group j, p_j, and the total size of the population. In turn, α is a scalar greater than 0 but smaller than 1. The RI exhibits an important statistical property: it is invariant to the choice of the reference group.

Of course, there are relative and absolute measures of socio-economic inequality, not only of health inequality. So, on the one hand, we need to define whether we are going to use relative or absolute measures of health inequality—and which ones—but the same decision about the socio-economic variables awaits. Regarding relative socio-economic inequality, if you accept the contention that income or wealth inequality affect negatively health, you may believe that this applies to disadvantaged individuals but that the health of the better-off would be protected by their higher incomes or wealth. However, the point about relative measures is that it is income *inequality* what is deleterious, not lower incomes alone: relatively rich individuals in more unequal societies would exhibit poorer health than similarly rich individuals in more equal societies (Frank 2007; Wilkinson and Pickett 2010). One popular explanation is that inequality erodes social cohesion and support, which would adversely impact on the whole population.

4.3.7 Life Course Approach to Socio-economic Determinants of Health Inequalities in Later Life

Another important decision is whether we either adopt a life course approach (should we go back to socio-economic determinants of childhood health inequalities—or to intrauterine inequalities, perhaps—in order to understand health disparities in later life?) or we focus on the relationship between socio-economic disparities in later life and health inequalities in later life. For example, Wohland et al. (2014) compared the drivers of life expectancy and disability life expectancy at birth and at age 85 in local areas in Great Britain between 1991 and 2001. Social class and local unemployment rates could account for inequalities at birth, but socio-economic variables appeared less important to explain inequalities at age 85. However, this result could, to some extent, be confounded by a 'survivor effect': life expectancy in the UK stood at 76 years in 1991 and by 2001 it had increased to 78 years. Among the people aged 85 and over, there could have been a sizeable sub-sample who had survived the lethal effects of socio-economic inequalities earlier in their life course.

Further, a life course approach to health inequalities can accommodate structural determinants and social and political contexts, such as changes in the welfare system, that may have varying impacts over health access and outcomes depending also on the stage in the life course of a person when these changes take place (i.e. a period effect) (Corna 2013).

4.3.8 Normative Issues

According to Harper and Lynch (2017, p. 92), 'measures of inequality inherently reflect, to a greater or lesser extent, different ethical and value judgements about what aspects of health inequality are important to capture.' We saw the extended concentration index that included a parameter of inequality aversion, for example. The normative question of why health inequality in later life should be of concern at all and why policies should pursue the reduction of the disparities in health is seldom posed and answered. However, it is of paramount importance to make the value judgements explicit and consider the sensitivity of results to alternative normative positions.

4.3.9 Theories, Hypotheses, and Pathways

As we said above, no matter how much evidence is compiled showing an association between socio-economic inequality and health inequality, theories and hypotheses are needed to tell coherent and credible stories, subject to empirical verification, about intervening causal mechanisms. Three different conceptual models have been suggested: the critical period model, the cumulative life course model, and the social mobility model (Hallqvist et al. 2004; Rosvall et al. 2006).

4.3.9.1 The Critical Period Model

This model proposes that exposure to socio-economic disadvantage in some sensitive periods during the life course leaves an imprint of adverse health status in later life. Typically, those critical periods correspond to either childhood or before the person was born: in utero. The hypothesis is that low socio-economic conditions affect a child's health or a foetus's development, which would have adverse health consequences later in life independently of other exposures along the individual's life course. Poor childhood health has been found to be associated with adverse health conditions in later life, including cancer, lung disease, cardiovascular conditions, and arthritis (Blackwell et al. 2001) as well as with self-rated health, depression, functional limitations, and cognitive functioning (Luo and Waite 2005). In turn, advocates for the 'foetal origins' hypothesis (Barker 1990, 2001; Lucas et al. 1999) reported that health conditions in later life such as coronary heart disease and disorders and risk factors including hypertension, diabetes, or obesity are related to intrauterine insults to which the individual was exposed during gestation.

4.3.9.2 The Cumulative Life Course Model

This model proposes that initial adverse conditions have a cumulative impact across the life course as a result of an accumulation of risks (Kuh et al. 2003). Therefore, even though there may be an association between maternal or early childhood socio-economic position and health outcomes in later life, such statistical findings would reflect less the 'long arm' (Hayward and Gorman 2004) of childhood disadvantage than the effects of lifelong disadvantage: absent cumulative exposures over the life course, later life negative health outcomes would not manifest. On the contrary, the longer the exposition to disadvantaged socio-economic circumstances, the greater the health risks and the more adverse the health status in later life would be.

4.3.9.3 The Social Mobility Model

This model—also known as the health selection or drift hypothesis—argues that there is a casual link between the health status of individuals and their chances of social mobility, both inter- and intra-generational. The emphasis is not on the role of upward and downward intergenerational or intra-generational socio-economic mobility on health but the other way round: that health status impacts on the chances of social mobility so that people born into socio-economic disadvantage are locked into their adverse circumstances along their life course as a result of bad health constituting a barrier to social mobility—see Volume IV, Part II for theories of inter- and intra-generational social mobility.

These models put forth hypotheses about origins and causal links between socio-economic conditions and health status. An alternative view is to consider the mechanisms that would be in operation. Three mechanisms have been proposed: the materialist, the lifestyle, and the psychosocial hypotheses (Smith et al. 1994).

- The materialist (or neo-materialist) hypothesis places the emphasis on poor material living and working conditions, on the political and economic circumstances and processes underlying socio-economic inequality and disadvantage, and on the insufficient availability of resources to the healthcare and social welfare systems—all of which, it is claimed, impact adversely on health in later life.
- The lifestyle hypothesis focuses on behavioural factors such as smoking or alcohol consumption and on the access to, and information and utilisation of, healthcare services, which would be the reasons for adverse health outcomes in later life.
- The psychosocial hypothesis—see Elstad (1998)—argues that reduced social status and empowerment, autonomy, and social integration would negatively affect stress and emotions with deleterious consequences for health in later life.

Ploubidis et al. (2011) compared the power of these three hypotheses to explain health differentials among older people in England. The authors found support for the materialist and the lifestyle hypotheses but not for the psychosocial path and concluded that 'at least in the older population, the interpretation of links between [socio-economic position] and health must begin with the material and health related lifestyle causes of inequalities' [p. 9].

Review and Reflect

- Reflect on the following comment to Stringhini et al. (2017), about a multi-cohort and meta-analysis study of the association of occupational position, a number of risk factors (high alcohol intake, physical inactivity, current smoking, hypertension, diabetes, and obesity), and all-cause and cause-specific mortality, for over 1.7 million people from seven high-income countries:

  …the strength of evidence for the effect of social rank on mortality, as exemplified by the study by Stringhini and colleagues, is now impossible to ignore. …What is needed is strong advocacy from the health professions, led by doctors, for this wider view of risk factors. Does this mean that it is

(continued)

> *no longer enough for us, as doctors, to know about clinical medicine and human biology? Must we in the health professions also become adept at macroeconomics and sociology? Let us hope so.*
>
> *(Tobias 2017, p. 1173)*

- We saw in the previous chapter three theories of the demand for health. How much can they explain the health inequalities by socio-economic groups?
- Discuss the following statement:

  > *Unlike the social distribution of other goods, such as power or wealth, where, from a liberal point of view, it is at least possible to think of some advantages of a certain degree of inequality, it is not possible to think of an advantage of social differences in length of life.*
  >
  > *(Doblhammer 2008, p. vii)*

- Comment on the following thought: *…it is possible to have equitable inequalities and inequitable equalities* (Mooney and McGuire 1987, p. 71).
- 'The womb may be more important than the home' (Barker 1990, p. 1111). Look up in recent surveys of the literature if the 'foetal origins hypothesis' of health conditions in later life is supported and if socio-economic variables are found to be associated with poor maternal and foetal nutrition indicators to see whether the evidence would support the conjecture of a socio-economic explanation.
- Cookson et al. (2016) analysed socio-economic inequities in healthcare in England. They found slight pro-rich inequity in visits to specialists but not to family doctors, and in clinical process quality, patent experience, and preventive care. Besides, they reported substantial pro-rich inequities in avoidable emergency hospitalisation. They concluded [p. 372]:

  > *These findings are all consistent with a broad economic framework that sees health care as just one input into the production of health over the life course, alongside many other socio-economically patterned inputs including environmental factors (for example, living and working conditions), consumption (for example, diet and smoking), self-care (for example, seeking medical information) and informal care (for example, support from family and friends).*

  Why would health inequities be consistent with such an economic framework? How would an alternative economic framework have to see healthcare in order not to be consistent with health inequities?
- Deaton (2002) opines that the term 'socio-economic status' is 'unhelpful for policy discussions' [p. 14]—a shorthand for income, education, social rank, or social class '…that is useless for thinking about policy in the absence of an instrument that acts on them all' [p. 20].

  Discuss.

(continued)

- Comment on the following assertion:

  Ageing population is a fiction, created by the powerful for their own purposes. Populations have always been ageing; it is the gift of social progress and triumph over disease and premature death, as well as unwanted births. That said, there are some populations not ageing, as in sub-Saharan Africa with the HIV/AIDS pandemic or in Russia where socioeconomic upheaval have resulted in lowered life expectancies in recent decades. Few would wish to live in such societies. That part of the population that is "aged" is flexible and determined largely by policy fiat, i.e., pension or public health care eligibility (as with Medicare in the United States). It does not move as life expectancy rises. There are therefore growing numbers in the social policy category of "senior citizens." That this is a social good rather than a concern is missed by the power that creates the old age category …Ageing population is also the excuse for almost all neoliberalist social policy contractions.

  (McDaniel 2009, p. 688)

Notes

1. The 'disappointment' element that gives name to this paradox comes from the original study by Osika and Montgomery (2008) on height, low mood, and economic disadvantage: taller people tend to exhibit a reduced risk of depression than relatively shorter individuals; however, the authors found that taller individuals on low incomes would exhibit a raised risk of depression compared to relatively shorter individuals on low incomes. They hypothesised that as tall stature is associated with wealth and therefore signals financial advantage, relatively low incomes and financial distress may produce disappointment among relatively taller individuals and, with it, accentuate the risk of depression.
2. See Braveman (2006) for other definitions.
3. Similar long-term health effects were detected in 2000 by Lee (2014) among men who were born in Korea in 1951—that is, during the Korean War.
4. Except puerperal diseases and categories with very few recorded deaths.
5. See Ware et al. (1995).
6. Ever so insightful and mighty with a pen, Samuelson (1958) wondered whether any sentences beginning with the word 'surely' could validly finish with a question mark…
7. See Bergh et al. (2016) for a recent comprehensive survey of the relationship between economic variables and health inequality.

8. See also the 2016 Boyer Lectures ‘Fair Australia: Social Justice and the Health Gap’ by Michael Marmot available at http://www.abc.net.au/radionational/programs/boyerlectures/series/2016-boyer-lectures/7802472.
9. A statistical phenomenon that occurs when studying repeated measurements of the same subjects over time as relatively high values of a variable are likely to be followed by relatively low values nearer the true mean value, thus confounding true change and random, non-systematic error. See Barnett et al. (2005) for a short introductory tutorial.
10. See also Gravelle et al. (2002) and Rodgers (2002).
11. See Formosa and Higgs (2015) for a collection of articles on social class in old age.
12. See Ásgeirsdóttir and Ragnarsdóttir (2013) and World Health Organization (2016). Also, see Regidor (2004a,b) for a glossary on measures of health inequality.

References

Almond, Douglas. “Is the 1918 influenza pandemic over? Long-term effects of in utero influenza exposure in the post-1940 US population.” *Journal of Political Economy* 114, no. 4 (2006): 672–712.

Ardito, Chiara et al. “Scar on my heart: effects of unemployment experiences on coronary heart disease.” *International Journal of Manpower* 38, no 1 (2017): 62–92.

Ásgeirsdóttir, Tinna Laufey, and Dagn Ósk, Ragnarsdóttir. “Determinants of relative and absolute concentration indices: evidence from 26 European countries.” *International Journal for Equity in Health* 12, no. 1 (2013): 53.

Avlund, Kirsten, Taina Rantanen, and Marianne Schroll. “Factors underlying tiredness in older adults.” *Aging Clinical and Experimental Research* 19, no. 1 (2007): 16–25.

Baker David W. et al. “Health literacy and mortality among elderly persons.” *Archives of Internal Medicine* 167, no. 14 (2007): 1503–1509.

Barcellini, Wilma et al. “Heterogeneity of immune responsiveness in healthy elderly subjects.” *Clinical Immunology and Immunopathology* 47, no. 2 (1988): 142–151.

Barker David James P. The fetal and infant origins of adult disease. *BMJ* 301 (1990): 1111.

—. Fetal and infant origins of adult disease. *BMJ* 149, Suppl. 1 (2001): S2–S6.

Barnett, Adrian G., Jolieke C. van der Pols, and Annette J. Dobson. Regression to the mean: what it is and how to deal with it. *International Journal of Epidemiology* 34, no. 1 (2005): 215–220.

Bennett, Ian M. et al. “The contribution of health literacy to disparities in self-rated health status and preventive health behaviors in older adults.” *The Annals of Family Medicine* 7, no. 3 (2009): 204–211.

Bergh, Anreas, Therese Nilsson, and Daniel Waldenström *Sick of Inequality? An Introduction to the Relationship Between Inequality and Health* Cheltenham: Edward Elgar, 2016.

Berkman, Lisa F., and Sally Macintyre. "The measurement of social class in health studies: old measures and new formulations." In *IARC Scientific Publications*. Edited by M. Kogevinas et al., vol 138, 51–64. Lyon: International Agency for Research on Cancer, 1997.

Blackwell, Debra L., Mark D. Hayward, and Eileen M. Crimmins. "Does childhood health affect chronic morbidity in later life?" *Social Science and Medicine* 52, no. 8 (2001): 1269–1284.

Bonamore, Giorgio, and Fabrizio Carmigiani. "Addresing the unemployment-mortality conundrum: non-linearity is the answer." *Social Science and Medicine* 126, C (2015): 67–72.

Braveman, Paula. "Health disparities and health equity: concepts and measurement." *Annual Review of Public Health* 27 (2006): 167–194.

Braveman, Paula A. et al. "Health disparities and health equity: the issue is justice." *American Journal of Public Health* 101, S1 (2011): S149–S155.

Braveman, Paula, and Laura Gottlieb. "The social determinants of health: it's time to consider the causes of the causes." *Public Health Reports* 129, Suppl. 2 (2014): 19–31.

Buchwald, Sabine et al. "Tooth loss and periodontitis by socio-economic status and inflammation in a longitudinal population-based study." *Journal of Clinical Periodontology* 40, no. 3 (2013): 203–211.

Carter-Pokras, Olivia, and Claudia Baquet. "What is a "health disparity"?" *Public Health Reports* 117, no. 5 (2002): 426–434.

Case, Anne. "Does money protect health status? Evidence from South African pensions." In *Perspectives on the Economics of Aging*. Edited by David A. Wise, 287–312. Chicago: University of Chicago Press, 2004.

Catalano, Ralph, and Benjamin Bellows. "Commentary: if economic expansions threatens public health, should epidemiologists recommend recessions?" *International Journal of Epidemiology* 34, no 6 (2005): 1212–1213.

Catalano, Ralph, Raymond Novaco, and William McConnell. "A model of the net effect of job loss on violence." *Journal of Personality and Social Psychology* 72 (1997): 1440–1447.

Chandola, Tarani et al. "Social inequalities in self reported health in early old age: follow-up of prospective cohort study." *British Medical Journal* 334, no. 7601 (2007). https://doi.org/10.1136/bmj.39167.439792.55.

Chapin, Charles V. "Deaths among taxpayers and non-taxpayers income tax, Providence, 1865." *American Journal of Public Health* XIV, no. 8 (1924): 647–651.

Chu, Wei-Min et al. "Late-career unemployment and all-cause mortality functional disability and depression among the older adults in Taiwan: a 12-year population-based cohort study." *Archives of Gerontology and Geriatrics* 65 (2016): 192–198.

Cookson, Richard et al. “Socio-economic inequalities in health care in England.” *Fiscal Studies* 37, no. 3-4 (2016): 371–403.

Corna, Laurie M. “A life course perspective on socioeconomic inequalities in health: a critical review of conceptual frameworks.” *Advances in Life Course Research* 18, no. 2 (2013): 150–159.

Cox, Anna M. et al. “Socioeconomic status and stroke.” *The Lancet Neurology* 5, no. 2 (2006): 181–188.

Crombie, Iain K. et al. *Closing the Health Inequalities Gap: An International Perspective* Copenhagen: WHO Regional Office for Europe, 2005

Davalos, María E., Hai Fang, and Michael T. French. “Easing the pain of an economic downturn: macroeconomic conditions and excessive alcohol consumption.” *Health Economics* 21, no. 11 (2012): 1318–1335.

Deaton, Angus. “Policy implications of the gradient of health and wealth.” *Health Affairs* 21, no. 2 (2002): 13–30.

—. “Health, inequality and economic development.” *Journal of Economic Literature* 41, no. 1 (2003): 113–158.

Deb, Partha et al. “The effect of job loss on overweight and drinking.” *Journal of Health Economics* 30, no. 2 (2011): 317–327.

Disease Mortality Global Burden of and Causes of Death Collaborators. “Global, regional, and national life expectancy all-cause mortality and cause-specific mortality for 249 causes of death, 1980-2015: a systematic analysis for the Global Burden of Disease Study 2015.” *The Lancet* 388 (2016): 1459–544.

Doblhammer Gabriele. “Foreword.” In *Socioeconomic Differences in Old Age Mortality*. The Springer Series on Demographic Methods and Population Analysis. Edited by Rasmus Hoffman. Dordrecht: Springer, 2008.

Dupre, Matthew et al. “The cumulative effect of unemployment on risks for acute myocardial infarction.” *Archives of Internal Medicine* 172, no. 22 (2012): 1731–1737.

Editor’s choice. *British Medical Journal* 312, no. 7037 (1996). https://doi.org/10.1136/bmj.312.7037.0.

Elstad, Jon Ivar. “The psycho-social perspective on social inequalities in health.” *Sociology of Health and Illness* 20, no. 5 (1998): 598–618.

Formosa, Marvin, and Paul Higgs, eds. *Social Class in Later Life: Power Identity and Lifestyle* Bristol: Policy Press, 2015.

Frank, Robert. *Falling Behind: How Rising Inequality Harms the Middle Class*. Wildavsky Forum Series. Los Angeles: University of California Press, 2007.

Gallo, William. “Evolution of research on the effect of unemployment on acute myocardial infarction risk: comment on the cumulative effect of unemployment on risks for acute myocardial infarction.” *Archives of Internal Medicine* 172, 22 (2012): 1737–1738.

Galobardes, Bruna, John Lynch, and George Davey Smith. “Measuring socioeconomic position in health research.” *British Medical Bulletin* 81–82, no. 1 (2007): 21.

Gravelle, Hugh. "How much of the relation between population mortality and unequal distribution of income is a statistical artefact?" *British Medical Journal* 316, no. 7128 (1998): 382–385.

Gravelle, Hugh, John Wildman, and Matthew Sutton. "Income, income inequality and health: what can we learn from aggregate data?" *Social Science and Medicine* 54, no. 4 (2002): 577–589.

Grundy Emily, and Gemma Holt. "The socioeconomic status of older adults: how should we measure it in studies of health inequalities?" *Journal of Epidemiology and Community Health* 55, no. 12 (2001): 895–904.

Hallqvist, Johan et al. "Can we disentangle life course processes of accumulation, critical period and social mobility? An analysis of disadvantaged socio-economic positions and myocardial infarction in the Stockholm Heart Epidemiology Program." *Social Science and Medicine* 58, no. 8 (2004): 1555–1562.

Han, Dong-Hun, and Young-Ho Khang. "Lifecourse socioeconomic position indicators and tooth loss in Korean adults." *Community Dentistry and Oral Epidemiology* 45, no. 1 (2017): 74–83.

Harper Sam, and John Lynch. "Health inequalities: measurement and decomposition." *Methods in Social Epidemiology*. Edited by J. Michael Oakes and Jay S. Kaufman. San Francisco: Jossey-Bass Wiley, 2017.

Hayward, Mark D., and Bridget K. Gorman. "The long arm of childhood: the influence of early-life social conditions on men's mortality." *Demography* 41, no. 1 (2004): 87–107.

Health, Australian Institute of and Welfare. *Australia's Health 2012* 13. Canberra, 2012.

Howard, David H., Tetine Sentell, and Julie A. Gazmararian. "Impact of health literacy on socioeconomic and racial differences in health in an elderly population." *Journal of General Internal Medicine* 21, no. 8 (2006): 857–861.

Huisman, M. et al. "Socioeconomic inequalities in mortality among elderly people in 11 European populations." *Journal of Epidemiology and Community Health* 58, no. 6 (2004): 468–475.

Ibiyemi, Olushola, and Ejiro Idiga. "Tooth loss among the elders in an inner city area of Ibadan, Nigeria." *Gerodontology* 34, no. 2 (2017): 264–271.

Iparraguirre, José. "Have winter fuel payments reduced excess winter mortality in England and Wales?" *Journal of Public Health* 37, no. 1 (2014b): 26–33.

—. "Socioeconomic determinants of risk of harmful alcohol drinking among people aged 50 or over in England." *BMJ Open* 5, no. 7 (2015b): e007684. https://doi.org/10.1136/bmjopen2015007684.

Iversen, Lars et al. "Unemployment and mortality in Denmark, 1970–1980." *British Medical Journal (Clinical Research Edition)* 295, no. 6603 (1987): 879–884.

Karagas, Margaret R. et al. "Heterogeneity of hip fracture: age, race, sex, and geographic patterns of femoral neck and trochanteric fractures among the US elderly." *American Journal of Epidemiology* 143, no. 7 (1996): 677–682.

Katsarou, Alexia et al. "Socio-economic status, place of residence and dietary habits among the elderly: the Mediterranean islands study." *Public Health Nutrition* 13, no. 10 (2010): 1614–1621.

Kawachi, Ichiro, SV Subramanian, and Naomar Almeida-Filho. "A glossary for health inequalities." *Journal of Epidemiology and Community Health* 56, no. 9 (2002): 647–652.

Keppel, Kenneth et al. *Methodological Issues in Measuring Health Disparities*, vol. 141, 1. Hyattsville: U.S. Department of Health and Human Services, 2005.

Kim, Woorim et al. "Job displacement and social safety net on depressive symptoms in individuals aged 45 years or above: findings from the Korean Longitudinal Study of Aging." *Ageing and Society* (2017) https://doi.org/10.1017/S0144686X16001471.

Kindig, David A. "Understanding population health terminology." *The Milbank Quarterly* 85, no. 1 (2007): 139–161.

Kindig, David, and Greg Stoddart. "What is population health?" *American Journal of Public Health* 93, no. 3 (2003): 380–383.

King, Nicholas. "Justice, evidence and interdisciplinary health inequalities research." In *Understanding Health Inequalities and Justice: New Conversations Across the Disciplines*, Edited by Mara Buchbinder Michele Rivkin-Fish, and Rebecca Walker Studies in Social Medicine. Chapel Hill: University of North Carolina Press, 2016.

Klijs, Bart et al. "Educational disparities in the burden of disability: contributions of disease prevalence and disabling impact." *American Journal of Public Health* 104, no. 8 (2014): e141–e148.

Kuh, D. et al. "Life course epidemiology." *Journal of Epidemiology and Community Health* 57, no. 10 (2003): 778–783.

Lee, Chulhee. "In utero exposure to the Korean War and its long-term effects on socioeconomic and health outcomes." *Journal of Health Economics* 33 (2014): 76–93.

Linden, Mikael, and Devdatta Ray. "Aggregation bias-correcting approach to the health- income relationship: life expectancy and GDP per capita in 148 countries, 1970-2010." *Economic Modelling* 61 (2017): 126–136.

Livingston, Michael. "Socioeconomic differences in alcohol-related risk-taking behaviours." *Drug and Alcohol Review* 33, no. 6 (2014): 588–595.

Lucas, A., M.S. Fewtrell, and T.J. Cole. "Fetal origins of adult disease-the hypothesis revisited." *British Medical Journal* 319, no. 7204 (1999): 245–249.

Lundin, Andreas et al. "Unemployment and coronary heart disease among middle-aged men in Sweden: 39243 men followed for 8 years." *Occupational and Environmental Medicine* 71, no. 3 (2014): 183–188.

Luo, Ye, and Linda J. Waite. "The impact of childhood and adult SES on physical, mental, and cognitive well-being in later life." *The Journals of Gerontology: Series B* 60, no. 2 (2005): S93–S100.

Mackenbach, Johan P. "Inequalities in health in The Netherlands according to age, gender marital status, level of education, degree of urbanization, and region." *The European Journal of Public Health* 3, no. 2 (1993): 112–118.

Mackenbach, Johan P. et al. "Inequalities in alcohol-related mortality in 17 European countries: a retrospective analysis of mortality registers." *PLoS Med* 12, no. 12 (2015): 1–31. https://doi.org/10.1371/journal.pmed.1001909.

Marmot, Michael. "Social determinants of health inequalities." *The Lancet* 365, no. 9464 (2005): 1099–1104.

—. *The Status Syndrome: How Social Standing Affects Our Health and Longevity*. New York: Henry Holt and Company, 2007.

Marmot, Michael, Commission on Social Determinants of Health et al. "Achieving health equity: from root causes to fair outcomes." *The Lancet* 370, no. 9593 (2007): 1153–1163.

Martikainen, Pekka, and Tapani Valkonen. "Excess mortality of unemployed men and women during a period of rapidly increasing unemployment." *The Lancet* 348 (1996): 909–912.

Martikainen, Pekka, Netta Mäki, and Marcus Jäntti. "The effects of unemployment on mortality following workplace downsizing and workplace closure: a register-based follow-up study of Finnish men and women during economic boom and recession." *American Journal of Epidemiology* 165, no. 9 (2007): 1070–1075.

Matthews, Ruth J., Carol Jagger, and Ruth M. Hancock. "Does socioeconomic advantage lead to a longer healthier old age?" *Social Science and Medicine* 62, no. 10 (2006): 2489–2499.

McDaniel, Susan A. "Challenging gerontology's empirical molehills: a commentary on Powell's foucauldian toolkit." *Journal of Applied Gerontology* 28, no. 6 (2009): 685–689.

McKee, Martin, and David Stuckler. "Older people in the UK: under attack from all directions." *Age and Ageing* 42, no. 1 (2013): 11–13.

McKinlay, John B. "Paradigmatic obstacles to improving the health of populations implications for health policy." *Salud Pública de México* 40, no. 4 (1998): 369–379.

Montgomery, Scott et al. "Mortality following unemployment during an economic downturn: Swedish register-based cohort study." *BMJ Open* 3, no. 7 (2013).

Mooney, Gavin. *Challenging Health Economics* Oxford: Oxford University Press, 2009.

Mooney, Gavin, and Alistair McGuire. "Distributive justice with special reference to geographical inequality and health care." *Health and Economics. Proceedings of Section F (Economics) of the British Association for the Advancement of Science Bristol, 1986*. Edited by Alan Williams, 68–81. Basingstoke: Macmillan Press, 1987.

Moreno-Betancur Margarita et al. "Relative index of inequality and slope index of inequality: a structured regression framework for estimation." *Epidemiology* 26, no. 4 (2015): 518–527.

Morris, Joan K., Derek G. Cook, and A. Gerald Shaper. "Loss of employment and mortality." *British Medical Journal* 308, no. 6937 (1994): 1135–1139.

Noelke, Clemens, and Mauricio Avendano. "Who suffers during recessions? Economic downturns, job loss, and cardiovascular disease in older Americans." *American Journal of Epidemiology* 182, no. 10 (2015): 873–882.

Noelke, Clemens, and Jason Beckfield. "Recessions, job loss, and mortality among older US adults." *American Journal of Public Health* 104, no. 11 (2014): e126–e134.

O'Donnell, Owen et al. *Analyzing Health Equity Using Household Survey Data. A Guide to Techniques and Their Implementation*. WBI Learning Resources Series. Washington: The World Bank, 2007.

Osika, Walter, and Scott Montgomery. "Economic disadvantage modifies the association of height with low mood in the US, 2004: the disappointment paradox." *Economics and Human Biology* 6 (2008): 95–107.

Pamuk, Elsie R. "Social class inequality in mortality from 1921 to 1972 in England and Wales." *Population Studies* 39, no. 1 (1985): 17–31.

Ploubidis, George B., Bianca L. DeStavola, and Emily Grundy. "Health differentials in the older population of England: an empirical comparison of the materialist, lifestyle and psychosocial hypotheses." *BMC Public Health* 11, no. 1 (2011). https://doi.org/10.1186/1471-2458-11-390.

Preston, Samuel H., Michael R. Haines, and Elsie Pamuk. "Effects of industrialization and urbanization on mortality in developed countries." In *Solicited Papers Vol. 2. 19th International Population Conference*. Liege: Ordina Editions, 1981.

Probst, Charlotte et al. "Socioeconomic differences in alcohol-attributable mortality compared with all-cause mortality: a systematic review and meta-analysis." *International Journal of Epidemiology* 43, no. 4 (2014): 1314–1327.

Pyle, Marsha A., and Eleanor P. Stoller. "Oral health disparities among the elderly: interdisciplinary challenges for the future." *Journal of Dental Education* 67, no. 12 (2003): 1327–1336.

Rahman, Md Mijan, Hafiz T.A. Khan, and Trish Hafford-Letchfield. "Correlates of socioeconomic status and the health of older people in the United Kingdom: a review." *Illness, Crisis and Loss* 24, no. 4 (2016): 195–216.

Rao, Sunil V. et al. "Socioeconomic status and outcome following acute myocardial infarction in elderly patients." *Archives of Internal Medicine* 164, no. 10 (2004): 1128–1133.

Regidor, Enrique. "Measures of health inequalities: part 1." *Journal of Epidemiology and Community Health* 58, no. 10 (2004a): 858–861.

—. "Measures of health inequalities: part 2." *Journal of Epidemiology and Community Health* 58, no. 11 (2004b): 900–903.

Rodgers, Gerald B. "Income and inequality as determinants of mortality: an international cross-section analysis." *International Journal of Epidemiology* 31, no. 3 (2002): 533–538.

Rose, Geoffrey. *The Strategy of Preventive Medicine*. Oxford: Oxford University Press, 1993.

—. "Sick individuals and sick populations." *International Journal of Epidemiology* 30, no. 3 (2001): 427–432.

Rosvall, Maria et al. "Similar support for three different life course socioeconomic models on predicting premature cardiovascular mortality and all-cause mortality." *BMC Public Health* 6, no. 1 (2006). https://doi.org/10.1186/1471-2458-6-203.

Rudberg, Mark et al. "The natural history of delirium in older hospitalized patients: a syndrome of heterogeneity." *Age and Ageing* 26, no. 3 (1997): 169–174.

Ruhm, Christopher J. "Are recessions good for your health?" *The Quarterly Journal of Economics* 115, no. 2 (2000): 617–650.

Samuelson, Paul A. "An exact consumption-loan model of interest with or without the social contrivance of money." *The Journal of Political Economy* 66, no. 6 (1958): 467–482.

Schaap, Maartje M., Heleen M.E. van Agt, and Anton E. Kunst. "Identification of socioeconomic groups at increased risk for smoking in European countries: looking beyond educational level." *Nicotine and Tobacco Research* 10, no. 2 (2008): 359–369.

Schöllgen, Ina, Oliver Huxhold, and Clemens Tesch-Römer. "Socioeconomic status and health in the second half of life: findings from the German Ageing Survey." *European Journal of Ageing* 7, no. 1 (2010): 17–28.

Smith, George Davey David Blane, and Mel Bartley. "Explanations for socioeconomic differentials in mortality." *The European Journal of Public Health* 4, no. 2 (1994): 131–144.

Spasojevi, Jasmina. "Effects of education on adult health in Sweden: results from a natural experiment." *Current Issues in Health Economics*. Edited by Daniel Slottje and Rusty Tchernis, Chapter 9, 179–199. Bingley, 2010.

Sreeramareddy Chandrashekhar T. Sam Harper, and Linda Ernstsen. "Educational and wealth inequalities in tobacco use among men and women in 54 low-income and middle-income countries." *Tobacco Control* 0 (2016): 1–9. https://doi.org/10.1136/tobaccocontrol-2016-053266.

Stamatakis, Katherine A., George A. Kaplan, and Robert E. Roberts. "Short sleep duration across income, education, and race/ethnic groups: population prevalence and growing disparities during 34 years of follow-up." *Annals of Epidemiology* 17, no. 12 (2007): 948–955.

Stefansson, Claes-Göran. "Long-term unemployment and mortality in Sweden, 1980-1986." *Social Science and Medicine* 32, no. 4 (1991): 419–423.

Stringhini, Silvia et al. "Socioeconomic status and the 25x25 risk factors as determinants of premature mortality: a multicohort study and meta-analysis of 1.7 million men and women." *The Lancet* 389, no. 10075 (2017): 1229–1237.

Subramanian, S.V., and Ichiro Kawachi. "Income inequality and health: what have we learned so far?" *Epidemiologic Reviews* 26, no. 1 (2004): 78–91.

Sullivan, Daniel, and Till von Wachter. "Job displacement and mortality: an analysis using administrative data." *Quarterly Journal of Economics* 124, no. 3 (2009): 1265–1306.

Talih, Makram. "A reference-invariant health disparity index based on Renyi divergence." *The Annals of Applied Statistics* 7, no. 2 (2013): 1217–1243.

—. "Examining socioeconomic health disparities using a rank-dependent Rényi index." *The Annals of Applied Statistics* 9, no. 2 (2015): 992–1023.

Tapia Granados, José A. et al. "Individual joblessness, contextual unemployment, and mortality risk." *American Journal of Epidemiology* 180, no. 3 (2014): 280–287.

Theil, Henri. *Linear Aggregation of Economic Relations*. Contributions to economic analysis. Amsterdam: North-Holland Publishing Company, 1954.

Tobias, Martin. "Social rank: a risk factor whose time has come?" *The Lancet* 389, no. 10075 (2017): 1172–1174.

Vagero, D., and A.M. Garcy. "Does unemployment cause long-term mortality? Selection and causation after the 1992-1996 deep Swedish recession." *European Journal of Public Health* 26, no. 5 (2016): 778–783.

Valdois, S. et al. "Heterogeneity in the cognitive profile of normal elderly." *Journal of Clinical and Experimental Neuropsychology* 12, no. 4 (1990): 587–596.

Wagstaff, Adam. "Inequality aversion, health inequalities and health achievement." *Journal of Health Economics* 21, no. 4 (2002): 627–641.

Wagstaff, Adam, Eddy Van Doorslaer, and Pierella Paci. "Equity in the finance and delivery of health care: some tentative cross-country comparisons." *Oxford Review of Economic Policy* 5, no. 1 (1989): 89–112.

Wagstaff, Adam, Pierella Paci, and Eddy Van Doorslaer. "On the measurement of inequalities in health." *Social Science and Medicine* 33, no. 5 (1991): 545–557.

Ward, Andrew Pamela Jo Johnson, and Mollie O'Brien. "The normative dimensions of health disparities." *Journal of Health Disparities Research and Practice* 6, no. 1 (2013): 46–61.

Ware, John, Mark Kosinski, and Susan Keller. *SF-12: How to Score the SF-12 Physical and Mental Health Summary Scales* Boston, 1995.

Whitehead, Margaret. "The concepts and principles of equity and health." *International Journal of Health Services* 22, no. 3 (1992): 429–445.

WHO. *Global Report on Ageing and Health* Geneva: World Health Organization, 2015.

Wilkinson, Richard, and Kate Pickett. *The Spirit Level: Why Equality is Better for Everyone* London: Penguin Books, 2010.

Wohland, Pia et al. "Drivers of inequality in disability-free expectancy at birth and age 85 across space and time in Great Britain." *Journal of Epidemiology and Community Health* 68, no. 9 (2014): 826–833.

Wolfson, Michael et al. "Relation between income inequality and mortality: empirical demonstration." *British Medical Journal* 319, no. 7215 (1999): 953–957.

World Health Organization. *Health Equity Assessment Toolkit (HEAT): Software for Exploring and Comparing Health Inequalities in Countries. Built-in Database Edition. Version 1.1* Geneva, 2016.

5

Economics and the Value of (Later) Life

'*Every fool mixes up value and price*' wrote the Spanish poet Antonio Machado,[1] and the discussion about value and price is no more alive than in economic analyses of the value of life. At the heart of the debate is the perennial economic problem of scarcity of resources: let's assume there are not enough healthcare resources to provide to all people the best health that modern technology and medical knowledge can attain, who should receive health care? Or, *in extremis*, who should live? [2]

> 'Surely', I wanted to say to the hard-nosed health economists and public health doctors around me, but did not dare, 'the real utility of the drug is to give dying patients hope? The hope that they might be statistical outliers and live longer than average? How do you measure the utility of hope?' …Healthy people, I have concluded, including myself, do not understand how everything changes once you have been diagnosed with a fatal illness. How you cling to hope, however false, however slight, and how reluctant most doctors are to deprive patients of that fragile beam of light in so much darkness…When faced by people who are dying you are no longer dealing with the rational consumers assumed by economic model-builders, if they ever existed in the first place.
>
> (Marsh 2014, p. 247)

> Jim Hacker: It says here, smoking related diseases cost the National Health Service £165 million a year.
> Sir Humphrey Appleby: Yes but we've been into that, it has been shown that if those extra 100,000 people had lived to a ripe old age, it would have cost us even more in pensions and social security than it did in medical treatment. So,

J. L. Iparraguirre, *Economics and Ageing*,
https://doi.org/10.1007/978-3-319-93357-3_5

> financially speaking it's unquestionably better that they continue to die at their present rate.
>
> (Lynn and Jay 1989, p. 188)

One classic approach to respond from an economic point of view, which has plenty of currency nowadays, is based on the concept of the quality-adjusted life year (QALY) (Klarman et al. 1968).

5.1 QALY

This approach to valuing human life starts from the (rather innocuous) assumption that people value both the length and the quality of their lives. A **quality-adjusted life year (QALY)** is an indicator of time following a particular treatment or intervention weighted by the quality of life over the period. It is calculated by the product of years of life and quality of life; it is, then, a measure that captures both mortality and morbidity. The quality weights are scaled between 0 and 1, though negative values are acceptable. One year of life at the best possible health is set equal to one QALY; either less than one year at perfect health or one year at less than perfect health corresponds to less than one QALY: both six months of life at best possible health and one year of life at half the level of health equal 0.5 QALYs, for example. Death has a score of 0; as mentioned, negative values are not ruled out: people may evaluate certain scenarios as 'worse than death' or 'worse than not intervening', and so on. Räsänen et al. (2006), for instance, estimated the QALYs of cataract surgery among patients aged 71 years old in Finland and found that for those patients who had had one eye operated already, the average change in QALYs of an operation of the second eye was negative; the deterioration was not related to clinical results but to changes in quality of life.

QALYs are useful for making comparisons. For example, a study finds that a particular procedure (a standard troponin test for acute coronary syndrome in people who present to an emergency department with chest pain) renders 15.101 life years and 11.730 QALYs (NICE 2014). Given the difference between life years and QALYs, we can conclude that those life years are expected to be lived at less than perfect health. These figures can be compared with QALYs for different treatments—say, a high-sensitivity test with 15.076 life years and 11.712 QALYs. Clearly the standard test has longer survival and higher QALYs than the high-sensitivity alternative. Can a decision or recommendation be made on these results? Not yet: QALYs are but one element in cost-effectiveness or cost-utility analysis[3]: we need the *cost* components as well. To continue with the example, imagine the standard test costs £2697 and the high-sensitivity test costs £2253. Which one to choose? How can we compare the cost and the utility together? We calculate the **incremental cost-effectiveness ratio (ICER)**.

The ICER is the difference in the mean costs of two healthcare interventions in a population of interest divided by the difference in the mean outcomes or effects (measured usually by QALYs[4]) in the same population. In other words, the ICER is a comparison between the incremental cost of a drug or intervention and the incremental improvement in health status resulting from that drug or intervention. Given two options, a and b, the ICER is calculated thus:

$$\text{ICER} = \frac{\text{Cost}_a - \text{Cost}_b}{\text{QALY}_a - \text{QALY}_b} \tag{5.1}$$

Therefore, the ICER of using the high-sensitivity test compared to the standard test is

$$\text{ICER} = \frac{£2697 - £2253}{11.730 - 11.712} = \frac{£444}{0.018} = £24{,}666.67$$

The high-sensitivity test has an ICER of £24,666.67 per QALY compared to the standard test: it is more cost-effective. Should we choose the high-sensitivity test then? We cannot make a decision yet. We need a threshold value: how much the decision-maker (e.g. a government) is willing to pay for one unit of health gain—for one QALY, for example. If the ICER exceeds the threshold, we will recommend the high-sensitivity test. Of course, some healthcare interventions are more costly and less effective than others, in which case the former are discarded and the latter would be preferable. However in many instances the situation arises where one option is more costly but more effective than an alternative (as in our example). A graphic device, known as the cost-effective plane, depicts the four possibilities (Van Hout et al. 1994) (Fig. 5.1).

If the new treatment or drug is more expensive and less effective than the existing option, the former is discarded and the latter dominates (north-west quadrant); conversely if the new treatment or drug is less expensive and more effective (south-east quadrant). In order to decide between any two alternatives, when one is more expensive but more effective than the other (north-east and south-west quadrants), we compare the ICER and the threshold (Fig. 5.2).

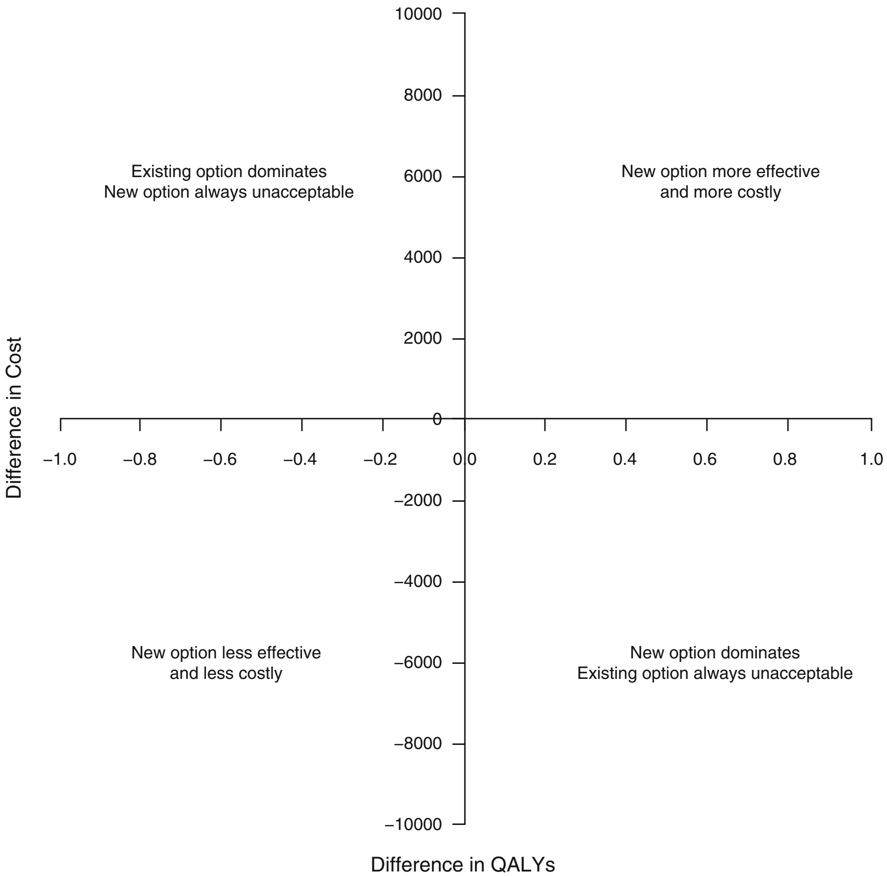

Fig. 5.1 The cost-effectiveness plane. *Source: Figure is illustrative, prepared with mock data*

In the south-west quadrant, the new option is less effective but less costly, so the decision is about how much money we are willing to *save* per QALY *lost*. In the north-east quadrant, the new option is more effective but more costly, so the decision is about how much money we are willing to *spend* per QALY *gained*. The shaded areas in Fig. 5.3 show the regions of acceptability of the new option.

One interesting finding from behavioural economics is that the prospect of losing, say, \$100 means more than finding or winning \$100. This effect, known as the *endowment effect*—see Volume IV, Chap. 1—reflects the degree of loss aversion experienced by the decision-makers (or the average loss aversion of the population). This effect indicates that the psychological cost of a loss exceeds

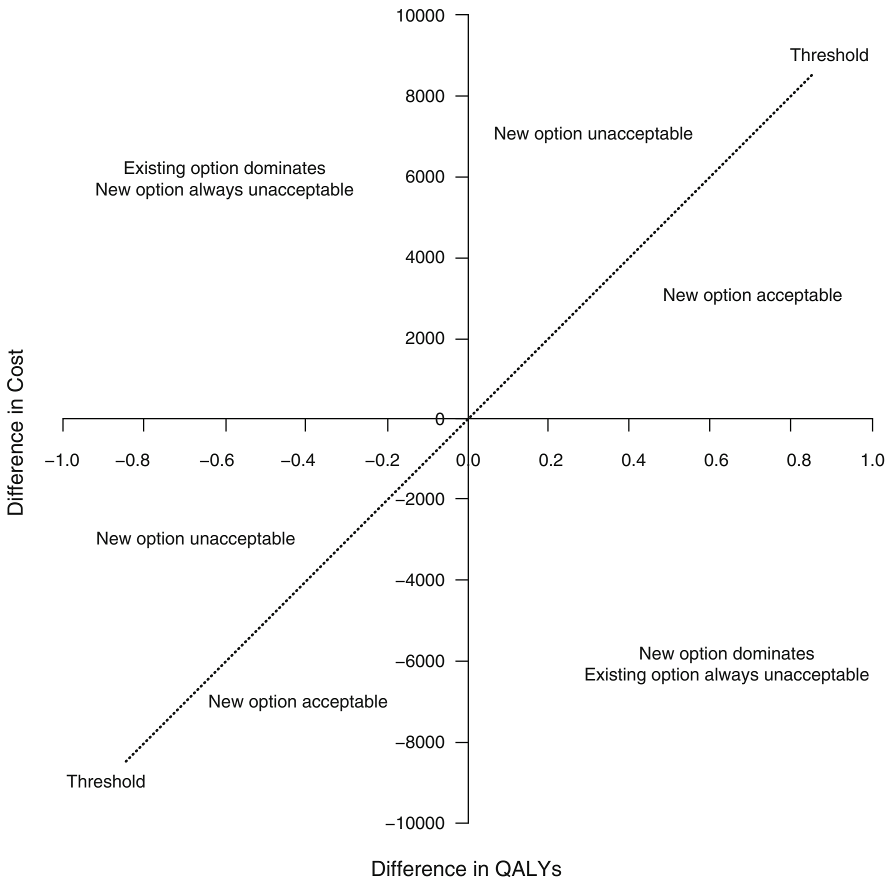

Fig. 5.2 The cost-effectiveness plane and threshold. *Source: Figure is illustrative, prepared with mock data*

the psychological benefit of a gain of the same amount. Given the endowment effect, we could impose a more stringent threshold on the south-west quadrant (where the choice is about saving money but losing health) compared to the north-east quadrant (where the choice involves a trade-off between spending money and gaining health). In other terms, what decision-makers (and the public) are willing to pay for a gain and the compensation they are willing to accept for a loss may differ: there would not be a one-to-one relationship between willingness to pay and willingness to accept (Severens et al. 2005). In order to reflect this disparity, O'Brien et al. (2002) argued that there should be a kink at the origin onto the south-west quadrant with the line exhibiting a greater slope than on the north-east quadrant (Fig. 5.4).

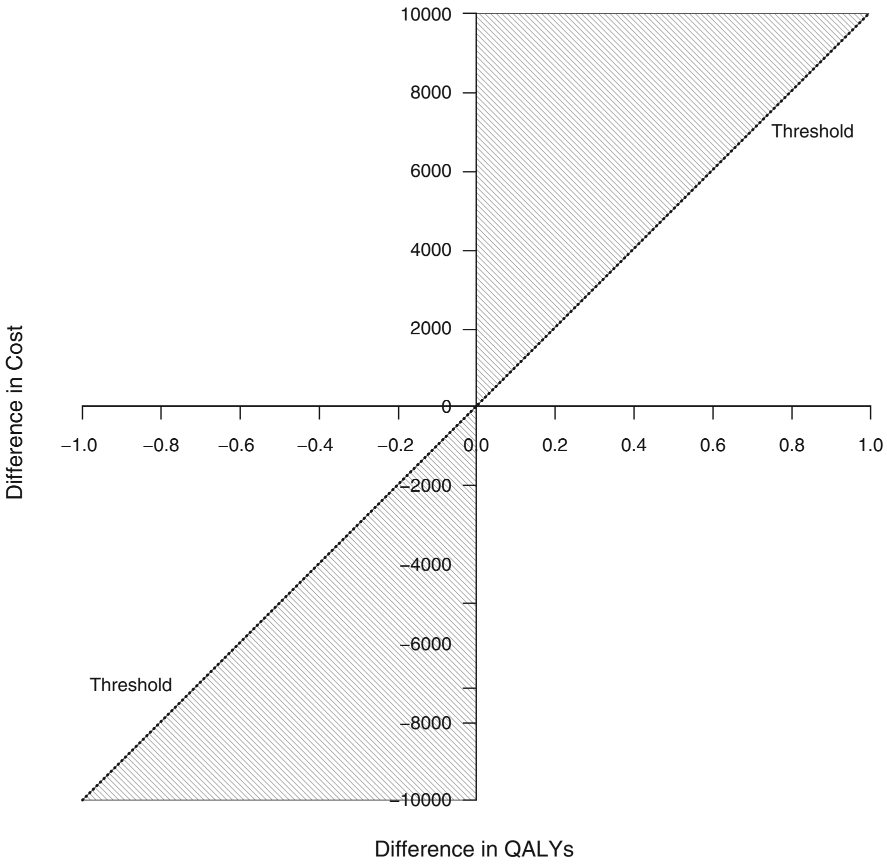

Fig. 5.3 The cost-effectiveness plane. Acceptability regions of new options. *Source: Figure is illustrative, prepared with mock data*

The presentation of ICER so far has abstracted from confidence intervals, but of course in practice, we encounter ranges of costs, QALYs, and ICER for each of the alternatives.

The analyses are carried out from two different perspectives:

- The cost (or healthcare system or payer) perspective, which only considers the budget impact on the payer, the public sector, or the public healthcare system, including the statutory health insurance system
- The societal perspective, which incorporates the costs for other stakeholders than the public sector, including patients, their relatives, friends, and other related individuals (from out-of-pocket healthcare and transport costs to

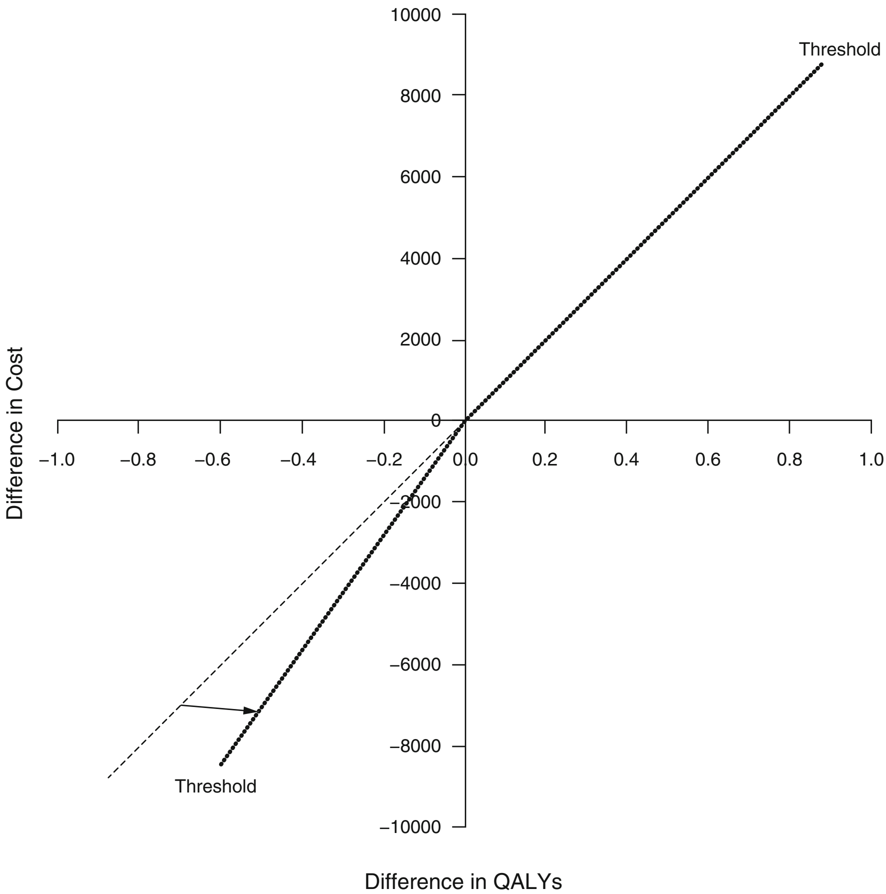

Fig. 5.4 The cost-effectiveness plane. Acceptability regions of new options with loss aversion. *Source: Figure is illustrative, prepared with mock data*

earnings losses, etc.), voluntary services, and other sectors of the economy apart from the health sector (e.g. health-related productivity losses)

Countries have adopted or recommended either perspective or both in their health evaluation guidelines. For example, Israel, Germany, England, Scotland, Wales, New Zealand, and Cuba have adopted a healthcare system or payer perspective. The societal perspective is the approach adopted in France, Italy, Finland, the Netherlands, Portugal, and Sweden. Directives and guidelines in Australia, the USA, Spain, and Norway recommend both perspectives (Claxton et al. 2010).

Furthermore, it has been argued that a societal perspective should include any other direct and indirect economic impacts of health interventions onto other sectors (from education to the labour market) as well as their direct and indirect macroeconomic effects (e.g. via consumption or investment) and any influences on or distortions of pricing and investment incentives. These wider considerations point to the adoption of a cost-benefit, rather than cost-utility, analysis framework, which, though generally in use in other sectors (e.g. economic evaluation of transport or environmental investment projects), is disregarded for health evaluation.

Additional restrictive assumptions are adopted in health evaluations based on QALYs:

- Only changes in health-related quality of life are considered, rather than impacts on other domains of quality of life. Within an individual utility function maximisation framework, this is tantamount to assuming that only the impact of the health status on an agent's utility is relevant for decision-making about the allocation of healthcare resources. This, in turn, implies a further assumption of separability in the utility function between health-related attributes and any other attributes in the utility function such as income-related components (Keeney and Raiffa 1993, ch. 5).
- The weights that reflect the impact of each health level on an individual's utility or quality of life do not vary over time. This implies that the per-period utility function does not vary over the lifetime of an individual.
- The individual exhibits neutrality to risk with respect to the length of her life. This implies that she is indifferent between living with certainty up to T periods (i.e. her life is T periods long with certainty) and a scenario with an uncertain length but with a life expectancy of T periods.

There are two issues around QALYs that remain to be discussed: the measure of quality of life and whether QALYs implicitly discriminate against older people.[5]

Measures of Quality of Life in QALYs QALYs reflect quantity and quality of life. Most studies resort to either of two measures of health-related quality of life: the Medical Outcomes Study 36-Item Short-Form Health Survey (SF-36) (Ware et al. 1993)—or any of its shorter versions, the SF-6, SF-12, and SF-20—and the EQ-5D index (EQ-5D) (Reenen and Oppe 2015).[6]

The SF-36 is a non-disease-specific, non-preference-based indicator of health status. A non-disease-specific indicator of health status is designed to reflect quality of life in relation to general health instead of quality of life in connection to one specific illness or condition. A non-preference-based indicator of health status is designed to *measure* quality of life (or its changes as a condition progresses) instead of *valuing* the impact of health. A non-disease-specific indicator measures the impact of health in general on quality of life rather than of a medical condition in particular. The SF-36 consists of scaled scores along the following eight domains or dimensions: physical functioning, role limitations because of physical health problems, role limitations because of personal or emotional problems, bodily pain, general health, vitality, social functioning, and mental health perceptions.

The EQ-5D is also a non-disease-specific indicator of health status, but in contrast to the SF-36, it is preference-based so its focus is on valuing the impact of health on quality of life. The EQ-5D is a 'standardised non-disease-specific instrument for describing and valuing health-related quality of life' (Reenen and Oppe 2015, p. 3). It comprises five health domains or dimensions: mobility, self-care, ability to perform usual activities, pain or discomfort, and mood (anxiety and depression), each one divided into three categories (Reenen and Oppe 2015, p. 5).

The UK National Institute for Health and Care Excellence recommends the use of the SF-36 survey to measure health-related quality of life in adults (NICE 2013). In turn, Haywood et al. (2005) recommend the SF-36 to broadly assess health status in community-dwelling older people with limited morbidity and the EQ-5D to obtain a more succinct measure when substantial changes in health status are expected. Whilst some studies show that both instruments present high responsiveness (also referred to as 'discriminative capacity', i.e. the ability to detect clinically relevant cases) when applied to older people—see, for example, Tidermark et al. (2003) for patients with displaced femoral neck fractures—Rowen et al. (2009) found that there are significant discrepancies when the SF-36 is mapped onto the EQ-5D for more severe states of the latter instrument. This line of academic enquiry is ongoing and should not concern us any further, but there are two additional problems worth mentioning regarding preference-based indicators such as the EQ-5D: whose preferences should be reflected and how to elicit these preferences or valuations. Given that the EQ-5D is an indicator of preferences about levels of health-related quality of life, you may think that it should reflect the patients' preferences. Good point, but we must bear in mind that the opinions of medical specialists, relatives (particularly if patients' opinions cannot be canvassed as, for example, among older people suffering from advanced Alzheimer's disease), and the 'general population' or 'the taxpayer' could be also deemed relevant—and they may not be aligned: Shafrin et al. (2017) find that whilst patients with advanced-stage melanoma or lung cancer place high value in therapies that give them a chance of durable though variable survival, oncologists place high value in treatments with fixed survival; Alonso-Coello et al. (2015) report similar results for oral antithrombotic therapy in patients with atrial fibrillation; and Harrison et al. (2008) report likewise for colorectal cancer; and so on. Discordant preferences have also been identified between patients and carers (Shin et al. 2015). Regarding the second point, different mechanisms have been developed to elicit preferences by different stakeholders (e.g. government and private sector organisations, payers, patients, practitioners, hospitals, etc.), each with their pros and cons, including contingent valuation, the person trade-off approach, the benefit trade-off approach, and stated preference discrete choice modelling.[7]

Are QALYs Ageist? Given the wide use of QALYs to inform resource allocation in healthcare, we are going briefly to consider some of the arguments about whether this instrument is inherently discriminatory against older people. The crux of the matter is whether chronological age beyond a certain level is a morally relevant criterion to deny a person their claim to healthcare and, *in extremis*, survival. Other morally relevant criteria—equity, for example—are not embedded in the formulae to compute QALYs or ICER, except that each QALY has the same weight across individuals. Therefore, any other ethical considerations would have to be added by decision-makers on top of the quantitative cost-utility results. Lübbe (2016) points out that these ethical considerations cannot be left out of the health-maximisation exercise and calls for a modification of the estimation methodology.

We must distinguish between the use of QALYs to decide on the allocation of two or more particular drugs or interventions on one patient or on a homogeneous group of patients and the use of QALYs to decide on the allocation of one drug or intervention on more than one patient or on a heterogeneous group of patients. The ethical implications of each allocative decision are different. The use of QALYs to inform allocative decisions on one person or homogeneous group of people (where 'homogeneity' here means that these people could be treated as one person as no ethically relevant aspects would distinguish any one person from any other) would not raise any major ethical issues—provided the person/people did not object to improving their health or prolonging their lives through the drug or the intervention, and so on. However, when it comes to deciding *who* should get the treatment or medicine, QALYs are ethically problematic for a number of reasons, of which here we are interested in only one: the implicit or explicit use of chronological age as a rationing criterion. Using chronological age as a criterion for rationing or priority setting is 'one of the most controversial issues in health policy' (Bognar 2016, p. 163).

To fix ideas, let's consider a thought experiment. There are two patients, P_1 and P_2, of whom P_1 is the younger, and due to budgetary constraints, only one of them can receive a treatment that would extend her life (or postpone her death); the other person will die on the day the treatment is given to the other patient. Who should be treated?

Supporters of **utilitarian ageism** (Nord et al. 1996) respond: the younger person, P_1, because *ceteris paribus* she has a longer life to live and therefore more expected benefits would be accrued given her longer life expectancy compared to treating the older person. Ageist utilitarians use chronological age as a proxy for period life expectancy, which in turn acts as an indicator for the expected lifetime benefits; as the younger person has an expected longer period life expectancy, this ethical position favours her to the detriment of an older person (Bognar 2016).

Imagine now that the treatment can only extend life for the same number of years irrespective of the patient who is treated. So, the expected life expectancy since treatment of either patient would be the same if either the younger or the older person received it. Now the ageist utilitarian argument crumbles: projected life expectancy would not act as an ethical justification to decide in favour of one of the patients.

Enter the **fair innings** argument. A supporter of this argument would respond: each person is entitled to a 'normal' lifespan; dying earlier than a given threshold is tantamount to a premature death, to a life 'cut short', whilst being alive beyond this lifespan is akin to living 'a bonus' or on 'borrowed time'. If the younger person has not reached her normal lifespan and the older person has, then it is ethically acceptable to treat the younger person because she has not reached her 'fair innings' (Harris 1985). Williams (1997) explains that the fair innings argument is outcome based, centres on a whole lifetime experience rather than on any particular point along the life course, reflects aversion to inequality, and is quantifiable. The problem with this whole-life approach is that it would not matter if older people live in, say, excruciating pain now provided they have lived, on average, over the course of their lives in similar health status than younger people are expected to live along their own lives (Bognar 2016). Another problem, of course, is that if neither patient has reached the threshold nor if both have, the fair innings argument does not apply, regardless of the chronological age of each person, which begs the question of why setting a threshold at all when chronological age can be used as a grading tool by which claims to healthcare resources diminish as people grow older.

A different ethical criterion is known as **prioritarianism**, which is an application of the worse-off principle inspired by Rawls (1971) to the allocation of healthcare resources (Brock 2002). This criterion is not ageist, and, in fact, it could be understood, in practice, as giving greater priority the older the patient. The ethical principle on which prioritarianism rests is that priority should be given to the worse-off, sicker patient (e.g. as defined using the SF-36 or EQ-5D instruments). Chronological age is not a factor that enters the ethical decision—although it is the case, of course, that older people are sicker than younger people on average. However, it would not matter whether P_1 is younger than P_2: whoever is in worse health should receive the treatment or medication. The problem with this principle is that it ignores the prognosis after receiving treatment, so even if the chances of recovery were remote, the sicker individual would be given priority. Another problem is that it is 'myopic' in that it does not consider the progression of a disease: an individual may not be very ill now so that she would not receive treatment, but foregoing such treatment would condemn her to a much worse health status in the future (Kamm 1993).

It appears that the use of QALYs contains elements of inherent, tacit, implicit discrimination against older people. However, there is a counter-argument raised by the proponents of QALYs: in the formulae to calculate quality-adjusted life years gained, chronological age is not taken into account. If we assume exactly the same quality of life, extending the life of a baby by one year is worth the same as extending the life of a middle-aged or an octogenarian by one year. 'Yes, but', object those in the opposite camp, 'the average health-related quality of life of a baby is much higher than the average health-related quality of life of an octogenarian so that a measure that adjusts by quality of life such as a QALY favours the former'. Whether this is ethically defensible or not, I leave to the reader to conclude—and at the end of this chapter, I have included two quotations for you to ponder. One additional consideration: some authors base their ethical positions regarding the use of QALYs upon surveys of preferences or other ways of elicitation of preferences (e.g. willingness to pay methods) by representative samples of the population. This empirical approach to moral philosophy, where ethical dilemmas and considerations are left to the 'public' to decide or where, at least, public opinion about them is one element to account for, has—as should come as no surprise—its opponents. Besides, public survey results tend to support 'weighting QALYs according to the age of the patient receiving them, independent of their remaining life expectancy' (Buchanan-Hughes and Kusel 2016), but the preferences by the general public tend to differ from those of patients' (Versteegh and Brouwer 2016).

One notion against the use of QALYs is the **double jeopardy** argument, which was raised against diminishing prospects for people living with disability concerning the calculus of their QALYs vis-à-vis a person without disability (Harris 1985, 1987). If healthcare resources that can cure a given condition have to be allocated between two patients, one of whom has a disability not related to that medical condition, assuming the intervention would bring back the health statuses of both patients to the levels prior to the illness or condition that that intervention treats and cures, *ceteris paribus* the individual without disability would be computed higher QALYs. In this sense, the disabled patient would be affected doubly: first, she has to live with the disability and poorer quality of life and, second, she will be denied treatment because of her disability. Some authors looked at the intersection of disability and chronological age, race and chronological age, and gender and chronological age, and at the intersection of all these domains at the same time, alerting of a multiplicity of jeopardy (Carreon and Noymer 2011; Moodley 2006).

5.2 Alternatives to QALYs

The most well-known alternative to QALYs is the **disability-adjusted life years (DALYs)** measure, defined as 'the present value of the future years of disability-free life that are lost as the result of the premature deaths or cases of disability occurring in a particular year' (Bank 1993, p. x). QALYs are not disease-specific; DALYs are. DALYs attempt to quantify the 'burden' of disease and disability as a basis for prioritisation and allocation of healthcare resources. For each death from (in theory) each medical condition or (in practice) each category of disease, the starting point is an estimate of the number of years lost defined as the difference between the actual chronological age of death and the expected age of death for a person of that age in a low-mortality population. For non-fatal conditions and disability, the expected duration of life with such condition or disability is weighted according to a severity factor. So, DALYs are a combination of years of life lost (YLLs) and years of life with a disability (YLDs): DALY = YLL + YLD.

Each component depends on the particular condition or disability, c; the age, a; and gender, g of the individual; and the year, t: $\text{YLL} = f(c, a, g, t)$; $\text{YLD} = f(c, a, g, t)$. For fatal diseases, we need to compute the difference between the death and the life expectancy at the age of death. If we define N as the number of deaths by one particular condition in a year and L as the life expectancies of each person who died at age a from that particular condition, then we obtain: $\text{YLL}(c, a, g, t) = N(c, a, g, t) \cdot L(c, a, g)$. For disability and non-fatal diseases, we need the incidence[8] of each disability and non-fatal condition, I; the severity weight, W; and the average duration of life with disability or condition, L:

$$\text{YLD} = I(c, a, g, t) \cdot W(c, a, g) \cdot L(c, a, g).$$

Then we apply a discount rate and an age weight.

Regarding the discount rate, the rationale is to apply it 'so that future years of healthy life were valued at progressively lower levels'; in most studies, a constant three per cent rate per year is used—which implies that in 25 years, a life is worth half of what is worth today (with a five per cent discount rate, in 25 years the value of a life would be one-third of today's value; with a ten per cent discount rate, it would be worth a tenth). However, Graham et al. (2017) report that in a survey of over 10,000 people in Britain, only a minority of respondents favoured a health policy that would save lives in the current generation and none or fewer in the future (i.e. your grandchildren's) generation; the majority chose a policy that would bring benefits equally to all generations or progressively increasing benefits to future generations. The authors question the use of constant or hyperbolic (declining) discount rates—see Volume I, Chap. 8, and Volume IV, Chap. 9—and, especially, their rationale as 'reflecting public preferences'; on the contrary, the findings would suggest that the public favours intergenerational fairness over time.

The age weights—reached through a 'consensus judgement' by experts—are applied 'so that years of life lost at different ages [are] given different relative values' (Bank 1993, p. 26). At the core of these age weights, there lies a notion of 'productive' years defined as periods in a life course in which most people are in paid employment and of 'dependence' (children and older people past retirement age would 'depend' on those in the workforce)—a notion similar to the life-cycle hypothesis; see Volume I, Chap. 8. 'Productive' years would be socially more important; hence they would get higher weights. Exactly which years of age get which weights can be obtained analytically. A general formula for DALYs is

$$\text{DALY} = \int_{x=a}^{x=a+L} W \cdot \left\{K \cdot C \cdot x \cdot e^{-\beta \cdot x} + (1 + K)\right\} \cdot e^{-r(x-a)} \cdot dx \tag{5.2}$$

where x is the age of the individual in one particular period and a is the age of the onset of the condition or disability, K is an age-weighting modulation constant equal to either 0 or 1 (this constant appears in the formula only to allow for the possibility that no age weights are used—if $K = 0$; if $K = 1$, then age weights are included), C is an age-weighting correction constant, β is the age weight, and r is the discount rate. As we can see, Eq. (5.2) contains three age-weighting factors, K, C, and β. The relationship between the age-correction constant C and the age weight β can be seen in the formula for the value of a year of life at each age (as in what follows age weights are applied, $K = 1$)[9]:

$$VL_x = C \cdot x \cdot e^{-\beta \cdot x} \tag{5.3}$$

The maximum value of a year of life at a given age corresponds to

$$C \cdot e^{-\beta \cdot x} - \beta \cdot C \cdot x \cdot e^{-\beta \cdot x} = 0 \tag{5.4}$$

which is obtained when the age x is equal to $\frac{1}{\beta}$. So, the age at which the maximum value is given depends on the value of the age weight. For example, if $\beta = 0.04$, the maximum value corresponds to individuals aged 25 years old; if $\beta = 0.08$, the maximum value is given to children aged 12 and a half years. Sensitivity studies tend to use weights ranging between 0.02 and 0.06, hence giving maximum values to ages between 50 and 16.67 years.

Let's look at Eq. (5.4) again. For values of x below or lower than the maximum, the function is increasing; it decreases for values of ages above the maximum. This can be seen if we consider that

$$\begin{gathered} C \cdot e^{-\beta \cdot x} - \beta \cdot C \cdot x \cdot e^{-\beta \cdot x} > 0 \\ \text{when} \\ C \cdot e^{-\beta \cdot x} \cdot (1 - \beta \cdot x) > 0 \end{gathered} \tag{5.5}$$

Considering that $C > 0$ and $e^{-\beta \cdot x} > 0$, the inequality in Eq. (5.5) holds only if $(1 - \beta \cdot x) > 0$, which means that it holds only when $x < \frac{1}{\beta}$. So, Eq. (5.4) is increasing for values of x below the maximum and decreasing for ages above this value.

The age-weighting correction constant C is chosen so that the same value of a year of life under the curve—that is, Eq. (5.3)—is obtained for ages between 0 and 100 years (the area is normalised at 100). We have

$$\int_{x=0}^{x=100} C \cdot x \cdot e^{-\beta \cdot x} = 100 \tag{5.6}$$

From here we can obtain an expression for the correction constant:

$$C = \frac{100}{\left[\frac{e^{(-100\cdot\beta)}}{\beta}\cdot(-100-\frac{1}{\beta})+\frac{1}{\beta^2}\right]} \tag{5.7}$$

Therefore, C depends on β: the age-weighting correction constant depends on the age weights, so that only the latter are of interest—the correction constant only ensures that the integral below the value of a year of life curve equals 100.

Other less frequently used alternatives to QALYs and DALYs include CALYs, YHLs, HYEs, and SAVE.

- **capability-adjusted life years (CALYs)** (Maansdotter et al. 2017), a non-welfarist[10] measure based on the capability approach; see Volume IV, Chap. 1. CALYs measure the remaining life years adjusted with capability-based weights. This is still a work in progress, and its proponents understand the choice of capabilities and their weights depends, ultimately, on national circumstances and culture.
- **years of healthy life (YHLs)**, an index that consists of a valuation of health status—usually activity-related status and self-reported or perceived health—and life expectancy (Erickson et al. 1995).
- **healthy years equivalents (HYEs)** (Mehrez and Gafni 1989), which capture mortality and morbidity but also patients' preferences for different health statuses.
- **saved young life equivalent (SAVE)** (Nord 1992), an explicitly ageist measure that defines that saving the life of a young person and bringing her back to full health is 'the maximum benefit that a single individual can obtain'—procedures that target older people would be given a lower equivalence number, reflecting the lower 'social value' ascribed to old age.

Review and Reflect

1. Discuss the following quotation:

    Older people have higher rates of common disorders that are amenable to prevention and management than younger people. A health-care system that gives adequate priority to older people would contribute more to the achievement of targets to reduce overall mortality and morbidity than a

(continued)

system that only focuses on younger people who are at intrinsically lower risk.

(*Lloyd-Sherlock et al. 2015, p. 2148*)

2. Discuss these two defences of age-based rationing in the allocation of health-care resources, known, respectively, as the *Full Biographical Lifespan* and the *Prudential Lifespan Account*:

   It is a tragedy when life ends prematurely even though it is possible to save that life, and when old age is full of burdens even though resources are available to relieve them. It is an outrage when, through selfishness, discrimination, or culpable indifference, the elderly are denied what they need and deserve. But it is only a sadness, an ineradicable part of life itself, when after a long and full life a person ages and dies in a society that has cherished and supported that person through the various stages of life. It is wise to want to banish the tragedy and outrage, but not the sadness.

   (*Callahan 1987, p. 204*)

   If we treat blacks and whites or men and women differently, then we produce inequalities between persons, and such inequalities raise questions about justice. For example, if we hire and fire on the basis of race or sex rather than talents and skills, then we create unjust inequalities. If we treat the old and the young differently, however, we may or may not produce inequality between persons. If we treat them differently just occasionally and arbitrarily, then we will be treating different persons unequally. But if we treat the young one way as a matter of policy and the old another way, and if we do so over their whole lives, then we treat all persons the same way. There is no inequality between persons since each person is treated both ways in the course of a complete life. Thus, the banal fact that we age means that age is different from race or sex for purposes of distributive justice…Unequal treatment at different stages of life may be exactly what we want from institutions that operate over a lifetime…Prudent allocation among stages of our lives is our guide to what is just between the young and the old.

   (*Daniels 2008, pp. 171–172*)

3. Lübbe (2016) opines that claims and rights have no place in welfare economics, given its moral philosophical underpinnings in consequential utilitarianism. For some authors, this is the correct approach whilst for others therein resides the main flaw in the use of QALYs for public decision-making. Discuss.

   - Comment on the following two quotes included in Vincent (2001):

     The generational equity debate is based upon three premises: (1) that in recent years the elderly have benefited disproportionately in terms of social spending when compared with other age groups; (2) that these gains have come at the expense of other age groups; and (3) that the elderly have had the power to make the decisions that

(continued)

permit this advantage to continue. It assumes that the elderly furnish a cohesive political bloc with sufficient power to determine political decisions on specific issues. Wrongly, it contends that there is a decisive age versus youth continuing context; that elderly voting behaviour is self-interested, and that the elderly constitute a homogeneous voting bloc. Such a view contains little in the way of empirical evidence. The flaws in this rights' position need little elaboration—it is relativistic in terms of obligations; it is ageist in the treatment of the elderly as a homogeneous mass; and it is subjective in implying that the key contributions to society are made by particular types of citizen.

(Vincent 2001, p. 192)

- From an article published in the magazine *The Economist*[11] (Vincent 2001, p. 182):

It is the old themselves who, for their own dignity and out of concern for their successors, must learn to demand less…

Notes

1. '*Todo necio confunde valor y precio*', (Machado 1997, LXVIII).
2. Fuchs (1998).
3. Using QALYs is a cost-utility analysis, but references to cost-effectiveness, though incorrect, are widespread in the academic literature. Cost-effectiveness analyses measure the cost of a drug or intervention in terms of a particular outcome. Cost-utility measures the cost of a drug or intervention in terms of utilities—usually, quality of life. See Birch and Gafni (1992) for more on the differences between cost-effectiveness and cost-utility analyses and Gray et al. (2011, ch. 2) for a description of other methods of evaluation in health economics.
4. Depending on the focus of the study, effects can also be expressed in the number of patients discharged, changes in cholesterol level, and so on (Van Hout et al. 1994).
5. For ethical considerations around QALYs, see McKie et al. (1998).
6. There are other instruments of health-related quality of life developed for specific conditions (the Diabetes QoL questionnaire, the EORTC QLQ-C30 for cancer, the AUA symptom index for urinary conditions, etc.), and other general measures very seldom used in the context of cost-effectiveness studies such as the COOP Health Assessment Charts, the Functional Status Questionnaire, the Goteborg Quality of Life Instrument, the 12-Item Health Status Questionnaire, the MOS 20-Item Short-Form Health Survey, the concise Quality of Life Index, the Australian Quality of Life Index, the World

Health Organization Quality of Life Measure, the Health Utility Index, and so on.

7. See Gray et al. (2011, ch. 5) for a summary.
8. Some studies use prevalence—that is, the number of people who contracted the condition or became disabled in a period of time, usually a year, plus all those who already had the condition or disability in previous periods and still have it in the current period. Incidence refers only to the number of new cases in a period of time, usually a year.
9. In discrete time, see Volume I, Sect. 7.2, the formula becomes

$$VL_x = C \cdot (0.5 + x) \cdot e^{-\beta \cdot (0.5+x)}$$

See Larson (2013).
10. Welfarism is an approach to the evaluation of policies based on the aggregation of individual utilities. Non-welfarism is an approach that gives weight to other considerations than individual utility—for example, fairness, horizontal equity, and so on, or, as here, capabilities.
11. '*A time to die*', The Economist, 5 August 1989.

References

Alonso-Coello, Pablo et al. "Values and preferences for oral antithrombotic therapy in patients with atrial fibrillation: Physician and patient perspectives." *Health Expectations* 18, no. 6 (2015): 2318–2327.

Birch, Stephen, and Amiram Gafni. "Cost effectiveness/utility analyses: Do current decision rules lead us to where we want to be?" *Journal of Health Economics* 11, no. 3 (1992): 279–296.

Bognar, Greg. "Priority setting and age." In *Prioritization in Medicine An International Dialogue*. Edited by Eckhard Nagel, Michael Lauerer, and Valentin Schätzlein, 163–178. Cham: Springer International Publishing, 2016.

Brock, Dan W. "Priority to the worse off in health-care resource prioritization." In *Medicine and Social Justice Essays on the Distribution of Health Care*. Edited by Rosamond Rhodes, Margaret P. Battin, and Anita Silvers, 362–372. Oxford: Oxford University Press, 2002.

Buchanan-Hughes, A.M., and J. Kusel. *The Trade-Off Between Qaly Maximization And Social Values: A Systematic Review Of Public Opinion Surveys. International Society for Pharmacoeconomics and Outcomes Research, May 21 25 2016*. Washington, DC, 2016. http://wwwcostellomedicalcom/wpcontent/uploads/2014/03/Poster_PHP54-1.pdf.

Callahan, Daniel. *Setting Limits: Medical Care in an Ageing Society*. New York, NY: Simon and Schuster, 1987.

Carreon, Daisy, and Andrew Noymer. "Health-related quality of life in older adults: Testing the double jeopardy hypothesis." *Journal of Aging Studies* 25 (2011): 371–379.

Claxton, Karl et al. *Appropriate Perspectives for Health Care Decisions*. CHE Research Paper 54. York, 2010.

Daniels, Norman. *Just Health. Meeting Health Needs Fairly*. New York, NY: Cambridge University Press, 2008.

Erickson, Pennifer Ronald Wilson, and Ildy Shannon. *Years of Healthy Life*. Healthy People 2000 Statistical Note. Hyattsville, MD, 1995.

Fuchs, Victor R. *Who Shall Live?: Health, Economics, and Social Choice*, vol. 3. Economic Ideas Leading to the 21st Century. Singapore: World Scientific Publishing Co, Inc., 1998

Graham, Hilary et al. "Do People favour policies that protect future generations? Evidence from a British survey of adults." *Journal of Social Policy* 46, no. 3 (2017): 423–445.

Gray, Alastair et al. *Applied Methods of Cost-Effectiveness Analysis in Health Care*. Hand-Books in Health Economic Evaluation. Oxford: Oxford University Press, 2011.

Harris, John. *The Value of Life*. London: Routledge, 1985.

—. "Qalyfying the value of life." *Journal of Medical Ethics* 13, no. 3 (1987): 117–123.

Harrison, James D. et al. "Patient and physician preferences for surgical and adjuvant treatment options for rectal cancer." *Archives of Surgery* 143, no. 4 (2008): 389–394.

Haywood, K.L., A.M. Garratt, and R. Fitzpatrick. "Quality of life in older people: A structured review of generic self-assessed health instruments." *Quality of Life Research* 14, no. 7 (2005): 1651–1668.

Kamm, Frances Myrna. *Morality Mortality: Death and Whom to Save from It. Volume 1.* New York: Oxford University Press, 1993.

Keeney, Ralph L., and Howard Raiffa. *Decisions with Multiple Objectives: Preferences and Value Trade-Offs*. Wiley Series in Probability and Mathematical Statistics. Applied probability and statistics. Cambridge: Cambridge University Press, 1993.

Klarman, Herbert, John Francis, and Gerald Rosenthal. "Cost effectiveness analysis applied to the treatment of chronic renal disease." *Medical Care* 6, no. 1 (1968): 48–54.

Larson, Bruce A. "Calculating disability-adjusted-life-years lost (DALYs) in discrete-time." *Cost Effectiveness and Resource Allocation* 11, no. 8 (2013). https://doi.org/10.1186/1478-7547-11-18.

Lloyd-Sherlock, Peter et al. "A premature mortality target for the SDG for health is ageist." *The Lancet* 385, no. 9983 (2015): 2147–2148.

Lübbe, Weyma. "Social value maximization and the multiple goals assumption: Is priority setting a maximizing task at all?" In *Prioritization in Medicine An International Dialogue*. Edited by Eckhard Nagel, Michael Lauerer, and Valentin Schätzlein, 57–66. Cham: Springer International Publishing, 2016.

Lynn, Jonathan, and Anthony Jay. *The Complete Yes Prime Minister*. London: BBC Books, 1989.

Maansdotter, Anna et al. "We propose a novel measure for social welfare and public health: Capability-adjusted life-years, CALYs." *Applied Health Economics and Health Policy* 15, no. 4 (2017): 1–4.

Machado, Antonio. *Poesías Completas*. Madrid: Espasa-Calpe S.A., 1997

Marsh, Henry. *Do no Harm. Stories of Life Death and Brain Surgery*. London: Phoenix, 2014.

McKie, John et al. *The Allocation of Health Care Resources: An Ethical Evaluation of the 'QALY' Approach*. Farnham: Ashgate, 1998.

Mehrez, Abraham, and Amiram Gafni. "Quality-adjusted life years, utility theory and healthy-years equivalents." *Medical Decision Making* 9, no. 2 (1989): 142–149.

Moodley, Roy. "Double, triple, multiple jeopardy." *Anti-Discriminatory Counselling Practice*. Edited by Colin Lago and Barbara Smith, 120–134. London: Sage Publications, 2006.

NICE. *Guide to the Methods of Technology Appraisal 2013 (PMG9)*. Technical report. London, 2013.

—. *Myocardial Infarction (acute): Early Rule Out Using High-Sensitivity Troponin Tests (Elec- sys Troponin T High-Sensitive ARCHITECT STAT High Sensitive Troponin-I and AccuTnI+3 assays)*. Diagnostics guidance 15. London, 2014.

Nord, Erik. "An alternative to QALYs: The saved young life equivalent (SAVE)." *British Medical Journal* 305, no. 6858 (1992): 875–877.

Nord, Erik et al. "The significance of age and duration of effect in social evaluation of health care." *Health Care Analysis* 4, no. 2 (1996): 103–111.

O'Brien, Bernie J. et al. "Is there a kink in consumers' threshold value for cost-effectiveness in health care?" *Health Economics* 11, no. 2 (2002): 175–180.

Räsänen, Pirjo et al. "Cost-utility of routine cataract surgery." *Health and Quality of Life Outcomes* 4, 1 (2006). https://doi.org/10.1186/1477-7525-4-74(citedonpage140).

Rawls, John. *A Theory of Justice*. Cambridge, MA: Harvard University Press, 1971.

Reenen, Mandy van, and Mark Oppe. *EQ-5D-3L User Guide Basic Information on How to Use the EQ-5D-3L Instrument*. Technical report. Version 5.1. Rotterdam, 2015.

Rowen, Donna, John Brazier, and Jennifer Roberts. "Mapping SF-36 onto the EQ-5D index: How reliable is the relationship?" *Health and Quality of Life Outcomes* 7, no. 1 (2009). https://doi.org/10.1186/1477-7525-7-27.

Severens, Johan L. et al. "Cost-effectiveness acceptability curves and a reluctance to lose." *Pharmacoeconomics* 23, no. 12 (2005): 1207–1214.

Shafrin, Jason et al. "Patient versus physician valuation of durable survival gains: Implications for value framework assessments." *Value in Health* 20, no. 2 (2017): 217–223.

Shin, Dong Wook et al. "Discordance among patient preferences, caregiver preferences, and caregiver predictions of patient preferences regarding disclosure of terminal status and end-of-life choices." *Psycho-Oncology* 24, no. 2 (2015): 212–219.

The World Bank. *World Development Report 1993: Investing in Health*. New York, NY: Oxford University Press, 1993.

Tidermark, J. et al. "Responsiveness of the EuroQol (EQ 5-D) and the SF-36 in elderly patients with displaced femoral neck fractures." *Quality of Life Research* 12, no. 8 (2003): 1069–1079.

Van Hout, Ben A. et al. "Costs, effects and C/E-ratios alongside a clinical trial." *Health Economics* 3, no. 5 (1994): 309–319.

Versteegh, Matthijs, and Werner Brouwer. "Patient and general public preferences for health states: A call to reconsider current guidelines." *Social Science and Medicine*165 (2016): 66–74.

Vincent, John. *Geronticide Killing the Elderly* London: Jessica Kingsley Publishers, 2001.

Ware, J.E. et al. *SF-36 Health Survey: Manual and Interpretation Guide*. Boston, MA: The Health Institute, New England Medical Center, 1993.

Williams, Alan. "Intergenerational equity: an exploration of the 'fair innings' argument." *Health Economics* 6, no. 2 (1997): 117–132.

Part III

Long-Term Care

6

Caregiving Need

6.1 Introduction

The economic study of health (see Part II in this volume) and of long-term care (LTC)—also referred to as long-term care and support—shares various points in common. However, LTC has also distinct features, which merit a close examination on their own. For example, LTC is provided to a great proportion in most countries, irrespective of their level of economic development and the organisation of their welfare state, by unpaid individuals—in most cases, family members of those in need of care services. This chapter does not cover all the topics that a thorough economic analysis of LTC should look into,[1] but focuses on those aspects in which individual or population ageing play a salient role or which have a direct bearing on the quality of life of older people.

Knijn and Kremer (1997, p. 330) define 'care' as 'the provision of daily social, psychological, emotional, and physical attention for people'. The economic literature on care services concentrates on *long-term* care, as *short-term* care is considered equivalent to either intermediate or respite care services (Stalker 1996). In this sense, for this branch of economics, care means long-term care. To illustrate, Shaw et al. (2009, p. 2) defined respite care as 'the provision of a temporary break in caregiving activities for the informal carer to reduce care distress and promote well-being', whilst long-term care has been defined as:

> a range of services required by persons with a reduced degree of functional capacity, physical or cognitive, and who are consequently dependent for an extended period of time on help with basic activities of daily living (ADL)

J. L. Iparraguirre, *Economics and Ageing*,
https://doi.org/10.1007/978-3-319-93357-3_6

> …frequently provided in combination with help with basic medical services …as well as prevention, rehabilitation or services of palliative care. Long-term care services can also be combined with lower-level care related to "domestic help" or help with instrumental activities of daily living (IADL).
>
> (Francesca et al. 2011, pp. 11–12)

In this definition of LTC, we can notice a lexical association (Fellbaum 2015) between care, later life, and irreversibility. Embedded in this semantic association is the notion that older people in need of care, unlike healthcare, suffer from chronic diseases or disability which 'lasts as long as a person is alive' (Norton 2000, p. 957). Conceptually, LTC is about *care, not cure*. Several studies in nursing, philosophy, and sociology have looked into the distinction between care and cure, which has economic implications—among others, the feminisation of the labour market for care services; see Brau and Moulin (1992), Glouberman and Mintzberg (2001), Jecker and Self (1991), Kottow (2001), and Treiber and Jones (2015). The following is a useful explanation of the distinction between LTC and healthcare:

> The difference between long-term care versus curative and rehabilitative health care is that the latter two aim at changing the medical condition of the person whereas long-term care only compensates for a lasting inability. A nurse visiting an older person at home to change a bandage and inspect the healing of a wound or administer an injection, for example, provides curative health care, not long-term care. But of course, if the nurse during the same visit helps the older person to take a bath, then the nurse provides a combination of curative health care and long-term care. Similarly, an older person attending physiotherapy to regain mobility after a hip-replacement receives rehabilitative care, not long-term care.
>
> (Lundsgaard 2005, p. 9)

According to Knapp and Somani (2010, p. 250), the primary goal of LTC 'is not to cure ill health but to allow individuals to achieve and maintain optimal levels of personal functioning'. In a similar vein, Cremer et al. (2012, p. 110) identified LTC as 'permanent, non-accidental and due to old age' and recommended that 'it should be distinguished from other phenomena, such as illness, disability and handicap'. In addition, Evashwick (2005, p. 4) explains:

> The goal of long-term care is to enable a person to maintain the maximum level possible of functional independence. Unlike acute care, for which the goal is to cure, long-term care recognizes that a person's condition may be irreversible and may possibly deteriorate over time.

These views reflect a mental association of later life with loss. This semantic evocation between chronological age and loss of independence is a cultural construct that neither reflect the reality of the vast majority of older people nor accommodate the possibility of any gains as a result of developmental changes in functioning with advancing years (Baltes 1995, 1996).[2]

To begin with, the vast majority of older people do not need any care (Timonen 2008). Second, the negation of any developmental gains introduces an element of uncertainty about the duration of the provision of the services and therefore its cost so that 'risk' is defined by the longevity risk plus any accentuation or escalation of their condition over time. Whilst the main cause of termination of use of LTC services is the death of the recipient,[3] it is by no means the only reason, especially with regard to informal care services: studies into the transitions in and out of care show that 'going into' care is not always a one-way ticket: for example, using the predisposing-enabling-need factors model, Geerlings et al. (2005) found a retraction from receiving informal care to not receiving any care three years later. Tellingly, the loss of independence is known as the 'fifth risk'—a recent addition to the other four 'risks' (health, workplace accidents, longevity risk, and retirement) and household-related risks—on which social security systems and welfare states in general were designed and structured to manage (Esping-Andersen 2003; Vasselle 2008, 2011). And because '[s]ocial policy means public management of social risks' (Esping-Andersen 2003, p. 36),

LTC services are provided by actors in five sectors: the family, the state, for-profit (or market) organisations, non-profit (or voluntary) organisations, and informal networks of support. These sectors form a 'mixed economy of care' or welfare (Powell 2007). 'Mixed' in this context not only denotes that the provision of services from the different sectors co-exist with and to some extent compete with or complement each other but also that their boundaries are rather blurred. Furthermore, it is a mixed 'economy'—apart from the plurality of intervening sectors—because issues of finance and regulation interact with the provision of services across those sectors (Powell 2007, fig. 1.2).

The prevalent view among policy-makers, the general public, and not a few academics is that LTC has been historically provided within the realm of the household and that in a sense the family is the 'natural' place for the delivery of LTC services. This notion belongs to the realm of the myths that must be debunked and of the misconceptions that need to be cleared once and for all (if only!). In fact, since antiquity there has been a mixed economy of care with multifarious sources of support, including the next of kin surely, but also a network of informal communal care provision consisting of neighbourhood and kinship relations beyond the household, as well as formal institutional care, mainly by parishes and local governments (Horden 2013).

A formidable challenge is pending: that of developing a complete theoretical model—in a context of uncertainty regarding becoming dependent and the length of the lifespan—encompassing:

- the many various motivations for providing informal care
- its relationship with home-based, community-based, and institutional-based formal care
- the interplay of bequests and inter-vivos transfers
- the relationship with wealth, income, and work
- how the different funding options—including private insurance—affect the provision of and demand for informal and formal care and the quality of life of older recipients and other outcomes

Therefore we are going to peek into some of its potential building blocks, to illustrate what economists have thought about these issues and to ponder about the strengths and limitations of their approaches.

6.2 Definition and Measurement

We need to start with need. The definition of LTC above relates LTC to dependency on help to perform activities of daily living. It distinguishes between basic and instrumental activities of daily living. The former are simply known as activities of daily living. **Activities of daily living (ADLs)** involve routine, everyday self-care activities (Katz et al. 1963), including:

- having a bath or a shower
- walking across a room
- dressing or undressing
- getting in and out of bed
- using the toilet
- eating, including cutting up food

Instrumental activities of daily living (IADLs) require higher mental and physical capacity and functioning (Lawton and Brody 1969) and comprise:

- using a map to get around in a strange place
- preparing a hot meal

- shopping for groceries
- making telephone calls
- taking medication
- doing work around the house or garden
- managing money

There are various constructs for measuring long-term need. Some of the most widely used are:

6.2.1 Katz Scale

Used almost universally, it is based on the ADL excluding walking across a room but including continence (although some authors do not consider continence an ADL). Each activity is graded according to the level of dependence as performed independently, performed with assistance, or unable to perform (Katz et al. 1963; Kessler 2008).

6.2.2 Barthel Scale

This index of functional ability was developed for hospital settings—not among older people living in the community—and has three versions: with 5, 10, and 15 items, respectively (Mahoney and Barthel 1965).

6.2.3 Physical Self-Maintenance (Lawton) Scale

This index is a disability measure based on both ADL and IADL—see Lawton and Brody (1969).

6.2.4 AGGIR Scale

Used in France,[4] the AGGIR scale classifies older people according to the level of independence by means of ten variables: coherence in speech and behaviour; orientation in time and location; bathing; dressing; feeding; hygiene; transfers such as lying down, sitting down, and so on; walking inside; walking outside; and distant communication—use of telephone, remote alarms, and so on—with three categories each: no problem, partially need of help, and cannot perform without help; see Dupourqué (2012), Kessler (2008), and République Française (1977).

Six groups of older people are distinguished:

- completely dependent, bedridden, severely impaired mentally
- confined or impaired mental faculties
- older people in need of functional help several times a day
- older people in need of partial help with one or more ADLs
- older people in need of partial help with one or more IADLs or with bathing and home care
- non-dependent, autonomous older people

Each of these groups has a predicted level of demand for care services, which is the basis of the APA cash benefit aimed at (partly) financing home-based care.

6.2.5 SMAF Scale

Developed by the World Health Organization, SMAF[5] combines ADL and IADL measures with continence, communication functions, mental functions (such as memory, orientation, understanding, etc.), and mobility (Hébert et al. 1988).

6.2.6 GALI Scale

GALI is a single-item instrument originally developed to monitor the healthy life years or disability-free life expectancy indicator across countries—see Sect. 3.3 in this volume. It was validated by Jagger et al. (2010) as a measure of poor functioning and disability and therefore as a substitute for ADL and IADL if time or budget constraints prevent gathering data on daily activities (Van Oyen et al. 2006).

There are other constructs as well to measure need (e.g. the timed 'up-and-go' test, the Kenny Self-Care Evaluation Scale, the Rapid Disability Rating Scale, Jette's Functional Status Index, the Edmonton Functional Assessment Tool, etc.), some of which are specific instruments for older people with certain medical conditions (e.g. dementia, arthritis) or living in residential and nursing homes (e.g. the Plaisir scale)—or to assess risks (e.g. of falls).

As in any other topic of study in economics, in LTC we can distinguish between supply and demand. In addition, we can also make a distinction between formal and informal LTC. Formal LTC includes personal care, day care, assisted living, respite care, nursing care, and hospice care (Stallard 2010). Informal LTC comprises personal care services only. These delimitations are not as clear-cut as they seem: there are grey areas. For example, between community and institutionalised care, when nursing services are provided at housing options for older people such as retirement communities, senior apartments, congregate housing, and continuing care retirement communities. Another grey area is the sub-acute care, which falls somewhere between institutionalised care and hospital healthcare. Finally hospice-based services usually have institutional and community components. It is advisable to research these two dimensions (i.e. supply/demand and formal/informal care) together as there are strong interconnections. For example, older people are not only the main recipients of formal and informal long-term care services but also the main providers of informal LTC.

6.3 Formal and Informal Care

6.3.1 Formal Care

Formal care includes community-based (domiciliary or day centres) and institutional care, and it can be publicly or privately funded, or both. Formal care is delivered by public, for-profit, and non-profit organisations, and public expenditure can be used not only to fund services provided by public sector organisations but to fund privately provided services as well. Public funding for LTC comes from two sources: general taxation and social insurance (i.e. contributions by employers and workers). Publicly funded formal care delivered by private firms can be subject to two different payment rules, which form a central tenet of the incentive structure facing the firms which provide these services, either in the 'community' or in institutions: cost-reimbursement rules or prospective payment rules. Under cost-reimbursement payment rules, providers are paid for each service separately—which, particularly in nursing homes, generate incentives towards more amenities of higher quality in order to attract residents but with ensuing increases in costs and reimbursements by the government. Under prospective payment rules, providers are paid a fixed amount for each service based on the characteristics of the recipient—that is, an average cap per recipient—or, in residential settings, a 'per diem' rate. Changes from cost-reimbursement to prospective payment schemes in the USA[6] have been found to reduce utilisation of home care services without increasing the probability of admissions into residential care, an evidence suggestive of little substitution between formal home-based care and residential care (Huckfeldt et al. 2014; McKnight 2006)—see below. In turn, the reduction in formal home-based care utilisation due to prospective payment methods has been somewhat offset by an increase in informal care services, especially among older people on low incomes, which imposed additional caregiving burden on their families (Golberstein et al. 2009).

The level of economic development along with institutional, cultural, and historical factors helps explain the differences in delivery and funding of LTC services across countries. Except for a few exceptions (e.g. Denmark, Austria, and Poland), in developed countries, the largest share of spending in LTC corresponds to institutional care, although the largest share of services is delivered in the community. In developing countries, informal care is the predominant form of delivery (Habib and Hirschfeld 2003; Mayston et al. 2014). In many of these countries, care as a policy topic is neglected, and government intervention is absent (Lloyd-Sherlock 2014), which means that families with members (not only in later life) in need of care and support have to navigate what has been termed a 'journey without maps' (Mayston et al. 2017).

6.3.2 Informal Care

Unpaid caregivers conform a whole army of unseen, unnoticed, and, in a sense, 'marginalised' (Kesselring 2004)[7] workers. Informal carers may receive income transfers and payments ('cash-for-care' schemes) in compensation or recognition of their services (Breda et al. 2006; Da Roit and Le Bihan 2010; Da Roit et al. 2016). In some countries, the transfers or payments are made to the older person in need of care, which are then used in part to pay informal carers, whilst in other countries the transfers or payments are made directly to the informal carers (Lundsgaard 2005).

Informal care is usually considered a cost-saving alternative to formal community-based care options; however, this line of reasoning is flawed. To begin with, it is disputed whether formal and informal care services are substitutes or not and, if so, to what extent (see below). Furthermore, many of informal carers partially forego paid work or leave the labour market completely to fulfil the care responsibilities which entails, in addition to a financial blow to the individuals and their families, a macroeconomic cost with fiscal repercussions that must be factored in when estimating the relative costs of informal and formal care. In this section, we look at the monetary value (sometimes referred to as the 'economic contribution') of informal care. We leave the questions of substitutability between informal and formal care and of the determinants of the formal/informal mix for other sections in this chapter.

6.3.2.1 Estimation of the Monetary Value of Informal Care

Various techniques have been propounded to measure the monetary value of informal care (Faria et al. 2012; Koopmanschap et al. 2008). Basically, they can be classified into two families of methods: revealed and stated preference methods.

Revealed preference methods use wages and other observational data to derive the monetary value of care. They include:

- Proxy Good or Market Cost Method. It uses the price of a close market cost substitute (usually, a wage rate) to value the time spent on informal care; it can be decomposed by the tasks involved, each one with its own market cost.
- Opportunity Cost Method. Its focus is the benefits foregone (usually, the carer's market wage rate) as a consequence of the time spent providing informal care. This method is not very useful if the carer is, for example, retired, and leads to different estimates depending on the carer's income.
- Valuation of Well-Being Method. The focus of this method is on the positive effects that caring may exert on a carer's quality of life, and relies on quality of life measurement instruments specifically designed for care settings, such as the CarerQol (Brouwer et al. 2006; Hoefman et al. 2017). The results are expressed in changes in levels of happiness or quality of life, rather than in monetary terms.

Stated preference methods rely on a monetary value of informal care that individuals are asked to estimate in surveys or on thought exercises about hypothetical trade-offs, and comprise:

- Conjoint Measurement. Caregivers are presented with scenarios or hypothetical 'states of the world', one of whose dimensions—at least—is expressed in monetary terms. Some of the dimensions of the scenarios could be the number of hours of informal care provided or the types of tasks. The idea is to elicit the monetary value of additional compensations for, say, caring one more hour or performing one extra task.
- Contingent Valuation Method. Carers are asked how much money as a *minimum* they would be willing to receive in exchange of one additional

hour of informal care or the *maximum* amount they would be willing to pay in exchange of one hour less of informal care.
- Valuation of Health Effects. In contrast to the valuation of well-being method, here the focus is on the negative or adverse impact of informal care provision on the carer. Usually, the effect is measured in terms of changes in the carer's quality of life—estimated by means of instruments such as the EQ-5D; see Sect. 3.3 in this volume

Estimates of the monetary value of informal care have been produced for a number of countries, though they are not necessarily comparable even within one same country given the different methods applied and datasets used. We need to distinguish between the value of informal care received by older people and the value of informal care provided by older people, and within the latter a further distinction has to be made between the care services that older people provide to other older people and to younger people. Not all the authors make such distinctions when producing estimates, as can be inferred from the following examples.

- Johnson and Schaner (2005, Table 1) estimated—under a moderate cost assumption—that the value of unpaid spousal and parental care by adults age 55 and older in the USA in 2002 amounted to $60.4 billion (equivalent to 37.3 per cent of total value of unpaid activities by people in this chronological age group and to 44.3 per cent of total spending on formal long-term care services for older people). Of this total, almost 59 per cent was performed by women.
- In 2006, Gibson and Houser (2007) estimated that the economic value of informal care by caregivers age 18 or older in the USA was equivalent to the total spending for the national social insurance programme (Medicare) and 40 per cent more than the US budget deficit.
- Also using data from the USA, Greenwald and Associates (2015) estimated that roughly 14.3 per cent of all adults were engaged in the provision of unpaid care services to someone aged 50 years or older—49 per cent of carers care for someone age 75 years or older, whilst 19 per cent of carers were 65 years of age or older (and 7 per cent were aged 75 years or over).
- Using data from 1997 for Australia, De Vaus et al. (2003) estimated that the value of unpaid adult care services (excluding cooking, shopping, and cleaning) by people aged 55 or over amounted to approximately 0.7 per cent of the value of all unpaid work by this age cohort—which includes all domestic chores, voluntary work, childcare, and so on. Data from 2010

show that there were over 530,000 people aged 65 or over providing informal care in Australia (Economics 2010, Table 1.2).

- Iparraguirre (2014) estimated that the monetary value of informal care provided by the population aged 65 or over in the UK in 2012 amounted to about 19 per cent of the value of all unpaid activities by people aged 65 or over. Moreover, Webber et al. (2016) estimated that the value of informal care provided by adults aged 50 or over in the UK in 2014 represented around 2 per cent of total gross domestic product.
- For Spain, total unpaid care (not only for or by older people, but mostly for older people) in 2002 was estimated to represent between 1.25 per cent and 1.93 per cent of GDP (Oliva et al. 2007).
- In Italy and Poland, Francavilla et al. (2011) reported that the value of adult care was around 1 per cent and 0.2 per cent of GDP, respectively.
- Using the proxy good method, Paraponaris et al. (2012) estimated that informal care by relatives and friends to meet the needs of older people in France was equivalent to about 3.7 per cent of the total expenditures devoted to the longevity risk. Moreover, using the proxy good method, Paraponaris and Davin (2015) estimated that the monetary value of informal care of patients with dementia living in the community in France in 2008 amounted to around 2.4 per cent of total current health spending, whilst using the opportunity cost method, the estimate reached 3.3 per cent of total current health spending.

6.3.2.2 Economic Costs of Informal Care

In health economics, the economic costs of disease are usually classified into direct and indirect. Direct costs reflect 'changes in resource use that are directly attributable to a healthcare intervention' (Andersson et al. 2002, p. 47), and indirect costs are defined as productivity or income loss during the time absent from an income-generating activity due to an illness. Sometimes, 'time costs' are included to reflect the detriment of leisure time brought about by caring responsibilities. Some authors recommend that the costs accrued by informal carers outside the household in terms of paid and unpaid time losses should be included as indirect costs (Keating et al. 2014; Liljas 1998). Even though I concur with Andersson et al. (2002, p. 53) that 'the cost of informal care in evaluations of home care programs is often underestimated due to the exclusion of indirect costs', I contend that the indirect costs that should be included go far beyond the items which economic evaluations tend to incorporate. Furthermore, the direct/indirect dichotomy is somewhat artificial: costs are costs, and provided they come as a consequence of caring responsibilities, they should be factored in. A non-exhaustive list of costs informal caregivers incur includes: reduced employment, reduced pension contributions and pension income, human capital depreciation, adverse health effects, and lack of time (van den Berg and Ferrer-i-Carbonell 2007; Keating et al. 2014; Bauer and Sousa-Poza 2015).

6.4 The Sandwich Generation

In the USA it is far more likely for people aged 50–79 to have three generations of living kin (parents, children, and grandchildren) than two (parents and children)—39 per cent of men and 40.8 per cent of women (Margolis and Wright 2017). In Canada, 28 per cent of the 8.1 million caregivers are 'sandwiched', 'caught between the competing demands of caring for at least one dependent child and one or more aging parents' (Boyczuk and Fletcher 2016, p. 51). Grundy and Henretta (2006) reported that one-third of women aged 55–69 years both in the USA and the UK looked after at least one ascendant and descendant relative—the 'women in the middle' (Brody 2003)—and Suh (2016) estimated that people who care for children and parents in the USA provided care for around 20 hours a week on average by 2012. These are members of the **sandwich generation**: people who *simultaneously* (Cravey and Mitra 2011) have caregiving responsibilities for their ageing parents and their children or grandchildren (although some authors include people with financial responsibilities for members of a younger generation and caregiving responsibilities for someone older as part of the 'sandwich', most of the research focuses on dual upstream and downstream caregiving).

Duxbury and Higgins (2017) discussed the different definitions of sandwich generation—such as the chronological ages of its members and of their children included in the delimitation of the 'generation': are people in their late 30s included, for example?; does having a 25-year-old son living in the house make his 53-year-old mother who looks after her own 91-year-old mother 'sandwiched'?; and so on. These discrepancies make it difficult to compare findings across the literature. Despite their methodological differences, most studies accord that the phenomenon of being 'in the middle' is on the rise in developed countries. However, in developing countries this depends on the demographic forces in play in each country: a study of the sandwich generation in Brazil reports that its size follows closely the structural changes in the population resulting from the 'demographic transition'—see Volume I, Chap. 2: the proportion of women sandwiched between children and parents was high until the 1960 birth cohort to decline thereafter (Campos de Lima et al. 2015).

Another common thread in this literature is the idea of being 'caught' or 'squeezed' in the middle—that is, the idea that the members of the sandwich generation play their double caregiving roles not of their own volition but 'by dint of circumstances' as Chisholm (1999, p. 187) put it, or, in the words of the first academic to use the 'sandwich' metaphor:

> The position of the children of the aging in relation to their parents, children, and grandchildren exposes them to a unique set of unshared stresses in which giving of resources and service far outweighs receiving or exchanging them.
>
> (Miller 1981, p. 419)

This sense of the dual caregiving responsibilities being imposed upon individuals is reflected in the evidence that suggests that, compared to informal caregivers only of members of the previous generation (usually, a parent), sandwiched caregivers are more likely to suffer from depression, stress, and a lower health status in general (Boyczuk and Fletcher 2016; McGarrigle et al. 2014; Rubin and White-Means 2009).

Another crucial topic in the literature is the intersection between sandwiched caregiving and labour market participation. Many members of this 'generation' are in paid employment, which for some authors constitutes an additional burden (Yamashita and Soma 2015). Sandwiched caregivers in employment tend to show higher rates of absenteeism, higher turnover intention, lower punctuality, and lower productivity than employees with caregiving responsibilities for members of only one generation (Duxbury and Dole 2015)—in contrast, Rubin and White-Means (2009) indicated that being employed *reduced* the stress and burden of sandwiched carers compared to those not in employment. We mentioned above the costs borne by caregivers in paid employment; members of the sandwich generation are exposed to heightened risks of career disruptions, losing out on promotion opportunities and foregoing income due to shifting from full-time to part-time work or quitting paid employment altogether. There is also some indication that sandwiched caregivers are more likely to take home work to do during weekends and in the evenings, which places additional strain on their family life, than non-sandwiched caregivers and workers with no caring responsibilities. Moreover, in many organisations, there is a stigma attached to taking time off to provide care and support to an older member of the family that is not present, or not as pronounced, on colleagues with childcare responsibilities (Duxbury and Higgins 2017).

In the models section below, we discuss the evidence around the effects of caregiving on the extensive margin of labour—that is, on the decision to work or not—and on the intensive margin of labour, that is, on the number of hours of work. However, the labour market effects are not restricted to foregone employment opportunities, cessation of employment, or reduced hours. They extend to:

- limited career opportunities (Bolin et al. 2008; Fast et al. 2013; Koerin et al. 2008)
- increased absenteeism (Katz et al. 2011)
- decreased prospects of returning-to-work or un-retirement after caring responsibilities ceased (Gonzales et al. 2017)
- reduced productivity, and so on
- reduced leisure time (Gladwell and Bedini 2004; Romero-Moreno et al. 2016; Schüz et al. 2015)
- reduced social participation (Loucks-Atkinson et al. 2006; Miller and Montgomery 1990)
- out-of-pocket expenses, which includes transport, housing, supplies, and so on. Out-of-pocket costs impact directly on reduced financial security, increased risk of social exclusion, reduced quality of life, depression, self-neglect, reduced savings, dependence on high-interest loans, cutbacks on necessities, and so on—see Duncan et al. (2015) and Shooshtari et al. (2017)
- strain and family conflict, including work-to-family conflict—that is, 'the extent that paid work demands interfere with an individual's ability to meet family responsibilities'—and family-to-work conflict, that is, 'the degree that family demands hinder the performance of paid work activities' (Glavin and Peters 2015, p. 6)
- emotional and mental health demands imposed by the actual provision of care services, which include (Liu et al. 2017):
  - feelings of guilt (Pierron-Robinet et al. 2016)
  - depression and stress (Langa et al. 2004; Vallée et al. 2016)
  - poor sleep patterns and diet (Vitaliano et al. 2003)
  - reduced perceived control (Glavin and Peters 2015)

No single study of the costs of informal care has attempted to estimate the impacts listed above in monetary terms. Usually, the assessments of the economic burden of caregiving—as well as those studies that estimate the burden of informal care of people who suffer from particular diseases—are confined to out-of-pocket expenses and one or more labour market-related indicators. A step in the right direction is the study of the economic burden of family caregiving for the elderly in southern Ghana by Amendah et al. (2017), which, in addition to out-of-pocket outlays and foregone earnings due to lost work time, included an index of burden and an index of financial stress. However, the authors did not estimate the monetary value of these indices—they only indicated a significant statistical association. Tools like the 'Cost of Care Index' (Kosberg and Cairl 1986) or the 'Perceived Caregiver Burden scale' (Stommel et al. 1990), on the other hand, serve other purposes—for example, screening—but are not suited to provide a basis for economic estimates of the cost of informal caring.

Review and Reflect

1. On commenting about dependency ratios, Westendorp (2015, p. 135) stated:

   While our principal responsibility used to be raising the young to adulthood, in the future it will mainly be older people who require our care and support. Most people prefer the idea of wiping babies' bottoms to that of wiping old people's bottoms, but that is a different matter. From an economic point of view, it is far from being a doomsday scenario.

   Regardless of any considerations about the future, are caring for babies and older people indistinguishable 'from an economic point of view'? Discuss.
2. In connection with the notion that dependency in later life is a new social risk, discuss the following contention:

   …risk, particularly an individualized and responsibilized risk, is replacing need as the core principle of social policy formation and welfare delivery.
   (Kemshall 2002, p. 1)

Notes

1. For introductions to the economics of LTC, see Cremer (2014), Cremer et al. (2012), Norton (2000), and Siciliani (2014).
2. On long-term care as a socially constructed concept and practice, see Weicht (2015).
3. Death as a cause of termination of private LTC insurance increases with the chronological age of the policyholder (Ho 2016).
4. AGGIR is the acronym of 'Autonomie Gérontologie Groupes Iso-Ressources', French for *Gerontological Independence—Iso Resources Groups*.

5. Acronym of 'Système de Mesure de l'Autonomie Fonctionnelle'—that is, Functional Autonomy Measurement System—in French.
6. Introduced by the Balanced Budget Act of 1997 (BBA97)—Public Law 105 - 33.
7. 'Das Spektakuläre an der Pflege zuhause durch Angehörige ist, dass sie als gesellschaftliches Phänomen und als menschliche Notwendigkeit so unspektakulär, so selbstverständlich, ja so marginalisiert ist' (Kesselring 2004, p. 504).

References

Amendah, Djesika et al. "Economic burden of family caregiving for elderly population in southern Ghana: The case of a peri-urban district." *International Journal for Equity in Health* 16, no. 16 (2017). https://doi.org/10.1186/s12939-016-0511-9

Andersson, Agneta, Lars-Åke Levin, and Bengt Göran Emtinger. "The economic burden of informal care." *International Journal of Technology Assessment in Health Care* 18, no. 1 (2002): 46–54.

Baltes, Margret M. "Dependency in old age: Gains and losses." *Current Directions in Psychological Science* 4, no. 1 (1995): 14–19.

Baltes, Margret M. *The Many Faces of Dependency in Old Age*. Cambridge: Cambridge University Press, 1996.

Bolin, Kristian, Björn Lindgren, and Petter Lundborg. "Your next of kin or your own career? Caring and working among the 50+ of Europe." *Journal of Health Economics* 27, no. 3 (2008): 718–738.

Bauer, Jan Michael, and Alfonso Sousa-Poza. "Impacts of informal caregiving on caregiver employment, health, and family." *Journal of Population Ageing* 8, no. 3 (2015): 113–145.

Boyczuk, Alana M., and Paula C. Fletcher. "The ebbs and flows: Stresses of sandwich generation caregivers." *Journal of Adult Development* 23, no. 1 (2016): 51–61.

Brau, Jacqueline, and Madeleine Moulin. To care or to cure: un défi pour les soignantes auprès des âgés en institution. In: *International Review of Community Development/Revue internationale d'action communautaire* 28: *Prendre soin. Liens sociaux et médiations institutionnelles* 107–118, 1992.

Breda, Jef et al. When informal care becomes a paid job: The case of personal assistance budgets in Flanders. In *Cash and Care: Policy Challenges in the Welfare State*. Edited by Caroline Glendinning and Peter Kemp, 155–170. Bristol: Policy Press, 2006.

Brody, Elaine M. *Women in the Middle: Their Parent-Care Years, Second Edition*. Springer Series on Lifestyles and Issues in Aging. Springer, New York, NY, 2003.

Brouwer, Werner et al. "The CarerQol instrument: A new instrument to measure care-related quality of life of informal caregivers for use in economic evaluations." *Quality of Life Research* 15, no. 6 (2006): 1005–1021.

Campos, de Lima, Everton Emanuel, Maria Carolina Tomás, and Bernardo Lanza Queiroz. "The sandwich generation in Brazil: Demographic determinants and implications." *Revista Latinoamericana de Población* 9, no. 16 (2015): 59–73.

Chisholm, June F. "The sandwich generation." *Journal of Social Distress and the Homeless* 8, no. 3 (1999): 177–191.

Cravey, Tiffany, and Aparna Mitra. "Demographics of the sandwich generation by race and ethnicity in the United States." *The Journal of Socio-Economics* 40, no. 3 (2011): 306–311.

Cremer, Helmuth. "The economics of long-term care: An introduction." *The BE Journal of Economic Analysis & Policy* 14, no. 2 (2014): 339–342.

Cremer, Helmuth, Pierre Pestieau, and Grégory Ponthière. The economics of long-term care: A survey. *Nordic Economic Policy Review* 2 (2012): 107–148.

Da Roit, Barbara, and Blanche Le Bihan. "Similar and yet so different: Cash-for-care in six European countries' long-term care policies." *Milbank Quarterly* 88, no. 3 (2010) 286–309.

Da Roit, Barbara, Blanche Le Bihan, and August Österle. 2016. Cash-for-care benefits. In *Long-Term Care Reforms in OECD Countries. Successes and Failures*. Edited by José Luis Fernández, Cristiano Gori, and Raphael Wittenberg, 143–166. Bristol: Policy Press.

De Vaus, David A., David I. Stanton, and Matthew Gray. *Measuring the Value of Unpaid Household, Caring and Voluntary Work of Older Australians*. Melbourne: Australian Institute of Family Studies, 2003.

Duncan, Karen A et al. *Care-Related Out-of-Pocket Costs*. Technical Report. Edmonton, AB, 2015.

Dupourqué, Etienne. "AGGIR, the work of grids." *Long-term Care News* 32 (2012): 1–11.

Duxbury, Linda, and Gregory Dole. Squeezed in the middle: Balancing paid employment, childcare and eldercare. In *Flourishing in Life Work and Careers: Individual Wellbeing and Career Experiences*. Edited by Ronald J Burke, Kathryn M Page, and Cary L Cooper. New Horizons in Management, 141–166. Cheltenham: Edward Elgar, 2015.

Duxbury, Linda, and Christopher Higgins. *Something's Got to Give: Balancing Work, Childcare and Eldercare*. G Reference, Information and Interdisciplinary Subjects Series. Toronto: University of Toronto Press, 2017.

Economics, Access. *The Economic Value of Informal Care in 2010, Report for Carers Australia* Research Report. Canberra, 2010.

Esping-Andersen, Gøsta. *Social Foundations of Postindustrial Economies*. Oxford: Oxford University Press, 2003.

Evashwick, Connie, ed. *The Continuum of Long-Term Care*. Delmar Series in Health Services Administration. Clifton Park, NY: Cengage Learning, 2005.

Faria, Rita, Helen Weatherly, and Bernard van den Berg. A review of approaches to measure and monetarily value informal care. In *Unit Costs of Health and Social*

Care 2012. Edited by Lesley Curtis, 22–31. Canterbury: Personal Social Services Research Unit - University of Kent, 2012.

Fast, Janet et al. *The Intersection of Caregiving and Employment Across the Life Course*. Technical Report, Edmonton, AB, 2013.

Fellbaum, Christiane. Lexical relations. In *The Oxford Handbook of the Word*. Edited by John R. Taylor Oxford Handbooks, chap. 19, 350–363. Oxford: Oxford University Press, 2015.

Francavilla, Francesca et al. *Use of Time and Value of Unpaid Family Care Work: A Comparison Between Italy and Poland* IZA Discussion Paper 5771. Bonn: Institute for the Study of Labor (IZA), 2011.

Francesca, Colombo et al. *OECD Health Policy Studies Help Wanted? Providing and Paying for Long-term Care: Providing and Paying for Long-term Care*. OECD Health Policy Studies. Paris: OECD Publishing, 2011.

Geerlings, Sandra W et al. "Predicting transitions in the use of informal and professional care by older adults." *Ageing & Society* 25, no. 1 (2005): 111–130.

Gibson, Mary Jo, and Ari Houser. *Valuing the Invaluable: A New Look at the Economic Value of Family Caregiving* AARP Public Policy Institute Issue Brief 142, 1–12, Washington, DC, 2007.

Gladwell, Nancy J, and Leandra A Bedini. "In search of lost leisure: the impact of caregiving on leisure travel." *Tourism Management* 25, no. 6 (2004): 685–693.

Glavin, Paul, and Amanda Peters. "The costs of caring: Caregiver strain and work-family conflict among Canadian workers." *Journal of Family and Economic Issues* 36, no. 1 (2015): 5–20.

Glouberman, Sholom, and Henry Mintzberg. "Managing the care of health and the cure of disease Part I: Differentiation." *Health Care Management Review* 26, no. 1 (2001): 56–69.

Golberstein, Ezra et al. "Effect of medicare home health care payment on informal care." *Inquiry: The Journal of Health Care Organization, Provision, and Financing* 46, no. 1 (2009): 58–71.

Gonzales, Ernest, Yeonjung Lee, and Celeste Brown. "Back to work? Not everyone. Examining the longitudinal relationships between informal caregiving and paid work after formal retirement." *The Journals of Gerontology: Series B* 72, no. 3 (2017): 532–539.

Greenwald & Associates. *Caregiving in the U.S.* Research Report. Bethesda, MD, 2015.

Grundy, Emily, and John C Henretta. "Between elderly parents and adult children: A new look at the intergenerational care provided by the 'sandwich generation." *Ageing & Society* 26, no. 5 (2006): 707–722.

Habib, Jack, and Miriam Hirschfeld. *Long-term Care in Developing Countries: Ten Case-Studies*. New York, NY: World Health Organization, 2003.

Hébert, R, R Carrier, and A Bilodeau. "The Functional Autonomy Measurement System (SMAF): Description and validation of an instrument for the measurement of handicaps." *Age and Ageing* 17, no. 5 (1988): 293–302.

Ho, Cathy. *U.S. Long-Term Care Insurance Persistency A Joint Study Sponsored by LIMRA and The Society of Actuaries* Technical Report. Schaumburg, IL, 2016.

Hoefman, Renske, Job van Exel, and Werner Brouwer. "Measuring care-related quality of life of caregivers for use in economic evaluations: Carerqol tariffs for Australia, Germany, Sweden, UK, and US." *PharmacoEconomics* 35, no. 4 (2017): 469–478.

Horden, Peregrine. Housold care and informal networks: Comparisons and continuities from antiquity to the present. In *The Locus of Care: Families, Communities, Institutions, and the Provision of Welfare Since Antiquity*. Edited by Peregrine Horden and Richard Smith, 21–70. Routledge Studies in the Social History of Medicine. London: Routledge, 2013.

Huckfeldt, Peter J et al. Effects of medicare payment reform: Evidence from the home health interim and prospective payment systems. *Journal of Health Economics* 34 (2014): 1–18

Iparraguirre, José. *Age UK Chief Economist's Report. Spring 2014*. Technical Report. London, 2014.

Jagger, Carol et al. "The global activity limitation index measured function and disability similarly across European countries." *Journal of Clinical Epidemiology* 63, no. 8 (2010): 892–899.

Jecker, Nancy S, and Donnie J "Self. Separating care and cure: An analysis of historical and contemporary images of nursing and medicine." *The Journal of Medicine and Philosophy* 16, no. 3 (1991): 285–306.

Johnson, Richard W, and Simone G Schaner. *Value of Unpaid Activities by Older Americans Tops $160 Billion Per Year* Technical Report 4. Washington, DC, 2005.

Katz, Sidney et al. "The index of ADL: A standardized measure of biological and psychosocial function." *Journal of the American Medical Association* 185 (1963): 914–919.

Katz, Ruth et al. "Employers' knowledge and attitudes regarding organizational policy toward workers caring for aging family members." *Journal of Aging & Social Policy* 23, no. 2 (2011): 159–181.

Keating, Norah C et al. "A taxonomy of the economic costs of family care to adults." *The Journal of the Economics of Ageing* 3 (2014): 11–20.

Kemshall, Hazel. *Risk, Social Policy and Welfare*. Introducing Social Policy Buckingham: Open University Press, 2002.

Kesselring, Annemarie. "Angehörige zu Hause pflegen: Anatomie einer Arbeit." *Schweiz- erische Ärztezeitung* 85, no. 10 (2004): 504–506.

Kessler, Denis. "The long-term care insurance market." *The Geneva Papers on Risk and Insurance-Issues and Practice* 33, no. 1 (2008): 33–40.

Knapp, Martin, and Ami Somani. Long term care, organization and financing. In *Health Systems Policy Finance and Organization*. Edited by Guy Carrin et al., 250–258. Amsterdam: Elsevier Science, 2010.

Knijn, Trudie, and Monique Kremer. "Gender and the caring dimension of welfare states: Toward inclusive citizenship." *Social Politics: International Studies in Gender State & Society* 4, no. 3 (1997): 328–361.

Koerin, Beverly B, Marcia P Harrigan, and Mary Secret. "Eldercare and employed caregivers: A public/private responsibility?" *Journal of Gerontological Social Work* 51, no. 1–2 (2008): 143–161.

Koopmanschap, Marc et al. "An overview of methods and applications to value informal care in economic evaluations of healthcare." *Pharmacoeconomics* 26, no. 4 (2008): 269–280.

Kosberg, Jordan I, and Richard E Cairl. "The cost of care index: A case management tool for screening informal care providers." *The Gerontologist* 26, no. 3 (1986): 273–278.

Kottow, Michael H. "Between caring and curing." *Nursing Philosophy* 2, no. 1 (2001): 53–61

Langa, Kenneth M et al. "Extent and cost of informal caregiving for older Americans with symptoms of depression." *American Journal of Psychiatry* 161, no. 5 (2004): 857–863.

Lawton, M Powell, and Elaine M Brody. "Assessment of older people: Self-maintaining and instrumental activities of daily living." *The Gerontologist* 9, no. 3 (1969): 179–186.

Liljas, Bengt. "How to calculate indirect costs in economic evaluations." *Pharmacoeconomics* 13, no. 1 (1998): 1–7.

Liu, Shuai et al. "Caregiver burden and prevalence of depression, anxiety and sleep disturbances in Alzheimer's disease caregivers in China." *Journal of Clinical Nursing* 26, no. 9–10 (2017): 1291–1300.

Lloyd-Sherlock, Peter. "Beyond neglect: Long-term care research in low and middle income countries." *International Journal of Gerontology* 8, no. 2 (2014): 66–69.

Loucks-Atkinson, Angela, Douglas A Kleiber and Gail M Williamson. "Activity restriction and well-being in middle-aged and older caregivers." *Topics in Geriatric Rehabilitation* 22, no. 4 (2006): 269–282.

Lundsgaard, Jens. *Consumer Direction and Choice in Long-Term Care for Older Persons, Including Payments for Informal Care: How Can it Help Improve Care Outcomes, Employment and Fiscal Sustainability?* OECD Health Working Paper 20. Paris, 2005.

Mahoney, Florence I, and Dorothea W Barthel. "Functional evaluation: the Barthel index: A simple index of independence useful in scoring improvement in the rehabilitation of the chronically ill." *Maryland State Medical Journal* 14 (1965): 61–65.

Margolis, Rachel, and Laura Wright. "Older adults with three generations of Kin: Prevalence, correlates, and transfers." *The Journals of Gerontology: Series B* 72, no. 6 (2017): 1067–1072.

Mayston, Rosie, et al. Exploring the economic and social effects of care dependence in later life: Protocol for the 10/66 research group INDEP study. *Springerplus* 3, no. 1 (2014). https://doi.org/10.1186/2193-1801-3-379

Mayston, Rosie, et al. "A journey without maps Understanding the costs of caring for dependent older people in Nigeria, China, Mexico and Peru." *PloS one* 12, no. 8 (2017). https://doi.org/10.1371/journal.pone.0182360.

McGarrigle, Christine A, Hilary Cronin, and Rose Anne Kenny. "The impact of being the intermediate caring generation and intergenerational transfers on self-reported health of women in Ireland." *International Journal of Public Health* 59, no. 2 (2014): 301–308.

McKnight, Robin. "Home care reimbursement, long-term care utilization, and health outcomes." *Journal of Public Economics* 90, no. 1 (2006): 293–323 .

Miller, Dorothy A. "The 'sandwich' generation: Adult children of the aging." *Social Work* 26, no. 5 (1981): 419–423.

Miller, Baila, and Andrew Montgomery. "Family caregivers and limitations in social activities." *Research on Aging* 12, no. 1 (1990): 72–93.

Norton, Edward C. Long-term care. In *Handbook of Health Economics*. Edited by Anthony J. Culyer and Joseph P Newhouse. Handbook of Health Economics, vol. 1b, chap. 17, 955–994. Amsterdam: Elsevier, 2000.

Oliva, Juan, Rubén Osuna, and Natalia Jorgensen. Los Costes de los Cuidados Informales en España. In *Aspectos Económicos de la Dependencia y el Cuidado Informal en España*. Edited by Sergi Jiménez-Martín, 177–214. Barcelona: Universidad Pompeu Fabra, 2007.

Paraponaris, Alain, and Bérengère Davin. Economics of the iceberg: Informal care provided to French elderly with dementia. *Value in Health* 18, no. 4 (2015): 368–375.

Paraponaris, Alain, Bérengère Davin, and Pierre Verger. "Formal and informal care for disabled elderly living in the community: An appraisal of French care composition and costs." *The European Journal of Health Economics* 13, no. 3 (2012): 327–336.

Pierron-Robinet, Géraldine, et al. Les incidences du sentiment de culpabilité sur la demande d'aide de l'aidant familial. *Annales Médico-psychologiques, revue psychiatrique* (2016). http://dx.doi.org/10.1016/j.amp.2016.02.016

Powell, Martin. The mixed economy of welfare and the social division of welfare. *Understanding the Mixed Economy of Welfare*. Edited by Martin Powell, 1st ed., 1–22. Bristol: Policy Press at the University of Bristol, 2007.

République Française. *Décret 97–427 du 28 Avril 1977 relatif aux conditions et aux modalités d'attribution de la prestation spécifique dépendance instituée par la loi nr 97–60 du 24 janvier 1997* , 1977.

Romero-Moreno, R et al. "Stressors and anxiety in dementia caregiving: Multiple mediation analysis of rumination, experiential avoidance, and leisure." *International Psychogeriatrics* 28, no. 11 (2016): 1835–1844.

Rubin, Rose M, and Shelley I White-Means. "Informal caregiving: Dilemmas of sandwiched caregivers." *Journal of Family and Economic Issues* 30, no. 3 (2009): 252–267.

Schüz, Benjamin et al. "Leisure time activities and mental health in informal dementia caregivers." *Applied Psychology: Health and Well-Being* 7, no. 2 (2015): 230–248.

Shaw C et al. "Systematic review of respite care in the frail elderly." *Health Technology Assessment* 13, no. 20 (2009): 1–246.

Shooshtari, Shahin, et al. "Care-related out-of-pocket spending and caregiving consequences: Results from a Canadian Population-based Study." *Journal of Family and Economic Issues* 38, no. 3, (2017): 1–16.

Siciliani, Luigi. "The economics of long-term care." *The BE Journal of Economic Analysis & Policy* 14, no. 2 (2014): 343–375.

Stalker, Kirsten. *Development in Short-term Care: Breaks and Opportunities*. Library of International Political Economy London: Jessica Kingsley Publishers, 1996.

Stallard, Eric. Long term care for aging populations. In: *Health Systems Policy Finance and Organization*. Edited by Guy Carrin et al., 357–369. Amsterdam: Elsevier Science, 2010.

Stommel, Manfred, Charles W Given, and Barbara Given. "Depression as an overriding variable explaining caregiver burdens." *Journal of Aging and Health* 2, no. 1 (1990): 81–102.

Suh, Jooyeoun. "Measuring the "sandwich": Care for children and adults in the American time use survey 2003–2012." *Journal of Family and Economic Issues* 37, no. 2 (2016): 197–211.

Timonen, Virpi. *Ageing Societies: A Comparative Introduction*. Maidenhead: McGraw-Hill Open University Press, 2008.

Treiber, Linda A, and Jackie H Jones. "The care/cure dichotomy: nursing's struggle with dualism." *Health Sociology Review* 24, no. 2 (2015): 152–162.

Vallée, A et al. "Évaluation du ressenti des aidants, filles et fils de personnes âgées dépendantes atteintes de démence." *Éthique & Santé* 13, no. 2 (2016): 83–90.

van den Berg, Bernard, and Ada Ferrer-i-Carbonell. "Monetary valuation of informal care: The well-being valuation method." *Health Economics* 16 (2007): 1227–1244.

Van Oyen, Herman et al. "Monitoring population disability: Evaluation of a new Global Activity Limitation Indicator (GALI)." *Sozial-und Präventivmedizin* 51, no. 3 (2006): 153–161.

Vasselle, M. Alain. *Rapport d'information fair au nom de la mission commune d'information sur la prise en charge de la dépendance et la création du cinquième risque*. Rapport d'information 447. Paris: France: Sénat Session Extraordinaire de 2007–2008, 2008.

———. *Rapport d'information fair au nom de la mission commune d'information sur la prise en charge de la dépendance et la création du cinquième risque* Rapport d'information 263. Paris: Sénat Session Extraordinaire de 2010–2011, 2011.

Vitaliano, Peter P Jianping Zhang, and James M Scanlan. "Is caregiving hazardous to one's physical health? A meta-analysis." *Psychological Bulletin* 129, no. 6 (2003): 946–972.

Webber, Dominic, et al. *Household satellite accounts: 2005 to 2014* Newport, 2016.

Weicht, Bernhard. *The Meaning of Care: The Social Construction of Care for Elderly People*. Basingstoke: Palgrave Macmillan, 2015.

Westendorp, Rudi. *Growing Older Without Feeling Old. On Vitality and Ageing* London: Scribe Publications, 2015.

Yamashita, Junko, and N Soma. The double responsibilities of care in Japan: Emerging new social risks for women providing both childcare and care for the elderly. In *New Life Courses, Social Risks and Social Policy in East Asia*. Edited by Raymond KH Chan, Jens O Zinn, and Lih-Rong Wang. Comparative Development and Policy in Asia, 95–111. Abingdon: Routledge, 2015.

7

Demand for and Supply of LTC Services

7.1 Demand

There is an abundance of economic theories and models of LTC. They address mainly three points: the supply and demand of informal care, the relationship between informal and formal care, and the intra-household power and negotiation dynamics leading to decisions about LTC use. This section looks into the demand for LTC; we review the other aspects later on in the chapter.

The economics of the demand for LTC is more straightforward than the study of its supply, so it comes first. The individual demand for care services depends on five factors (Kemper 1992):

- need
- price
- income (and wealth)
- availability of informal sources (e.g. marital status or number of children—particularly daughters—but also urbanisation, immigration, etc.)
- socio-demographic and cultural characteristics

These variables are sometimes classified into *predisposing*, *enabling*, and *need* factors in what is known as the ‘behavioural model’ of the use of care services (Andersen and Newman 1973; Logan and Spitze 1994). Predisposing factors include age, gender, ethnicity, and socio-demographic and cultural variables. Enabling factors comprise income and wealth, cost (including insurance), and

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https://doi.org/10.1007/978-3-319-93357-3_7

the availability of informal and formal care resources. Need factors are those related with the degree of disability, cognitive impairment, and so on.

The majority of the studies that use this model tend to find that variables belonging to each of the three categories of factors are significantly associated with the demand for LTC or with unmet care needs. Two examples:

- Using data from the Netherlands for people aged 55–85 years, Geerlings et al. (2005) investigated transitions in the use of informal, non-profit community-based care (services that are subsidised by the government in that country), for-profit community-based (e.g. domiciliary) care provided by private firms, and institutional care (which is mostly subsidised) between 1992/93 and 1998/99. They found that people with more favourable predisposing, enabling, and need factors were more likely to transition from informal care to not needing—and consequently, not demanding—any care. Other related variables are proximity to death and the number of medical conditions. At an aggregate level, the demand for LTC depends on demographic, disability, and macroeconomic trends as well as cultural characteristics and the policy framework.
- In their study of people aged 80–109 years during 2005–11 in China, Zhu (2015) reported that many predisposing, enabling, and need factors strongly associated with the probability of having unmet care needs. For individuals living in rural and urban settings, the two most important variables were economic status and having someone other than a family member as a caregiver (i.e. two enabling factors). Predisposing factors such as age and gender, need factors such as the level of disability and cognitive impairment, and the type of primary caregiver (i.e. an enabling factor) distinguished the situation in terms of probability of having unmet needs among older people in rural and urban settings.

Studies of LTC demand seldom include any interactions across the intervening variables (e.g. between income and disability, or gender and wealth, etc.) or adopt a life course approach to combine the study of LTC demand with, for example, the cumulative disadvantage theory—see Volume I, Sect. 4.3. To a large extent, this limitation is related to data unavailability rather than any technical shortcomings in the research community. Richer and longer datasets (as those from cohort studies) will, in time, allow to test indirect and long-term effects. I conjecture that the role of the economic dimension (e.g. income, wealth, family economic background during childhood, etc.) as a determinant of LTC demand among older people will come up as even more significant than it has done in the literature so far.

7.1.1 Projections of LTC Expenditure and Demand

We mentioned above that the association between later life and need is potentially misleading and that it contributes to the social construction of old chronological age as a stage of irreversible decay. However, it is true that the statistical association between chronological age (a predisposing factor) and loss of independence (a need factor) is undeniable. For example, Joël (2012) noted that, in France in 2012, the rate of loss of independence was 7 per cent among people in their 60s, 17 per cent among octogenarians, and 42 per cent for people aged 90 or over. In the same vein, Fig. 7.1 shows—also for France—that the proportion of beneficiaries of a cash transfer for people in various states

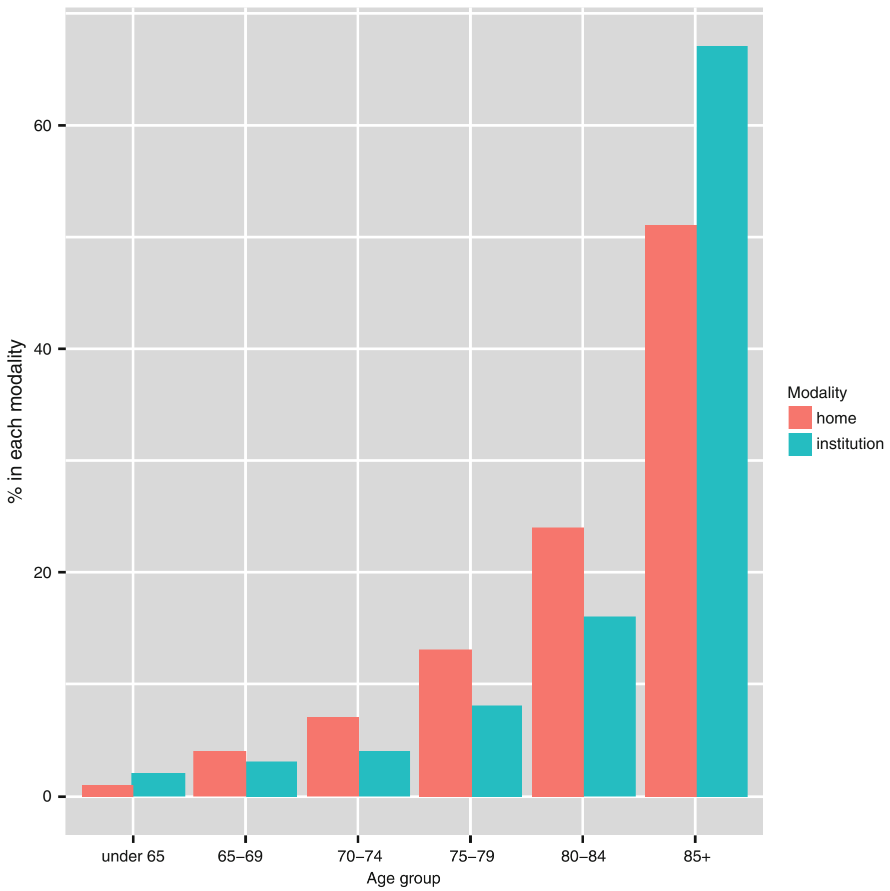

Fig. 7.1 Proportion of beneficiaries of APA by age group and modality in France, 2014
Source: Joël (2012)

of dependency in 2014 (the 'Allocation Personnalisée d'Autonomie' (APA)) increased with chronological age group for care services in both home and institutional settings.

Similar age profiles are found elsewhere. However, as with projections of public health spending, exercises that project expenditure on long-term care tend to report conflicting results:

- Spillman and Lubitz (2000) studied data on spending in nursing home care from 1987 for the USA and found that total expenditure among older people increased substantially with chronological age and, therefore, longevity.
- Spillman and Lubitz found that the relative importance of healthcare and LTC spending in the last two years of life changes with chronological age at death: for people who died aged 75 years old, healthcare expenditure was six times higher than spending on LTC in nursing homes, whilst for individuals who died at the age of 95 years, spending in nursing home services was 1.5 times higher than healthcare expenditure. These findings are aligned with those reported by many authors. For example, Forma et al. (2017) looked at records for Finland between 2000 and 2011 and reported that the demand for LTC services increasingly concentrated in the last years of life of the older people studied and it was more likely the older the individual: 'the longer people live and the older they die, the more likely they are to need LTC at the end of their lives' (Forma et al. 2017, p. 668). From these findings, these authors concluded that increasing longevity will increase the demand for LTC.
- Other studies failed to find a strong association between population ageing and healthcare expenditure but found that demographic change would increase LTC spending (Yang et al. 2003). This was the conclusion by McGrail et al. (2000), who studied data of individuals in their last six months of life in British Columbia, Canada, in 1987–88 and 1994–95, and by Murphy and Martikainen (2013), looking into data for Finland between 1998 and 2003. The same applies to Häcker and Hackmann (2012) who studied data for Germany between 2000 and 2009 and to Werblow et al. (2007), although the latter found only a small effect of chronological age on LTC spending in Switzerland in 1999.
- In contrast, for other authors, population ageing does not play a major role in driving LTC spending. (Meijer et al. 2011) provided a parallel argument to the 'red herring' hypothesis in healthcare economics—see Sect. 3.3 in this volume—in a formal LTC context: time to death would be a non-significant driver of formal long-term care spending once disability is controlled for, which would put into question many of the projections of LTC expenditure.

- Olivares-Tirado and Tamiya (2014) failed to reject this hypothesis with data for Japan between 2000 and 2007; once they factored in the levels of functional disability, chronological age ceased to be a significant predictor of LTC spending.
- Ehing et al. (2015) confirmed these results for Germany between 2003 and 2010: these authors suggest there has been a 'compression of LTC morbidity', which would make projections of increasing LTC spending with extended longevity less, rather than more, likely.
- Larsson et al. (2014) introduced another element of consideration: analysing data for the last two years of life of older people in Sweden between 1995 and 2004, these authors attributed the place where the LTC services were delivered over this last stage of the life course to gender and marital status differences—the odds that men would die in a nursing home, where care services are more costly, were half those of women, and the odds of married people were also half those of unmarried individuals.

All in all, we should treat the following statement by Costa-Font et al. (2017, p. 365) as a healthy warning: 'Without reform, the public financing of long-term care is expected to keep expanding for reasons beyond the ageing of the world's population.' Notice the adverb 'beyond': demographic change is not forecast to be main the driver. The increasing labour market participation of women, the growing responsibilities that the care sector is taking on in relation to the provision of post-acute care, the low rate of productivity growth in the sector, and the heightened expectations about quality have been frequently mentioned in the literature as the most relevant undercurrents beneath the projections of the demand for and the fiscal impact of formal LTC.

These projections are currently based on two methods: aggregate models that simulate the impact of demographic and economic changes on LTC expenditure and longitudinal models based on individual data that determine transition probabilities into care and between types of services conditional to changes in disability, marital status, family configuration, income, and so on and simulate the impact on LTC spending of changes in these variables.

An example of the former method is the annual 'Ageing Report' produced by the European Union which is based on a macro-simulation model (Economic, Affairs, and Economic Policy Committee 2017). The starting point is a baseline estimate of the older population in need in each EU country. Then the population is divided into groups according to chronological age, gender, dependency rates and severity, type of care service, and so on. With these data, and data on public spending per head, estimates of unit costs of both community-based and institutional care are produced. Finally, different macroeconomic assumptions are applied to obtain scenarios of long-term projections of public LTC spending. Several assumptions are introduced (e.g. the elasticity of demand for LTC is equal to 1; either cost profiles and dependency levels are kept constant or converge across countries over the planning horizon, etc.).

The ASIM III model developed by Lagergren (2007) for Sweden, the German long-term care projections model (Rothgang 2001), and England's PSSRU long-term care finance model (Wittenberg and Hu 2015) are all examples of macro-simulation models—see Ansah et al. (2017) and Gupta and Harding (2007) for further details of other macro-simulation models for making projections of future long-term care expenditure. Examples of the latter method include the projections for France in Marbot and Roy (2012), which are based on the Destinie micro-simulation model (Afsa and Buffeteau 2007; Buffeteau et al. 2011), and the CARESIM model developed in England by Hancock et al. (2007). Lagergren et al. (2017) present a micro-simulation model to compare the prospects of LTC spending in Sweden and Japan. For England, the PSSRU's macro-simulation model and CARESIM micro-simulation model have been linked (Wittenberg et al. 2007).

7.2 Supply of LTC Services

Caring for an older member of the family (informally and without a direct financial compensation) has been theoretically treated as part of intra-family transfer models, which are in turn part of the 'economics of households' literature. Intra-family transfers can be horizontal or vertical. Horizontal transfers involve family members of the same age cohort or 'generation', such as spouses, partners, or siblings. Vertical transfers can be 'upwards'—that is, from younger to older family members—or 'downwards', from older to younger family members. Caring for an older family member can be an example of a horizontal transfer (e.g. caregiving between spouses) or an upward transfer (e.g. a daughter caring for her older father). One way to model an upward caregiving decision is to think of an alternative: a monetary transfer from a child to an older parent for the latter to buy formal care services. Borrowing from the healthcare literature, the models tend to focus on the older person in need of care and define a production function where caring is the result of informal caring by children. They can be extended in many ways, for example, with the introduction of formal community- and home-based care services bought privately, or services provided at nursing homes, and so on.

Becoming an informal carer, particularly of another member of the family but also of a neighbour or friend, is seen by some scholars as a transition, and caregiving as a distinct stage, in a person's life course (Barrett et al. 2014). Informal caregiving involves foregoing leisure time—and in many cases income, as well as career promotion opportunities and pay increases. Besides, the intensive provision of care (i.e. for long hours) has been reported to have deleterious physical and mental health consequences for the caregivers (Caputo et al. 2016; Doebler et al. 2017; Schulz and Sherwood 2008; Zhu et al. 2015). Evidently, it's not all about costs and negative effects. Providing care to an older member of the family or to a friend or neighbour is also a positive experience (Cohen et al. 2002; Kate et al. 2012; Liew et al. 2010; López et al. 2005)—caregivers derive some utility out of caring for another person.

The first task an economic model of LTC supply must explain is why so much care services are provided informally by 'adult' family members. I placed the adjective 'adult' in inverted commas in the previous sentence to highlight that in much of the literature on economics of long-term care, people of working age are identified as 'adult' actors, whereas the older recipients of the services are known, variously, as parents, ageing parents, service users, and so on, but not as 'adults', even in models where they are assumed to unilaterally make or partake with the 'adult' actors (say, their children) in decisions about locus (i.e. place, see below) and type of care and support. This practice reflects and reproduces, albeit most surely inadvertently, a deleterious discourse that structures and confines later life into a non-productive, burdening temporal stage—what Katz (1996, p. 61) termed 'a marginalized social time'. Having made this point, in what follows I will drop the inverted commas for clarity of exposition, but not to condone or share in the spirit of this methodological practice. Back to the main conundrum about the supply of informal LTC, which, put simply, is: why do they do it? This is a policy-relevant question given the changes in family composition and demographic structure, the increasing labour market participation of women, and the growing proportion of one-person households in most countries.

7.2.1 Models of the Supply of Informal Care

Economic models of LTC vary with regard to the explanatory factors of the motivation behind the decision to provide care and also with regard to the assumptions about:

- the size of the support network or the number of people intervening in the decision processes
- the utility functions of each of the actors

- the nature of living or care arrangements
- how 'partial' the equilibrium is assumed—that is, whether the focus is exclusively on LTC or whether it extends to the interplay between informal LTC and, for example, the employment opportunities of, or the decision to take early retirement by, the caregivers
- the dynamics of intra-family decisions (e.g. whether the older person in need takes part in the decisions concerning locus and type of care or not)

Another point of divergence is whether the time allocated or to be allocated to informal LTC is assumed to clash with leisure or paid work—which, of course, in some instances (e.g. a retired informal carer) may not be relevant, but in others is important to distinguish: the opportunity costs are usually not the same.

Different theories have propounded a number of explanatory factors of the informal caregiving decision, including (Gameren and Velandia Naranjo 2015):

- Altruism
- Strategic exchange
- Non-strategic exchange
- Social norms
- Reciprocity
- Duty
- Demonstration effect

To this list we can add, when informal care is remunerated, the existence of a reservation wage.

We briefly consider each of these reasons, but bearing in mind that the interpretation of the caregiving motivation by caregivers and recipients of the services is not easy to elicit. Therefore, the different alternative hypotheses regarding purposes or motivation—which, to make the empirical work even more complicated, usually coalesce—are difficult to disentangle statistically. For example, regarding reciprocity, in their study based on Canada, Funk (2012) reported that delayed reciprocity—see Volume I, Chap. 8—was rejected by adult children as an explanation or rationale for the care and support they gave to their parents, in favour of mutuality, duty, and love; but the author left open the possibility that this result may have come as part of a combination of mixed symbolic meanings and the influence of the cultural context.

7.2.1.1 Pure Altruism

Altruism consists in making a choice in order to increase the well-being or utility of others at the expense of one's own. We can think of altruism as a strong motive and explanatory factor for caring. Perhaps 'altruism' as defined above is another word for compassionate love (Fehr and Sprecher 2009) or, plain and simple, love (Bolle 1991), which—incidentally—according to Silverstein et al. (1995) are the factors that motivate daughters to provide social support to older parents the most. However, this is only one conceptualisation of altruism, known as 'pure altruism', which we saw in Volume I, Chap. 8. In that chapter we also encountered the notion of 'impure' altruism, which in a caregiving context may be more apposite:

> For long, we have adopted the fairytale view of children or spouses helping their dependent parents with joy and dedication, what we call pure altruism. We now increasingly realize that family solidarity is often based on forced altruism (social norm) or strategic considerations (reciprocal altruism).
>
> Cremer et al. (2012, p. 128)

Therefore, there is more to altruism than meets the eye. In fact, we can further distinguish four forms of impure altruism: warm glow, reluctant, forced, and reciprocal altruism. We met the idea of warm glow—that is, that the act of giving in itself increases an actor's utility regardless of the instrumental accomplishments resulting from the gift—in Volume I, Chap. 8. In a LTC setting, warm glow translates into a motivation for informal caregiving because it is emotionally rewarding to the carer (regardless of the impact on the recipient). 'Reluctant' altruism is manifest in the presence of free-riding (e.g. if an older person in need has more than one sibling), 'forced' altruism is related to prevailing social norms, and 'reciprocal' altruism is a way of 'paying back'; they will be discussed in sections below. Here we concentrate on pure altruism.

Before considering the case of pure altruism, it is worth noting that the structure of economic models of supply of informal LTC needs other elements than motivation:

- Whether there is one potential informal caregiver (a spouse and no children, or one sibling) or more.
- Whether altruism is one-sided or two-sided. One-sided altruism assumes that the older parent is altruistic and the adult child is selfish.[1] Two-sided models assume that both the parent and the child are altruistic.

- If two-sided, whether all actors exhibit the same type of altruism.
- Whether the information known by all relevant actors is perfect or imperfect.
- Whether the caregiving decision is exogenous or endogenous (e.g. whether the income of an adult potential informal carer is independent from the caring decision—i.e. exogenous—or not).

We are not going to review all the options[2]; instead, we illustrate some of the theoretical derivations with two examples. First, the simplest of models: a one-sided pure altruism model as presented by Sloan et al. (2002). Second, the 'rotten kid' model.

In the first model, an older person—let's call her the mother, p—needs help with ADL and has only one child, say, a daughter, k, who is in paid employment and whose income is exogenous. Because we are considering the supply of LTC services for older people, let's assume that the daughter is altruistic and her mother is selfish. The precise meaning of altruism and selfishness in this context is that the utility of the selfish party (the mother) is an element of the utility function of the altruistic actor (the daughter), whilst the utility function of the selfish parent does not depend on the utility or well-being of the altruistic child—hence the selfishness of the former.[3] In other words, the child's preferences are inter-dependent, non-egoistic; the parent's preferences are independent, egoistic. In symbols, the daughter's utility—U^k—depends on her level of consumption, C_k, and her mother's utility, U^p. Under the assumption that the preferences are separable, the daughter's utility is expressed thus:

$$U^k = U^k[C^k, U^p] \tag{7.1}$$

with $\partial U^k/\partial C^k > 0$ and $\partial U^k/\partial U^p > 0$.

The parent's utility is a function of her consumption, C_p; the informal care services her daughter provides, S; and any transfers she receives from the government, G:

$$U^p = U^p(C^p, S, G) \tag{7.2}$$

with the three first derivatives also positive.

The daughter, as we mentioned, is in paid employment. Denoting her wage rate by w, her budget constraint is

$$C^k = Y^k + w.(L - S) - T \tag{7.3}$$

where Y denotes her wealth, L is the total time that she can devote to paid employment, and financial transfers to her mother, T. Note that we assume that any time allocated to caregiving comes at time, hence the term $w(L - S)$.

In turn, her mother's budget constraint is simply

$$C^p = Y^p + T \tag{7.4}$$

We want to determine the optimal length of time for which the daughter will provide informal care services to her mother. Remember the daughter is altruistic so that her utility is a function of her mother's utility. Remember also that her mother's utility is a function of the informal care services she gets from her daughter. Therefore, her daughter would give her mother as many hours as possible, except that the longer she spent giving care to her mother the shorter she would spend in paid employment, earning a wage to finance her consumption. So, on the one hand, more care services would increase the daughter's utility, but on the other, they would reduce it. Let's find out the (first-order) conditions for an optimum. We form the Lagrangian[4] to maximise a utility function formed after Eq. (7.2) is replaced in Eq. (7.1), subject to the budget constraints (Eqs. 7.3 and 7.4):

$$U^k[C^k, U^pC^p, S, G] - \lambda_k.[C^k - Y^k - w.(L - S) + T] - \lambda_p.[C^p - Y^p - T] \tag{7.5}$$

After estimating the first derivatives of Eq. (7.5) with respect to the daughter's consumption level, the time dedicated to look after her mother, and the money she transfers to her mother, we obtain the following expression:

$$\frac{\partial V}{\partial U} \cdot \frac{\partial U}{\partial S} = \frac{\partial V}{\partial U} \cdot \frac{\partial U}{\partial C^p} . w \tag{7.6}$$

which can be simplified into

$$\frac{1}{w} \cdot \frac{\partial U}{\partial S} = \frac{\partial U}{\partial C^p} \tag{7.7}$$

Equation (7.7) indicates that the optimum is obtained when the mother's marginal utility of receiving one additional unit of money from her daughter equals the mother's marginal utility of receiving one additional unit of care services weighted by (or in terms of) her daughter's wage rate (Sloan et al. 2002, p. 366). Now we have everything we need to study the effects of changes in any of the variables in the model on the two upstream transfers under consideration: caring time and money transfers. (Sloan et al. 2002, Table 1) present the results subject to some additional plausible assumptions, where it is shown, for example, that an increase in the daughter's wealth increases both her caring time and financial transfers to her mother but that a rise in the daughter's wage rate although increases the amount of money she transfers to her mother can either increase or reduce the time she devotes to caregiving. This is the usual trade-off between an income effect and a substitution effect: a higher wage implies a higher income per hour of work so that the daughter can devote a longer time than before to caring, but a higher wage also implies a higher opportunity cost of caregiving so that the daughter would be foregoing a higher amount of money than before on providing care. Using data from the USA for 1992, Sloan et al. (2002) reported a positive association between wage rates and money transfers and a negative association with caregiving hours: adult children on higher wages tended to transfer more money to their parents but dedicated fewer hours to informal caregiving.

The second model is known as the **rotten kid theorem** or model. It was introduced by Becker (1974)—see also Becker (1993). Imagine an altruistic parent and a selfish child. Altruism drives the parent to make transfers to the child. Those transfers depend on the family income. Selfishness drives the child to make efforts towards increasing the family income so that bigger transfers may come her way. Therefore, despite their selfishness, the children 'are motivated to maximize family income and consumption, even if their welfare depends on their own consumption alone' (Becker 1974, p. 1088). The child is not altruistic but 'led by the invisible hand of self interest' (Becker 1993, p. 284) acts as though she were and maximised the joint household income. We follow the exposition by Yamashige (2017, ch. 5). In contrast to the previous model, now we assume that the daughter is selfish and the mother is altruist. So the daughter's utility can be expressed by

$$U^k = U^k[C^k] \tag{7.8}$$

and her mother's utility by

$$U^p = U^p[C^p, U^k] \tag{7.9}$$

The selfish daughter can decide to provide informal care to her mother. But why? Isn't she selfish? Her mother's utility does not enter her own utility function, so—again—why? As we said earlier, her mother makes transfers to her daughter; if the daughter can maximise total household income by caring for her mother, she will certainly do that—out of selfishness. In order to solve the daughter's problem, we need to look at the model backwards. The mother maximises her utility (i.e. Eq. (7.9)) subject to her budget constrain, which is:

$$C^p + C^k = Y^p(S) + Y^k(S) \tag{7.10}$$

where Y denotes income and, as in the previous model, S stands for caregiving services from the daughter to her mother. The daughter's consumption, C^k, is a term that enters the mother's utility (it is included in U^k) and the mother's budget constraint. From the mother's point of view, the daughter's consumption increases with the household income: $C^k = C^k[Y^p(S) + Y^k(S)]$. Therefore, from the daughter's perspective, if she can increase household income, she will increase her own consumption. More, it will be optimal if she maximises the household income provided the marginal utility of an additional unit of household income is greater than an additional unit of any other action she may take. By providing care, she obtains a monetary transfer; by maximising the household income via the provision of care, she maximises the monetary transfer from her mother. The crucial assumption is that the provision of care changes the budget constraint of the mother. The mother is altruistic, so whatever the action her daughter takes, the mother will transfer some money, but the point is that any other action only increases the daughter's income and utility, but does not increase the mother's income whereas S—that is, the provision of care—increases not only the daughter's income but also the mother's and, in so doing, increases the monetary transfers to the daughter. It is optimal for the daughter to provide informal care.

What about the empirical evidence about this theorem? In the words of Bergstrom (2008, p. 247), 'The trouble with the rotten kid theorem is that it fails to hold in models that make slight concessions toward realism'. Of course, Becker's model has been the platform for many refinements, so it is more important as a theoretical framework for further developments than as a testable description of reality. The strategic model of informal care that follows is one such extension.

7.2.1.2 Strategic Exchange

We saw the theory of strategic bequests (Bernheim et al. 1985) as part of our discussion of the life-cycle hypothesis—see Volume I, Chap. 8. Remember that the idea behind this theory is that older people would make explicit or tacit promises on how to allocate their accumulated wealth among potential beneficiaries so that they may receive care services from the latter.

Let's look back at the 'rotten kid' model. There we had that the daughter's utility depended on her consumption and that the mother's utility was a function of her consumption and her daughter's consumption. With strategic exchanges the care services from the daughter to the mother enter directly into both utility functions:

$$\begin{aligned} U^p &= U^p[C^p, S] \text{ , for the mother} \\ U^k &= U^k[C^k, S, U^p] \text{ , for the daughter} \end{aligned} \tag{7.11}$$

In order to be able to engage in this strategic game, not only must the older person have good cognitive skills and awareness to play it but also to threaten to disinherit. Consequently, this theory predicts a positive association between an older person's cognitive ability and the level of informal care she receives by next of kin. Furthermore, another testable prediction from this theory is that there is a negative association between wealth levels of family members and the care they provide, as the potential bequests would act less as a motivation for them compared to less well-off family members.

7.2.1.3 Non-strategic Exchange

Similar to the strategic bequests explanation, there are exchange models that assume a quid pro quo stance, but with bargaining. Care services are, according to these specifications, one of the many types of resources that can be potentially exchanged within a family (or, in some cases, between neighbours and friends). Financial resources, affection and love, understanding and emotional support, childcare, and housekeeping are some of the several other resources routinely exchanged within spouses—and many of them also between parents and their children, siblings, and so on—see (Safilios-Rothschild 1976). In addition, Tomini et al. (2016) investigated co-existing exchange relations: older people as potentially beneficiaries of informal care and donors of financial gifts, for example, and vice versa. In total, the authors looked into 16 different possibilities in the exchange of gifts and money and informal care between older people and their family and friends in 16 European countries, from neither receiving nor giving any financial gifts or informal caring services to both giving and receiving financial gifts and informal care. They reported a positive relationship between receiving and giving (as well as receiving help without exchanging financial gifts) which increased with chronological age and physical proximity and was more likely among women.

Sloan et al. (1997) developed a formal model and tested this theory using data from the USA for 1989, though failed to find empirical support for this theory of informal care provision. However, several papers reported findings supportive of this hypothesis. For example,

- Cox (1987) tested a pure altruism and a strategic model of inter-vivos income transfers—not of informal care, but informal LTC is another inter-vivos transfer—on data from the USA for 1979. The findings lent support to the strategic exchange model and tended to reject the pure altruism model.
- Norton and Van Houtven (2006) found that adult children who provided informal care to their parents were likely to receive a monetary transfer than those who did not provide informal care, using data of households in the USA with at least one member of age 70 years or over between 1993 and 1995.
- Norton et al. (2013) replicated these findings with data for older women in the USA between 1999 and 2003.
- Using data of people aged 50 or over in 11 European countries from 2004, Alessie et al. (2014) tested whether a pure altruism model or an exchange model provided a better fit.
- Horioka (2002, 2014) and Horioka et al. (2016) found supporting evidence for the strategic motive in Japan.

It is worth bearing in mind, though, that as Laferrère and Wolff (2006) explained, this model only works with more than one child and when a parent can leave a bequest or make transfers whilst alive materially relevant for the child.

7.2.1.4 Social Norms

Social norms are reflected in the expectations of care, in the general prevalent cultural orientation towards others in general and family members in particular, in the perception of disability and the readiness to call for help, and in the motivations to provide care (Revenson et al. 2016). Also known as 'forced altruism' (despite its negative connotations), the 'social norms' explanation for informal LTC points out that:

> …transfers are not always provided free of pressure from other family members, and familial norms of obligations and traditions appear to matter …This evidence suggests that the standard set of economic considerations -utility

> interdependence, budget constraints, exchange, and the like- are insufficient for a complete understanding of private transfer behavior. Rather, considerations of norms and related concepts from sociology are essential
>
> (Cox and Soldo 2013, p. 491)

Gentili et al. (2017) developed the following simple model that considers the role that cultural characteristics play in intra-household decisions about LTC options. The model starts from the perspective of an older person in need of care (or her household's, if assumed as one single decision-making unit). Her utility is a function of consumption, C, and the amount of LTC services she receives, LTC:

$$U = C + d.\phi(\text{LTC}) \tag{7.12}$$

where d is an index of her level of disability—and therefore, the intensity of care she needs—and ranges between 0 and 1. The function phi transforms care into utility and is assumed to be increasing (i.e. the more services the older person receives, the more utility she experiences) and strictly concave (i.e. the utility presents a diminishing slope as LTC increases—see Volume I, Chap. 8).

There are two types of LTC services, domiciliary care, DC, and nursing home care, NH, which are perfect substitutes:

$$\text{LTC} = \delta.DC + (1 - \delta).NH \tag{7.13}$$

where δ measures the preference for domiciliary care. This coefficient incorporates the cultural characteristics into the model: older people with strong family ties would exhibit higher preferences for 'ageing in place' (Pastalan 1990) and 'caring in place' (Peace 1998), and would be more reluctant to enter a nursing home than older people with weaker family ties. If we consider the household as the decision-making unit, we could interpret that households, which understand caring for an older family member as a duty, spend more time with her and put off the decision to admit her into a nursing home until later—that is, until the disability gets worse—compared to households without such cultural value.

The older person's (or household's) budget constraint is given by

$$\omega = C + p_{dc}(d).DC + p_{nh}.NH \tag{7.14}$$

where $p_{dc}(d)$ is the cost of formal domiciliary care—which is a function of disability—and p_{nh} is the cost of nursing home care. The equation sets the price of consumption goods and services equal to 1 to simplify and assumes, first, that the cost of domiciliary care is increasing with disability (i.e. the first derivative of the price of domiciliary care with respect to disability is positive: $\frac{\partial p_{dc}}{\partial d}$) and, second, that the use of nursing home care services does not depend on the level of disability.

Replacing Eqs. (7.13) and 7.14 in Eq. (7.12) and estimating the first derivatives of the utility with respect to both domiciliary care and nursing home care, we obtain:

$$(1-\delta)p_{dc}(d) = \delta . p_{nh} \tag{7.15}$$

that is, the share between domiciliary and institutional care in equilibrium is given by the respective prices of these services but also by the preference for staying at home, which acts like a weighting factor. If the left-hand side term is bigger than the one on the right, then the older person opts for nursing home care, because the weighted price of a unit of service (say, a day) in a nursing home is lower than the weighted price of a unit of domiciliary care. If we solve Eq. (7.15) for d, we can find a threshold level of the disability level above which the older person chooses nursing home care:

$$d = \left(\frac{\delta}{1-\delta}\right)\left(\frac{p_{nh}}{p_{dc}}\right) \tag{7.16}$$

We obtain that the higher the threshold is, the more the older person or her family prefers domiciliary care (i.e. the higher δ is). One corollary of this model is that older people in need of care with stronger family ties would enter nursing homes with higher disability levels than older people without this cultural trait. Gentili et al. tested this model with data from Swiss cantons between 2006 and 2013. Linguistic differences were used as proxies for cultural variation: individuals in French- and Italian-speaking cantons were assumed to have stronger family ties than individuals in German-speaking cantons. The authors found that older people in French- and Italian-speaking cantons were admitted in nursing homes with higher dependency levels compared to those in German-speaking cantons.

7.2.1.5 Reciprocity

The concept of reciprocity was introduced in sociology by Gouldner (1960) as a second-order or repayment obligation and in the gerontological literature by Wentowski (1981). The idea is mostly applicable to parent-child relationships.

It is based on the evidence that middle-aged children are more likely to support their older parents in need, either financially or with informal care services, if their parents invested time, sentiment, and financial resources on their children when young or adolescent (Blieszner and Hamon 1992; Seelbach 1984; Sheehan and Donorfio 1999; Silverstein et al. 2002).[5] Caregiving would represent, thus, a return in kind on the investments made earlier in their life course that the now older parents in need of care services benefit from. For the adult children, caring for their parents would be 'a means of paying back' (Birditt and Fingerman 2013, p. 78), an 'acknowledgement of past assistance received' (Doty 1986, p. 46). For the older parent, all the care and love and attention she invested in her child in the past bought 'inadvertently …*future* gratitude', an 'upward altruism as a side-effect of downward altruism' (Laferrère and Wolff 2006, p. 939).

Several studies found that reciprocity was a significant motivator for adult children to provide care services to their parents, for example, Ikkink et al. (1999) and Geurts et al. (2012) in the Netherlands; Verbrugge and Chan (2008) in Singapore; Lennartsson et al. (2010) in Sweden; Schwarz et al. (2005) in Germany; Koh and MacDonald (2006) and Parrott and Bengtson (1999) in the USA; and Leopold and Raab (2011) in a study across 12 European countries with data from 2004.

Reciprocity can be long-term (i.e. caring as a means of returning many years later what the parents did for the carer when the latter were children or young, etc.)—this is the view proposed by Antonucci and Jackson (1990), who drew an analogy between reciprocity and a 'support bank': people would 'maintain an ongoing account of the amount of support or various benefits they have given to and received from others …kept at different levels of consciousness' (Antonucci and Jackson 1990, p.178). With data from the USA, Henretta et al. (1997) and Silverstein et al. (2002) reported long-term reciprocal effects of earlier financial parental support on their children's propensity to look after the parents later in life. Reciprocity can also be concurrent or short-term (i.e. with very short deferral, or none at all, between the acts of receiving and giving). The conceptual difference between short-term reciprocity and merely exchange was developed in Schwarz et al. (2005): a child-parent transaction is reciprocal and not simply an exchange if:

- it eases the burden dependency places on the relationship,
- the time/caregiving transfers and financial transfers are subjectively defined as not having a 'common currency', and
- parents have enough financial means and receive substantial time (intensive caregiving) from their children.

Looking into data from 12 European countries for 2004, Schwarz et al. (2005) reported evidence of short-term reciprocal parent-child relationships. The authors also found that it was prevalent in southern countries (Italy, Greece, and Spain), weaker in the central countries in their sample (Austria, Belgium, France, Germany, the Netherlands, and Switzerland), and absent in the Nordic countries—which they ascribed to differences in the respective welfare regimes in each region, particularly the legally defined duty to care (see the section on duty below) and the level of development of formal, professional care services. However, using data from Germany for 2005/06, Klaus (2009) found short-term effects among children in mid-adulthood, whilst among older groups long-term reciprocity was more prevalent. Klaus conjectured that this change reflected the depletion of resources in later life: the older the parent, the fewer resources they would have to reciprocate with either concomitantly or in the short run. In this same vein, mentioned that older men without housing or financial wealth in Mexico suffered from a lack of hope to benefit from any future reciprocity concerning the satisfaction of their care needs from their children—see also Silva and Vázquez-Garnica (2008).

7.2.1.6 Duty

Duty of care has not been used much in economics as part of formal models or econometric empirical work, but the topic has been the subject to vast scholarship in several disciplines including anthropology, philosophy, medicine, and law. Usually framed in a parent-child relationship, it is associated with the notion of filial obligation—see Stuifbergen and Van Delden (2011) for a good discussion.

Econometric studies on informal LTC within families that use a comparative approach across countries or datasets from more than one country tend to fail to consider the different legal frameworks in place and how the national legislations impose responsibilities and duties of care of older relatives in need on different family members. Sayn (2008) presents the following table that shows the wide variations across European countries with regard to maintenance obligations within members of the household and the extended family—see also Sayn (2006). (It is important to note that whilst healthcare systems are converging across the developed countries in terms of structure, funding, and outcomes, this is not the case with their long-term care systems.) (Table 7.1)

'Can we force families to be a "we"?' wondered Ziettlow and Cahn (2017, p. 148), before discussing filial responsibility laws in the USA. The question

Table 7.1 Duties of support towards relatives in need of care

Relative	Portugal	Italy	France	Germany	Belgium	England
Spouse	Yes	Yes	Yes	Yes	Yes	Yes
Former spouse	Yes	Yes	Yes	Yes	Yes	Yes
Legally declared concubine	No	No	Yes	Yes	Yes	No
Underage children	Yes	Yes	Yes	Yes	Yes	Yes
Adult children	Yes	Yes	Yes	Yes	Yes	No
Parents	Yes	Yes	Yes	Yes	Yes	No
Grandparents and beyond	Yes	Yes	Yes	Yes	No	No
Grandchildren and beyond	Yes	Yes	Yes	Yes	No	No
Godparents/godchildren	Yes	Yes	Yes	No	Yes	No
Siblings	Yes	Yes	No	No	No	No
Uncles/aunts—nephews/nieces	Yes	No	No	No	No	No

Source: Sayn (2008, Table 1, p. 33)

is appropriate because it is likely that the *subjective* definition of caregiving (Walker et al. 1995), the relationship and exchanges it entails, and the behaviours it is accompanied by are different in a context where, as in Shanghai, China, adult children who fail to visit their older parents 'frequently'[6] risk being sued with adverse effects on their credit scores to the extent of preventing them from opening a bank account, buying property, or starting a business from, say, England, where the legislation does not impose such obligations.[7] The legal and judicial frameworks are part of the institutions of a country. Economists should take into consideration the differences across countries or within countries and how these may affect decisions about the provision of informal care to older relatives, friends, and neighbours, because—as new institutional economics teaches (Furubotn and Richter 2005; Kapp 2012; Richter 2015)—institutions are central to economic decisions, processes, and performance. There are also variations within a country: in the USA, for instance, filial responsibility laws are a matter of each state and not of the federal government; not all the states have statuses enacting caring duties, and moreover, each state court is not legally bound by decisions taken by courts in other states, so much so that among those states that have enacted caring duties the level of enforcement differs markedly (Macon 2016; Sketchley and McMillan 2013).

7.2.1.7 Demonstration Effect

The demonstration effect hypothesis provides one explanation for the mechanisms underlying informal caregiving decisions: parents repeatedly set the example and demonstrate a caring behaviour and attitude towards others—their own parents, for example—in front of their young children; though these actions are costly, parents would be shaping their children's preferences, therefore increasing the likelihood that the children will behave likewise and provide them care services should they develop care needs in later life (Cox and Stark 1994; Stark 1999).

Though not essential, the exposition and formal modelling of the demonstration effect hypothesis usually includes members of three cohorts: a grandparent, a parent, and a child. Unlike the strategic bequest hypothesis that focuses on the binary relationship between a parent and a child, in the demonstration effect models a parent provides care to their own parent (i.e. the grandparent) with no expectation of getting any downward transfers from her: instead, the expectation is being created that the child will act in the same manner in the future. There is nothing 'altruistic' in the behaviour of the parent towards her grandparent: it is totally self-interested with the focus on receiving transfers from the child in the future. Of course, this hypothesis precludes any transfers in cash or in kind from parents to grandparents if the child is not around (Laferrère and Wolff 2006)—moreover, Cox and Stark (2005) conjectured that parents help their children with downpayments to buy a house in order to encourage the 'production' of grandchildren because the presence of grandchildren would increase the likelihood that the children cared for the parents if needs happened to arise.

The most basic model consists of three generations of the same family with a single grandparent, a single parent, and a single child. If we focus on the parent, her utility has two components: what she does for her mother—denoted by x—and what her child is expected to do for her, y. The latter is not cast in stone: investing in the demonstration effect is risky, so let's assume there is a probability $0 \leq \pi \leq 1$ that the child will imitate her mother in due course. If the child imitates her mother—that is, if the child in due course does for her parent what she saw her mother did for her grandmother—the latter's utility becomes $U^I(x, x)$; otherwise, if the demonstration effect does not fully do the trick, the parent's utility is $U^S(x, y)$. The parent's expected utility becomes

$$EU(x, y, \pi) = \pi.U^I(x_G, x_K) + (1 - \pi).U^S(x_G, y) \quad (7.17)$$

where, solely in order to facilitate the exposition, we distinguish between care provided to a parent, x_G, and care received from a child, x_K—which, remember, are exactly the same (i.e. $x_G = x_K$) for we are dealing with the case where the child does imitate the parent.

The model assumes that the costs of providing care to one's parent exceed the benefits, so we get $\frac{\partial U^I}{\partial x_G} < 0$. In turn, this provision may be imitated by the child and her care will increase the parent's utility, so as a consequence of a change in x_G, we expect a change in x_K and consequently we also get $\frac{\partial U^I}{\partial x_K} > 0$. The parent's objective is to choose the optimal level of informal care to provide to her own mother, that is, x^*. The first difference of the expected utility function with respect to x is

$$E\left(\frac{\partial U}{\partial x_G}\right) = \pi.\left(\frac{\partial U^I}{\partial x_G} + \frac{\partial U^I}{\partial x_K}\right) + (1-\pi).\frac{\partial U^S}{\partial x_G} \tag{7.18}$$

from where we obtain

$$-\pi.\left[\frac{\partial U^I}{\partial x_G} + (1-\pi).\frac{\partial U^S}{\partial x_G}\right] = \pi.\frac{\partial U^I}{\partial x_K} \tag{7.19}$$

On the left-hand side of Eq. (7.19), we have the marginal cost of caregiving—that is, the marginal cost of investing in demonstration by caring for one's parent and the marginal cost of not receiving care services from one's child. On the right-hand side, we have the marginal benefit of receiving care from one's child. The optimal level of investment in care for a parent (x^*) is obtained when the marginal cost equals the marginal benefit. This level depends on the probability that the child imitates the mother, π, and on the amount of the transfer if she does not imitate her mother (y). It is not difficult to show that if the probability of imitation, π, is higher, then the amount of caregiving services x increases—that is, $\frac{\partial x^*}{\partial \pi} > 0$. It is more difficult to show that if there were n children instead of one, so that the parent's utility were $U(x, n.y)$, under the usual assumption of risk aversion, the care services provided by the parent to her own mother would be lower, for she would be more afraid of not receiving help by her own children—see derivation in Laferrère and Wolff (2006, fn. 80, p. 941).

The model—with some extensions, such as longevity risk, for example—provides a number of testable hypotheses. The evidence for or against these hypotheses is, as usual, mixed—and even though most studies seem to validate the presence of the demonstration effect, as Arrondel and Masson (2006, p. 980) remarked, 'the possibility of alternative interpretations of the findings cannot be ruled out'. Some of the findings reported in the literature include:

- Wolff (2001) found evidence supportive of the demonstration effect hypothesis using data for France from 1992: adult children exhibited more frequent contact and visits to their parents if they had children of their own compared to adult children with no progeny. However, the authors found that the motivation was unrelated to a demonstration effect but on the informal care grandparents provided to their grandchildren.

- Jellal and Wolff (2003) reported confirming evidence using data for France from 1992: adults who would gain the most from the demonstration effect (women—as they live longer than men, people with health conditions, and single parents) were investing more in upward transfers than other people with children, and older people who had invested in demonstration when younger were more likely to receive care services from their children than those who had not.
- Giménez et al. (2007), looking into data for Spain in 2002–03, reported results validating the hypothesis. The authors proposed explanations from social learning theory, including social cognitive theory, to interpret how the effect might operate (which is important, as this hypothesis seems to assume that preferences are shaped by 'demonstration' without an explanation of how): people learn by reinforcement and imitation through watching repeatedly and retaining what other people do.
- Mitrut and Wolff (2009) started from the stylised fact that women live on average longer and provide more informal care than men, they would have a greater incentive to 'demonstrate' and instil affection onto their children than men. From this proposition, the authors conjectured that if parents had daughters, they would invest more time in this demonstration than if they had sons—a hypothesis they tested and validated using data for Romania from 2005.
- Tao (2014) argued against the previous evidence supporting the demonstration effect from a neuroscience perspective: biological gender differences in empathy would make females more likely to care for other people and therefore to visit their older parents more often than men. Using data for Taiwan between 2003 and 2007, Tao found that among people with no children—for whom the demonstration effect would not apply—adult women with no children visit their parents more often than adult men with no children, and concluded that this would invalidate the explanation by Mitrut and Wolff based on the selfish calculus of long-term rewards proposed by the demonstration effect hypothesis.

7.2.1.8 The Reservation Wage of Informal Caregiving

Factors that affect labour market participation can either influence the decision between work or not (i.e. the extensive margin) or the number of hours worked (i.e. the intensive margin). Particularly for caregivers of working age, an economic theory of LTC supply has to explain the caring decision given the opportunity cost of providing care, that is, the labour market wage they could be earning per period—say, per hour.

Transitioning into caregiving reduces labour market participation, especially in terms of the number of hours worked (i.e. the extensive margin), but also changes the economic status (i.e. the intensive margin), particularly among people providing long hours of care. Substitution and income effects are in operation: time devoted to caring competes with leisure and with work so to some extent if leisure time is not substituted on a one-to-one basis, some of the paid working time is affected; on the other hand, reduced number of hours of work may induce caregivers to seek for better remunerated employment opportunities so that total income may not fall as a result of a reduction in the labour supply. A third effect has been mentioned in the context of informal caregiving which may dampen the negative effects on labour market participation of carers: the 'respite effect', by which paid employment provides respite for a caregiver. Caregivers may also face a 'care penalty' in terms of reduced wage rates as they need to opt for flexible work, which usually carry a lower wage rate than general work arrangements.

In labour economics, the reservation wage is the minimum wage at which an individual is willing to work. One family of labour economic models uses the concept of the reservation wage of caring to seek explanations for changes in the extensive and intensive margins. These models have been expanded to investigate LTC decisions within households. Instead of the binary decision as to work or not to work, now actors have three options in how to allocate their time: work, leisure, or caring. The reservation wage of caring is the minimum wage (or transfer or benefit) at which an individual—usually assumed of working age—is willing to forego paid employment to become a carer, either formal (wage) or informal (transfer or benefit).

Nocera and Zweifel (1996) presented the following model where the reservation wage of caring plays a pivotal role. Imagine an individual of working age facing the alternatives of being in paid employment, spending leisure time, or caring for an older relative. The income she would earn if in paid employment would finance her consumption of goods and services. So, her utility is a function of consumption, leisure time, and caring time:

$$U = U(C, L, Z) \tag{7.20}$$

It is easy to see that utility ultimately depends on how this agent allocates her time. We assume that utility increases with consumption and leisure, but regarding the time devoted to caring, it could as well be positive as negative. We further assume that she gets a transfer or compensation as a carer. Her total income can be formalised thus:

$$Y = (T - L - A).w + M \tag{7.21}$$

where T stands for total time available (some models simply use 24, denoting the number of hours in a day), L represents the time devoted to leisure, A is the caring time, w is the market hourly wage, and M is the compensation or transfer. We also assume that all income is spent on consumption goods and services. Therefore, with p denoting consumer prices, we get:

$$Y = p.X \tag{7.22}$$

from where we obtain the budget constraint

$$(T - L - A).w + M = p.X \tag{7.23}$$

With total time fixed (i.e. $dT = 0$), the total differentiation of Eq. (7.23) is

$$\begin{aligned} -w.dL - w.dA + dM &= p.dX \\ dX &= -\frac{w}{p}.dL - \frac{w}{p}.dA + \frac{dM}{p} \end{aligned} \tag{7.24}$$

The consumption function can be expressed as

$$C = C(L, X) \tag{7.25}$$

where X denotes goods and services consumed, and the LTC function can be represented by

$$Z = Z(A) \tag{7.26}$$

The total differentiation of the consumption function (Eq. (7.25)) is

$$dC = \frac{\partial C}{\partial L}dL + \frac{\partial C}{\partial X}dX \tag{7.27}$$

and the total differentiation of the LTC function results in

$$dZ = \frac{\partial Z}{\partial A} dA \tag{7.28}$$

Finally, the total differentiation of the utility function is given by

$$dU = \frac{U}{C} dC + \frac{U}{L} dL + \frac{U}{Z} dZ \tag{7.29}$$

The indifference curve—that is, the combinations of consumption time, leisure time, and caring time—that would make this actor indifferent in the sense that the impact on her utility of one additional hour dedicated to one activity had to be compensated by exactly the same impact (*note*: the same impact, not necessarily the same length of time) on her utility of less time devoted to any of the other two or to both together, is given by $dU = 0$, that is, where Eq. (7.29) equals 0.

We now replace the total differentiation of consumption, of leisure, and of the budget constraint into the indifference curve; we obtain:

$$\frac{\partial U}{\partial C}\left\{\frac{\partial C}{\partial L}.dL + \frac{\partial C}{\partial X}.\left[-\frac{w}{p}.dL - \frac{w}{p}.dA + \frac{dM}{p}\right]\right\} + \frac{\partial U}{\partial L}.dL + \frac{\partial U}{\partial Z}.\left(\frac{\partial Z}{\partial A}.dA\right) = 0 \tag{7.30}$$

In this model, the reservation wage of caring is given by $\frac{dM}{dA}$, an expression of which can be obtained from Eq. (7.30):

$$\frac{dM}{dA} = w.\left\{1 - \frac{\frac{\frac{\partial U}{\partial Z}}{\frac{\partial U}{\partial C}}}{\left(\frac{\frac{\partial C}{\partial X}}{\frac{\partial Z}{\partial A}}\right).\frac{w}{p}} - \frac{dL}{dA}\left[\frac{\frac{\frac{\partial C}{\partial L}}{\frac{\partial C}{\partial X}}}{\frac{w}{p}} - 1 + \frac{\frac{\frac{\partial U}{\partial L}}{\frac{\partial U}{\partial C}}}{\frac{\partial C}{\partial X}.\left(\frac{w}{p}\right)}\right]\right\} \tag{7.31}$$

which under some simplifying assumptions reduces to[8]

$$\frac{dM}{dA} = w - \left\{\frac{\frac{\partial U}{\partial Z}\frac{\partial Z}{\partial A}}{\frac{\partial C}{\partial X}.\frac{\partial C}{\partial X}} - \frac{\partial L}{\partial A}\left[\frac{\frac{\partial U}{\partial L}}{\frac{\partial U}{\partial C}.\frac{\partial C}{\partial X}}\right]\right\} \tag{7.32}$$

Let's study this expression from right to left. The partial derivative of utility with respect to leisure is positive (i.e. $\frac{\partial U}{\partial L} > 0$), because we assume that people enjoy having more free time (don't you?). We adopt the usual assumptions that the partial derivative of utility with respect to consumption is positive (i.e. $\frac{\partial U}{\partial C} > 0$) and that the partial derivative of consumption with respect to consumption goods and services is also positive (i.e. $\frac{\partial C}{\partial X} > 0$). Consequently, the expression between parentheses is positive. The partial derivative of leisure with respect to time devoted to caring is negative (i.e. $\frac{\partial L}{\partial A} < 0$), for leisure and caregiving are competing uses of time (though not necessarily on a one-to-one basis, so the partial derivative is negative but may be different from minus one). The last term is, consequently, negative; it is preceded by a minus sign, so the higher it is, the greater the reservation wage becomes. Now we turn to the second term. The partial derivative of caring services with respect to caring time is assumed to be positive (i.e. $\frac{\partial Z}{\partial A} > 0$), because we are ruling out any abuse, mistreat, or neglect by the caregiver, so any length of time devoted to caring (A) should add something positive in terms of care services the older person in need gets (Z); it could be more, it could be less—depending on how efficient the carer is—but the assumption is that there is always some positive contribution. The denominator, in turn, is positive; we have already seen its two elements. Consequently, with these three elements positive, the second term would only be negative if the partial derivative of utility with respect to caregiving were either negative or equal to zero (i.e. $\frac{\partial U}{\partial Z} \leq 0$). Of course, as the term is preceded by a minus sign, if $\frac{\partial U}{\partial Z}$ is negative or equal to zero, then this term also increases the reservation wage. But what does it mean that the partial derivative of utility with respect to caregiving is positive or negative? It denotes how much utility a carer draws from providing informal care. If it is positive, the person enjoys the activity. Even if this were the case, we could find a reservation wage greater than the market wage. So, unless the amount of utility derived from providing informal care is huge, informal carers require a reservation wage. Except in the particular case in which the utility derived is sizeable, caring entails an opportunity cost that needs be compensated.

Nocera and Zweifel (1996) tested their model with data from 1993 for individuals aged over 40 years in Switzerland; they found that the reservation wage of caring was positively associated with market wages among women but independent for men. From a policy-making point of view, the reservation wage can be understood as 'the amount of resistance to be expected against any attempt to substitute informal care for institutional LTC' [p. 93], so the authors looked into two alternatives: paying a subsidy to caregivers or a voucher scheme given to older people in need of LTC, and recommended the latter, for it would give older people in need the choice to look for an informal carer outside their family circle or even a formal care provided.

The literature stemming from this model and analysis focused on:

- The relationship between market wage remuneration and the amount of hours of caregiving. The model predicts that people on higher employment income are less likely to provide informal care services.
- Whether bequests are related to caregiving.
- Whether caregiving reduces the hours worked (i.e. the effects at the intensive margin) and whether caregiving reduces labour market participation altogether (i.e. the effects at the intensive margin).

Regarding the last point, about the impact of caregiving on the intensive and extensive margins, the empirical evidence is not conclusive, though the bulk of the academic work is supportive of negative labour market effects. To cite but a few studies, one or both effects were found in operation by:

- Fevang et al. (2008) in Norway between 1993 and 2005.
- Gray and Hughes (2005), Berecki-Gisolf et al. (2008), and Nguyen and Connelly (2014) in Australia in 2000, 2004, and 2008, respectively.
- King and Pickard (2013) in England between 2002/03 and 2008/09.
- Carr et al. (2016) in the UK in the period 2009–14.
- Fukahori et al. (2015) and Yamada et al. (2015) in Japan between 1997 and 2005, and in 2010, respectively.
- Casado-Marín et al. (2011) in Spain for 1994–2001.
- Jacobs et al. (2017) and Skira (2015) among women in the USA from, respectively, 1992–2003 and 1994–2008.
- Lilly et al. (2010) reported effects on the extensive margin, but not on the intensive margin, of informal caregiving in Canada in 2002: caring responsibilities negatively affected labour participation but not the number of hours worked.

In contrast, other studies failed to find any significant effects of informal caring on the extensive or intensive margins—for example, Leigh (2010) in Australia during the years 2001–07; Ciani (2012) and Crespo and Mira (2014) in a sample of European countries between 1994–2001 and 2004–07; or Oshio and Usui (2017) with data from Japan between 2009 and 2011.

Carmichael and Charles (1998) and Heitmueller and Inglis (2007) found a care wage penalty in the UK, and Bittman et al. (2007) reported reduced wages as a result of starting providing informal care in Australia—but other studies failed to find statistically significant or, if significant, very small effects.

The evidence, nevertheless, may be contaminated by an underlying selection process if the unemployed and part-time workers happen to be more likely to provide care—and there is suggestive evidence that this may be the case (Carmichael et al. 2010; He and McHenry 2016; Michaud et al. 2010; Moscarola 2010). Moreover, there is some evidence that time constraints derived from caregiving responsibilities influence labour market transitions more among women than men, while health-related factors associated with the burden of taking on informal caring affect more the labour market decisions of men than women (Schneider et al. 2013). Further, Pickard et al. (2017) considered the case of 'replacement care'—where an older person has unmet care needs as a result of insufficient formal community-based care—and found, in England between 2013 and 2015, that under these circumstances, informal carers are more likely to leave paid employment. Besides, work-family balance policies such as flexible working practices seem to be associated with greater number of hours of informal care provision (Bryan 2012). Bauer and Sousa-Poza (2015) present a good overview of the empirical findings in the literature.

The inconclusiveness of the empirical evidence should qualify any general pronouncements about the labour market effects of informal caring—and we should be wary of blunt statements in this regard. Most of the papers do find some negative impact, but it is also true that most of the literature has considered only a short list of the tapestry of intervening variables such as co-residence, working practices, physical and mental health burden, or formal care constraints and changes in eligibility criteria.

This last point relates to the wider methodological point of how 'partial' the models are: not all models take into account—for example—that, at the very least, three inter-related considerations come into play at the same time when an older person develops LTC needs: labour market participation, health status, and socio-economic status. Berecki-Gisolf et al. (2008) looked at these interactions, though without a mathematical formalisation, in their econometric study on transitions into informal caring and out of paid employment among Australian women in their 50s between 2001 and 2004. They found, after controlling for health and socio-economic levels, that becoming a carer was independent of employment status but women with caring responsibilities were more likely to reduce their labour force participation than women in that age group in paid employment without caring responsibilities.

7.2.2 The Institutional Setting of the LTC System and the Supply of LTC Services

Within the supply of care services, an important distinction concerns the institutional setting in which the services are provided. Non-institutionalised care is provided 'in the community'—that is, in the homes of the older people who receive the services (i.e. domiciliary care) and in adult day-care centres. Institutionalised care is provided in assisted living/residential and nursing facilities or 'homes'.

There are strong interconnections between the actors mentioned above (i.e. the family, the state, the for-profit and non-profit organisations, and the informal networks of support) and the two settings. In this regard, some authors refer to the 'locus of care' (Horden and Smith 2013) and the LTC 'continuum' from non-institutionalised to institutionalised care (Evashwick 2005; Havens 1995; Last et al. 2016; Pratt 2010; Rowles and Teaster 2015). Locus of care refers both to the location where the services are delivered—in older people's own homes, in large establishments, and so on—and whom among the actors are the main providers and sources of funding. In turn, the continuum of care refers to 'an integrated, client-oriented system of care composed of both services and integrating mechanisms that guides and tracks clients over time through a comprehensive array of health, mental health, and social services spanning all levels of intensity of care' (Evashwick 2005, p. 4).

As Cremer et al. (2012) explained, each one of the economic actors has advantages and disadvantages insofar as providers of LTC services. For example, the provision by families depends on some form of intra-household solidarity, which may not always be present within a family circle. Besides, many older people do not have any relatives, others have close family members whom themselves are older and have their own needs, and others still do not have relatives at a practical geographical distance from their homes to get the daily care they need. In turn, the public provision of services, although universal and redistributive in principle, tends to be the result of the interplay between cultural expectations about the role of families, the desire for the development of quasi-markets, and public budget constraints, which often subject services to rationing. Finally, market provision without public subsidies tends to be expensive, which makes it unaffordable to many; moreover, private insurance products are under-developed.

How LTC services are designed affects public LTC spending. The design of LTC differs across countries, and often across municipalities within countries, principally in terms of the nature of entitlements and eligibility to services, finance, delivery, and its integration and coordination with healthcare and other social services (Brodski and Clarfield 2010). There are four main funding mechanisms of publicly financed LTC (Wittenberg 2016):

- Social insurance
- Taxation and user charges
- Taxation without user charges
- Social insurance and taxation

There are several classifications of LTC systems, many of which are based on the comparative work by Esping-Andersen (1990) on welfare states. The following classification—widely used in the literature on comparative welfare states—was introduced by Daly and Lewis (2000) (Table 7.2):

Applebaum et al. used a different approach: with a combination of funding mechanisms, delivery or provision structure (availability of residential care, for instance), the mix of universalism or means-testing to access the services, the degree of availability of LTC services, and the amount of out-of-pocket spending by recipients of the services or their families, these authors proposed the following typology of LTC systems (Table 7.3):

In Esping-Andersen (1990), the Danish sociologist Gøsta Esping-Andersen proposed a classification of welfare states into *liberal*, *corporatist*, and *social*

Table 7.2 Daly and Lewis (2000) typology of LTC systems

	Macro-level	Micro-level
Applies to	Division of care (labour, responsibility, cost) among the state, the market, the family, and the community	Distribution of care (labour, responsibility, cost) among individuals within the family and the community and type of state support
Empirically indicated by	Care infrastructure	Who delivers the caring Who is the recipient
	Distribution among sectors	Type of relation between caregiver and recipient Economic, normative, and social conditions of caring Economic activity of women
Trajectories of change	State	Changes in distribution of caring activities
	Market	Changes in carers' identity
	Family	Changes in delivery conditions
	Community	Changes in relations between caregiver and recipient

Source: Daly and Lewis (2000, Figure 1)

Table 7.3 Applebaum, Bardo, and Robbins's typology of LTC systems

	Group 1	Group 2	Group 3
Funding	Public insurance available	Mixture of public insurance and means-testing	All funding is means-tested
Community-based (domiciliary or not)	Widely available	Widely available	Commonly available
Institutional care	Widely available	Widely available	Commonly available
Housing options	Widely available	Widely available	Commonly available
Cash payments	Often available	Generally available	Available on a limited basis
Informal care	One component	An important part	A critical element
Examples	Germany, Japan, Korea, the Netherlands	Australia, France, Ireland, Spain, Switzerland	Estonia, Italy, Poland, Romania, USA
	Group 4	**Group 5**	
Funding	Means-testing but limited availability of funds	No public funds available	
Community-based (domiciliary or not)	Of limited availability	Not available	
Institutional care	Of limited availability	Not available	
Housing options	Of limited availability	Not available	
Cash payments	Not available	Not available	
Informal care	Very heavy reliance	Exclusive reliance	
Examples	Argentina, Brazil, China, Egypt, India, Mexico, South Africa, Thailand	Bangladesh, Ghana, Kenya, Nepal	

Source: Applebaum et al. (2013, Table 1) *democratic*. The USA would be the prototype of a liberal welfare state and Germany and Sweden, of the corporatist and social democratic regimes, respectively. Like most typologies in social sciences, these are not clear-cut categories: in reality, all welfare states exhibit elements of these three regimes. Though Esping-Andersen (1990) has become a classic, it has been subject to criticisms and extensions. One important criticism is that Esping-Andersen's original classification was blind to the gender dimension—which, in the context of caregiving, is crucial (Knijn and Kremer 1997). One important extension is the addition of two categories: the Mediterranean (i.e. Southern European) and the Antipodean (i.e. Australian) welfare states. Another important extension is the use of cluster analysis and other statistical techniques to obtain alternative data-driven classifications of welfare states. Apart from the threefold categorisation of welfare states, Esping-Andersen (2003) looked at the extent of dependence on or dominance of the family as the actor responsible for the provision of LTC. Along this dimension, welfare regimes can be classified into *familialistic* and *non-familialistic*.

Familialistic welfare regimes assign to or expect from households to take on the majority of welfare obligations. Non-familialistic welfare regimes impose on or expect from households a much reduced involvement, with a concomitant increased presence of market-based provision. *De-familialisation* is the term Esping-Andersen proposed for policies that not only 'lessen individuals' reliance on the family' but that also 'maximize individuals' command of economic resources independently of familial or conjugal reciprocities' (Esping-Andersen 2003, p. 45)—see Gómez and Barbadillo (2015) for an analysis of de-familialisation measures in the 2006 Spanish Dependency Law ('Ley de Dependencia').[9]

Hemerijck (2015) contended that changes in the welfare states across Europe since the late 1970s have come about, largely, as a consequence of macro-level economic changes, some of which are germane to social care policies and the social care markets, including wage moderation to curb down production costs and encourage employment growth and exports, selective universalism, cost-containment measures that would be eroding the social insurance infrastructure, the increasing dependence on co-financing and private contributions, and the de-familialisation of the social care function. Therefore, we cannot disengage the configuration and changes of the care services delivery systems with the economic dynamics taking place across countries, and how these changes may clash against sectoral, historical, and cultural forces, including the social expectations and preferences about how and which services should be provided to older people in need of care.

The institutional framework is part also of the official definition of who is 'in need' and of whom of those 'in need' gets publicly funded care and which services, and so on. In this regard, it is important to bear in mind that definitions and labels enshrined in legislation and social policies actively contribute to the social construction of norms, expected behaviours, and identity (Guillemar 1991). In designing policies and in evaluating their effects, we must check whether we are inadvertently contributing to casting older people into social categories which may ultimately carry very negative consequences for their quality of life.

7.2.3 Contractual Schemes

Social care is a de-centralised activity, whose responsibility has been in many countries delegated to local governments, across which the evidence shows disparities in contractual arrangements, as well as in quality, fees, and so on—Mackintosh (2000, p. 1) is still proved right in his recommendation that 'social care contracting should be understood as a process of mutual shaping of both a divided care industry and an internally divided local authority economic culture'. Among the different types of contracts between governments and private sector providers of LTC services, the most important are:

- Call-off contracts. These are long-term contracts with fixed prices per individual units of service set in advance, which may reflect aggregate categories such as old, mentally ill, and so on, but are independent of the particular needs of each individual (Forder 1997).
- Block contracts. These are long-term contracts with fixed prices by which the public sector authority responsible for the provision of the services books a number of placements or beds in advance at an agreed rate (Mackintosh 2000). The government pays the private contractors the sum of money in question irrespective of whether the provision is materialised. The agreement establishes a number of hours of care service and prospective beneficiaries, and so on, but ex post the numbers may fall short of what was predicted.
- Spot contracts. These are contingency short-term, or even one-off, contracts by which the public sector authority purchases one service or item of service at a time from a list of approved providers at an agreed price (Mackintosh 2000). These contracts are contingent on the needs of the users (Preker et al. 2000).

- 'Model of approval' contracts. These are contracts by which the government sets both the price and the minimum quality standards in advance and agrees to contract with any for-profit provider that meets the requirements (Preker et al. 2000). There is no competition on prices, but on quality.
- 'Preferred provider' contracts. These are contracts by which the government guarantees exclusive business to one particular provider according to a geographical area or 'zone'.
- Personal budgets. These arrangements by which the government agrees with an older person in need of (formal) care services the level and cost of the services. A 'personal budget' is defined, and the government either transfers a cash payment to the older person for her to purchase the services directly from private sector providers or gives the budget to the provider chosen by the older person which is called off as the services are provided (Baxter et al. 2011).

Each type of contract has its advantages and disadvantages. For example, block contracts are more predictable than spot contracts, and can also be cheaper given the stability they bring to the care providers and the economies of scale they facilitate, so price discounts are not unusual. In contrast, block contracts may turn care management more into a targeting of services than in an assessment of older people's needs and may replace the social workers' first-hand, independent knowledge of the needs of prospective users with a set list of activities that may not be accurately tailored to the reality of the beneficiaries (Lewis and West 2014).

We are interested in two of the many incentives and effects of alternative contractual schemes in LTC: access and quality. Our concern about access is related with the possibility that some older people may be excluded or 'priced out' of the provision of the care services they need. Our concern about quality is related with the possibility that some older users of care services may not be receiving care of the same standard as other users, with detriment to their independence, dignity, and ultimately quality of life—if not life itself. Let's consider these two areas of concern.

7.2.3.1 LTC Contracts and Access

Contractual schemes and the reimbursement policies affect access (Norton 2000; Scanlon 1980). Governments usually pay to providers lower prices than privately funded users of LTC services. We can think of providers as profit-maximising units whose profits depend on the number of privately funded users who pay a given price and publicly funded users who pay (of for whom the LTC provider receives from the government) a lower price. With unit costs assumed to be the same for each type of user, excess demand and fixed supply (usual assumption in the short run) would make the providers maximise their profits with respect to the prices charged to the privately funded users so that the marginal revenue from these users equals the marginal revenue from the publicly funded users (Norton 2000). Publicly funded older people in need of LTC services would find restricted access to the services—see (Su 2016) for evidence in nursing homes in Texas, USA.[10]

7.2.3.2 LTC Contracts and Quality

The prices that the government agrees to pay to the providers of LTC services in call-off and block contracts are fixed. The prices agreed upon in spot contracts are not fixed but are contingent on the expected cost of providing the service. The effects of the type of contract on the prices depend on whether the market operates in or near equilibrium or with excess demand, on whether the provider is a for-profit or a non-profit organisation, and on whether information is fully shared between providers and prospective older recipients or there is asymmetry in the information both parties hold.

Excess Demand From Scandinavian countries (Trætteberg 2017) to the USA (Ching et al. 2015; He and Konetzka 2015), and from Italy (Del Boca and Venturini 2016) and Switzerland (Crivelli et al. 2002) to Japan (Mitchell et al. 2006), the markets of residential LTC services are characterised by excess demand. If the markets operated in equilibrium, under fixed price contracts, higher prices would act as incentives to private sector providers to compete for patients via increased quality. However, given the excess demand, there is no need to compete for patients (waiting lists may be considered as the non-monetary prices that in addition to the actual monetary prices clear demand and supply). Given this lack of need to compete for patients, Nyman (1988) conjectured that excess demand would drive quality downwards among for-profit providers—and found evidence supporting his hypothesis using data for Wisconsin, USA, from 1983.

Ownership If the private providers treat both privately funded and publicly funded users, instead of only the former, quality may also be affected under excess demand (Siciliani 2014). Regarding non-profit care providers, higher prices could have a positive effect on quality because, given that a non-profit firm is 'barred from distributing any profits it earns to persons who exercise control over the firm' (Hansmann 2009, p. 228), it would invest in higher quality. In effect, non-profit residential and nursing homes tend to exhibit higher quality of care than for-profit organisations (Comondore et al. 2009; Hillmer et al. 2005; Xu et al. 2013; You et al. 2016). Further insight on this point was presented by Pesis-Katz et al. (2013), who studied the determinants of nursing home choice in the USA before the introduction of the rating system; the authors reported that decisions were made on the basis of dimensions that were easy to evaluate such as distance from prior residence, not-for-profit status, and quality of hotel services but that more difficult characteristics such as clinical quality were not taken into account.

Asymmetric Information Apart from the market situation and ownership structure, a third element germane to care quality outcomes is the degree of asymmetry in the information about the actual disability and general health conditions of prospective older users and about the actual level of quality of care the provider is committed to delivering. Asymmetric information intersects with the type of ownership: if there is an imbalance in what prospective users and providers know about each other—for example, if older prospective residents or their relatives are incapable of fully assessing the quality of the services that a nursing home promises to deliver—non-profit organisations provide a better quality service than for-profit care organisations (Hansmann 1980). This would be the case because for-profit organisations would not have enough incentives under these circumstances not to charge prices higher than the quality of their services might warrant—as a matter of fact, everything would be set for them to take advantage of the situation. Instead, given that non-profit organisations are barred from distributing any profits, they would not be perversely incentivised in this regard.

7.2.3.3 Implications

Which are the implications for older users of LTC services of differential access and quality? Not accessing services of good quality is—or should be—unacceptably deleterious. Care quality is measured by means of a classification into structural, process, and outcome-related indicators (Donabedian 1983) or into non-clinical and clinical indicators. Structural indicators include staff training, staff/resident ratio, and ownership type (i.e. whether for-profit or non-profit). Process indicators include the institutional practices, policies, guidelines, standards, and procedures in place, and the relationships with residents and other providers. Outcome indicators include clinical variables such as prevalence of physical restraints, urinary incontinence, pressure ulcers or use of depressants, falls, mortality, and so on. Non-clinical indicators of quality include deficiency complaints, staff turnover rate, staff/resident ratio, or levels of training of staff. Clinical indicators correspond to the outcome indicators in the typology proposed by Donabedian. Aggregate measures are also used, such as the Five-Star Quality Rating System in the USA (CMS 2017) or the four-point rating system in England (CQC 2017).

Chou (2002), using data of almost 3000 nursing home residents aged 65 or over between 1984 and 1994 in the USA, found that when asymmetric information was present, residents in non-profit homes exhibited lower mortality rates and lower prevalence rates of decubitus ulcers, dehydration, and urinary tract infections—see also Ben-Ner et al. (2012) and Quéinnec (2012).

The role of quality ratings to re-balance the information asymmetry in the LTC markets has been also subject to numerous studies. For example, Werner et al. (2016) found a strong response in the demand for nursing home services as a result of the introduction of the Five-Star Quality Rating System in the USA in 2008: one year later, the worst-performing nursing homes had lost around eight per cent of market share, and the best-performing institutions had gained six per cent of market share.

Apart from the asymmetry in information stemming from the inability of an older person in need of LTC services in a residential locus to accurately evaluate the quality of the services that she may receive, it is very also important to consider that she could also present 'insufficient physical, mental, or social capacities to safeguard their personal interests' (Eika 2009, p. 133), which would prevent her from assessing information about quality even when such information were available—an example of what Eika termed 'limited consumer sovereignty'.

7.2.4 Baumol's Cost Disease and the LTC Sector

William Baumol was a US economist who contributed, among other things, to the study of relative costs across industries. His main argument on this topic—known as the Baumol's cost disease hypothesis—goes like this (Baumol 1967; Baumol et al. 1993):

(a) technological advance embedded in physical capital is an important driver of productivity growth;
(b) therefore, industries with labour-intensive production processes will exhibit lower productivity than the rest as they would have fewer possibilities for productivity gains by introducing cost-saving or more productive innovations;
(c) on the other hand, differences in wage rates for workers with similar skills, qualifications, and experience tend to iron out in competitive markets;
(d) as a result of lower productivity and labour costs equal to the average industry, prices in labour-intensive industries will grow faster than the average price index. Wages, and consequently costs, in the formal care sector should rise higher than the average wage rate.

Most studies that tested this hypothesis found evidence of cost disease in cultural and artistic activities but also in education and, crucially for our purposes, in an industry with some similarities to LTC: health—see, for example, Bates and Santerre (2013), Colombier (2017a), and Rossen and Faroque (2016). As we mentioned above, health and LTC do share some characteristics. LTC is more labour-intensive than healthcare. Thus, if healthcare is subject, to a certain extent, to Baumol's cost disease, LTC would be even more so:

> Caring is a "people industry' -it is labour intensive. The nature of the dominant activities -washing, feeding and taking care of the older person- cannot be replaced by technology or by machine. Being people-intensive, care costs are likely to rise disproportionately -there can be no economies of scale as would occur in Fordist-style industries.
>
> (Vincent 2001, p. 40)

It is worth noting that the fact that wage rates in the LTC sector do not increase does not necessarily mean that the hypothesis should be rejected. Providers could resort to cheaper sources of labour so much so that wages in the care sector could lag behind the rest of the economy—and this could happen at the same time that unit prices went up. For example, Karlsson et al. (2006) reported that between 1993 and 2002, in the UK, the unit price of social care services increased by 3.7 per cent a year against an average annual inflation rate of 1.7 per cent, whilst average wages went up by 4.1 per cent a year. The prices in the sector, therefore, exceeded those in the economy at large—an evidence of the Baumol's disease—but fell behind labour costs: either labour productivity increased or wages in the LTC sector did not keep up with the growth in earnings in the rest of the economy.

Despite the Baumol's cost disease hypothesis is mentioned in almost every study and included in almost every projection of LTC sector costs, we need to take into account, first, that migrant workers are being recruited into the sector across the developed world as a source of poorly paid labour and, second, that technological advances are beginning to increase the productivity of the sector.

7.2.5 Migration and LTC Supply

There is solid and ample evidence that increasing numbers of low-wage migrants are being employed in the LTC industry (Anderson and Shutes 2014; Peng 2016)—the so-called global care chain (Hochschild 2000).

- The influx of migrant care workers is a growing trend in several countries, from Canada (Atanackovic and Bourgeault 2013) to the Netherlands (Da Roit and Bochove 2017) and Norway (Munkejord 2017).
- Del Boca and Venturini (2016) studied the case of Italy where they concluded that 'elderly care is now monopolized by foreign women workers, with the availability of immigrant care givers crowding out the alternative solutions that were in place' [p. 75].
- In contrast, in the UK, most foreign care workers—the vast majority of whom come from outside the European Union—are employed in the private residential sector (Shutes and Chiatti 2012).
- Peng (2016) cited the case of Taiwan, where in 2016 there were 224,000 registered foreign live-in caregivers providing personal home care services to older people.
- An interesting example is Japan, where strict immigration policies have been in place for decades, as its government signed agreements with the Philippines, Vietnam, India, and Indonesia to allow for hundreds of care workers—almost exclusively, female—to move to Japan on a temporary basis (Ford and Kawashima 2013; Onuki 2011).
- South Korea is not only an important receiving country of foreign women care workers to work in the formal care sector, but also has a burgeoning marriage market between Korean bachelors and foreign women who are

expected, among other tasks, to carry out informal caregiving services for their parents-in-law (Um 2013).

- Finally, it is worth highlighting the extreme situation of women from Romania and Slovakia who commute into Austria for live-in 24-hour care work, generally in two-weekly to four-weekly shifts (Bauer and Österle 2016).

7.2.6 Technology and LTC Supply

Technological advances are being introduced in home care settings as well—see Bravo et al. (2012) and Moraitou et al. (2017)—with some evidence of cost-effectiveness (Aanesen et al. 2011; Graybill et al. 2014). Furthermore, innovations in computerised systems such as the multi-agent system have been introduced in nursing homes with proven reductions in the time nurses spent carrying out administrative tasks which allowed nurses to spend longer time to carry out personal patient care tasks such as toileting, repositioning, or feeding (Corchado et al. 2008; Fraile et al. 2010; Sanz-Bobi et al. 2012)—whether this shift is cost-reducing is still an open question, but the changes point to caregiving services of better quality.

7.2.7 Do Recessions Increase or Decrease the Supply of Carers?

The answer to the question above is eminently an empirical one, and it depends on the policies, institutions, level of economic development, and cultural practices of the country or countries under study. Economic recessions may have various consequences for the supply of LTC (Van Houtven 2015), and given that some of the impacts would increase the supply whilst other effects would contract the supply of LTC, we need to discuss them separately.

- An economic downturn can push part of the workforce into unemployment or part-time work. This may induce either some of these displaced workers—particularly women—if previously employed in other sectors or members of their households, again mostly women, previously not in paid work to seek employment in the LTC sector, which is, as we mentioned above, low-paid and labour-intensive. By inducing this behaviour, a contraction in economic activity may increase the supply of workers in the LTC sector. However, these same forces would induce informal carers to seek paid employment either in the formal care sector or elsewhere to offset the drop in earnings, thus reducing the supply of informal carers. The pool of informal carers in the extended social network can also experience a contraction via the same mechanism.

- The reduction in household income can also impact on the quantity demanded of privately funded formal care and co-payments.
- A recession in a neighbouring country may push potential caregivers out to seek employment in the LTC sector as migrant workers in a country not experiencing economic contraction (see the subsection on migration and LTC supply above)
- Furthermore, given the important concentration of informal caregivers near retirement age, some may decide to postpone transitioning into full-time retirement as a consequence of the deterioration of household income; hence, they may not take any further caregiving responsibilities as they would under different economic circumstances, thus reducing LTC supply.
- Economic recessions also affect housing patterns of young adults with many returning to their parental home, which introduces changes in the structure of many households (Cherlin et al. 2013; Keene and Batson 2010; Qian 2012). Higher rates of intergenerational co-residence may increase the supply of informal support with instrumental daily activities such as shopping or help around the house but may also create further care-related strain and burden.
- Finally, governments tend to implement measures with the objective to contain the growth in public expenditure during economic downturns, which the implication that publicly funded formal care and subsidies to informal carers may be curtailed and, with it, employment in the sector.

Looking into data about people aged 50 years or older in 11 European countries between 2004/05 and 2010/11, Costa-Font et al. (2015) reported that as a result of the Great Recession that started at the end of 2007 and lasted until mid-2009, the supply of informal caregiving went up and, with it, the proportion of older people living in the community who received informal care services.

7.3 Relationship Between Informal and Formal Care

The model by Nocera and Zweifel (1996) presented above includes assumptions regarding the degree of substitutability or complementarity between formal and informal care. This is another area of active research because if informal and formal care are substitutes, the more services are provided informally, the less the government needs to fund or the households to buy relatively more expensive formal care services. Five different models have been proposed in the gerontological literature to formalise the relationship:

- the *substitution* model (Greene 1983): informal and formal domiciliary services are substitutes.
- the *hierarchical compensatory* model (Cantor 1979): people in need of care services resort first to informal care provision (and within informal caregivers, first to the next of kin and, if they are not available, to neighbours and friends), and only if these informal sources are exhausted, the services from formal care providers are demanded.
- the *complementary* model (Chappell and Blandford 1991): formal care services are used when informal caregivers cannot cope or the tasks required to meet the needs exceed their capacity. This model combines the substitution and the hierarchical compensatory views and is also known as the *bridging* model (Sussman 1976), for informal care would act as a bridge onto formal care services.
- the *task-specific* model (Litwak 1985): informal and formal care services are complementary but in the sense that the former are more suitable for some tasks while the latter are more suitable for other tasks.
- the convoy of care model (Kemp et al. 2013): a convoy or personal network is 'the structure within which social support is given and received' (Kahn and Antonucci 1980, p. 255); in the context of LTC,

> convoys of care are the evolving collection of individuals who may or may not have close personal connections to the recipient or to one another, but who provide care, including help with activities of daily living (ADLs) an instrumental activities of daily living (IADLs), socio-emotional care, skilled health care, monitoring, and advocacy …who does what in individual care convoys generally changes over time through negotiation. Care convoys and negotiations are influenced by factors at the societal, community, care industry, care setting, formal-informal network, and individual levels.…care convoys have outcomes for self and identity, which are intimately connected to care recipients' ability to age in place and well-being, as well as for informal caregivers' sense of fulfilling family responsibility …, satisfaction with care, and levels of care burden and formal care workers' job satisfaction.
>
> (Kemp et al. 2013, p. 18)

Economists have generally looked into the substitution/complementarity/independence triad without paying much attention to the wealth of research in other social sciences. The majority of economic studies have analysed the impact of changes in the quantity demanded of informal care services on the demand for formal care services, whilst a few others have studied the effect of changes in formal care demand on the use of informal care. Unless in the theoretical extreme case of perfect substitution, substitute goods are only partial replacements for one another, so their cross elasticity of demand is positive but not infinite. Therefore, the impact of the changes in the quantity demanded of informal care services on the demand for formal care is not necessarily of the same magnitude as the impact of the changes in the quantity demanded of formal care services on the demand for informal care. Furthermore, some studies have looked into formal and informal care, whilst others have focused on the effects of types of informal services on different kinds of formal services, and others still have considered the effects of one or both services on, for example, hospitalisations or visits to family doctors, and so on.

The possibility that the demand for formal and informal care may not be independent from one another creates 'reverse causation' (also known as 'simultaneous determination' or 'endogeneity')—a problem which earlier studies failed to control for. The sheer amount of academic work on this topic, and their somehow conflicting findings arising in part due to the alternative econometric approaches applied and the datasets analysed belonging to different countries and periods, make it difficult to distil one prevalent view among researchers. Besides, there are several intervening variables mediating in what is, ultimately and usually, a choice made by an older person who needs care and support, or their immediate family. Let's briefly review some of the most cited work in this strand of the literature, starting with a very short list of papers spanning over three decades and various countries, all of which have found that informal care is a substitute for formal care.

- In one of the first carefully designed econometric studies in which endogeneity issues were dealt with, Greene (1983) looked at the effects of informal care on formal care in Tucson, Arizona, the USA, in 1980, and found substantial substitution: informal care reduced the demand for formal care services.
- Kemper (1992) arrived at a similar conclusion after studying data from a nationwide programme in the USA for 1982–83.
- Lo Sasso and Johnson (2002) found that informal help from adult children reduced the likelihood of nursing home use among people aged 70 and older in the USA between 1993 and 1995.

- Van Houtven and Norton (2004) investigated two US-wide surveys, from 1995 and 1998, respectively, and found that informal care reduced formal home care and the demand for nursing home services.
- Charles and Sevak (2005) studied data from a representative survey of older people in the USA between 1993 and 2000 and reported that informal care was a substantial substitute for nursing home care services.
- Bolin et al. (2008a) reached the same results for a number of European countries in 2004 after studying people aged 50 or over living as singles and who had at least one child or grandchild: receiving informal help from their children or grandchildren reduced the demand for formal care services.
- Bolin et al. (2008a) studied care services received by people aged 50 years or over (and also by those aged 70 or over) living alone and with at least one child in 12 European countries in 2004. The authors found that formal and informal caring are substitutes, but that the effect is small—and they also reported that its magnitude would vary depending on cultural and institutional characteristics of the welfare state in each country.
- Du (2012) used data from the USA between 2002 and 2004 of individuals aged 70 or over who were single and had at least one living adult child, and reported that informal care acted as a substitute for nursing home care and hospital inpatient care, but not for formal home care services.
- Hollingsworth et al. (2017) reported that the introduction of free formal care services (a lump-sum care allowance) in Scotland, UK, in 2002, reduced the probability that a co-residing adult member of the household provided informal care to an older person in need and an increase in the labour force participation among people aged 55 or over (which corresponds to the age group most likely to provide in-house informal care).
- In another study of data across eight countries in Europe (between 2010 and 2012), Bremer et al. (2017) found that informal care substitutes for formal home care among older adults with dementia.
- In their study of gay men aged 50–87 years in the USA, Shippy et al. (2004) found evidence in favour of the hierarchical compensatory model (though within informal caregivers, after the partner, who was the first choice, friends were preferred to members of the biological family).

Needless to say, other studies have failed to find any reduction in formal home care services as a consequence of increasing informal care use. Here is a short selection:

- One earlier example is Christianson (1988)—possibly the first carefully designed study in this field from an econometric point of view, as it controlled for the endogeneity between formal and informal care. Using data from interventions in the USA in 1985 implemented with the aim that severely impaired older people substituted community care services—both formal and informal—for nursing home care services, Christianson did not find any significant substitution effects.

- Pezzin et al. (1996) reported only some limited effects looking into the same data.
- McMaughan Moudouni et al. (2012) failed to find an association between increase hours of formal home care and fewer informal home care hours with data also from the USA but between 2004 and 2006.
- Another study that failed to find any association between the demand for informal and formal care is Moscovice et al. (1988), which looked into data for Minnesota, USA, from 1982.
- In their study of transitions in the use of care services in the Netherlands, Geerlings et al. (2005) found that the demand for informal and formal care operated, by and large, independently from one another but that some key variables mediated in their relationship. For example, living with a partner made the use of formal services less likely (substitution effect), but receiving informal care made it more likely to receive formal care three years later—informal care would act as a 'bridge' onto formal care (Sussman 1976). Geerlings et al. surmised that the closer the tie between the older person in need and the carer, the more likely informal care services would substitute formal care.

Regarding complementarity between formal and informal care:

- Litwin and Attias-Donfut (2009) found evidence between informal and formal domiciliary care among people aged 75 or more years in France and Israel in 2004–06.
- Geerts and Van den Bosch (2012) reported similar results in their study of people aged 65 or over in nine European countries between 2004/05 and 2006/07.
- The findings in the study of people aged 40 or over in Spain in 1999 by Jiménez-Martín and Prieto (2012) supported the complementary model.
- So did a study of people aged 75 or older using data from 1991 to 1994 in Australia (Edelbrock et al. 2003)—although the authors found that higher users of medical services were also higher users of informal care services, which provided evidence for the bridging hypothesis.

It is my appreciation that the weight of the empirical evidence is, in broad terms, that informal care services can partially substitute formal home and institutional care. However, speaking in such 'broad' terms is not much useful for policy decision-making. We need to bear in mind that 'care', formal and informal, domiciliary and institutionalised, encompasses a great number of tasks and services, so we may find that particular informal services are closer substitutes for particular formal services but not as strong replacements for other formal services.

We now turn the attention to the effects of formal care on the demand of either informal care services or institutional care. The focus depends on the locus of care in which demand is sought to be reduced. First, the studies on the effects of formal domiciliary care on informal (domiciliary as well, of course) care are interested in the possibility that veering demand away from informal care may release informal caregivers from their 'burden' of care, so that they may either increase their labour market participation or improve on care-related health conditions. We can envisage a fiscal (and wider economic) motive: foregone income due to caring responsibilities means foregone taxes, and deteriorating health means increased healthcare costs. Other studies looked into the relationship between formal domiciliary care and institutionalised (also formal, of course) care. In this case, there is above all a cost-saving motive, as domiciliary care services are—on average—cheaper to provide than residential and nursing home care. Most of the literature reports that formal care services substitute informal care. Three papers for illustrative purposes:

- Arntz and Thomsen (2011) studied the effects of the introduction of consumer-director personal budgets in Germany with data between 2004 and 2008. Among older people who resorted to formal care provision from private sector agencies, this intervention substituted these services provided by private sector agency care workers for less costly independent carers. Among older people who resorted to informal care services, the introduction of personal budgets had a strong substitution effect: informal care services were crowded out.
- Moya-Martínez et al. (2014) probed data from Spain for 2008 and reported that formal care use can reduce informal care demand to 60 per cent of its then current levels (in a country where informal care costs were estimated to be equivalent to 8 per cent of the gross domestic product).
- Arnault and Goltz (2017) used data on people aged 60 or over in France for 2008 and found that the demand of informal care decreased with increased quantity demanded of formal home care services.

Some authors focused on particular formal services. For example, Grabowski et al. (2012) investigated two datasets from nursing homes in the USA covering the periods 1993–2007 and 2000–07, respectively, and found that an increase in assisted living supply modestly decreased nursing home care use. In turn, Agree and Freedman (2000) and Agree et al. (2005) considered whether assistive technologies (ATs) were substitutes or complements of informal and formal home care; both papers found that ATs substituted informal care but complemented formal care services. In a study on data for people aged 65 years or over in Switzerland, Gonçalves and Weaver (2017) found small effects of formal home care in increasing the probability of hospitalisations but in reducing average length of stay as well.

7.4 LTC Insurance

Formal LTC is costly for private households: it has been estimated that in the USA a couple turning 65 years of age will spend (in 2004–06 US dollars) about US$63,000 in LTC over their remaining lifetimes and faces a five per cent chance of incurring costs exceeding US$260,000; besides, at age 85 the expected costs amount to US$477,000 (Webb and Zhivan 2010). Another estimate found that out-of-pocket nursing home expenditure in the last three years of life was very skewed, with an average (in 2006 US dollars) of US$4731 but a 95th percentile equal to US$26,136—Hurd et al. (2017) estimated it at US$47,000 using data for 2010—and a catastrophic maximum spending of US$285,645 (Marshall et al. 2011). A third study, also from the USA, looked into household spending on LTC for older people with dementia (Kelley et al. 2015). The authors estimated that out-of-pocket and informal care spending five years before death amounted, on average, to US$61,522 and US$83,022, respectively (in 2010 US dollars), −1.8 and 2.17 times higher out-of-pocket and informal care costs for older people with any other condition than dementia.

Private households can fund the cost of privately formal LTC services from three sources: wealth (i.e. accumulated savings), transfers from government, and private insurance. Let's continue with the US situation, and consider the expected costs of formal LTC against the backdrop of the median net worth of households headed by a person aged 75 or over amounting, at the time Webb and Zhivan made their projections, to US$191,000 (Frank 2012)—the bulk of which was housing wealth. Moreover, bear in mind the great heterogeneity within older people in terms of wealth, disability, and network of potential informal caregivers, and we can agree with (Frank 2012, p. 338) that the average household is not 'in a position to absorb the risks of [LTC] and also maintain consumption levels'. One solution, for which in principle there should be plenty of scope for market development, would be to buy an insurance product to cover these contingencies; in fact, LTC is deemed to be 'the largest insurable risk facing the elderly in most western societies' (Costa-Font et al. 2017, p. 38). However, the private LTC insurance market is small around the world—what economists have dubbed the 'LTC insurance puzzle'.

As we already mentioned, the institutional framework and the cultural milieu greatly influence the structure of the LTC provision in a country. Some countries have introduced a universal system of LTC insurance—'universal' in this context refers to not being selective or means-tested, that is, a system in which eligibility is defined by the level of need regardless of income or wealth. These schemes are either funded by general taxation or mandatory contributions from workers and employers and vary in terms of coverage.[11] One of the largest components of the institutional LTC costs is accommodation, which is not included (or has been excluded if originally covered), capped, or means-tested in the public social care insurance schemes in most countries. Informal care exhibits greater diversity—the household structure is taken into account in some countries (e.g. insurance contributions in Germany are higher for people with no children), whilst in other it is not. The Netherlands was the first country to introduce a universal LTC insurance scheme in 1968, the *Algemene Wet Bijzondere Ziektekosten—Exceptional Medical Expenses Act*, which covers home and institutional care for older people as well as for the mentally and physically handicapped and for chronic psychiatric patients (Mot et al. 2010; Schut and Van Den Berg 2010). Similar schemes followed, but since the mid-2000s, they have been subject to modifications generally with a view to rein in costs: largesse and generosity have given way to tightened eligibility and higher contribution rates. These changes have set the healthcare and social care coverage within countries further apart—some authors have noticed a trend towards healthcare systems convergence across developed countries which is not mirrored in the evolution of national social care systems. Apart from rationing efforts via more stringent eligibility criteria, a number of policy initiatives and interventions have been implemented in various countries to induce a higher uptake of private LTC insurance—with mixed results. Some of these policies include:

- Tax incentives. In a study of the effects of tax subsidies on private insurance coverage between 1998 and 2001 across the states in the USA, Goda (2011) found that the average tax subsidy increased LTC insurance purchase rates by approximately 28 per cent among people aged 50–69 years but that this effect was concentrated on relatively wealthy individuals and on relatively high incomes. Given that these individuals were not likely to rely on publicly funded LTC services, the net fiscal impact of the subsidies was negative: a saving of 84 cents per dollar—see also Bergquist et al. (2016), Courtemanche and He (2009), and Nixon (2014).

- Public-private partnerships. Most states in the USA have a LTC insurance partnership programme, an initiative that started in 1992. A partnership programme is a combination of private and publicly funded LTC insurance that allows policyholders to retain assets equivalent to the amount of the coverage; consequently, this policy does not target the cost of private insurance but its benefits (Lin and Prince 2013; Meiners 2009). Using data for people aged 65 or over between 2002 and 2010, Greenhalgh-Stanley (2014) reported mild effects on LTC purchase. Similarly, Lin and Prince (2016) reported meagre effects in their study of middle-income individuals of 50–69 years of age also between 2002 and 2010 but also found that both financial literacy and awareness of the programme were positively associated with increasing probability of LTC insurance purchase.
- Awareness campaigns. Whilst publicity around the existence of the schemes and policies is a necessary condition for the creation of demand for private LTC insurance products, its effectiveness may not be high (Iwasaki et al. 2010) and—at the risk of stating the obvious—it has to be of the 'right' sort: regarding the public-private partnerships, Bergquist et al. studied the reasons for the low uptake and purchase rates of LTC insurance and noted the extensive media coverage given to leading insurance firms pulling out of the LTC market, concluding:

> We cannot expect consumers to view Partnership-type public-private programmes any differently than traditional private LTCI unless government can reduce the inherent uncertainties about the future of LTC costs and risks.
>
> (Bergquist et al. 2016, p. 1782)

When universality is not in place—or when its boundary is redefined only to become applicable to certain subgroups of the population via means-testing and quasi-market development policies (Moberg 2017; Szebehely 2017)—service users face considerable out-of-pocket costs. The same happens if users do not accept the quality of the services that providers offer at the fees set by the public authorities and decide to spend extra money to receive services of higher quality. In all these cases private insurance products should blossom, but—as we said—they fail to, and the 'puzzle' remains.

What explanations have been given for the 'puzzling' evidence that despite the high costs of LTC and the non-negligible risk of requiring care services most people do not purchase private LTC insurance? The literature has identified a number of factors constricting private LTC insurance both from the demand and supply side of the market (Norton 2000; Pestieau and Ponthière 2012). Before briefly presenting them, it is important to take into consideration that these explanatory factors are listed in isolation from each other for presentation purposes but that:

> …multiple factors appear to limit demand, and there are substantial differences in which factors people consider the most important. Thus, a policy intervention that addresses only one market limitation, such as pricing, without addressing other concerns, such as counter-party risk, is unlikely to increase demand dramatically.
>
> (Brown et al. 2012, p. 1300)

Demand factors include:

- Limited rationality. LTC insurance covers for a low-probability event—usually, in years to come if at all—which may carry high costs. Other rare but high impact events include natural disasters such as hurricanes, floods, wildfires, earthquakes (Kunreuther 1996). The demand for LTC insurance is deemed to be low because individuals would suffer from cognitive myopia and would have difficulty with assessing the mathematical expectation of such events and, consequently, of the actual damage they would be insuring against. However, this conjecture has not been validated empirically: in fact, the evidence on expectations for nursing home placements seems to reflect the actual patterns and probabilities of use (Akamigbo and Wolinsky 2006; Holden et al. 1997; Lindrooth et al. 2000). Furthermore, a study found that most people aged 70 or over in the USA overestimated their likelihood of moving to a nursing home, contradicting the theoretical explanation of low demand for LTC insurance as a result of the systematic underestimation of the probability of developing care needs (Taylor et al. 2005).

  Nevertheless, a study based on behavioural economics—see Volume IV, Part III—and neuroeconomics (see Volume I, Chap. 1, and Sect. 4.2) has proposed a different set of explanations, based on the uncontroversial stylised facts that LTC decisions deal with losses of ambiguous probability that would occur far ahead in the future (Hsu et al. 2008). In Volume IV, Part III, we present behavioural economic principles and how they relate to the study of economics and ageing. Here we briefly touch upon some ideas used by economists to explain the reduced demand for LTC insurance among older people. When agents take decisions about losses or negative outcomes, they tend to exhibit risk-seeking behaviour instead of being risk averse (the mainstream assumption in microeconomics). Furthermore, losses are weighed more than gains: losing a given amount of money causes more disutility than the utility that chancing upon the same amount of money generates. Therefore, as Hsu et al. explain, a risk-seeking agent would reject a US$2500 premium for an insurance to cover her 25 per cent chance of needing LTC services that cost US$10,000—and would not find any insurance company willing to sell her a policy she finds acceptable. As with risk, many people exhibit ambiguity-seeking behaviour for losses instead of being ambiguity averse, as mainstream microeconomics assumes: economic agents seeking ambiguity in decisions involving losses would only be willing to pay less than actuarially fair for a LTC insurance, which offers coverage for an event with unknown probability. Finally, many agents discount the future following a hyperbolic or quasi-hyperbolic function—see Volume I, Chap. 8, and Volume IV, Chap. 9—rather than at an exponential rate, which is the usual assumption in microeconomics. Under hyperbolic discounting, the future (a future loss, in the case of LTC) is valued less than under exponential discounting, so an agent exhibiting this behaviour would only accept a premium below that which is actuarially fair. There would be certain structural changes in the brain associated with advancing chronological age which could be associated with behaviours closer to those proposed by behavioural economics than those assumed by mainstream microeconomics and decision theory.

- Denial of dependence. It may be seen as another instance of limited rationality, but some authors (particularly, in sociology, psychology, and psychoanalysis) have identified this response—which goes beyond the demand for LTC insurance and questions the conceptualisation of need and caregiving as well as the roles of caregivers—as, variously, a cultural trait (Van de Velde 2015), a gender-related characteristic (Bigo 2008; Chodorow 1978), or a psychic effect of neo-liberalism (Layton 2014).
- Quantity rationing. LTC insurance provides only limited coverage of expected expenditures associated with the provision of services than what consumers demand (i.e. they demand more comprehensive policies). Although it has been reported that, on average, policies only cover one-third of all LTC-related expenses (Pestieau and Ponthière 2012), quantity rationing does not seem to play a central role in restricting the demand (Brown and Finkelstein 2007).

- LTC experience. LTC insurance demand depends on previous experience: using data of people aged 50 or over in the USA between 1998 and 2006, Coe et al. (2015) found that having a parent or a parent-in-law who is or was a resident at a nursing home increased the probability of purchasing LTC insurance; in contrast, informal care use did not trigger the same response among adult children. Moreover, Tennyson and Yang (2014) reported that personal experience with giving care to a family member—either at the moment or previously—was positively associated with an intention to purchase LTC insurance. Other studies confirming these results are Finkelstein et al. (2012) and Gottlieb et al. (2009).
- Ignorance or poor numerical ability. In a study of residents in the USA aged 50 years or older in 2010, McGarry et al. (2016, 2017) found that numeracy skills were positively associated with the likelihood of holding a LTC insurance policy—similarly, see Chan and Elbel (2012) for the effects of numeracy on the demand for health insurance.
- Housing property. Another potential substitute for private LTC insurance is home equity (Stucki 2006), either because an older person who needs to be admitted to a nursing home can sell her house to fund the LTC services or because by means of financial products such as a reverse mortgage (Merlis 2005; Rasmussen et al. 1997), she can keep her property and obtain enough money to fund the services (Brown and Finkelstein 2009). Housing tenure, then, becomes a form of self-insurance against disability risk in later life: Heiss et al. (2005) conjectured that the low rates of property downsize among older people—far lower than what the life-cycle hypothesis predicts—could be explained by 'the conscious decision to keep the house as a form of insurance against catastrophic events' [p. 279], such as admission to a nursing home. Davidoff (2007, 2010) arrived to a similar conclusion on finding a negative relationship between the ratio of home equity to total wealth (i.e. the ratio between the market value of the home net of housing debt and total wealth) and the demand for LTC insurance in the USA: home equity would only be tapped into in case of LTC needs, suggesting that home equity would be crowding out LTC insurance among relatively wealthy older people (the relatively worse off would be covered by the public insurance scheme—i.e. Medicaid).
- Absence of a bequest motive. According to Pauly (1990), the low uptake of private LTC insurance among middle-class older people can be explained by an absence of a bequest motive and the fact that LTC insurance would cover primarily the older person's estate: in other words, it would protect bequests that the older person does not want whilst reducing consumption while she is alive.

- Rigidity of reimbursement rules. Reflecting upon the French case, Cremer et al. (2012) proposed that LTC insurance policies provide for payments as monthly lump-sums, based on the degree of dependency. Whilst the difficulty to perform daily activities can be objectively measured up to a certain extent (see above), the tasks involved in the caregiving activities the difficulty gives rise to are much more difficult to evaluate. Therefore, potential policyholders would risk receiving less money than what they might need to cover their care costs. Cremer et al. opine this may help explain the level of under-development of the private LTC market.
- Crowding out by publicly funded insurance or family informal caring. Publicly funded LTC and informal caregiving by family members may substitute private insurance (Norton 2000; Sloan and Norton 1997). However, this should have but a minimal effect, because of some form of means-testing in most welfare states. Nevertheless, individuals may expect that the government (as a Good Samaritan) or their families (trusting in either altruism or intra-family solidarity) will provide for their LTC needs in the future—more and more a misconception about the direction that LTC policy is heading to almost worldwide and given the demographic trends around family formation and fertility. Regardless of how accurate this expectation may turn out to be, if it is widespread and effectual, agents would not purchase private LTC insurance. In a study of 15 European countries, Costa-Font and Courbage (2015) reported that strong expectations about future family provision of informal care do substitute and consequently reduce the demand for private LTC insurance, whereas strong expectations about publicly funded care are complemented by the demand for private LTC insurance.

Among the supply factors, we can mention the following:

- Asymmetric information. Two problems originate in an asymmetry in the relevant information that consumers and suppliers hold. They are not exclusive to LTC insurance but apply to any type of insurance product (and other goods and services as well provided there is inequality in information among agents): adverse selection and moral hazard.[12]
  - **Adverse selection** is 'a negative bias in the quality of goods or services offered for exchange when variations in the quality of individual goods can be observed by only one side of the market' (Wilson 2008, p. 25). In the LTC insurance context, the relevant information about the 'quality' of the services corresponds to the degree of dependence that the prospective

policyholder (i.e. the prospective consumers of the care services) may exhibit and, consequently, the level and intensity of care services they may need. In case of adverse selection, what remains hidden is the information; the asymmetry takes place ex ante—that is, before the purchase of the insurance product.

The asymmetry in question reflects the fact that the prospective policyholders and their families know more about the difficulties they experience than the private insurance providers. As older people with higher risk would be charged more than those exposed to lower risk of incapacity, consumers in worse condition would have an incentive to conceal from the insurers that they are more likely to suffer from the contingency they need the insurance for. We mentioned in the first three chapters that older people exhibit great heterogeneity in various aspects—biological, financial, psychological, cognitive, and so on—and, as Norton (2000, p. 978) explains:

> Selection is more serious in marketing private insurance to elderly than nonelderly because the elderly are more heterogeneous in their risk and more likely to know something about their risk.

Observing or estimating this risk is costly for the insurers, therefore the tendency is to pool the risks and equalise premiums, which 'constitutes, in effect, a redistribution of income from those with a low propensity of illness to those with a high propensity' (Arrow 1963, p. 964). Given this asymmetry in information, a LTC insurance market may not even exist at all—Akerlof (1970) conjectured in relation to healthcare that 'the average medical condition of insurance applicants deteriorates as the price level rises—with the result that no insurance sales may take place at any price' [p. 492]. The same applies, in theory, to LTC. Insurers have tools at their disposal to reveal and obtain the information they may lack and hence redress the inequality vis-á-vis the prospective policyholders, including self-selection, lists of categories of risks, and multi-period contracts (Dionne and Doherty 1992).

There is some evidence suggestive of the presence of adverse selection in private LTC insurance. For example, using a high body mass index, high levels of alcohol consumption, and self-reported poor health status as proxy indicators of risk of disability, using data of people aged 50 years or over in France in 2007, Courbage and Roudaut (2008) found that the three indicators were significantly associated with the probability of purchasing private LTC insurance. However, James and Lahti (2006) failed to find any association between using data for people aged 72 years or over in the USA between 1995 and 2000.

– In Sect. 3.2, this volume, we defined 'moral hazard' as 'a mis-allocation of resources as a result of changes in incentives by insurance and other risk spreading products given some degree of discretionary power by the insured agent to influence the occurrence of the eventuality she is insured against'. In other words, there is moral hazard if, as a result of insuring against a loss, the agent acts in such a way that the probability of incurring in the loss increases. In case of moral hazard, what remains hidden are the actions; the asymmetry takes place ex post—that is, after the purchase of the insurance product. The mis-allocation in question refers to an excessive use of LTC services above optimal levels (i.e. the levels at which the marginal benefits and costs would be equalised). The policyholders' actions increase the risk—although it is unlikely that purchasing LTC insurance can reduce precautions to prevent the probability of needing care or induce reckless or risky behaviour that would increase such risk (which is known as ex ante moral hazard), as a consequence of moral hazard, the number of policyholders and the claims payments do multiply; besides, moral hazard is one of the main reasons for insurers to leave the LTC market (Cohen et al. 2013).[13]

  Pauly (1990) presented another view on the risk of moral hazard in LTC. We saw above that Pauly conjectured that the lack of a bequest motive may explain the low uptake of LTC insurance. This author also proposed that it would be rational for older people who prefer to live in their home for as long as possible rather than in an institution not to buy LTC insurance against the event of having to move to a nursing home as it would provide an incentive to her family to send her into a residential facility at the earliest signs of frailty or cognitive impairment, given that the insurance product would reduce the relative price of institutional care against informal or formal home-based and community-based care (Sloan and Norton 1997).

- Excessive transaction costs. As a result of the presence of adverse selection, LTC insurance tends to be overpriced for people with a low risk of needing care services, either because they hold private information about their lower probability or because they expect to demand informal services from family, friends, or neighbours should they develop any care needs. A key financial indicator in the insurance industry is the loss ratio, which in the context of LTC insurance can be defined as either the present value of expected future claims divided by the present value of future premiums or the accumulated value of past claims divided by the accumulated value of past premiums (Margus 2007). The higher the loss ratio, the greater are the claims in relation to the premiums. LTC insurance tends to have high and increasing loss ratios—for example, in the USA, average annual loss ratios have crept from 37 per cent in 1999 to 76 per cent in 2014 (Ameriks et al. 2016), as a consequence of steep selling costs. A loss ratio of 76 per cent means that the policyholders receive back, on average, 76 per cent of every unit of money spent on the premium (e.g. 76 cents for every dollar). The presence of adverse selection affects the loss ratio (Lee et al. 2015).

- Aggregate inter-temporal risk. LTC insurance shares with other insurance products (e.g. life insurance) a combination of two risks: a cross-sectional risk reflecting the fact that some individuals will have greater claims than others and an aggregate risk reflecting the fact the actuarial forecasts of events losses precision the farther in time the horizon lies—and compared to life insurance, life expectancy forecasts are more precise than forecasts of care needs. The second risk is 'aggregate' because it is common to all policyholders; therefore it cannot be diversified and insured against (pooling the idiosyncratic element of the risk is not possible), and given its significant variability and temporal autocorrelation, it constitutes a crucial determinant of the LTC market failure (Cutler 1993a).
- Imperfect competition and inefficient risk bearing. Given the presence of moral hazard, many countries have implemented strategies to influence the demand and the supply in the LTC markets with the objective of reducing inefficiency—Bakx et al. (2015) discussed some examples implemented in Germany, Belgium, Switzerland, and the Netherlands; see also Pestieau and Ponthière (2012).
- Dynamic problems with long-term contracting. Even if there is no information asymmetry when an individual purchases a LTC insurance policy, over time she may learn or obtain new information about the risk of developing care needs. Imagine that she learns she has a lower risk than she thought when she bought the policy. If the contract or scheme does not include any incentives or clauses so that the policyholder commits to the contract, the consumer will lapse or drop out of the contract in search for a cheaper deal. This is a source of reclassification risk because future premiums will rise as a consequence of the heightened average future risk of the remaining policyholders. In anticipation, insurers set pre-payments or front-loading of part of the premium—not the full premium because of financial or liquidity constraints that tend to preclude the payment of full premiums up-front.[14] The result would be the same, in theory, as in adverse selection: prices will

rise above actuarially fair levels and good, low risks will be pushed out of the market.

Finkelstein and McGarry (2005) found support for dynamic selection behind lapses of LTC insurance by older people in the USA, but could not rule out other explanations such ex post realisation that the purchase had been a mistake in the first place—see also Cramer and Jensen (2008)—and liquidity constraints following adverse wealth or income shocks. Regarding the latter, Konetzka and Luo (2011) found little evidence that changes in health status caused lapse or cancellation of LTC insurance policies between 1996 and 2006 in the USA; instead, the authors argued that financial constraints and disadvantage were the main factors behind lapsation behaviour: most older people who let their policies lapse were more likely to be on relatively low incomes, poorly educated, of an ethnic minority, and less healthy—see also Dorn et al. (2017). Moreover, Hou et al. (2015) and Li and Jensen (2012) added poor cognitive ability to liquidity constraints among the explanatory factors for LTC insurance policy lapses.

Seen from the insurer's perspective, lower than expected lapse rates imply that there will remain more policies in the portfolio than anticipated when they were priced. Because claim costs increase with the duration of a policy, this creates a wedge between costs and price (i.e. income). According to a report by the Office of Disability, Aging and Long-Term Care Policy of the government of the USA, errors in the prediction of lapse rates are one of the main factors behind insurers exiting the LTC market (Cohen et al. 2013).

7.4.1 Do LTC Subsidies Reduce Household Saving?

The introduction and expansion of social protection could reduce precautionary savings—if agents expect that the government will provide for them on a rainy day, they would not see the need to save to cope with adverse eventualities. Some studies found this negative effect on savings from unemployment insurance and health insurance. Costa-Font and Vilaplana-Prieto (2017) investigated the effect of the introduction of a universal subsidy to older people in need of LTC in 2007 in Spain (previously, the provision of LTC in Spain was means-tested), and found that it reduced the amount saved and the probability of saving among individuals under 75 years of age, especially on lower-middle incomes and without children. When the generosity of the scheme was reduced in 2013, the authors noted that household savings increased.

7.4.2 Do LTC Subsidies Reduce Informal Caregiving?

Ponthière (2013) developed a model in which the government introduces a subsidy to help older people in need because their children do not provide them with the informal care they need, as their children did not develop an altruist trait. The model, then, combines a subsidy with the social norms motivation for informal care. The altruistic behaviour towards older parents in need of care is transmitted earlier in the life cycles of both parents and children, from the former to the latter as part of the socialisation process. We start with the intergenerational transmission of altruist and introduce the subsidy later.

The model assumes two alternative socialisation technologies: the 'it's the family' technology, in which socialisation takes place exclusively inside the family and the parental effort alone is responsible for the transmission of the altruistic trait, and the 'it takes a village' technology, in which socialisation takes place partly outside the family and the parental effort combines with the share of the population that exhibits altruistic behaviour. Given that the results from both socialisation technologies are qualitatively similar, we will concentrate on the process inside the family. The model assumes two different levels of altruism: pure, complete altruism and no altruism (although the basic model can be easily extended by assuming different degrees of altruism). It also assumes that the child is the decision-maker and can be altruistic or not, depending on the outcomes of the socialisation process, whilst the father is assumed selfish. Using the same notation as above, we have the following utility functions for the child and the parent, respectively:

$$U^k(C_t^{k,i}) = U^{k,i}(C_t^{k,i}) + \beta_i.U^{p,i}(C_t^{p,i}) \text{ , for the child and}$$
$$U(C_t^{p,i}) = U^{p,i}(C_t^{p,i}) \text{ , for the parent} \tag{7.33}$$

where $i \in a, n$ stands for altruism or non-altruism and β denotes the degree of altruism, which is either equal to 0 (no altruism trait) or 1 (pure altruism). Consumption of an altruist parent is equal to $C_t^{p,a}$ and that of a selfish parent is $C_t^{p,n}$.

The intergenerational transmission of the altruism trait is a function of the parental effort alone (in the 'it's the family' model), $e_t^{p,i}$, which is costly to the parent as it generates a disutility δ that is assumed to reduce the parent's utility by:

$$\delta.\frac{\left(e_t^{p,i}\right)^2}{2}$$

The 'it's the family' model also assumes that the function between parental effort and the transmission of altruism to the child is simply:

$$p_{t+1}^{p,a} = e_t^{p,a} \text{ , for the altruist parent, and}$$
$$p_{t+1}^{p,n} = 1 - e_t^{p,n} \text{ , for the non-altruist parent}$$

However, not all the parents are altruistic, so not all the children are born to altruistic parents. Moreover, some children born to altruistic parents may not acquire the trait, despite the efforts of their parents. In contrast, non-altruistic, selfish parents, through their socialisation efforts, may reduce the probability that their children become selfish. So, apart from the probability that a child be exposed to a social norm transmission process, we also need to factor in the probability that the child actually becomes altruistic or not—which we denote by q_t and $1 - q_t$, respectively.

We consider the case of two periods. In period t the child is born with no innate trait regarding altruism or selfishness. In $t + 1$ she is either altruistic or selfish. The four possible options are:

- $p_{t+1}^{a,a} = p_{t+1}^{a} + (1 - p_{t+1}^{a}).q_t$ a child born to an altruistic parent acquires the altruism trait
- $p_{t+1}^{a,n} = (1 - p_{t+1}^{a}).(1 - q_t)$ a child born to an altruistic parent does not acquire the altruism trait
- $p_{t+1}^{n,a} = (1 - p_{t+1}^{n}).q_t$ a child born to a non-altruistic parent acquires the altruism trait
- $p_{t+1}^{n,n} = p_{t+1}^{n} + (1 - p_{t+1}^{n}).(1 - q_t)$ a child born to an non-altruistic parent does not acquire the altruism trait

Parental socialisation effort can be expressed thus:

$$e_t^{p,a} = (1 - q_t).\left[\frac{U^{p,a}(C_{t+1}^{p,a}) - U^{p,n}(C_{t+1}^{p,n})}{\delta}\right] \text{ , for an altruistic parent}$$
$$e_t^{p,n} = q_t.\left[\frac{U^{p,a}(C_{t+1}^{p,a}) - U^{p,n}(C_{t+1}^{p,n})}{\delta}\right] \text{ , for a non-altruistic parent} \tag{7.34}$$

Remember that the child is the decision-maker. An altruistic child faces the following optimisation problem:

$$\max U^{k,a}(C_t^{k,a}) + U^{p,a}(C_t^{p,a}) - \delta.\frac{(e_t^{p,a})^2}{2} + p_{t+1}^{a,a}.U^{p,a}(C_{t+1}^{p,a}) + p_{t+1}^{a,n}.U^{p,n}(C_{t+1}^{p,n}) \tag{7.35}$$

subject to the budget constraint $C_t^{k,a} + C_t^{p,a} \leq y$.

We construct the Lagrangian and maximise with respect to the child's and parent's consumption and obtain the first-order condition, which is the usual equality between marginal utilities:

$$\frac{\partial U^{k,a}}{\partial C_t^{k,a}} = \frac{\partial U^{p,a}}{\partial C_t^{p,a}} \tag{7.36}$$

In turn, a non-altruistic child faces this optimisation problem:

$$\max U^{k,n}(C_t^{k,n}) - \delta.\frac{(e_t^{p,n})^2}{2} + p_{t+1}^{n,a}.U^{p,a}(C_{t+1}^{p,a}) + p_{t+1}^{n,n}.U^{p,n}(C_{t+1}^{p,n}) \tag{7.37}$$

subject to the budget constraint $C_t^{k,n} + C_t^{p,n} \leq y$, with which we obtain these first-order conditions:

$$\begin{aligned} C_t^{k,n} &= y \\ C_t^{p,n} &= 0 \end{aligned} \tag{7.38}$$

that is, a non-altruistic child does not provide any care and support to her parent and consumes the entirety of her income.

The consumption of an altruist child is lower than that of a non-altruist child: $C^{k,a} < C^{k,n} = y$. In turn, the consumption level of an altruist parent is higher than that of a non-altruist parent: $C^{p,a} = \theta.y > C^{p,n}$, where $\theta > 0$ is a constant fraction of the income of an altruist parent.

Therefore, depending on whether their children acquire the altruist trait or not, their parents (i.e. older people) may end up with very different resources in later life—and this inequality depends on the proportion of altruistic people in the population. This is the first conclusion of the model, but Ponthière introduces a government that levies a lump-sum tax T on non-altruistic children and transfers all the funds to older people in need—that is, the parents of non-altruistic children—as a subsidy g. We have:

$$(1 - q_t).T = (1 - q_t).g \text{ that is, } T = g$$

Then a further assumption is introduced: that informal care by children is more productive than formal care funded by the government (the rationale being that given that informal caregiving are not subject to as a stricter legal, administrative, and organizational structure than formal care firms, they would exhibit higher quality and productivity (Jousten et al. 2005)). That's not the end of the assumptions: we also assume that each older person whose child is selfish benefits only from a fraction $0 < \mu < 1$ of the public subsidy she gets (i.e. $\mu.g$), not from all the transfer. What are the implications of the introduction of this subsidy? The socialisation efforts of, respectively, an altruistic and non-altruistic parent now become:

$$\begin{aligned} e_t^{p,a} &= (1 - q_t).\left[\frac{U^{p,a}(\theta.y) - U^{p,n}(\mu.g)}{\delta}\right] \text{, for an altruistic parent} \\ e_t^{p,n} &= q_t.\left[\frac{U^{p,a}(\theta.y) - U^{p,n}(\mu.g)}{\delta}\right] \text{, for a non-altruistic parent} \end{aligned} \tag{7.39}$$

If we compare the socialisation effort of an altruistic and a non-altruistic parent before and after the introduction of the subsidy—that is, if we compare Eqs. (7.34) and (7.39)—we can see that the socialisation efforts after the introduction of the subsidy are lower than what they were before the policy for both altruistic and non-altruistic parents. This is the second finding of the model. Furthermore, the higher the productivity of public formal care (i.e. the higher μ), the lower the parental socialisation efforts will be. This is a third finding. In theory, it is possible—depending on the individual preferences captured in the marginal utilities and the costs and transmission effectiveness of the social norm—that family altruism may disappear completely as a result of the public transfer.

Another element to take into consideration is the extent to which a subsidy may change the perception of the relationship between the caregiver and the user. We mentioned in Volume I, Chap. 8, that the notion of indirect reciprocity was used to study blood donations, intra-family relations, and volunteering as well. Titmuss (1970) observed, in the context of blood donations, that the introduction of private markets (and hence prices) into an activity hitherto based on altruistic, unpaid transfers, or exchanges reduced rather than encouraged the volume of that activity taking place—see also Arrow (1972), Mellström and Johannesson (2008), and Stewart (1992). Khalil (2004, p. 111) contended that a stipend is a symbol that 'indicates the negation of parental [or filial] love', which has a correlate in the finding reported by Gneezy and Rustichini (2000) that the introduction of a penalty distorted the nature and perception of a transaction: the introduction of a fine on parents who arrived late to collect their children at a day-care centre in Israel *increased* significantly the number—and therefore the proportion—of late coming parents. Gneezy and Rustichini conjectured that the fine removed the element of guilt or shame from the parents for arriving late and created, instead, a perception they had purchased the right to late arrival. Khalil appears to agree a monetary stipend changes how the caregiving relationship is subjectively defined, with a consequent reduction in the supply of informal caring—just as it happened with blood donations or, inversely, with late arrivals. However, Wilson (1993) surmised that if a monetary transfer is not tied specifically to the care service received, the older recipient may use it to reciprocate indirectly via a different cash transaction—for example, by giving an expensive Christmas gift or halving the cost of an electricity bill. Wilson suggested that care would then become an indirectly bought service, which would remove any feeling of guilt or obligation from the older person in need.

Review and Reflect

1. Discuss the following statement:

> *Economic difficulties may increase transfers under employment insurance; an improvement will bring a reduction in these transfers. These changes are not seen as a violation of equity. Likewise, if an increase in the income of old people results in a reduction in total benefits paid out by the federal old-age security program, this cannot be construed as an inequity.*
>
> *(Gauthier 2007, p. 297)*

2. Highly formalised economic models tend to seek optimisation of a nebulous variable termed 'utility' or 'felicity', which is operationalised in the empirical work in various ways. Reflect on the following excerpt from an article on human need and community care.

> *…the belief in the duty of good citizenship entails a further belief in the right not just to minimal levels of need satisfaction but to optimal levels as well, recognising that optimal levels may differ in proportion to unavoidable practical constraints imposed by different levels of national scarcity. As far as community care is concerned, this means specific types*

(continued)

of goods and services and as many of them as are necessary for individuals to achieve optimal levels of physical health and autonomy. It is the achievement of this aim that must be at the heart of good community care and organisation, and provision of and training for it …

Therefore governments that impute visions of good citizenship cannot then consistently argue for a minimal welfare state. It is contradictory to claim that citizens who for whatever reason cannot do their best should still do so. The continuation of this contradiction through the perpetuation of political policies that embody it reveals either lack of awareness or, more likely, irrational self-interest.

(Doyal 1997, p. 192)

Do you find any contradiction, as Doyal does, in the extension of the 'constrained optimisation' assumption to every agent in the context of long-term care or do you agree with the following statement by Samuelson?

the conversion of a problem whose economic context does not suggest any human, purposive, maximizing behavior into a maximum problem is to be regarded as merely a technical device for the purpose of quickly developing the properties of that equilibrium position.

(Samuelson 1947, p. 53)

3. Consider the following recommendation:

In focusing on the utility of bequests, some economists rely on the principle of rational self-interest to explain filial support to older parents. Sociologists, on the other hand, traditionally stress the importance of norms and sentiment in motivating support. We suggest that both perspectives need to be taken into account when examining intergenerational transfers of support by gender.

(Silverstein et al. 1995, p. 474)

Discuss economic approaches to LTC based on social norms and other motivations than self-interest and their empirical relevance. Can they be both articulated as part of a wider 'rational perspective? Can you highlight any examples in the chapter?

4. Discuss the following assertions in the context of economic models of supply for long-term care:

For positive analysis, whether we attribute differences in behavior to unobserved differences in household technology rather than to unobserved differences in tastes is mere semantics. For welfare analysis, however, whether we attribute differences in behavior to differences in technology rather than to differences in tastes can alter conclusions about whether a policy change increases or decreases welfare.

(Pollak 2003, p. 116)

(continued)

5. Comment on the following conclusion in a textbook on insurance economics:

   The increase in remaining life expectancy strengthens the demand for insurance coverage in general. However, private insurance is confronted with exacerbated problems of asymmetric information, while social insurance may be unable to honor its commitments. This makes it impossible to predict the effect on the future division of labor between private and social insurance.

   (Zweifel and Eisen 2012, p. 418)

   Why would information inequality between insurers and potential policyholders increase with longer life expectancy? Why would the public sector be unable to honour its social insurance commitments?
6. Discuss the following point:

   …conventional economic accounts of moral hazard exaggerate the incentive effects of real-world insurance and, at the same time, underestimate the social benefits of insurance. As a result, the economics of moral hazard systematically -and wrongly- undervalue efforts to protect the injured, the sick, and the poor, and absolve the more fortunate of their responsibility for that situation.

   (Baker 1996, p. 240)

7. In a study on the factors behind the decision by insurers to exit the LTC insurance market in the USA, the following historical overview is included, which highlights the interplay between locus of care and changes in the definition of the insured risk in the context of moral hazard:

   As agents and brokers came to play a larger role in the LTC product development process, it was clear that for the coverage to sell, it needed to pay for custodial services where people desired them most -in their own homes. This presented a dilemma for insurers because the primary risk management tool for managing claims was based on policyholder behavior: no policyholder really wanted to go into a nursing home, and this served as a brake on potential moral hazard and over-utilization of services. If policies began covering services in settings that people desired, like the home, this "brake" on moral hazard would disappear with the potential for making the underlying economics of the product unsustainable.

   It became clear that in order for the market to grow, the product would have to cover home and community-based services in a manner that enabled insurers to effectively manage what were viewed to be the primary risks of the product: adverse selection and moral hazard. This was accomplished in part by changing the basis on which benefits were paid from a medical necessity model to a functional and cognitive impairment model. There had been a growing realization, encouraged by professionals with geriatric experience who entered the industry or

(continued)

> *consulted with it, that measures of functional abilities were most closely related to the need for covered services -including home care.*
>
> *(Cohen et al. 2013, pp. 12–13)*

Why were insurance companies reluctant to offer policies 'covering services in settings that people desired' when the basis for the policies was medical necessity?

Why would basing the insurance products on measures 'more closely related to the need for covered services' reduce the moral hazard risk?

8. Comment on the following assertion:

> *…a public program for long-term care offering front-end coverage would suffer from an assuredly more acute moral hazard problem in light of the broad utility of long-term care services.*
>
> *(Kyle 2013, p. 125)*

Notes

1. That is, when modelling upstream transfers, as in this case. Of course, in the case of downstream transfers, one-sided models of altruism assume that the child is altruistic and the parent is selfish.
2. See Laferrère and Wolff (2006) for a good introduction.
3. This is the 'egocentric' view of altruism, according to Khalil (2004).
4. See Volume I, Chap. 8.
5. This is the 'egoistic' view of altruism, according to Khalil (2004).
6. Neither the law specifies how frequent is 'frequently' (Wu et al. 2017).
7. See Serrano et al. (2017) for a comparison of filial responsibility laws in Bangladesh, China, India, and Singapore.
8. We follow the presentation in Norton (2000).
9. Spanish Act 39/2006 on the Promotion of Personal Autonomy and Care for People in Dependency Situations. Available in Spanish on https://www.boe.es/buscar/pdf/2006/BOE-A-2006-21990-consolidado.pdf.
10. Funding source, which is closely related to income, is not the only barrier to access: for the USA, for example, there is ample empirical evidence that ethnicity has significant explanatory power for the differentials in access to LTC services independently from income—see Cai and Temkin-Greener (2015), Falcone and Broyles (1994), and Thomeer et al. (2014).
11. See Costa-Font (2011) for a discussion of the different schemes in Europe.
12. The literature on insurance economics is, needless to say, vast. A good introduction is Zweifel and Eisen (2012, ch. 7).
13. The epithet 'moral' in 'moral hazard' has nothing to do with ethics or moral philosophy. Economists view moral hazard a characteristic of the contracts

and arrangements, not of the agents who sign the contracts or enter the arrangements (Baker 1996).

14. For a theoretical model presenting the need to front-load premiums as a result of lack of consumers' commitment—though in the context of life insurance, see Hendel and Lizzeri (2003).

References

Aanesen, Margrethe, Ann Therese Lotherington, and Frank Olsen. "Smarter elder care? A cost-effectiveness analysis of implementing technology in elder care." *Health Informatics Journal* 17, no. 3 (2011): 161–172.

Afsa, Cedric, and Sophie Buffeteau. Model 7: DESTINIE ("Modèle Démographique Economique et Social de Trajectoires Individuelles Simulées, i.e. Demographic, Economic and Social Model of Simulated Individual Trajectories"). In *Modelling Our Future: Population Ageing Health and Aged Care*. Edited by Anil Gupta and Ann Harding, 467–470. International Symposia in Economics. Amsterdam: Elsevier, 2007.

Agree, Emily M, and Vicki A Freedman. "Incorporating assistive devices into community- based long-term care: An analysis of the potential for substitution and supplementation." *Journal of Aging and Health* 12, no. 3 (2000): 426–450.

Agree, Emily M. et al. "Reconsidering substitution in long-term care: When does assistive technology take the place of personal care?" *The Journals of Gerontology: Series B* 60, no. 5 (2005): S272–S280.

Akamigbo, Adaeze B, and Frederic D Wolinsky. "Reported expectations for nursing home placement among older adults and their role as risk factors for nursing home admissions." *The Gerontologist* 46, no. 4 (2006): 464–473.

Akerlof, George A. "The market for "lemons": Quality uncertainty and the market mechanism." *The Quarterly Journal of Economics* 84, no. 3 (1970): 488–500.

Alessie, Rob, Viola Angelini, and Giacomo Pasini. Is it true love? Altruism versus exchange in time and money transfers. *De Economist* 162, no. 2 (2014): 193–213.

Ameriks, John, et al. *The State of Long-Term Care Insurance: The Market, Challenges and Future Innovations* CIPR Study Series 2016 - 1. Kansas City, MO, 2016.

Andersen, Ronald, and John F Newman. "Societal and individual determinants of medical care utilization in the United States." In *The Milbank Memorial Fund Quarterly Health and Society*, 95–124. New York: Wiley, 1973.

Anderson, Bridget, and Isabel Shutes. *Migration and Care Labour: Theory Policy and Politics*. Basingstoke: Palgrave Macmillan, 2014.

Ansah, John P, et al. "Modeling to inform long-term care policy and planning for an aging society." In *Innovative Healthcare Systems for the 21st Century*. Edited by Hassan Qudrat-Ullah and Peter Tsasis, 183–224. Berlin: Springer International Publishing, 2017.

Antonucci, Toni C, and James S Jackson. "The role of reciprocity in social support." In *Social Support: An Interactional View*. Edited by Barbara Sarason and Pierce Gregory, 173–198. New York, NY: Wiley, 1990.

Applebaum, Robert, Anthony Bardo, and Emily Robbins. "International approaches to long-term services and supports." *Generations* 37, no. 1 (2013): 59–65.

Arnault, Louis, and Andreas Goltz. Can formal home care reduce the burden of informal care for elderly dependents? Evidence from France. *HAL ID: hal-01458362*, 2017.

Arntz, Melanie, and Stephan L Thomsen. "Crowding out informal care? Evidence from a field experiment in Germany." *Oxford Bulletin of Economics and Statistics* 73, no. 3 (2011): 398–427,

Arrondel, Luc, and André Masson. "Altruism, exchange or indirect reciprocity: What do the data on family transfers show?" In *Handbook of the Economics of Giving Altruism and Reciprocity*. Edited by Serge-Christophe Kolm and Jean Mercier Ythier. Handbooks in Economics, vol. 2, 971–1053. Amsterdam: North Holland Elsevier, 2006.

Arrow, Kenneth J. "Uncertainty and the welfare economics of medical care." *American Economic Review* 13, no. 5 (1963): 941–973.

Arrow, Kenneth J. "Gifts and exchanges." *Philosophy & Public Affairs* 1 (1972): 343–362.

Atanackovic, Jelena, and Ivy Lynn Bourgeault. "The employment and recruitment of immigrant care workers in Canada." *Canadian Public Policy* 39, no. 2 (2013): 335–350.

Baker, Tom. "On the genealogy of moral hazard." *Texas Law Review* 75, no. 2 (1996): 237–292.

Bakx, Pieter, et al. "Demand-side strategies to deal with moral hazard in public insurance for long-term care." *Journal of Health Services Research & Policy* 20, no. 3 (2015): 170–176.

Barrett, Patrick, Beatrice Hale, and Mary Butler. *Family Care and Social Capital: Transitions in Informal Care*. Dordrecht: Springer Netherlands, 2014.

Bates, Laurie J, and Rexford E Santerre. "Does the US health care sector suffer from Baumol's cost disease? Evidence from the 50 states." *Journal of Health Economics* 32, no. 2 (2013): 386–391.

Bauer, Gudrun, and August Österle. "Mid and later life care work migration: Patterns of re-organising informal care obligations in Central and Eastern Europe." *Journal of Aging Studies* 37 (2016): 81–93.

Bauer, Jan Michael, and Alfonso Sousa-Poza. "Impacts of informal caregiving on caregiver employment, health, and family." *Journal of Population Ageing* 8, no. 3 (2015): 113–45.

Baumol, William J. "Macroeconomics of unbalanced growth: the anatomy of urban crisis." *The American Economic Review* 57, no. 3 (1967): 415–426.

Baumol, William J. et al. "Health care, education and the cost disease: A looming crisis for public choice." *Public Choice* 77, no. 1 (1993): 17–28.

Baxter, Kate, Caroline Glendinning, and Ian Greener. "The implications of personal budgets for the home care market." *Public Money & Management* 31, no. 2 (2011): 91–98.

Becker, Gary S. "A theory of social interactions." *Journal of Political Economy* 82, no. 6 (1974): 1063–1093.

Becker, Gary S. *A Treatise on the Family Enlarged Edition*. Cambridge, MA: Harvard University Press, 1993.

Ben-Ner, Avner Pinar Karaca-Mandic, and Ting Ren. "Ownership and quality in markets with asymmetric information: Evidence from nursing homes." *The BE Journal of Economic Analysis & Policy* 12, no. 1 (2012): 1–33.

Berecki-Gisolf, Janneke et al. "Transitions into informal caregiving and out of paid employment of women in their 50s." *Social Science & Medicine* 67, no. 1 (2008): 122–127.

Bergquist, Savannah, Joan Costa-Font, and Katherine Swartz. "Partnership program for long-term care insurance: The right model for addressing uncertainties with the future?" *Ageing & Society* 36, no. 9 (2016): 1779–1793.

Bergstrom, Theodore C. 2008. "Rotten kid theorem." In *The New Palgrave Dictionary of Economics Volume 7*. Edited by Steven N Durlauf and Lawrence E Blume. 2nd ed., 247–248. Basingstoke: Palgrave Macmillan.

Bernheim, B Douglas, Andrei Shleifer, and Lawrence H Summers. "The strategic bequest motive." *The Journal of Political Economy* 93, no. 6 (1985): 1045–1076.

Bigo, Vinca. "Explaining modern economics (as a microcosm of society)." *Cambridge Journal of Economics* 32, no. 4 (2008): 527–554.

Birditt, Kira S, and Karen L Fingerman. "Parent-child and intergenerational relationships in adulthood." In *Handbook of Family Theories: A Content-Based Approach*. Edited by Mark A. Fine and Frank D. Fincham, 71–86. New York, NY: Routledge, 2013.

Bittman, Michael, Trish Hill, and Cathy Thomson. "The impact of caring on informal carers' employment, income and earnings: A longitudinal approach." *Australian Journal of Social Issues* 42, no. 2 (2007), 255–272.

Blieszner, Rosemary, and Raeann R Hamon. "Filial responsibility: Attitudes, motivators, and behaviors." In *Gender Families, and Elder Care*. Edited by Jeffrey W Dwyer and Raymond T Coward, vol. 138, 105–119. Sage focus editions. Thousand Oaks, CA: Sage Publications, 1992.

Bolin, Kristian, Bjorn Lindgren, and Petter Lundborg. "Informal and formal care among single-living elderly in Europe." *Health Economics* 17, no. 3 (2008a): 393–409.

Bolle, Friedel. "On love and altruism." *Rationality and Society* 3, no. 2 (1991): 197–214.

Bravo, J., R. Hervás, and M. Rodriguez. *Ambient Assisted Living and Home Care: 4th International Workshop, IWAAL 2012, Vitoria-Gasteiz, December 3–5, 2012, Proceedings*. Lecture Notes in Computer Science. Berlin: Springer, 2012.

Bremer, Patrick et al. "Informal and formal care: Substitutes or complements in care for people with dementia? Empirical evidence for 8 European countries." *Health Policy* 121, no. 6 (2017): 613–622.

Brodski, Jenny, and A Mark Clarfield. "Long term care in health services." In: *Health Systems Policy Finance and Organization*. Edited by Guy Carrin et al., 352–357. Amsterdam: Elsevier Science, 2010.

Brown, Jeffrey R, and Amy Finkelstein. "Why is the market for long-term care insurance so small?" *Journal of Public Economics* 91, no. 10 (2007): 1967–1991.

———. "The private market for long-term care insurance in the United States: A review of the evidence." *Journal of Risk and Insurance* 76, no. 1 (2009): 5–29.

Brown, Jeffrey R, Gopi Shah Goda, and Kathleen McGarry. "Long-term care insurance demand limited by beliefs about needs, concerns about insurers, and care available from family." *Health Affairs* 31, no. 6 (2012): 1294–1302.

Bryan, Mark L. "Access to flexible working and informal care." *Scottish Journal of Political Economy* 59, no. 4 (2012): 361–389.

Buffeteau, Sophie et al. Le modèle de microsimulation Destinie 2: principales caractéristiques et premiers résultats. *Économie et statistique* 441, no. 1 (2011): 101–121.

Cai, Xueya, and Helena Temkin-Greener. Nursing home admissions among Medicaid HCBS enrollees: Evidence of racial/ethnic disparities or differences? *Medical Care* 53, no. 7 (2015): 566–573.

Cantor, Marjorie H. Neighbors and friends: An overlooked resource in the informal support system. *Research on Aging* 1, no. 4 (1979): 434–463.

Caputo, Jennifer Eliza K Pavalko, and Melissa A Hardy. "The long-term effects of caregiving on women's health and mortality." *Journal of Marriage and Family* 78, no. 5 (2016): 1382–1398.

Carmichael, Fiona, and Sue Charles. The labour market costs of community care. *Journal of Health Economics* 17, no. 6 (1998): 747–765.

Carmichael, Fiona, Susan Charles, and Claire Hulme. "Who will care? Employment participation and willingness to supply informal care." *Journal of Health Economics* 29, no. 1 (2010): 182–190.

Carr, Ewan et al. "The association between informal caregiving and exit from employment among older workers: Prospective findings from the UK household longitudinal study." *Journals of Gerontology Series B: Psychological Sciences and Social Sciences*, 2016. https://doi.org/10.1093/geronb/gbw156

Casado-Marn, David, Pilar García-Gómez, and Ángel López-Nicolás. "Informal care and labour force participation among middle-aged women in Spain." In *SERIEs* 2.1, 1–29, 2011.

Chan, Sewin, and Brian Elbel. "Low cognitive ability and poor skill with numbers may prevent many from enrolling in Medicare supplemental coverage." *Health Affairs* 31, no. 8 (2012): 1847–1854.

Chappell, Neena, and Audrey Blandford. "Informal and formal care: Exploring the complementarity." *Ageing & Society* 11, no. 3 (1991): 299–317.

Charles, Kerwin Kofi, and Purvi Sevak. "Can family caregiving substitute for nursing home care?" *Journal of Health Economics* 24, no. 6 (2005): 1174–1190.

Cherlin, Andrew et al. "The effects of the great recession on family structure and fertility." *The Annals of the American Academy of Political and Social Science* 650, no. 1 (2013): 214–231.

Ching, Andrew T Fumiko Hayashi, and Hui Wang. "Quantifying the impacts of limited supply: The case of nursing homes." *International Economic Review* 56, no. 4 (2015): 1291–1322.

Chodorow, Nancy. *The Reproduction of Mothering*. Berkeley, CA: University of California Press, 1978.

Chou, Shin-Yi. "Asymmetric information, ownership and quality of care: An empirical analysis of nursing homes." *Journal of Health Economics* 21, no. 2 (2002): 293–311.

Christianson, Jon B. "The evaluation of the National Long Term Care Demonstration. 6. The effect of channeling on informal caregiving." *Health Services Research* 23, no. 1 (1988): 99–117.

Ciani, Emanuele. "Informal adult care and caregivers' employment in Europe." *Labour Economics* 19, no. 2 (2012): 155–164.

CMS. *Design for Nursing Home Compare Five-Star Quality Rating System: Technical Users' Guide* Technical report. Baltimore, MD, 2017.

Coe, Norma B, Meghan M Skira, and Courtney Harold Van Houtven. "Long-term care insurance: Does experience matter?" *Journal of Health Economics* 40 (2015): 122–131.

Cohen, Carole A, Angela Colantonio, and Lee Vernich. "Positive aspects of caregiving: Rounding out the caregiver experience." *International Journal of Geriatric Psychiatry* 17, no. 2 (2002): 184–188.

Cohen, Marc A, Ramandeep Kaur, and Bob Darnell. *Exiting the market: Understanding the Factors behind Carriers' Decision to Leave the Long-Term Care Insurance Market* Technical Report. Washington, DC, 2013.

Colombier, Carsten. "Drivers of health-care expenditure: What role does Baumol's cost disease play?" *Social Science Quarterly* (2017a). https://doi.org/10.1111/ssqu.12384

Comondore, Vikram R et al. "Quality of care in for-profit and not-for-profit nursing homes: systematic review and meta-analysis." *British Medical Journal* 339 (2009). https://doi.org/10.1136/bmj.b2732

Corchado, Juan M, Javier Bajo, and Ajith Abraham. "GerAmi: Improving healthcare delivery in geriatric residences." *IEEE Intelligent Systems* 23, no. 2 (2008): 19–25.

Costa-Font, Joan. *Reforming Long-term Care in Europe*. Chichester: Wiley, 2011.

Costa-Font, Joan, and Christophe Courbage. "Crowding out of long-term care insurance: Evidence from European expectations data." *Health Economics* 24, no. S1 (2015): 74–88.

Costa-Font, Joan, and Cristina Vilaplana-Prieto. Does the expansion of public long-term care funding affect saving behaviour? *Fiscal Studies* 38, no. 3 (2017): 417–443.

Costa-Font, Joan, Martin Karlsson, and Henning Øien. *Informal care and the great recession* CEP Discussion Paper 1360. London: Centre for Economic Performance London School of Economics and Political Science, 2015.

Costa-Font, Joan, Christophe Courbage, and Peter Zweifel. "Policy dilemmas in financing long-term care in Europe." *Global Policy* 8, no. S2 (2017): 38–45.

Costa-Font, Joan, Edward C Norton, and Luigi Siciliani. "The Challenges of public financing and organisation of long-term care." *Fiscal Studies* 38, no. 3 (2017): 365–368.

Courbage, Christophe, and Nolwenn Roudaut. "Empirical evidence on long-term care insurance purchase in France." *The Geneva Papers on Risk and Insurance Issues and Practice* 33, no. 4 (2008): 645–658.

Courtemanche, Charles, and Daifeng He. "Tax incentives and the decision to purchase long-term care insurance." *Journal of Public Economics* 93, no. 1 (2009): 296–310.

Cox, Donald. "Motives for private income transfers." *Journal of Political Economy* 95, no. 3 (1987): 508–546.

Cox, and Soldo. *Motives for Care that Adult Children Provide to Parents: Evidence from" Point Blank" Survey Questions* 44, no. 4 (2013). *The Nexus of Informal and Formal Care for Older Adults* .

Cox, Donald, and Oded Stark. Intergenerational transfers and the demonstration effect. In 329, 1994. https://ideas.repec.org/p/boc/bocoec/329.html

———. "On the demand for grandchildren: Tied transfers and the demonstration effect." *Journal of Public Economics* 89, no. 9 (2005): 1665–1697.

CQC. *How CQC monitors, inspects and regulates adult social care services* Technical report. London, 2017.

Cramer, Anne Theisen and Gail A Jensen. "Why do people change their minds? evidence from the purchase of long-term care insurance." In *Psychology of Decision Making in Economics, Business and Finance*. Edited by Klaus P Hofmann, 179–193. Hauppauge, NY: Nova Science Publishers, 2008.

Cremer, Helmuth, Pierre Pestieau, and Grégory Ponthière. "The economics of long-term care: A survey." *Nordic Economic Policy Review* 2 (2012): 107–148.

Crespo, Laura, and Pedro Mira. "Caregiving to elderly parents and employment status of European mature women." *Review of Economics and Statistics* 96, no. 4 (2014): 693–709.

Crivelli, Luca, Massimo Filippini, and Diego Lunati. "Regulation, ownership and efficiency in the Swiss nursing home industry." *International Journal of Health Care Finance and Economics* 2, no. 2 (2002): 79–97.

Cutler, David M. *Why doesn't the market fully insure long-term care?* Working Paper 4301. Cambridge, MA: National Bureau of Economic Research, 1993a.

Daly, Mary, and Jane Lewis. "The concept of social care and the analysis of contemporary welfare states." *The British Journal of Sociology* 51, no. 2 (2000): 281–298.

Da Roit, Barbara, and Marianne Bochove. "Migrant care work going Dutch? The emergence of a live-in migrant care market and the restructuring of the Dutch long-term care system." *Social Policy & Administration* 51, no. 1 (2017): 76–94.

Davidoff, Thomas. *Illiquid Housing as Self-Insurance: The Case of Long Term Care* Fisher Center Working Paper Berkeley CA, 2007.

———. "Home equity commitment and long-term care insurance demand." *Journal of Public Economics* 94, no. 1 (2010): 44–49.

Del Boca, Daniela, and Alessandra Venturini. Migration in Italy is backing the old age welfare. In *Labor Migration, EU Enlargement, and the Great Recession*. Edited by Martin Ka- hanec and Klaus F Zimmermann, 59–83. Berlin: Springer, 2016.

Dionne, Georges, and Neil Doherty. "Adverse selection in insurance markets: A selective survey." In *Contributions to Insurance Economics*, Edited by Georges Dionne, vol. 13, 97–140. Huebner International Series on Risk, Insurance and Economic Security New York, NY: Springer, 1992.

Doebler, Stefanie et al. "Informal care-giving and mental ill-health differential relationships by workload, gender age and area-remoteness in a UK region." *Health & Social Care in the Community* 25, no. 3 (2017): 987–999.

Donabedian, Avedis. Quality assessment and monitoring: Retrospect and prospect. *Evaluation & the Health Professions* 6, no. 3 (1983): 363–375.

Dorn, Mary E et al. "Understanding the determinants of a long-term care insurance purchase." *Journal of Financial Planning* 30, no. 11 (2017): 38–46.

Doty, Pamela. "Family care of the elderly: The role of public policy." *The Milbank Quarterly* 64 (1986): 34–75.

Doyal, Len. "Human need and the moral right to optimal community care." In *Community Care: A Reader*. Edited by J. Bornat et al. 2nd. ed., 185–195. Basingstoke, Macmillan Press, 1997.

Du, Juan. "Formal and informal care: An empirical Bayesian analysis using the two-part model." *Forum for Health Economics and Policy* 15, no. 2 (2012): 1–42.

Economic, Directorate-General for Financial Affairs, and the Economic Policy Committee (2017). *The 2018 Ageing Report. Underlying Assumptions & Projection Methodologies* Institutional Paper 065. Luxembourg: Luxembourg: European Commission.

Edelbrock, Dorothy et al. "The relation between unpaid support and the use of formal health services: The Sydney older persons study." *Australasian Journal on Ageing* 22, no. 1 (2003): 2–8.

Ehing, Daniel, Christian Hagist, and Tobias Saal. "Pflegeverläufe im Spiegel von Routine- daten der GKV: Eine Analyse für die Jahre 2003 bis 2010." *Zeitschrift für die gesamte Versicherungswissenschaft* 104, no. 2 (2015): 179–210.

Eika, Kari H. "The challenge of obtaining quality care: Limited consumer sovereignty in human services." *Feminist Economics* 15, no. 1 (2009): 113–137.

Esping-Andersen, Gøsta. *The Three Worlds of Welfare Capitalism*. Cambridge: Polity Press, 1990.

———. *Social Foundations of Postindustrial Economies*. Oxford: Oxford University Press, 2003.

Evashwick, Connie, ed. *The Continuum of Long-Term Care*. Delmar Series in Health Services Administration. Clifton Park, NY: Cengage Learning, 2005.

Falcone, David, and Robert Broyles. "Access to long-term care: Race as a barrier." *Journal of Health Politics, Policy and Law* 19, no. 3 (1994): 583–595.

Fehr, Beverley, and Susan Sprecher. "Compassionate love: Conceptual, measurement, and relational issues." In *The Science of Compassionate Love: Theory Research, and Applications*. Edited by Beverley Fehr Susan Sprecher, and Lynn G., 27–52. Underwood. Chichester: Wiley-Blackwell, 2009.

Fevang, Elisabeth, Snorre Kverndokk, and Knut Røed. *Informal care and labor supply* IZA Discussion Paper 3717, Bonn, 2008.

Finkelstein, Amy, and Kathleen McGarry. "Dynamic inefficiencies in insurance markets: Evidence from long-term care insurance." *The American Economic Review* 95, no. 2 (2005): 224–228.

Finkelstein, Emily S et al. "Are baby boomers who care for their older parents planning for their own future long-term care needs?" *Journal of Aging and Social Policy* 24, no. 1 (2012): 29–45.

Ford, Michele, and Kumiko Kawashima. "Temporary labour migration and care work: The Japanese experience." *Journal of Industrial Relations* 55, no. 3 (2013): 430–444.

Forder, Julien. "Contracts and purchaser-provider relationships in community care." *Journal of Health Economics* 16 (1997): 517–542.

Forma, Leena et al. "Long-term care is increasingly concentrated in the last years of life: A change from 2000 to 2011." *European Journal of Public Health* 27, no. 4 (2017): 665–669.

Fraile, Juan A et al. "Applying wearable solutions in dependent environments." *IEEE Transactions on Information Technology in Biomedicine* 14, no. 6 (2010): 1459–1467.

Frank, Richard G. "Long-term care financing in the United States: Sources and institutions." *Applied Economic Perspectives and Policy* 34, no. 2 (2012): 333–345.

Fukahori, Ryotaro, Tadashi Sakai, and Kazuma Sato. "The effects of incidence of care needs in households on employment, subjective health, and life satisfaction among middle- aged family members." *Scottish Journal of Political Economy* 62, no. 5 (2015): 518–545.

Funk, Lura M. "Returning the love', not 'balancing the books': Talk about delayed reciprocity in supporting ageing parents." *Ageing and Society* 32, no. 4 (2012): 634–654.

Furubotn, Eirik G, and Rudolf Richter. *Institutions and Economic Theory: The Contribution of the New Institutional Economics*. Economics, Cognition, and Society Ann Harbor MI: University of Michigan Press, 2005.

Gameren, Edwin van, and Durfari Velandia Naranjo. "Working and caring: The simultaneous decision of labor force participation and informal elderly and child support activities in Mexico. *Latin American Journal of Economics* 52 (2015): 117–148.

Gauthier, Hervé. "Social Spending: Recent changes and conditions for its long-term viability." In *Ages, Generations and the Social Contract: The Demographic Challenges Facing the Welfare State*, 279–299. Springer Dordrecht: Dordrecht, 2007.

Geerlings, Sandra W et al. "Predicting transitions in the use of informal and professional care by older adults." *Ageing and Society* 25, no. 1 (2005): 111–130.

Geerts, Joanna, and Karel Van den Bosch. "Transitions in formal and informal care utilisation amongst older Europeans: The impact of national contexts." *European Journal of Ageing* 9, no. 1 (2012): 27–37.

Gentili, Elena, Giuliano Masiero, and Fabrizio Mazzonna. 2017. The role of culture in long- term care arrangement decisions. *Journal of Economic Behavior and Organization* 143: 186–200.

Geurts, Teun, Anne-Rigt Poortman, and Theo G Van Tilburg. 2012. Older parents providing child care for adult children: Does it pay off? *Journal of Marriage and Family* 74 (2): 239–250.

Giménez, José Ignacio, Miriam Marcén, and José Alberto Molina. *How does the presence of children affect dependent care? A psycho-economic approach* IZA Discussion Paper 2726, Bonn, 2007.

Gneezy, Uri, and Aldo Rustichini. "A fine is a price." *The Journal of Legal Studies* 29, no. 1 (2000): 1–17.

Goda, Gopi Shah. "The impact of state tax subsidies for private long-term care insurance on coverage and Medicaid expenditures." *Journal of Public Economics* 95, no. 7 (2011): 744–757.

Gómez, M Victoria, and Patricia Barbadillo. "Attempts to de-familiarise care: The Spanish dependency law." *Family Science* 6, no. 1 (2015): 338–345.

Gonçalves, Judite, and France Weaver. "Effects of formal home care on hospitalizations and doctor visits." *International Journal of Health Economics and Management* 17, no. 2 (2017): 203–233.

Gottlieb, Alison S, Kimberly J Stoeckel, and Francis G Caro. "Residential adjustment of elders: Learning from experiences with parents and peers." *Journal of Housing for the Elderly* 23, no. 3 (2009): 149–165.

Gouldner, Alvin W. The norm of reciprocity: A preliminary statement. *American Sociological Review* 25 (1960): 161–178.

Grabowski, David C, David G Stevenson, and Portia Y Cornell. "Assisted living expansion and the market for nursing home care." *Health Services Research* 47, no. 6 (2012): 2296–2315.

Gray, Matthew, and Jody Hughes. "Caring for children and adults: Differential access to family-friendly work." *Family Matters* 70 (2005): 18.

Graybill, Erin M, Peter McMeekin, and John Wildman. "Can aging in place be cost effective? A systematic review." *PloS One* 9, no. 7 (2014). https://doi.org/doi.org/10.1371/journal.pone.0102705

Greene, Vernon L. "Substitution between formally and informally provided care for the impaired elderly in the community." *Medical Care* 21, no. 6 (1983): 609–619.

Greenhalgh-Stanley, N. “Can the government incentivize the purchase of private long-term care insurance? Evidence from the Partnership for Long-Term Care”. *Applied Economics Letters* 21, no. 8 (2014): 541–544.

Guillemar, Anne-Marie. “The decline of the social status? Evolution of the welfare state for the elderly in Europe: The past situation and future prospects.” In *The Economics of Care of the Elderly*. Edited by Jozef Pacolet and Celeste Wilderom, 166–190. Surrey: Avebury Academic Publishing Group, 1991.

Gupta, Anil, and Ann Harding, ed. *Modelling Our Future: Population Ageing Health and Aged Care*. International Symposia in Economics. Amsterdam: Elsevier, 2007.

Häcker, Jasmin, and Tobias Hackmann. “Lost in long-term care: Empirical evidence from German data 2000–2009.” *Health Economics* 21, no. 12 (2012): 1427–1443

Hancock, Ruth et al. *Paying for Long-Term Care for Older People in the UK: Modelling the Costs and Distributional Effects of a Range of Options*. PSSRU Discussion Paper 2336, 2007.

Hansmann, Henry. *The Ownership of Enterprise*. Cambridge, MA: Harvard University Press, 2009.

Hansmann, Henry B. “The role of nonprofit enterprise.” *The Yale Law Journal* 89, no. 5 (1980): 835–901.

Havens, Betty. “Long-term care diversity within the care continuum”. *Canadian Journal on Aging/La Revue canadienne du vieillissement* 14, no. 2 (1995): 245–262.

He, Daifeng, and R Tamara Konetzka. “Public reporting and demand rationing: Evidence from the nursing home industry.” *Health Economics* 24, no. 11 (2015): 1437–1451.

He, Daifeng, and Peter McHenry. “Does formal employment reduce informal Care-giving?” *Health Economics* 25, no. 7 (2016): 829–843.

Heiss, Florian, Michael D Hurd, and Axel Börsch-Supan. “Healthy wealthy and knowing where to live.” In *Analyses in the Economics of Aging*. Edited by David A Wise, 241–280. Chicago, IL: University of Chicago Press, 2005.

Heitmueller, Axel, and Kirsty Inglis. “The earnings of informal carers: Wage differentials and opportunity costs.” *Journal of Health Economics* 26, no. 4 (2007): 821–841.

Hemerijck, Anton. “Welfare states in motion. From social protection to social investment.” In *Handbook of European Politics*. Edited by José M Magone, 640–668. Abingdon, Routledge, 2015.

Hendel, Igal, and Alessandro Lizzeri. “The role of commitment in dynamic contracts: Evidence from life insurance.” *The Quarterly Journal of Economics* 118, no. 1 (2003): 299–328.

Henretta, John C et al. “Selection of children to provide care: The effect of earlier parental transfers.” *The Journals of Gerontology Series B: Psychological Sciences and Social Sciences* 52 (Special Issue) (1997): 110–119.

Hillmer, Michael P et al. “Nursing home profit status and quality of care: Is there any evidence of an association?” *Medical Care Research and Review* 62, no. 2 (2005): 139–166.

Hochschild, Arlie Russell. "Global care chains and emotional surplus value." In *On the edge: Living with Global Capitalism*. Edited by Will Hutton and Anthony Giddens, 130–146. London: Jonathan Cape, 2000.

Holden, Karen, Timothy McBride, and Maria Perozek. "Expectations of nursing home use in the health and retirement study: The role of gender health, and family characteristics." *The Journals of Gerontology Series B: Psychological Sciences and Social Sciences* 52, no. 5 (1997): S240–S251.

Hollingsworth, Bruce et al. *Labour supply and informal care supply: The impacts of financial support for long-term elderly care* IZA Discussion Papers 10988, Bonn: Institute for the Study of Labor (IZA), 2017.

Horden, Peregrine, and Richard Smith, ed. *The Locus of Care: Families, Communities, Institutions, and the Provision of Welfare Since Antiquity*. Routledge Studies in the Social History of Medicine. London: Routledge, 2013.

Horioka, Charles Yuji. Are the Japanese selfish, altruistic or dynastic? *Japanese Economic Review* 53, no. 1 (2002): 26–54.

———. "Are Americans and Indians more altruistic than the Japanese and Chinese? Evidence from a new international survey of bequest plans." *Review of Economics of the Household* 12, no. 3 (2014): 411–437.

Horioka, Charles Yuji et al. "Why do children take care of their elderly parents? Are the Japanese any different?" *International Economic Review* (2016). https://doi.org/10.1111/iere.12264

Hou, Wenliang, Wei Sun, Anthony Webb, et al. *Why Do People Lapse Their Long-Term Care Insurance?* Brief 15–17. Boston, MA: Center for Retirement Research at Boston College, 2015.

Hsu, Ming, Hung-Tai Lin, and Paul E McNamara. "Neuroeconomics of decision-making in the aging brain: The example of long-term care." In *Neuroeconomics*, Edited by Daniel Houser and Kevin McCabe, vol. 20, 203–225. Advances in Health Economics and Health Services Research, 2008.

Hurd, Michael D, Pierre-Carl Michaud, and Susann Rohwedder. Distribution of lifetime nursing home use and of out-of-pocket spending. *Proceedings of the National Academy of Sciences* 114, no. 37 (2017): 9838–9842.

Ikkink, Karen Klein, Theo Van Tilburg, and Kees C Knipscheer. "Perceived instrumental support exchanges in relationships between elderly parents and their adult children: Normative and structural explanations." *Journal of Marriage and the Family* 61 (1999): 831–844.

Iwasaki, Michiko et al. "The future of financing for long-term care: The own your future campaign." *Journal of Aging & Social Policy* 22, no. 4 (2010): 379–393.

Jacobs, Josephine C et al. "The impact of informal caregiving intensity on women's retirement in the United States." *Journal of Population Ageing* 10 no. 2 (2017): 159–180.

James, Sarah, and Torbjörn Lahti. "Multiple dimensions of private information: Evidence from the long-term care insurance market." *The American Economic Review* 96, no. 4 (2006): 938–958.

Jellal, Mohamed, and François-Charles Wolff. "Solidarités familiales par la démonstration." *Revue économique* 54, no. 4 (2003): 785–810.

Jiménez-Martn, Sergi, and Cristina Vilaplana Prieto. "The trade-off between formal and informal care in Spain." *The European Journal of Health Economics* 13, no. 4 (2012): 461–490.

Joël, Marie-Ève. Dépendance: au-delà des coûts. *projet* 326, 27–35, 2012.

Jousten, Alain et al. Long-term care insurance and optimal taxation for altruistic children. *FinanzArchiv: Public Finance Analysis* 61, no. 1 (2005): 1–18.

Kahn, Robert L, and Toni C Antonucci. "Convoys over the life course: Attachment, roles, and social support." In *Life-Span Development and Behavior*. Edited by Paul B Baltes, and Orville G Brim, vol. 3. Cambridge, MA: Academic, 1980.

Kapp, K. William. *The Foundations of Institutional Economics*, Edited by Sebastian Berger, and Rolf Steppacher. Abingdon: Taylor & Francis, 2012.

Karlsson, Martin et al. "Future costs for long-term care: Cost projections for long-term care for older people in the United Kingdom." *Health Policy* 75, no. 2 (2006): 187–213.

Kate, Natasha et al. "Scale for positive aspects of caregiving experience: Development, reliability and factor structure." *East Asian Archives of Psychiatry* 22, no. 2 (2012): 62.

Katz, Stephen. *Disciplining Old Age The Formation of Gerontological Knowledge*. Charlottesville, VA: University Press of Virginia, 1996.

Keene, Jennifer Reid, and Christie D Batson. "Under one roof: A review of research on intergenerational coresidence and multigenerational households in the United States." *Sociology Compass* 4, no. 8 (2010): 642–657.

Kelley, Amy S et al. "The Burden of health care costs for patients with Dementia in the last 5 years of lifeburden of health care costs for patients with dementia." *Annals of Internal Medicine* 163, no. 10 (2015): 729–736.

Kemp, Candace L, Mary M Ball, and Molly M Perkins. "Convoys of care: Theorizing intersections of formal and informal care." *Journal of Aging Studies* 27, no. 1 (2013): 15–29.

Kemper, Peter. "The use of formal and informal home care by the disabled elderly." *Health Services Research* 27, no. 4 (1992): 421–451.

Khalil, Elias L. "What is altruism?" *Journal of Economic Psychology* 25, no. 1 (2004): 97–123.

King, Derek, and Linda Pickard. "When is a carer's employment at risk? Longitudinal analysis of unpaid care and employment in midlife in England." *Health & Social Care in the Community* 21, no. 3 (2013): 303–314.

Klaus, Daniela. "Why do adult children support their parents?" *Journal of Comparative Family Studies* 40, no. 2 (2009): 227–241.

Knijn, Trudie, and Monique Kremer. "Gender and the caring dimension of welfare States: Toward inclusive citizenship." *Social Politics: International Studies in Gender State & Society* 4, no. 3 (1997): 328–361.

Koh, Sun-Kang, and Maurice MacDonald. "Financial reciprocity and elder care: Interdependent resource transfers. *Journal of Family and Economic Issues* 27, no. 3 (2006): 420–436.

Konetzka, R Tamara, and Ye Luo. Explaining lapse in long-term care insurance markets. *Health Economics* 20, no. 10 (2011): 1169–1183.

Kunreuther, Howard. Mitigating disaster losses through insurance. *Journal of Risk and Uncertainty* 12, no. 2 (1996): 171–187.

Kyle, Peter. Confronting the elder care crisis: The private long-term care insurance market and the utility of hybrid products. *Marquette Elder's Advisor* 15 (2013): 101–133.

Laferrère, Anne, and François-Charles Wolff. "Microeconomic models of family transfers." *Handbook of the Economics of Giving Altruism and Reciprocity* 2 (2006): 889–969.

Lagergren, Mårten. "A simulation model concerning future needs for long-term care of elderly persons in Sweden." In: *Modelling Our Future: Population Ageing Health and Aged Care*. Edited by Anil Gupta, and Ann Harding, 281–296. International Symposia in Economics. Amsterdam: Elsevier, 2007.

Lagergren, Mårten, Noriko Kurube, and Yasuhiko Saito. "Modeling trajectories of long-term care needs at old age: A Japanese-Swedish comparison." *International Journal of Population Studies* 3, no. 1 (2017): 79–93.

Larsson, Kristina, Ingemar Kåreholt, and Mats Thorslund. "Care utilisation in the last years of life in Sweden: The effects of gender and marital status differ by type of care." *European Journal of Ageing* 11, no. 4 (2014): 349–359.

Last, Marian, Jean Schuldberg, and Kenneth Merchant. 2016. "Long-term care continuum." In *Managing the Long-Term Care Facility: Practical Approaches to Providing Quality Care*. Edited by Rebecca Perley, 33–68. San Francisco, CA: Wiley.

Layton, Lynne. Some psychic effects of neoliberalism: Narcissism, disavowal, perversion. *Psychoanalysis, Culture & Society* 19, no. 2 (2014): 161–178.

Lee, Hsu-Hua, Ming-Yuan Hsu, and Chen-Ying Lee. An empirical analysis of relevance among risk factors, selection of insured amount and loss ratio: A case study of group injury insurance. *Journal of Applied Sciences* 15, no. 3 (2015): 500–507.

Leigh, Andrew. Informal care and labor market participation. *Labour Economics* 17, no. 1 (2010): 140–149.

Lennartsson, Carin, Merril Silverstein, and Johan Fritzell. "Time-for-money exchanges between older and younger generations in Swedish families." *Journal of Family Issues* 31, no. 2 (2010): 189–210.

Leopold, Thomas and Marcel Raab. "Short-term reciprocity in late parent-child relation- ships." *Journal of Marriage and Family* 73, no. 1 (2011): 105–119.

Lewis, Jane, and Anne West. "Re-shaping social care services for older people in England: Policy development and the problem of achieving 'good care'." *Journal of Social Policy* 43, no. 1 (2014): 1–18.

Li, Yong, and Gail A Jensen. "Why do people let their long-term care insurance lapse? Evidence from the health and retirement study." *Applied Economic Perspectives and Policy* 34, no. 2 (2012): 220–237.
Liew, Tau Ming et al. Predicting gains in dementia caregiving. *Dementia and Geriatric Cognitive Disorders* 29, no. 2 (2010): 115–122.
Lilly, Meredith B, Audrey Laporte, and Peter C Coyte. "Do they care too much to work? The influence of caregiving intensity on the labour force participation of unpaid caregivers in Canada." *Journal of Health Economics* 29, no. 6 (2010): 895–903.
Lin, Haizhen, and Jeffrey Prince. The impact of the partnership long-term care insurance program on private coverage. *Journal of Health Economics* 32, no. 6 (2013): 1205–1213.
Lin, Haizhen, and Jeffrey T Prince. Determinants of private long-term care insurance purchase in response to the partnership program. *Health Services Research* 51, no. 2 (2016): 687–703.
Lindrooth, Richard C, Thomas J Hoerger and Edward C Norton. "Expectations among the elderly about nursing home entry." *Health Services Research* 35 (5-II) (2000): 1181–1202.
Litwak, Eugene. *Helping the Elderly: The Complementary Roles of Informal Networks & Formal Systems*. Perspectives on Marriage and the Family New York, NY: Guilford Publications, 1985.
Litwin, Howard, and Claudine Attias-Donfut. The inter-relationship between formal and informal care: A study in France and Israel. *Ageing & Society* 29, no. 1 (2009): 71–91.
Lo Sasso, Anthony T, and Richard W Johnson. "Does informal care from adult children reduce nursing home admissions for the elderly?" *INQUIRY: The Journal of Health Care Organization, Provision, and Financing* 39, no. 3 (2002): 279–297.
Logan, John R, and Glenna Spitze. 1994. Informal support and the use of formal services by older Americans. *Journal of Gerontology* 49, no. 1 (1994): S25–S34.
López, Javier Jesús López-Arrieta, and Mara Crespo. Factors associated with the positive impact of caring for elderly and dependent relatives. *Archives of Gerontology and Geriatrics* 41, no. 1 (2005): 81–94.
Mackintosh, Maureen. "Flexible contracting? Economic cultures and implicit contracts in social care." *Journal of Social Policy* 29, no. 1 (2000): 1–19.
Macon, Sylvia. "Grow up virginia: Time to change our filial responsibility law." *University of Richmond Law Review* 51 (2016): 265.
Marbot, Claire, and Delphine Roy. Projections du coût de l'APA et des caractéristiques de ses bénéficiaires à l'horizon 2040 à l'aide du modèle Destinie. In: G 2012/10, 2012.
Margus, Paul E. "The lowly loss ratio." *The Financial Reporter* 71 (2007): 23–31.
Marshall, Samuel, Kathleen McGarry, and Jonathan S Skinner. "The risk of out-of-pocket health care expenditure at the end of life." In *Explorations in the Economics*

of Aging. Edited by David A Wise, 101–128. Chicago, IL: University of Chicago Press, 2011.

McGarry, Brian E et al. "The Impact of consumer numeracy on the purchase of long-term care insurance." *Health Services Research* 51, no. 4 (2016): 1612–1631.

McGarry, Brian E et al. "Consumer decision-making abilities and long-term care insurance purchase." *Journals of Gerontology Series B: Psychological Sciences and Social Sciences* (2017). https://doi.org/10.1093/geronb/gbx059.

McGrail, Kimberlyn et al. "Age, costs of acute and long-term care and proximity to death: Evidence for 1987–1988 and 1994–1995 in British Columbia." *Age and Ageing* 29, no. 3 (2000): 249–253.

McMaughan Moudouni, Darcy K. et al. "The relationship between formal and informal care among adult medicaid personal care services recipients." *Health Services Research* 47, no. 4 (2012): 1642–1659.

Meijer, Claudine de et al. "Determinants of long-term care spending: Age, time to death or disability?" *Journal of Health Economics* 30, no. 2 (2011): 425–438.

Meiners, Mark R. *Long-term Care Insurance Partnership: Consideration for Cost-effectiveness*. Issue Brief. Hamilton, NJ, 2009.

Mellström, Carl, and Magnus Johannesson. "Crowding out in blood donation: Was Titmuss right?" *Journal of the European Economic Association* 6, no. 4 (2008): 845–863.

Merlis, Mark. *Home equity conversion mortgages and long-term care*. Technical report. Washington, DC, 2005.

Michaud, Pierre-Carl, Axel Heitmueller and Zafar Nazarov. "A dynamic analysis of informal care and employment in England." In: *Labour Economics* 17, no. 3 (2010): 455–465.

Mitchell, Olivia S, John Piggott, and Satoshi Shimizutani. "Aged-care support in Japan: Perspectives and challenges." *Benefits Quarterly* 22, no. 1 (2006): 7.

Mitrut, Andreea, and François-Charles Wolff. "A causal test of the demonstration effect theory." *Economics Letters* 103, no. 1 (2009): 52–54.

Moberg, Linda. "Marketisation of Nordic eldercare is the model still universal?" *Journal of Social Policy* 46, no. 3 (2017): 603–621.

Moraitou, Marina, Adamantia Pateli, and Sotiris Fotiou. "Smart health caring home: A systematic review of smart home care for elders and chronic disease patients." In: *GeNeDis 2016. Advances in Experimental Medicine and Biology* Edited by Panayiotis Vlamos, 255–264. Cham: Springer, 2017.

Moscarola, Flavia Coda. Informal caregiving and women's work choices: Lessons from the Netherlands. *Labour* 24, no. 1 (2010): 93–105.

Moscovice, Ira, Gestur Davidson, and David McCaffrey. "Substitution of formal and informal care for the community-based elderly." *Medical Care* 26 (1988): 971–981.

Mot, Esther et al. *The long-term care system for the elderly in the Netherlands*. ENEPRI research report 90. Brussels: Belgium: Centre for European Policy Studies, 2010.

Moya-Martínez, Pablo, Francisco Escribano-Sotos, and Isabel Pardo-García. "Estimating total informal care costs in Spain. Can formal care reduce it?" *Ageing International* 39, no. 4 (2014): 403–420.

Munkejord, Mai Camilla. "I work with my heart: Experiences of migrant care workers in a Northern, rural context." *Journal of Population Ageing* 10, no. 3 (2017): 229–246.

Murphy, Michael, and Pekka Martikainen. "Use of hospital and long-term institutional care services in relation to proximity to death among older people in Finland." *Social Science & Medicine* 88 (2013): 39–47.

Nguyen, Ha Trong, and Luke Brian Connelly. "The effect of unpaid caregiving intensity on labour force participation: Results from a multinomial endogenous treatment model." *Social Science & Medicine* 100 (2014): 115–122.

Nixon, David C. "State tax subsidies to bolster the long-term care insurance market." *Journal of Public Policy* 34, no. 3 (2014): 415–436.

Nocera, Sandra, and Peter Zweifel. 1996. Women's role in the provision of long-term care, financial incentives, and the future financing of long-term care. In *Long-Term Care: Economic Issues and Policy Solutions*. Edited by Roland Eisen and Frank A Sloan, 79–102. New York, NY: Springer Science+Business Media.

Norton, Edward C. "Long-term care." In *Handbook of Health Economics*. Edited by Anthony J. Culyer, and Joseph P Newhouse, vol. 1b, chap. 17, 955–994. Handbook of Health Economics. Amsterdam: Elsevier, 2000.

Norton, Edward C, and Courtney Harold Van Houtven. "Inter-vivos transfers and exchange." *Southern Economic Journal* 73, no. 1 (2006): 157–172.

Norton, Edward C, Lauren H Nicholas, and Sean Sheng-Hsiu Huang. "Informal care and inter-vivos transfers: Results from the national longitudinal survey of mature women." *The BE Journal of Economic Analysis & Policy* 14, no. 2 (2013): 377–400.

Nyman, John. "The effect of competition on nursing home expenditures under prospective reimbursement." *HSR: Health Services Research* 23, no. 4 (1988): 555–574.

Olivares-Tirado, Pedro, and Nanako Tamiya. "Institutional long-term care expenditures and proximity to death in Japan." In *Trends and Factors in Japan's Long-Term Care Insurance System. Japan's 10-year Experience*. Edited by Pedro Olivares-Tirado, and Nanako Tamiya. Springer Briefs in Aging, 103–117. Berlin: Springer, 2014.

Onuki, Hironori. "The global migration of care labour: Filipino workers in Japan." In *Feminist Ethics and Social Policy: Towards a New Global Political Economy of Care*. Edited by Rianne Mahon, and Fiona Robinson, 60–74. Vancouver: UBC Press, 2011.

Oshio, Takashi, and Emiko Usui. "Informal parental care and female labour supply in Japan." *Applied Economics Letters* 24, no. 9 (2017): 635–638.

Parrott, Tonya M, and Vern L Bengtson. "The effects of earlier intergenerational affection, normative expectations, and family conflict on contemporary exchanges of help and support." *Research on Aging* 21, no. 1 (1999): 73–105.

Pastalan, Leon A, ed. *Aging in Place: The Role of Housing and Social Supports* New York, NY: The Haworth Press, 1990.
Pauly, Mark V. "The rational nonpurchase of long-term-care insurance." *Journal of Political Economy* 98, no. 1 (1990): 153–168.
Peace, Sheila. "Caring in place." In *Care Matters: Concepts, Practice and Research in Health and Social Care*. Edited by Ann Brechin et al., 107–122: London: Sage, 1998.
Peng, Ito. *Transnational migration of domestic and care workers in Asia Pacific* Technical report. Geneva: International Labour Organization, 2016.
Pesis-Katz, Irena et al. Making difficult decisions: The role of quality of care in choosing a nursing home. *American Journal of Public Health* 103, no. 5 (2013): e31–e37.
Pestieau, Pierre, and Grégory Ponthière. Long-term care insurance Puzzle. In *Financing Long-Term Care in Europe Institutions, Markets and Models*. Edited by Joan Costa-Font, and Christophe Courbage, 41–52. New York, NY: Springer, 2012.
Pezzin, Liliana E, Peter Kemper, and James Reschovsky. "Does publicly provided home care substitute for family care? Experimental evidence with endogenous living arrangements." *Journal of Human Resources* 31, no. 3 (1996): 650–676.
Pickard, Linda et al. "Replacement care' for working carers? A longitudinal study in England, 2013–2015." *Social Policy & Administration* (2017). https://doi.org/10.1111/spol12345.
Pollak, Robert A. "Gary Becker's contributions to family and household economics." In *Review of the Economics of the Household* 1 (2003): 111–141.
Ponthière, Grégory. "Long-term care, altruism and socialization." *The BE Journal of Economic Analysis & Policy* 14, no. 2 (2013): 429–471.
Pratt, John R. 2010. *Long-term Care: Managing Across the Continuum* Sudbury, MA: Jones & Bartlett.
Preker, Alexander S, April Harding, and Phyllida Travis. "Make or buy decisions in the production of health care goods and services: New insights from institutional economics and organizational theory." *Bulletin of the World Health Organization* 78, no. 6 (2000): 779–790.
Qian, Zhenchao. *During the great recession, more young adults lived with parents* Census Brief prepared for Project US2010. New York, NY: Russell Sage Foundation, 2012. http://www.s4.brown.edu/us2010/Data/Report/report08012012. pdf.
Quéinnec, Erwan. "Les organisations sans but lucratif repondent-elles à une demande de biens de confiance? Le cas des services de prise en charge." *Revue d'économie politique* 122, no. 1 (2012): 67–87.
Rasmussen, David W Isaac F Megbolugbe, and Barbara A Morgan. "The reverse mortgage as an asset management tool." *Housing Policy Debate* 8, no. 1 (1997): 173–194.
Revenson, Tracey A et al. "The influence of culture on caregiving cognitions and motivations." In *Caregiving in the Illness Context*. Edited by Tracey A. Revenson et al., 64–78. Basingstoke: Palgrave Macmillan, 2016.

Richter, Rudolf. *Essays on New Institutional Economics*. Cham: Springer International Publishing, 2015.

Rossen, Bradley, and Akhter Faroque. "Diagnosing the causes of rising health-care expenditure in Canada: Does Baumol's cost disease loom large?" *American Journal of Health Economics* 2, no. 2 (2016): 184–212.

Rothgang, Heinz. *Finanzwirtschaftliche und strukturelle Entwicklungen in der Pflegeversicherung bis 2040 und mögliche alternative Konzepte Endbericht zu einer Expertise für die Enquete-kommission "Demographischer Wandel" des Deutschen Bundestages* Technical report. Bremen, 2001.

Rowles, Graham D, and Pamela B Teaster. "The long-term care continuum in an aging society." In *Long-term Care in an Aging Society: Theory and Practice*. Edited by Graham D Rowles and Pamela B Teaster, 3–32. New York, NY: Springer Publishing Company, 2015.

Safilios-Rothschild, Constantina. "A macro-and micro-examination of family power and love: An exchange model." *Journal of Marriage and Family* 38, no. 2 (1976): 355–362.

Samuelson, Paul A. *Foundations of Economic Analysis*. Bombay: Oxford University Press, 1947.

Sanz-Bobi, Miguel A, David Contreras, and Álvaro Sánchez Miralles. Multi-agent systems orientated to assist with daily activities in the homes of elderly and disabled people. In *Human-Computer Interaction: The Agency Perspective*. Edited by Marielba Zacarias and José Valente de Oliveira, 131–167. Berlin: Springer, 2012.

Sayn, Isabelle. *La place de la famille dans la prise en charge des personnes âgées dépendantes* Technical report. Saint-Étienne, 2006. https://halshsarchivesouvertes.fr/halshs-00799786/

———. Les conceptions de l'aide familiale aux personnes âgées dépendantes dans le droit". *Gérontologie et société* 31, no. 4 (2008): 29–48.

Scanlon, William J. "A theory of the nursing home market." *Inquiry* 17, no. 1 (1980): 25–41.

Schneider, Ulrike et al. "Do I stay or do I go? Job change and labor market exit intentions of employees providing informal care to older adults." *Health Economics* 22, no. 10 (2013): 1230–1249.

Schulz, Richard, and Paula R Sherwood. "Physical and mental health effects of family caregiving." *Journal of Social Work Education* 44 (Suppl 3) (2008): 105–113.

Schut, Frederik T, and Bernard Van Den Berg. Sustainability of comprehensive universal long-term care insurance in the Netherlands. *Social Policy & Administration* 44, no. 4 (2010): 411–435.

Schwarz, Beate et al. "Adult parent-child relationships: Relationship quality support, and reciprocity." *Applied Psychology* 54, no. 3 (2005): 396–417.

Seelbach, Wayne C. "Filial responsibility and the care of aging family members". In: *Independent Aging: Family and Social Systems Perspectives*. Edited by William H. Quinn and George A. Hughston, 92–105. Rockville, MD. Aspen, 1984.

Serrano, Ray Richard Saltman, and Ming-Jui Yeh. "Laws on filial support in four Asian countries". *Bulletin of the World Health Organization* 95, no. 11 (2017): 788–790.

Sheehan, Nancy W, and Laura M Donorfio. "Efforts to create meaning in the relationship between aging mothers and their caregiving daughters: A qualitative study of caregiving". *Journal of Aging Studies* 13, no. 2 (1999): 161–176.

Shippy, R Andrew, Marjorie H Cantor, and Mark Brennan. "Social networks of aging gay men". *The Journal of Men's Studies* 13, no. 1 (2004): 107–120.

Shutes, Isabel, and Carlos Chiatti. "Migrant labour and the marketisation of care for older people: The employment of migrant care workers by families and service providers". *Journal of European Social Policy* 22, no. 4 (2012): 392–405.

Siciliani, Luigi. "The economics of long-term care". *The BE Journal of Economic Analysis & Policy* 14, no. 2 (2014): 343–375.

Silva, Leticia Robles, and Elba Karina Vázquez-Garnica. "El cuidado a los ancianos: las val- oraciones en torno al cuidado no familiar". *Texto & Contexto-Enfermagem* 17, no. 2 (2008): 225–231.

Silverstein, Merril, Tonya M Parrott, and Vern L Bengtson. "Factors that predispose middle- aged sons and daughters to provide social support to older parents". *Journal of Marriage and the Family* 57 (1995): 465–475.

Silverstein, Merril et al. "Reciprocity in parent-child relations over the adult life course." *The Journals of Gerontology Series B: Psychological Sciences and Social Sciences* 57, no. 1 (2002): S3–S13.

Sketchley, Twyla, and Carter McMillan. "Filial responsibility: Breaking the backbone of today's modern long term care system". *St. Thomas Law Review* 26 (2013): 131–164.

Skira, Meghan M. "Dynamic wage and employment effects of elder parent care". *International Economic Review* 56, no. 1 (2015): 63–93.

Sloan, Frank A, and Edward C Norton. "Adverse selection, bequests, crowding out, and private demand for insurance: Evidence from the long-term care insurance market". *Journal of Risk and Uncertainty* 15, no. 3 (1997): 201–219.

Sloan, Frank A, Gabriel Picone, and Thomas J Hoerger. "The supply of children's time to disabled elderly parents". *Economic Inquiry* 35, no. 2 (1997): 295–308.

Sloan, Frank A, Harold H Zhang, and Jingshu Wang. "Upstream intergenerational transfers". *Southern Economic Journal* 69, no. (2002): 363–380.

Spillman, Brenda C, and James Lubitz. "The effect of longevity on spending for acute and long-term care". *New England Journal of Medicine* 342, no. 19 (2000): 1409–1415.

Stark, Oded. *Altruism and Beyond* Cambridge: Cambridge University Press, 1999.

Stewart, Hamish. "Rationality and the market for human blood". *Journal of Economic Behavior & Organization* 19, no. 2 (1992): 125–143.

Stucki, Barbara R. "Using reverse mortgages to manage the financial risk of long-term care". *North American Actuarial Journal* 10, no. 4 (2006): 90–102.

Stuifbergen, Maria C, and Johannes JM Van Delden. "Filial obligations to elderly parents: A duty to care?" *Medicine Health Care and Philosophy* 14, no. 1 (2011): 63–71.

Su, Qing. "Do MedicAid and private-pay nursing home residents have equal access to quality care in Texas nursing home market?" *International Journal of Economic Research* 711 (2016): 72–91.

Sussman, Marvin. "The family life of old people." In *Handbook of Aging and the Social Sciences*, 218–243. Amsterdam: Elsevier, 1976

Szebehely, Marta. "Nordic eldercare weak universalism becoming weaker? Marta Szebe- hely". *European Journal of Public Health* 27 Suppl 3 (2017). https://doi.org/10.1093/eurpub/ckx187.611

Tao, Hung-Lin. "Why do women interact with their parents more often than men? The demonstration effect vs. the biological effect". *The Social Science Journal* 51, no. 3 (2014): 350–360.

Taylor, Donald H et al. "Do seniors understand their risk of moving to a nursing home?" *Health Services Research* 40, no. 3 (2005): 811–828.

Tennyson, Sharon, and Hae Kyung Yang. "The role of life experience in long-term care insur- ance decisions". *Journal of Economic Psychology* 42 (2014): 175–188.

Thomeer Mieke Beth, Stipica Mudrazija, and Jacqueline L Angel. "How do race and Hispanic ethnicity affect nursing home admission? Evidence from the Health and Retirement Study". *Journals of Gerontology Series B: Psychological Sciences and Social Sciences* 70, no. 4 (2014): 628–638.

Titmuss, Richard Morris. *The Gift Relationship: From Human Blood to Social Policy* Allen & Unwin. 1970.

Tomini, Florian, Wim Groot, and Sonila M Tomini. "Informal care and gifts to and from older people in Europe: The interlinks between giving and receiving". In *BMC Health Services Research* 16 (2016): 603. https://doi.org/10.1186/s12913-016-1830-7

Trætteberg, Håkon Solbu. "Active citizenship in Scandinavian schools and nursing homes". In *Promoting Active Citizenship: Markets and Choice in Scandinavian Welfare*. Edited by Karl Henrik Sivesind and Jo Saglie, 203–259. Cham: Springer International Publishing, 2017.

Um, Seong-gee. "The migration of Asian women for elder care: Governing the movement of carers to South Korea". *Transnational Social Review* 3, no. 2 (2013): 155–172.

Van de Velde, Cécile. *Sociologie des âges de la vie* Sociologie. Paris: Armand Colin, 2015.

Van Houtven, Courtney Harold. "Informal care and economic stressors". In *Family Care- Giving in the New Normal*. Edited by Joseph Gaugler and Robert L. Kane, 105–133. London: Academic, 2015.

Van Houtven, Courtney Harold and Edward C Norton (2004). "Informal care and health care use of older adults". In *Journal of Health Economics* 23, no. 6, 1159–1180.

Varley, Ann, and Maribel Blasco (1999). In *Ageing in a Gendered World: Women's Issues and Identities*. Edited by INSTRAW Santo Domingo: República Dominicana: International Research and Training Institute for the Advancement of Women, 153–178.

Verbrugge, Lois M, and Angelique Chan. "Giving help in return: Family reciprocity by older Singaporeans". In *Ageing & Society* 28, no. 1 (2008): 5–34.

Vincent, John. *Geronticide Killing the Elderly*. London: Jessica Kingsley Publishers, 2001.

Walker Alexis J, Clara C Pratt, and Linda Eddy. "Informal caregiving to aging family members: A critical review". *Family Relations* 44 (1995): 402–411.

Webb, Anthony, and Natalia Zhivan. *How Much is Enough?: The Distribution of Lifetime Health Care Costs*. Working Paper CRR WP 2010-1. Chestnut Hill, MA: Center for Retirement Research at Boston College, 2010.

Wentowski, Gloria J. "Reciprocity and the coping strategies of older people: Cultural dimen- sions of network building". *The Gerontologist* 21, no. 6 (1981): 600–609.

Werblow, Andreas, Stefan Felder, and Peter Zweifel. "Population ageing and health care expenditure: A school of 'red herrings'?" In: *Health Economics* 16, no. 10 (2007): 1109–1126.

Werner, Rachel M, R Tamara Konetzka, and Daniel Polsky. "Changes in consumer demand following public reporting of summary quality ratings: An evaluation in nursing homes". *Health Services Research* 51, no. S2 (2016): 1291–1309.

Wilson, Gail. "Money and independence in old age". In *Ageing Independence and the Life Course*. Edited by Sara Arber and Maria Evandrou, 46–64. London: Jessica Kingsley, 1993.

Wilson, Charles. "Adverse selection". In *The New Palgrave Dictionary of Economics Volume 1*. Edited by Steven N Durlauf and Lawrence E Blume. 2nd ed., 25–31. Basingstoke: Palgrave Macmillan, 2008.

Wittenberg, Raphael. "Demand for care and support for older people". In *Long-Term Care Reforms in OECD Countries. Successes and Failures*. Edited by José Luis Fernández, Cristiano Gori, and Raphael Wittenberg, 9–24. Bristol: Policy Press, 2016.

Wittenberg, Raphael, and Bo Hu. *Projections of demand for and costs of social care for older people and younger adults in England, 2015 to 2035* PSSRU Discussion Paper 2900, 2015

Wittenberg, Raphael et al. "PSSRU long-term care finance model and CARESIM: Two linked UK models of long term care for older people". In *Modelling Our Future: Population Ageing Health and Aged Care*. Edited by Anil Gupta and Ann Harding. International Symposia in Economics, 489–496. Amsterdam: Elsevier, 2007.

Wolff, François-Charles. "Private intergenerational contact in France and the demonstration effect". *Applied Economics* 33, no. 2 (2001): 143–153.

Wu, Fei, Tomohiro Morita, and Akihiko Ozaki. "Perspectives on Care for the Elderly in China". *JAMA Internal Medicine* 177, no. 3 (2017): 444–444.

Xu, Dongjuan, Robert L Kane, and Tatyana A Shamliyan. “Effect of nursing home char- acteristics on residents’ quality of life: A systematic review”. *Archives of Gerontology and Geriatrics* 57, no. 2 (2013): 127–142.

Yamada, Hiroyuki, and Satoshi Shimizutani, et al. “Labor market outcomes of informal care provision in Japan”. *Journal of the Economics of Ageing* 6 (2015): 79–88.

Yamashige, Shinji. *Economic Analysis of Families and Society: The Transformation of Japanese Society and Public Policies* Advances in Japanese Business and Economics Volume 16. Tokyo: Springer Japan, 2017.

Yang, Zhou, Edward C Norton, and Sally C Stearns. “Longevity and health care expenditures: the real reasons older people spend more”. *The Journals of Gerontology Series B: Psychological Sciences and Social Sciences* 58, no. 1 (2003): S2–S10.

You, Kai et al. “Do nursing home chain size and proprietary status affect experiences with care?” *Medical Care* 54, no. 3 (2016): 229–234.

Zhu, Carolyn W et al. “Health-care use and cost in dementia caregivers: Longitudinal results from the Predictors Caregiver Study”. *Alzheimer’s & Dementia* 11, no. 4 (2015): 444–454.

Zhu, Haiyan. “Unmet needs in long-term care and their associated factors among the oldest old in China”. *BMC Geriatrics* 15, no. 46 (2015). https://doi.org/10.1186/s12877-015-0045-9

Ziettlow, Amy, and Naomi Cahn. *Homeward Bound: Modern Families, Elder Care and Loss*. Oxford University Press, 2017.

Zweifel, Peter, and Roland Eisen. *Insurance Economics*. Springer Texts in Business and Economics. Heidelberg: Springer, 2012.

Glossary: Volume II (Numbers Refer to Chapter)

Activities of daily living (ADLs) Routine, everyday self-care activities such as having a bath or a shower, walking across a room, dressing or undressing, getting in and out of bed, using the toilet, and eating, including cutting up food. 6

Adverse selection 'A negative bias in the quality of goods or services offered for exchange when variations in the quality of individual goods can be observed by only one side of the market' (Wilson 2008, p. 25). 7

Capability-adjusted life years (CALYs) The remaining life years adjusted with capability-based weights. 5

Compression of morbidity The hypothesis that medical advancements reduce time spent in ill health or disability in later life in a greater proportion, measured in years, than they increase survival rates so that age-specific disability rates and health conditions would diminish. 3

Consumer sovereignty 'The controlling power exercised by free individuals, in choosing between ends, over the custodians of the community's resources, when the resources by which those ends can be served are scarce' (Hutt 1940, p. 66). 3

Demand-induced supply A shift in the supply of healthcare services induced by their demand. 3

Disability-adjusted life years (DALYs) The present value of the future years of disability-free life that are lost as the result of the premature deaths or cases of disability occurring in a particular year (Bank 1993, p. x). 5

Double jeopardy An ethical argumentation according to which the use of QALYs can affect some patients doubly in the allocation of healthcare resources: they live a medical condition, and that medical condition lessens their chances of receiving healthcare. 5

Dynamic equilibrium The hypothesis that medical advancements increase survival but reduce prevalence rates of age-related diseases so that the proportion of years of life spent in good health remains more or less constant. 3

Eubie Blake effect The hypothesis that more healthcare is spent on patients who are more likely to profit from the services for a longer time period. 3

Expansion of morbidity The hypothesis that medical advancements not only increase survival rates from previously incurable diseases but expand morbidity in later life, thus raising age-specific disability rates and health conditions. 3

Extensive margin The decision of whether to work in paid employment or not. 2

Fair innings An ethical position according to which given that each person is entitled to a 'normal' lifespan, it is ethically acceptable to treat a younger person who has not reached her normal lifespan than an older person who has. 5

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Fiscal imbalance An indicator of temporal sustainability of the current fiscal policy: current fiscal policy is sustainable if the present value of lifetime payments and transfers from households of all age cohorts (i.e. including all future cohorts yet to be born) to the government net of all the public spending over time minus net public assets is equal to zero. 1

Generational account The present value of the differences between the taxes individuals of different age cohorts are expected to pay over their remaining lifetimes and the transfer payments they are expected to receive over their remaining lifetimes. 1

Generational imbalance A measure of the extent to which a fiscal imbalance originates as a consequence of changing the relative burden of current fiscal policy falling upon different age cohorts—in particular, upon currently younger cohorts and those yet unborn. 1

Healthy years equivalents (HYEs) An index of mortality, morbidity, and patients' preferences for different health statuses. 5

Incremental cost-effectiveness ratio (ICER) The difference in the mean costs of two healthcare interventions in a population of interest divided by the difference in the mean outcomes or effects (measured usually by QALYs) in the same population. 5

Instrumental activities of daily living (IADLs) Activities that require higher mental and physical capacity and functioning than ADL using a map to get around in a strange place, preparing a hot meal, shopping for groceries, making telephone calls, taking medication, doing work around the house or garden, and managing money. 6

Intensive margin The decision of how many hours to allocate to paid employment, having already decided to work. 2

Kotlikoff's fiscal balance rule A measure of the burden placed on future cohorts compared to that placed on current cohorts by current fiscal policy that consists in equalling the net lifetime income of each successive cohort to government consumption less the interest on the economy's capital stock left over after the consumption of the current older population. 1

Life-cycle deficit The difference between consumption (both public and private) and earnings. 1

Moral hazard A mis-allocation of resources as a result of changes in incentives by insurance and other risk spreading products given some degree of discretionary power by the insured agent to influence the occurrence of the eventuality she is insured against. 3

Prioritarianism An ethical position according to which priority for healthcare should be given to the worse-off, sicker patient. 5

Quality-adjusted life year (QALY) An indicator of survival time following a particular treatment or intervention weighted by the quality of life over the period. 5

Red herring hypothesis The hypothesis that health costs are not driven by individual or population ageing but by proximity to death. 3

Rotten kid theorem A theorem that proposes that a child will make efforts towards increasing the family income out of pure selfishness, so that bigger transfers may come her way. 7

Sandwich generation People who have caregiving responsibilities for their ageing parents and their children or grandchildren. 6

Saved young life equivalent (SAVE) A measure that proposes that saving a young person's life is of higher social value than saving the life of an older person. 5

Supplier-induced demand Once an initial contact between a patient and a physician is made, it is the latter who determines the allocation of healthcare services on behalf of the former. 3

Utilitarian ageism An ethical position according to which given that a younger person has a longer life to live, more expected benefits would be accrued given her longer life expectancy compared to treating an older person. 5

Years of healthy life (YHLs) An index of health status and life expectancy. 5

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