Landscape Amenities

Economic assessment of Agricultural Landscapes

by

Isabel Vanslembrouck and
Guido Van Huylenbroeck

Springer

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A C.I.P. Catalogue record for this book is available from the Library of Congress.

ISBN-10 1-4020-3134-3 (HB) Springer Dordrecht, Berlin, Heidelberg, New York
ISBN-10 1-4020-3172-6 (e-book) Springer Dordrecht, Berlin, Heidelberg, New York
ISBN-13 978-1-4020-3134-2 (HB) Springer Dordrecht, Berlin, Heidelberg, New York
ISBN-13 978-1-4020-3172-4 (e-book) Springer Dordrecht, Berlin, Heidelberg, New York

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Published by Springer,
P.O. Box 17, 3300 AA Dordrecht, The Netherlands.

www.springeronline.com

Printed on acid-free paper

Cover photograph by Bärbel Tress and Gunther Tress

Printed in the Netherlands.

Foreword by the series editors

Our motivation for this series was to provide a forum for dealing with the complex and challenging variety of landscapes. The series should bring to the fore the positive and connective aspects of dealing with this variety instead of seeing them as barriers and separating elements. Yet there is not only the variety of the landscapes as such, but also the multiplicity of academic disciplines and approaches that characterize the study of landscapes. We also intended to provide examples of integration of academic knowledge cultures on one topic, rather than having different volumes presenting knowledge from different disciplines.

'Landscape Amenities' is the second volume of the series. The monograph focuses on the socio-economic evaluation of agricultural landscapes in its broadest sense. The book presents the variety of services provided by farmers and agricultural landscapes. Instead of limiting the book on one perspective, Vanslembrouck and Van Huylenbrouck discuss landscape amenities from the farmers' as well as consumers' perspectives. These sometimes contrasting views are analysed and synthesized towards a set of recommendations for future landscape management and policy development. The authors offer insight into different types of landscape amenities including non-commodity outputs such as recreational and tourism functions and their economic assessment using the multifunctionality concept as a framework. We recommend the book to students, researchers, professionals, and decision-makers involved in assessing and developing agricultural landscapes.

Toulouse and Wageningen, December 2004

Henri Décamps
Bärbel Tress
Gunther Tress

CONTENTS

INTRODUCTION

> At the dawn of the 21st century, the impact of human beings on the environment continues to provide cause for concern. For some, what matters is the loss of so much that is beautiful and valuable in its own right. For others, the concern is with the effects of environmental degradation on human health and well-being. Whatever one's view, humans, like all living species, are remarkably adaptive. While this message should be familiar, all too many of the participants in the environmental debate seem unaware of it. *(David Pearce[1])*

1. BACKGROUND AND SCOPE OF THE RESEARCH

Today, farmers' role in society is subject to many debates. This research is motivated by the need to have more insight into the changing character and the role of agriculture. It is clear that today's agriculture has a much broader significance for society than the mere provision of food and renewable resources. The achievement of sustainable forms of agriculture as well as its multifunctional role are now widely recognised. Promoting the positive environmental effects of agriculture and avoiding negative ones, has become one of the central issues of agricultural policy, both in the European context, in international negotiations (WTO) and at national level (manure action plan, sustainability, peri-urban agriculture).

Recently, multifunctionality appeared very high on the political agenda. In the World Trade Organisation (WTO) negotiations, the concept of multifunctionality contributes to the current debate about agricultural protection. The concept of multifunctional agriculture is however interpreted in many countries and by many authors quite differently. Therefore, a closer look at the concept and an analysis of what it can mean in particular, can be very useful.

For the European Union (EU), multifunctional agriculture contributes to the goals of sustainable development, protection of the environment, sustained vitality of rural areas, poverty alleviation, food safety and other consumer concerns including animal welfare (Burrell, 2001). Since the MacSharry reform of 1992, environmental issues and the contribution of agriculture to biodiversity and landscape has got special attention in the successive adaptations of EU policy. With Agenda 2000, structural policies emphasising this role, have got a prominent place in the so called second pillar of the Common Agricultural Policy (CAP). The implementation of the structural measures on regional level got a lot of attention, such as the definition of the sensitive areas, or the implementation of the manure action plan, among others.

One aspect which has got major attention is landscape maintenance through the provision of amenities by farmers. Rural landscapes and biodiversity have been shaped by agricultural production over centuries through the specific use of land in a way appropriate to natural conditions. Agriculture, as the major user of the available land in rural areas, exerts a dominant influence on the rural environment. Therefore, farmers play an important role in the management of the countryside, in the

[1] *In Maddison (2001)*

preservation of biodiversity and the protection of the environment. Because of several reasons, which will be discussed in the following chapters, this role has been neglected in the past. Therefore, research on how this function can be enhanced is most welcome.

The main subject of this work is the multifunctional character of agriculture, with special emphasis on the provision of landscape amenities, and more in particular the provision of rural landscape and landscape elements. Three distinct but connected sets of issues form the core of this analysis on multifunctionality:

1. the production relationships underlying the multiple outputs of agriculture;
2. the externality and public good aspect of these outputs, and the demand for non-commodity outputs;
3. the policy aspects of multifunctionality.

Those issues form the basis to answer following questions:

1. Do these functions, like e.g. the maintenance of the agricultural landscape, have a value, for which society wants or has to pay?
2. Do farmers have to be paid for the uptake of those 'extra' functions?

These key elements in analysing multifunctionality, will be illustrated by using the provision of landscape as an analytical case. Landscape is clearly a joint output of agriculture. When producing agricultural commodities, farmers automatically produce landscape. The question is if the resulting landscape is the one desired by society. Because a lot of specific landscape elements have lost their function to agriculture and because farmers are not remunerated for their maintenance, farmers tend to eliminate these. This means that if society wants a higher provision, incentives need to be given to producers of these amenities. A complication is that rural amenities, such as landscapes, are agricultural externalities and have not only use but also non-use values (OECD, 2001).

2. OBJECTIVES

Figure 1 gives a schematic representation of the core elements of our analysis. The provision of landscape amenities will be looked at both from demand and supply side, in order to arrive at an "equilibrium" situation. If there is a demand for those amenities, for which "consumers" want to pay, the question remains how to supply the amenities and what the role is for farmers, governments and other participants in this process.

The major objective of this study is to formulate recommendations about an optimal provision of landscape amenities by farmers, based on the analysis of both the supply and demand for landscape amenities. The problem of amenity provision will be analysed by:

1. examining the demand for landscape and amenity goods and services;
2. analysing the importance of agriculture in this demand;
3. identifying how to evaluate the production relationships (supply) and farmers willingness to provide agricultural amenities; and

4. suggesting possibilities of reconciling demand and supply in a complex and dynamic policy environment.

This results in following research questions:

1. Is there a demand for landscape amenities?
2. What is the impact of agriculture in this demand?
3. How do farmers react on incentives for providing landscape amenities?
4. What lessons can be drawn for mechanisms and policies to increase the provision?

Valuing the landscape amenities produced by agriculture is important in order to assess the benefits by farmers. The maintenance of rural landscapes and landscape elements is an important aspect of sustainable development. Resources used in agriculture must be used in such a way that it is not compromising their availability for future generations. This is also true for landscape amenities.

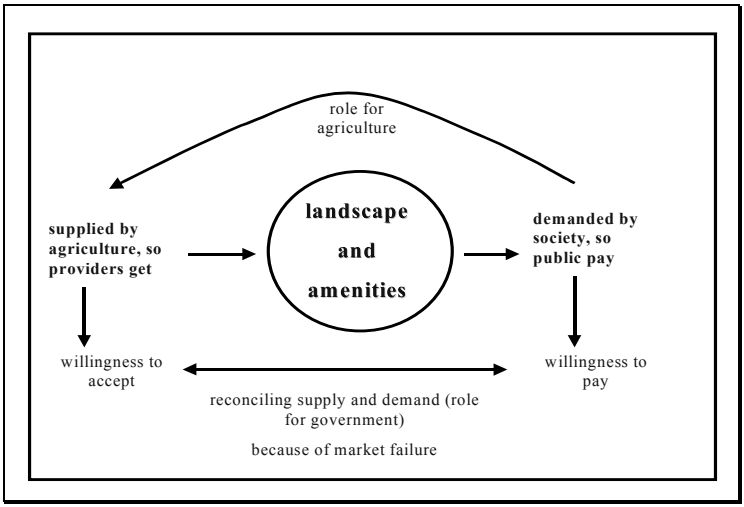

Figure 1. Landscape amenities from agriculture: supply and demand[2]

3. OUTLINE

The book consists of four parts, subdivided into different chapters.

Part I consists of three chapters, referring to the theoretical aspects of multifunctionality in agriculture. Chapter 1 gives a general introduction in the multifunctional role of agriculture. This is followed by the development of an

[2] *based on the discussion in the framework of a mini-symposium on "Agriculture's provision of positive amenities: supply, demand and the role for the government" (Oglethorpe and Racevskis, 2001)*

analytical framework, to illustrate the importance of recognising the multifunctional role of agriculture, both for the farmers themselves, as well as for the "consumers" and government. This model is based on the joint production relationship and focuses on the basic elements of the multifunctional role of agriculture. Chapter 2 specifies some theoretical insights into the way multifunctional outputs can be valued. In chapter 3, the framework developed in chapter 1, is applied to the specific case of the agricultural landscape, as one of the main non-commodity outputs of multifunctional agriculture.

Part II looks at the multifunctional role of agriculture from the consumer's point of view. Chapter 4 specifies the demand for landscape amenities in the form of rural tourism. In chapters 5 and 6 an attempt is made to answer the research question "Is there a demand for landscape amenities?" and if so, "What is the importance of agriculture in this demand?" Using different valuation techniques, those chapters try to quantify people's preferences related to the agricultural landscape. Consumers' demand for landscape amenities can be addressed by using different valuation methods. For chapter 5, an empirical study has been set up evaluating the contribution of rural amenities provided by agriculture in rural tourism. By using the hedonic pricing method, we are able to measure the influence of agriculture, among other factors, on the lodging prices of rural guesthouses in Flanders. A more detailed picture is obtained in chapter 6, by conducting a survey with rural tourists. The travel cost method based on these surveys, gives some information on the importance of agriculture for rural tourists and allows to estimate the recreational value of the rural landscape in the area visited by the respondents.

Part III seeks to analyse the farmer's engagement with his new role as manager of the countryside. Here we address the research question concerning production relationships. After an introductory chapter 7 on the agri-environmental challenge for agriculture, the supply of agricultural landscape amenities through a joint production with food and fibre is analysed by looking at the acceptance and uptake of agri-environmental measures in Belgium (chapter 8) and in the EU (chapter 9). These measures are based on the principle of compensating farmers for reducing agricultural intensity with the objective of maintaining the agricultural landscape. By analysing theoretically and empirically the jointness between production of food and fibre, and production of landscape amenities, and in how far farmers are willing to change the combination of both outputs, insight can be obtained into supply reactions on incentives to change production systems.

In part IV the analytical framework from part I is re-introduced, together with the results from the different empirical analyses. The conclusions emerging from each chapter are combined in order to proceed to a discussion of the policy implications of the provision of landscape amenities. The proposed analytical framework and the empirical results enable identification of potential policy issues. Some recommendations are formulated regarding the role of the government in the extension of the multifunctional character of agriculture, especially when it comes to the production of non-commodity outputs as the agricultural landscape.

All human activities are multifunctional, i.e. they contribute to a varied set of needs and values of society in addition to fulfilling the primary function which is their "raison d' être". *(Hans Alders[3])*

PART I

MULTIFUNCTIONALITY OF AGRICULTURE

[3] *In his opening speech as Chair of the FAO/Netherlands Conference on the Multifunctional Character of Agriculture and Land, Maastricht, the Netherlands, 12-17 September 1999 <http://www.fao.org/docrep/meeting/X3577e.htm>*

CHAPTER 1

MULTIFUNCTIONALITY IN A THEORETICAL FRAMEWORK

1. INTRODUCTION

The relationship between human society and the land has been progressively transformed in the course of the 20th century, particularly by increasing industrialisation, the mechanisation of agriculture, immediacy in global trade and communication, rapid increases in population size and densities, and the expanding use of biotechnologies. National, regional and international perspectives on agriculture must examine these and other factors in order to provide the best possible basis for allocating resources, establishing rules, formulating policy and making decisions. The emerging awareness that agriculture contributes in many varied forms to societal goals leads to a need for better understanding of the "multiple functions of agriculture" (FAO, 1999).

The first and most important function of agriculture remains to provide food and fibre, and related to that, food security, defined by FAO as " access for all people at all times to enough food for an active, healthy life". It is agriculture's "raison d'être" to provide food and raw materials for society and it is on this basis that farmers earn their living (as stated by H. Alders[3]). Modern agriculture in the late 20th century was highly successful at increasing food production with per hectare cereal yields increasing by 2-3 fold in the USA and Europe over 50 years, and by 60-80% in Asia and Latin America since the 1970s (Alexandratos, 1995).

In addition to producing food and fibre, agriculture also produces a wide range of non-commodity goods and services, shapes the environment, affects social and cultural systems and contributes to economic growth. It has a profound impact on many other aspects of local, national and global economies and ecosystems. Agriculture's multifunctionality suggests that it can deliver valued non-food functions that can not be produced by other economic sectors (Dobbs and Pretty, 2001). All these functions of agriculture can contribute to the achievement of sustainable development. According to Romstad et al (2002), the most central elements of multifunctional agriculture are:

- *landscape:* biodiversity, cultural heritage, amenity value of the landscape, recreation and access, scientific and educational value;
- *food related issues:* food security, food safety and food quality; and
- *rural concerns:* rural settlement and economic activity.

I. Vanslembrouck & G. Van Huylenbroeck,
Landscape Amenities: Economic Assessment of Agricultural Landscapes, 1—26.

But agriculture also presents major challenges to sustainable development. Negative external effects of agriculture include i.a. nutrient runoffs, erosion, and the risk of accumulation of pesticide and herbicide residuals in soils, water and the food chain.

Multifunctionality is a relatively new concept embracing older ideas (Romstad et al, 2000). Cultural landscape values, the environmental challenges of agriculture, the link to rural settlement and food security were elements of the agricultural policy even prior to the introduction of the multifunctionality concept. Previously, however, these different elements were treated more or less separately. Non-agricultural activity on the farm through provision of sport and recreational facilities, accommodation and catering has been there for a longer time, often referred to as pluriactivity (i.a. Bryden et al, 1993; Fuller, 1990; Ilbery and Bowler, 1998; Ohe, 2001).

The background on the debate on multifunctionality as a process of agricultural policy reform, started in the mid 1980s. At that time agricultural support and protection were at historically high levels and there was considerable tension in international agricultural trade (Cahill, 2001a). The term "multifunctional agriculture" emerged on the international stage as early as 1992, at the Rio Earth Summit. The emergence of the concept of multifunctionality responds to a wide range of concerns about significant, worldwide changes in agriculture and rural areas. These concerns include i.a. the progressive urbanisation of the global population, the integration and globalisation of markets, and the public good aspects of agriculture and associated landscapes, for developed and developing countries alike. How to consider off-farm activity and income, the longer term disbenefits of some form of agriculture, and the many challenges to achieve food security and how to address the problems of disadvantaged groups, are also encompassed by the concept.

The ongoing WTO negotiations form an important background for this discussion. Agriculture is high on the agenda, and there is an increasing focus on non-trade-concerns (NTC) like environmental, cultural and ethical issues (Romstad et al, 2000). Article 20 of the Agreement on Agriculture[4] (AoA) says that the NTCs are to be taken into account in the continuation of the negotiations on agriculture in the WTO. These concerns aim at goods that are not handled properly by markets (such as public goods). However, there is a difference between how the NTCs are handled and the concept of multifunctionality, as will be discussed further on in this chapter. Under the latter, both tradable and non-tradable goods are integrated into one consistent framework and not treated as separate issues.

Several major issues and challenges face policy makers in their attempts to restructure agricultural support based on the 'multifunctionality' perspective. This implies that income support to farmers will increasingly be tied to stewardship and social objectives, rather than to production objectives that dominated from the 1940s to the late 1980s (Dobbs and Pretty, 2001).

Because of the broad scope of the concept, we must take into account that multifunctionality has become a political slogan in the world of agriculture, with widely different interpretations (Cahill, 2001a). Food security, food safety, animal

[4] *http://www.wto.org/english/docs_e/legal_e/14-ag.pdf*

welfare, cultural and historic heritage values, environmental quality, landscape, biodiversity and rural development are just some of the outputs claimed to belong to the multifunctionality of the agricultural sector. The main aim of the notion of multifunctionality is, however, to bring the issues into a consistent framework.

2. DEFINING MULTIFUNCTIONALITY

The term "multifunctionality" seems to have somewhat various meanings in the agricultural policy debate, depending on the country and on the context in which it has arisen. Going through the literature on multifunctionality, you can find different definitions. While it is not the purpose of this work to give an overview of different definitions, views and interpretations of the concept, it is nevertheless necessary to adopt a "working definition" that provides an anchor for the discussion and defines the angle from which to approach the analysis. Two definitions seem rather relevant for our research.

OECD (2001a) uses the following definition: "multifunctionality refers to the fact that an economic activity may have multiple outputs, and by virtue of this, may contribute to several societal objectives at once. Multifunctionality is thus an activity oriented concept that refers to specific properties of the production process and its multiple outputs." Romstad et al (2000) define multifunctionality as "the set of interlinked outputs from productive activity where some goods are private and some are public. The public goods may be produced only by this activity, i.e., they are unique for the production in mind - or they may also be provided by other activities, i.e., they are secondary".

Although both definitions place another emphasis on the concept, it is rather clear that the core elements of multifunctionality are: (i) the existence of multiple commodity and non-commodity outputs that are jointly produced by agriculture; and (ii) the fact that some of the non-commodity outputs exhibit the characteristics of externalities or public goods, with the result that markets for these goods do not exist or function poorly.

The use of the concept of "multifunctionality" captures the economic, environmental and social dimensions of agriculture and the importance of their integration and optimisation for planners, decision-makers and practitioners. According to Caradec et al (1999) and FAO (1999), agriculture and related land use have several major functions:

- *The environmental function:* agriculture and related land use can have beneficial or harmful effects on the environment. The multifunctional approach can help to identify opportunities to optimise the linkages between agriculture and the biological and physical properties of the natural environment. It is relevant to a number of critical global environmental problems including biodiversity, climate change, desertification, water quality and availability, and pollution.
- *The economic function:* agriculture remains a principal force in sustaining operation and growth of the whole economy, even in highly industrialised countries. Valuation of the various economic functions

requires assessment of short, medium and long-term benefits. Important determinants of the economic function include the complexity and maturity of market development and the level of institutional development.

- *The social function*: the maintenance and dynamism of rural communities is basic to sustaining agro-ecology and improving the quality of life (and assuring the very survival) of rural residents, particularly of the young. On another level, the capitalisation of local knowledge and the forging of relationships between local and external sources of expertise, information and advice are fundamental to the future of existing rural communities. Social viability includes maintenance of the cultural heritage. Societies still identify intensely with their historical origins in agrarian communities and rural lifestyles.

The three functions are clearly interrelated. One could e.g. suggest that the environmental function is part of the economic function, as the latter comprises the well-being of people, and not only markets. Their relative importance depends on strategic choices at the local and national levels. The multiple functions may be relevant at many scales, from local, through national and regional, to global. Different functions and their implications may operate over different horizons - indeed some innovations and transformations may have short-term disadvantages, such as lower productivity, before leading to longer-term, overall economic and environmental benefits.

The application of the concept of multifunctional agriculture depends largely on the prevailing institutional conditions. As proposed by FAO (1999), a specific feature of institutional development is the level of complexity and maturity of the market economy. The level of market maturity is related to the overall economic development, the level of urbanisation and socio-cultural characteristics. In this context, low institutional development is characterised by weak markets, weak public institutions, low local public capacities and centralisation. High institutional development, on the other hand, refers to well-defined markets, efficient public institutions, high local public capacities and decentralisation (FAO, 1999).

Especially in international trade debates, the concept of multifunctionality is subject to widely differing interpretations. According to Burrell (2001), it mainly repackages two ideas. (i) To characterise agriculture as multifunctional is to acknowledge that, in addition to marketable production of food and fibre, farming generates other goods and services to which society attaches value. These other outputs contribute to societal objectives that are quite distinct from the aim of ensuring a reasonable standard of living to farmers. (ii) In addition, these outputs are, for the most part, not marketable in a conventional sense, and therefore farmers are remunerated specifically for providing them. Those governments that stress agriculture's multifunctionality argue that the provision of these non-food outputs will suffer if agricultural support prices are reduced by further trade liberalisation. The impact of the reduction in agricultural support on the effects of multifunctional agriculture has been analysed for the specific case of Finland in Yrjölä and Kola (2001).

The specific objectives served by multifunctional agriculture depend on the type of farming practised and the values of the society it serves. Therefore, the objectives can and do differ between countries (see e.g. Berthelot, 2001). For the EU, multifunctional agriculture contributes to the goals of sustainable development, protection of the environment, sustained vitality of rural areas, poverty alleviation, food safety and other consumer concerns including animal welfare. Other countries include food security and preservation of cultural heritage in their list (e.g. Norway, see Brunstad et al, 2001), and have singled out particular aspects of sustainable development and environmental protection, such as landscape maintenance, soil conservation, flood control (mainly Japan) and preservation of biodiversity (Burrell, 2001). Some of these objectives, however, need some critical consideration. It is debatable whether objectives such as food safety or quality are multifunctional characteristics of agriculture, but this discussion goes beyond the scope of this research.

Based on a thorough literature review, the following list of factors seems representative for the various aspects of multifunctional agriculture:

- environmental effects:
  - landscape (biological diversity, recreation, aesthetics);
  - cultural heritage;
  - pollution (changes in matter cycles);
- food security (availability in different situations);
- rural concerns (rural settlement, rural economic activity).

3. KEY CONCEPTS AND QUESTIONS

3.1. Production aspects of multifunctionality

The principal issue on the production side of multifunctionality concerns the nature and degree of jointness in the production of commodity and non-commodity outputs. Joint production exists if the production of two or more "goods" is interlinked in such a way that a change in the supply of one also affects the supply of the others. There are several approaches to emphasise the production aspects of multifunctionality. According to OECD (2001a) three reasons for jointness are frequently distinguished.

- *Technical interdependencies in the production process* occurs in situations where increases or decreases in the level of one output influence the supply of other outputs, without any change in input allocation to these outputs. A consequence is that the marginal productivities of the input used in the production of one output depend on how much is produced of the others. Two outputs are technically complementary if an increase in the supply of one raises the marginal input productivities in producing the other. They are technically competing if the reverse holds (Doll and Orazem, 1978). Therefore technical interdependencies are at the origin of many of the negative non-commodity outputs of agriculture, including soil erosion,

chemical residuals, nutrient leaching, etc. Positive effects due to technical interdependencies include, for instance, the impacts of crop rotation on nutrient balances and soil productivity.

- *Non-allocable inputs* can create jointness in production, where multiple outputs are obtained from the same input (Casavant et al, 1999). A classical example is the production of mutton and wool, which are jointly obtained from raising sheep. The production of meat and manure, or the association of landscape with particular production systems are other examples of joint products caused by non-allocable inputs. Very often specific farming systems create a certain landscape as non-commodity output through their commodity production. However, while these outputs are joint, they are rarely produced in fixed proportions and using different production methods can modify those proportions.
- *Allocable inputs, fixed at farm level*, but which can be allocated to various outputs in the production process. An increase or decrease in the production of one output changes the amount of the fixed factor available for the supply of others. For farmers this is especially important according to land and self-employed labour. In the short run these production factors are allocable fixed factors.

It is clear that this distinction in categories does not always correspond to the situation in reality. The overall jointness effect is often due to a combination of different sources, the relative importance of which can be difficult to assess.

Another approach is to look at the production aspects from the cost side, as will be considered in chapter 7. This approach refers to the possibility of cost savings through the joint production of several outputs, as opposed to separate provision ("economies of scope"). This issue does not arise where the outputs are so firmly linked that there is no way of providing them individually. But for many of the non-commodity outputs of agriculture, the linkage with commodity production is such that separate provision may be possible, although there is a cost-advantage in producing them jointly by agriculture (OECD, 2001a).

If there is no jointness, then the non-commodity outputs can be supplied independently of agricultural commodities, i.e. there is no particular agricultural policy issue to be explored and certainly no specific issue with an impact on trade or international relations. Non-agricultural provision is possible and the ideal provider is the one who can supply the "good" at the least cost. On the other hand, if jointness exists, a change in the production of the commodity output also brings along a change in output of the non-commodity output and vice versa. It may also give a cost advantage, opening up the possibility that provision of the non-commodity output may be cheaper if carried out in conjunction with production of a commodity. In other words, there are economies of scope. An important step, therefore, in any exploration of multifunctionality is to establish the degree of jointness with commodity production (Cahill, 2001a).

Joint production technologies in multifunctional agriculture are seldom strictly separable or strictly fixed-proportions, and several authors have elaborated the possibilities: fixed-proportions, complementarities, independence, and competitive

relationships among outputs (see i.a. Gatto and Merlo, 1999; Romstad et al, 2000). Despite the broad range of possibilities, Randall (2002) states that the following generalisations are plausible:

- for many green prices[5], production conditions are likely to involve some degree of complementarity with commodity production, which implies that green payments are likely to increase domestic commodity production and reduce commodity imports (or increase exports)[6];
- other kinds of green products - e.g. those that reduce pollution from farming and those that require pre-modern farming technologies - are likely to be competitive with commodity production, which implies that payments to encourage these kinds of green production are likely to reduce domestic commodity production and increase commodity imports (or reduce exports).

An important remark to be made here, is that the links between the commodity and non-commodity outputs have to be seen in a dynamic context. The intensity of agricultural production can be changed to modify the relationship between commodity and non-commodity outputs. New information, technologies and farmer experience create new ways of using a farm's resources and may influence the bundle of non-commodity outputs generated in the process. The degree of jointness between outputs may therefore change in the future.

Another issue that should be addressed are the spatial, scale and time dimensions of the non-commodity outputs. It is clear that there can be differences in the costs of production of non-commodity goods and the quality of these outputs across and within countries as well as differences in scale and productivity. There will be spatial variations in the demand for non-commodity outputs. These facts suggest that there is not an optimal policy regarding these multiple output, and that market and policy measures should be implemented using area-specific or local criteria. Apart from the spatial dimension, also time dimension can have its impact. In this context, the production time of a non-commodity output, the pattern of development, the speed at which farming practices and systems can be adjusted, and whether a non-commodity concern is permanent or temporary, are important. The different time dimensions of the non-commodity outputs need also to be taken into consideration (Cahill, 2001b).

3.2. Externality and public good aspects of multifunctionality

Jointness is a supply side issue. Moving to the demand side, the starting point is that, if all the non-commodity outputs were private goods, i.e. capable of being bought and sold in a market, there would be functioning markets: supply and demand would

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[5] the term "green prices" is used as a shorthand for "the prices of agriculture's multifunctional outputs"

[6] this remark is often cited in the international debate on multifunctional agriculture, by opponents, who state that promoting multifunctional aspects is a hidden form of protectionism (see also later in this chapter in section 3.3)

eventually balance, there would be no market failure and no particular need to look to government intervention. But, in reality, some of the non-commodity outputs exhibit the characteristics of externalities or public goods, with the result that markets for these goods do not exist or function poorly (see also 3.4).

Analysing externality and public good aspects are therefore important and can provide a conceptual framework to analyse how the benefits of multifunctionality are or could be distributed in and by society. Any policy discussion on externalities requires an analysis of the type and amount of demand that exists for each externality that is jointly produced with a marketable good. Moreover, it is important to discuss externality and public good aspects together, because externalities alone are not necessarily a source of market failure (OECD, 2001a). An explanation of these concepts, which turn out to be central in this analysis, is put forward.

3.2.1. Externality aspects

An external effect, or externality in short, is said to occur when the production or consumption decisions of one agent affect the utility of another agent in an unintended way, and when no compensation is made by the producer of the external effect to the affected party[7] (Perman et al, 1996). In other words, as can be found in the dictionary of environmental economics (Markandya et al, 2001), an externality arises when the actions of an individual, firm or community affect the welfare of other individuals, firms or communities. For this effect to be defined as an externality, the agent responsible must not take account of the effect that it has on the other party. Externalities reflect the fact that social and private costs and benefits often do not coincide, so that an action, which benefits an individual or firm, may harm society in general. For instance, it may be in the commercial interest of a farmer or forestry company to reduce the biodiversity in an ecosystem, but this imposes an external social cost, or externality. Externalities may be positive or negative.

The basic problem with externalities is that a good generating a positive externality tends to be under-provided because the market cannot incorporate the benefit to society generated by the positive externality. If the good generates a negative externality, then over-provision is likely. Producers of the good determine the level of production that maximises their profit while a higher or lower level of production might be necessary to maximise social welfare (OECD, 2001a). This means that there is a divergence between producers' interests and society's interests. Policies to correct this "market failure" basically require that producers are given incentives to incorporate the benefits into their decision-making process when producing the good, or be taxed (or regulated) to incorporate the costs. When an activity causing an externality has been corrected to the point at which economic efficiency has been attained, we say that the externality has been internalised.

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[7] *the condition of compensation of the victims can be the object of discussion, as e.g. a Pigovian tax does not require the victims to be compensated, but redresses the market failure (Pearce and Turner, 1990)*

3.2.2. Public goods

Even if some non-commodity outputs are positive externalities that cause market failures, government intervention is not necessarily the best option (Cahill, 2001a). There are various ways to narrow the gap between social and private costs, depending on the specific public good characteristics of these non-commodity outputs. A good definition and detailed classification of public goods is therefore needed.

Public goods are goods whose consumption by one person does not alter the availability of the good for all other consumers (Markandya et al, 2001). Such a good is 'non-rival in consumption'. To satisfy the definition of a pure public good, it must also be impossible, or possible only at a prohibitively high cost, to prevent people from consuming the good, so that the existing quantity of the good is consumed equally by all people.

Pure public goods are thus goods that are non-excludable and non-rival in consumption. Non-excludability refers to a circumstance where, once the resource has been provided, even those who fail to pay for it cannot be excluded from enjoying the benefits it confers (Tietenberg, 1996). A good is non-rival when a unit of the good can be consumed by one individual without diminishing the consumption opportunities available to others from the same unit. That is, society should not exclude anyone from using this good because there is no additional cost to accept another user. In practice it is very difficult to find a good that strictly meets these criteria. Therefore, most goods that are not private (i.e. rival[8] and excludable) are impure public goods[9].

Many environmental goods are public goods; clean air and the preservation of a nation's biodiversity are good examples. Because public goods can be consumed by all, there is no incentive for individuals or organisations to finance them. Thus the quantities supplied in a pure market economy would be lower than the socially efficient level. They are a form of positive externality, or market failure, and there is a role for government in providing the socially efficient amount of public goods (Markandya et al, 2001).

Although the definition of public goods seems rather straightforward, a classification of goods based on the concepts of rivalry and exclusion can be rather difficult. Figure 1.1 gives a possible classification, but the completion can be subject of debate. Public goods can be provided by governments, because it is difficult, if not impossible, to create markets for them and because voluntary provision always leads to under-supply. Categorising agricultural externalities under multifunctionality from a public point of view is, however, not so straightforward because the non-commodity outputs have different characteristics. Some characteristics, while theoretically valid, may not be significant in practice (e.g. exclusion mechanisms may not work well in actual situations). Biodiversity or non-

[8] *the property of rivalness can also be called divisibility or depletability (Perman et al, 1996)*
[9] *impure public goods include e.g. club goods, common property resources etc.*

use values[10] of landscape are elements of agricultural multifunctionality that have strong public good characteristics. However, there is a broad spectrum of other types of goods that are neither entirely public, nor entirely private. Examples are e.g. flood control or use-value of a landscape. Different degrees of excludability or rivalry allow some possibility for voluntary provision, for the creation of markets, or for the charging of user fees. These factors should inform decisions about when it is appropriate for governments to intervene and what the nature of those interventions should be.

The dynamic nature of these non-commodity outputs as pure or impure public goods is also an important factor. The public good nature of certain externalities, especially the possibility of exclusion, may change over time as a result of technical progress. Some may even become private goods. Analysing policy options without taking these dynamic aspects into account could lead to unnecessary or harmful intervention by government (OECD, 2001a).

Transaction and administrative costs are also important factors that need to be addressed in discussing the provision of public goods, especially in the context of future policy discussions. Transaction costs may be high because of non-exclusion and non-rivalry, because additional information is needed or because negotiation between agents is necessary. Transaction costs may also vary depending on the public good in question (OECD, 2001a).

EXCLUDABILITY		
	High	Low
High		
RIVALRY	Private goods (e.g. a highly demanded forest where visitors must pay for a ticket)	Common-pool resources (e.g. free-access forest/ landscape with serious congestion problems)
	Club goods (e.g. sport facilities where congestion is not felt)	Public goods (e.g. free-access forest/ landscape without congestion)
Low		
	Low	High
	EXTERNALITIES	

Figure 1.1. Characteristics of goods and resources (based on Slangen and Thijssen, 1993; Devlin and Grafton, 1998; Romstad et al, 2000; OECD, 2001a; Mantau et al, 2001)

[10] *non-use value refer to the utility that people derive from the existence of something even if they do not themselves make use of it (will be discussed further in more detail in chapter 2)*

3.2.3. Other issues associated with multifunctionality

In the international context, there is a strong overlap with Non Trade Concerns (NTCs). Multifunctionality per se does not appear in any WTO text (Burell, 2001). The concept of multifunctionality contributes, however, to the current international debate about agricultural protection. The distinction between "trade" and "non-trade" concerns is at the core of this debate. Non-trade concerns are normally restricted to public goods provisioning. If private and public goods are interrelated in production, such a distinction cannot be drawn (Romstad et al, 2000).

The overlap between the issues served by multifunctional agriculture and those categorised as NTCs is not without controversy. The main opponents of the multifunctionality argument are the US and the Cairns group. At least two issues set the scene for conflict. First, domestic policy measures designed to generate domestic benefits may, by virtue of joint production, harm other countries by diverting trade flows or reducing world prices for export competitors. Second, and probably more important, governments may use the umbrella of multifunctionality to support agriculture beyond levels of efficient countryside benefits (Latacz-Lohman and Hodge, 2001).

The main aim on the international scene of the debate concerning the multifunctionality of agriculture remains to reduce trade protection in a way that respects domestic non-trade objectives. In other words, to what extent can a government protect its non-tradable goods, e.g. landscape protection, without affecting the tradable goods, which are often jointly produced. It is clear that the margin is very narrow and open to different interpretations.

3.3. Externalities, public goods and economic efficiency

Where markets do not exist, it is evident that markets cannot allocate resources efficiently. The failure of markets to exist for many environmental resources is often a reflection of the fact that the resources in question are externalities or public goods. Therefore we will examine the implications for resource use of externalities and public goods from a microeconomic approach. As is well known from introductory microeconomic courses[11], imperfect competitive market structures can result in efficiency losses. We will investigate these losses in the context of multifunctional outputs of agriculture.

3.3.1. Externalities and economic efficiency

The main question occurring in this context is "How does the presence of externalities change the required efficiency conditions[12,13]?" To answer this

[11] *I refer to, among others, Varian (1993)*

[12] *this analysis is mainly based on the work of Perman et al (1996), dealing with the specific case of negative externalities, while our derivation is based on the existence of positive externalities, with an eye to our main research topic*

question, we will consider first the production efficiency condition. In the situation of an economy with two inputs, L and K, which can be combined to produce two goods X and Y, efficiency in production requires that the ratio of the marginal product of each input be identical in the production of both goods. That is

$$\left(\frac{MP_L}{MP_K}\right)^X = \left(\frac{MP_L}{MP_K}\right)^Y \tag{1.1}$$

In order for equation 1.1 to remain valid as a condition of productive efficiency, it is necessary to interpret the four marginal products in social marginal products. Therefore we define PMP_L as the private marginal product of labour, EMP_L as the external marginal profit of labour, and SMP_L as the social marginal product of labour. An equivalent notation applies to capital, or any other input. These three measures of marginal product are related by the identity

$$PMP_L + EMP_L = SMP_L \tag{1.2}$$

The idea is that when a firm chooses to employ an additional unit of labour, the marginal product of labour to that firm is PMP_L. If this employment of labour has an external effect on others, we denote that external effect as EMP_L. EMP_L can be positive or negative, depending on the externality. The social marginal product is the sum of these two. If all measures are interpreted in social terms, the productive efficiency condition is valid in an economy in which external effects occur, and can then be written as either

$$\left(\frac{SMP_L}{SMP_K}\right)^X = \left(\frac{SMP_L}{SMP_K}\right)^Y \tag{1.3}$$

or

$$\left(\frac{PMP_L + EMP_L}{PMP_K + EMP_K}\right)^X = \left(\frac{PMP_L + EMP_L}{PMP_K + EMP_K}\right)^Y \tag{1.4}$$

This illustrates how the efficiency conditions need to be interpreted in situations where economic activity generates external effects. It doesn't show yet why private profit maximising behaviour will fail to allocate resources efficiently in the presence of externalities. The key point here is that, left to act in their individual self-interests,

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[13] *this refers to the efficiency conditions in a competitive market, and are stated for convenience in annex 1.*

firms will only take account of what we have called private marginal products. So profit maximisation will result in the ratio of private marginal products being equalised between goods. Moreover, in a market economy these will be equal to the ratio of input prices. That is

$$\left(\frac{PMP_L}{PMP_K}\right)^X = \left(\frac{PMP_L}{PMP_K}\right)^Y = \frac{P_L}{P_K} \tag{1.5}$$

Clearly, the equalisation of private marginal product ratios will yield a different allocation of resources from that which derives from the equalisation of social marginal product ratios. As the latter is required for efficiency, private market behaviour will be inefficient in the presence of externalities.

A hypothetical example can illustrate this a bit more deeply. This example will bring out another way of thinking about efficiency, as it will show that if actors[14] act uncooperatively (that is, independently of one another) in pursuit of maximising their individual profits, the outcome is less good (and thus inefficient) compared with that where they act co-operatively, maximising their combined profits. We investigate the example in which there is a single positive externality in production, e.g. the maintenance of a nice agricultural landscape by producing food products and maintaining hedgerows or extensive field margins.

Suppose that one farmer produces good *X*, and another produces good *Y*. For simplicity, imagine that *X* is produced using one purchased input *K*, whilst *Y* is produced using another purchased input *L*. The production of *Y* generates a positive externality (e.g. an attractive landscape, resulting in an increased number of bikers), affecting the production of *X (*e.g. home-made ice-cream), but not affecting the production of *Y*. We denote the quantity of this externality by Ψ, and assume that its magnitude is an increasing function of the amount of labour used in producing *Y*.

Thus we can write the two production functions as

$$\begin{aligned} X &= X(K, \Psi) \\ Y &= Y(L) \end{aligned} \tag{1.6}$$

where

$$\Psi = \Psi(L)$$

Assume that $\partial X/\partial K > 0$, $\partial X/\partial \Psi > 0$, and $dY/dL > 0$. Note that the production of *Y* only involves inputs chosen by its own producer, while the production of *X* is only partly determined by inputs chosen by its own producer.

[14] *can be an individual, firm, society or any player in this process*

Although the firm producing X chooses K, Ψ is the result of choices made by the other producer, through its choice in input level.

In a competitive market economy, each firm maximises profits independently. The profit functions for the two firms can be written as

$$\begin{aligned} \Pi_X &= P_X X - P_K K = P_X X(K, \Psi) - P_K K \\ \Pi_Y &= P_Y Y - P_L L = P_Y Y(L) - P_L L \end{aligned} \tag{1.7}$$

Profit maximisation by each firm separately implies that K is chosen to maximise the profits in producing X, whilst, independently, L is chosen to maximise the profits in producing Y. It is necessary for profit maximisation that the input choices of the two firms satisfy the first-order conditions:

$$\begin{aligned} \frac{\partial \Pi_X}{\partial K} &= P_X X_K - P_K = 0 \\ \frac{\partial \Pi_Y}{\partial K} &= P_Y Y_L - P_L = 0 \end{aligned} \tag{1.8}$$

where $X_K = \partial X / \partial K$ and $Y_L = \partial Y / \partial L$. Rearranging equation 1.8, the profit maximising conditions can be written as:

$$\begin{aligned} P_X X_K &= P_K \\ P_Y Y_L &= P_L \end{aligned} \tag{1.9}$$

The left-hand side of each of these equations is the value (in terms of output) of the marginal product of the input. The right-hand side is a marginal cost. Equations 1.9 therefore state that the quantity employed of each factor input is chosen so that the value of its marginal product is equal to its marginal cost.

By rearranging equations 1.9, an alternative interpretation of these profit maximising conditions can be derived:

$$\begin{aligned} P_X &= \frac{P_K}{X_K} \\ P_Y &= \frac{P_L}{Y_L} \end{aligned} \tag{1.10}$$

Equations 1.10 state that in profit maximising equilibrium, the output price of each good equals its private marginal cost of production. This alternative interpretation will be used later.

Returning now to equations 1.9, which describe the input demands that will exist in a competitive market economy where no price is associated with the positive externality associated with the output of firm *Y*. However, this outcome cannot be one in which resources are allocated efficiently, taking into account that an efficient allocation implies that no unexploited net benefits exist. But there are unexploited net benefits in this case, because individual competitive behaviour does not maximise overall or combined profits. This can be understood by considering how profits would change if there was a small increase in the use of input *L*. The second of equations 1.9 shows that there would be no change in profits in producing good *Y*, because the incremental cost of labour (P_L) would be just balanced by the value of the marginal product of the additional unit of labour ($P_Y Y_L$). But the profits of firm *X* are increased; the increased use of *L* raises the quantity of benefits Ψ. Given that $\partial X/\partial \Psi > 0$, this increases the output of *X*, and augments the profits of its producer. A consequence of this is that joint profits would be increased if a higher quantity of labour were to be employed. Clearly, therefore, the competitive equilibrium is not efficient; it leads to an underused amount of *L*, reducing combined profits below their maximum level, and leaving unexploited Pareto[15] improvements.

3.3.2. Maximisation of joint products

It is thus necessary to look more closely at the efficient solution, which maximises joint or combined profits. Combined profits are given by

$$\Pi_{X+Y} = P_X X(K, \Psi) + P_Y Y(L) - P_K K - P_L L \tag{1.11}$$

The necessary conditions for a maximum of this combined profit function are obtained by differentiation of the joint profit function with respect to *K* and *L*:

$$\frac{\partial \Pi_{X+Y}}{\partial K} = P_X X_K - P_K = 0 \tag{1.12a}$$

$$\frac{\partial \Pi_{X+Y}}{\partial L} = P_X \frac{\partial X}{\partial \Psi} \frac{d\Psi}{dL} + P_Y Y_L - P_L = 0 \tag{1.12b}$$

Rearranging equation 1.12b results in

[15] *Pareto-efficiency is named after the nineteenth-century economist and sociologist Vilfredo Pareto (1848-1923) who was one of the first to examine the implications of this idea: "an economic situation is Pareto-efficient if there is no way to make some group of people better off without making some other group of people worse off".*

$$P_X \frac{\partial X}{\partial \Psi} \frac{d\Psi}{dL} + P_Y Y_L = P_L \tag{1.13}$$

The first term on the left-hand side of equation 1.13 is the value of the marginal positive externality done to X by the benefits produced by Y. The marginal benefit in physical units is given by $(\partial X/\partial \Psi).(d\Psi/dL)$. This is the marginal product of labour. This will be a positive quantity because all components are positive. In value terms, marginal benefit is found by multiplying this expression by P_X. The second term on the left-hand side of equation 1.13 is the value of the marginal product of L in the production of good Y. Combining the two components on the left-hand side gives the value of the marginal product of L, net of the value of the marginal benefit gained by L in the production of X. Equation 1.13 states that the maximisation of combined profits (and so economic efficiency) requires that this should be equal to the marginal cost of L, P_L. So what is found here is another interpretation of the productive efficiency condition in the presence of externalities. The input L should be used to the point where the net value of its marginal contribution in the production of good Y, $(P_Y Y_L - P_L)$ is just equal to the value of the marginal benefit in the production of X, as shown in figure 1.2.

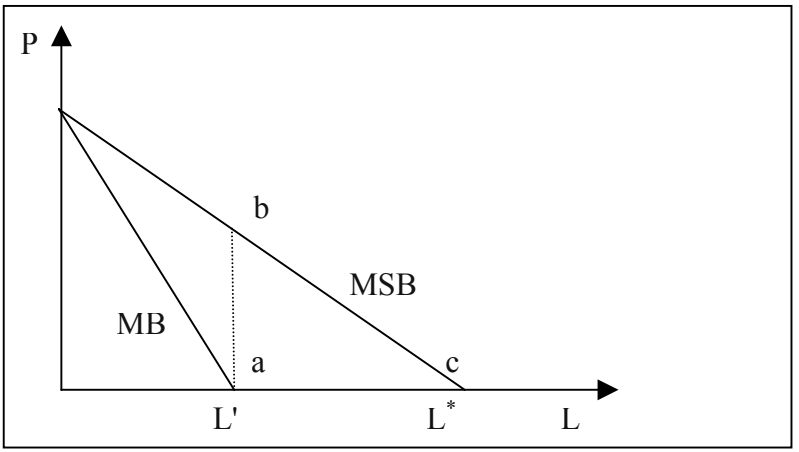

Figure 1.2. A positive externality, driving a wedge between private (MB) and social (MSB) benefits

Reconsidering the argument, profit-maximising behaviour in a market economy would result in the satisfaction of the second of equation 1.8. However, in the presence of an external effect, this is not economically efficient, as an unexploited Pareto-gain exists. The efficient solution is given by equation 1.13. Efficiency requires that the sum of $P_Y Y_L$ (the value of the output of Y obtained by using an additional unit of labour) and the value of the associated external benefit to the

production of X is equal to the incremental cost of a unit of labour, P_L. Figure 1.2 combines the two sets of information, and allows us to compare both "optimums". It is clear that, in the case of a positive externality, L^* as the socially optimal labour input level, is higher than that implied by private profit maximising, L'. The distance ab represents the magnitude of the marginal value of the external benefit.

Rearranging equation 1.13 yields

$$P_Y = \frac{P_Y}{Y_L} - \frac{P_X \dfrac{\partial X}{\partial \Psi}\dfrac{d\Psi}{dL}}{Y_L} \tag{1.14}$$

so that the price of Y equals the private marginal cost of producing good Y minus the marginal external cost of Y (the last term on the right-hand side, which is a positive quantity). A comparison of the private but inefficient allocation of good Y with the socially efficient allocation is shown graphically in figure 1.3, in terms of a supply and demand curve representation. Private profit maximisation in competitive markets leads to an output level Y', at which private marginal cost is equal to private marginal revenue. The competitive market price of Y is P'_Y, which takes no account of the external effect that Y has on X. The socially efficient output level is Y^*, which equates the marginal benefit derived from good Y with the social marginal cost of Y. This social cost is lower than the private cost by inclusion of the external benefit.

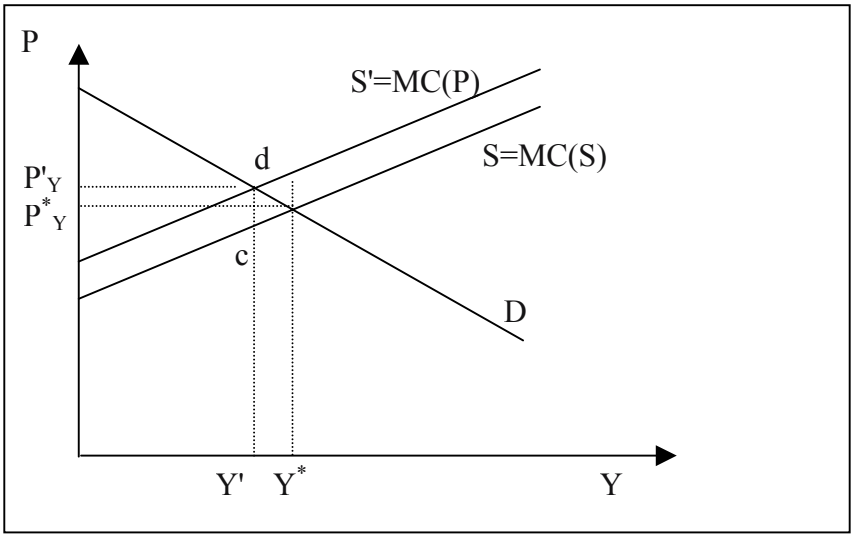

Figure 1.3. The private profit-maximising output and the socially efficient output of a good that creates a positive external effect

The distance cd represents a shadow price, which can be interpreted as an efficient externality subsidy on units of output *Y*. The socially efficient price, P^*_Y, is lower than the competitive market price, P_Y, because of the presence of the beneficial external effect.

An important question that arises here is how these inefficiencies associated with externalities can be eliminated. An attempt to answer this important question will be made in the following paragraphs. It will be shown there that, under certain circumstances, policy intervention is one way which can lead to efficient outcomes. The analysis in this section has already pointed to one measure that could bring about efficient outcomes: the use of subsidies.

3.3.3. Public goods and economic efficiency

The production, consumption and product-mix efficiency conditions for a competitive market situation are restated[16] in the upper part of table 1.1. In this case, as no public goods exist, *X* and *Y*, are each private goods. Note that $(U_X / U_Y)^A$ is the number of units of good *Y* that individual A is willing to pay for an additional unit of *X*. As the consumption of *X* is divisible, the social willingness to pay (WTP)[17] for one unit of *X* is equal to one consumer's WTP. Given fixed market prices, P_X and P_Y, this measure of WTP will be identical for all consumers. The expressions involving marginal products refer to the reduction in production of *Y* that would result from transferring resources into the production of an extra unit of *X*. In other words, it is the social opportunity cost of *X* in terms of *Y*. Efficiency requires that the individual WTP for *X* in units of *Y* is equal to the opportunity cost of *X* in units of *Y*.

Table 1.1. Private and public goods: consumption efficiency

Efficiency conditions for two private goods, *X* and *Y*:

$$\left(\frac{U_X}{U_Y}\right)^A = \left(\frac{U_X}{U_Y}\right)^B = \frac{MP_K^Y}{MP_K^X} = \frac{MP_L^Y}{MP_L^X} \left[= \frac{P_X}{P_Y}\right]$$

Efficiency conditions for a private good (*Y*) and a public good (*Z*):

$$\left(\frac{U_Z}{U_Y}\right)^A + \left(\frac{U_Z}{U_Y}\right)^B = \frac{MP_K^Y}{MP_K^Z} = \frac{MP_L^Y}{MP_L^Z} \left[= \frac{P_Z}{P_Y}\right]$$

However, in the case where one of the goods (*Y*) is private and the other (*Z*) is a public good, the efficiency condition is now that given in the lower part of table 1.1. As the consumption of *Z* is non-divisible, the social willingness to pay for one unit of *Z* is the sum over all consumers of each person's WTP, rather than being equal to

[16] *see also annex 1*

[17] *the concept "willingness to pay" will be addressed in more detail in chapter 2*

one person's WTP. The interpretation of the terms involving marginal products remains exactly as before. Thus efficiency in the allocation of resources requires that the sum of individual WTP is equal to the opportunity cost of *Z* in terms of *Y*. As the opportunity cost of *Z* in terms of *Y* is equal, in a market economy, to the ratio of the output prices[18], P_Z/P_Y, we can re-express this result as follows. For one public and one private good, economic efficiency requires that

$$\sum\left(\frac{U_Z}{U_Y}\right)=\frac{P_Z}{P_Y}$$

If we choose the units in such a way that $P_Y = 1$, we can write the two efficiency conditions as

$$\frac{U_X}{U_Y}=P_X \tag{1.15}$$

for two private goods, and

$$\sum\left(\frac{U_Z}{U_Y}\right)=P_Z \tag{1.16}$$

for one private good (*Y*) and one public good (*Z*). Equation 1.15 may be interpreted as stating that for any two private goods, consumption efficiency requires that the WTP for *X* (in units of *Y*) is equal to the price of *X* (in units of *Y*). On the other hand, for the case of *Z*, being a public good, equation 1.16 states that purchases should be arranged so that the sum of the WTP for *Z* (in units of *Y*) over all consumers of the good *Z* is equal to the price of *Z* (in units of *Y*).

There is an important matter to be careful about here. For a private good, the (implicit) demand curve for the resource is the horizontal sum of the individual demands. For a public good, the (implicit) demand curve for the resource is the vertical sum of individual demands. This distinction is illustrated in figures 1.4 and 1.5.

[18] *in the case of the public good Z, it can seem a little strange to talk about an "output" price, as it strictly refers to the WTP*

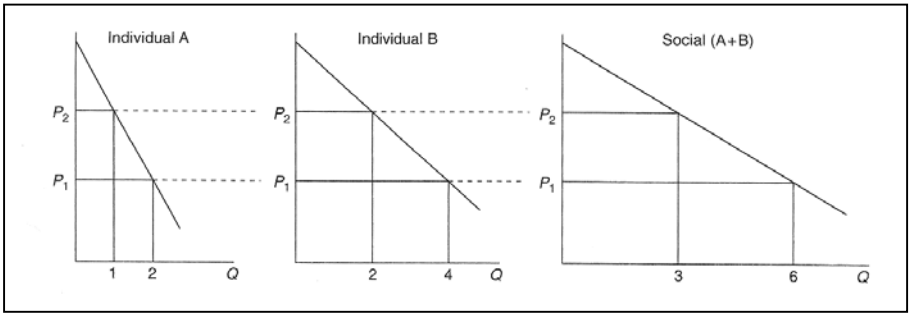

Figure 1.4. The aggregation of individual demands to social demands for a private good

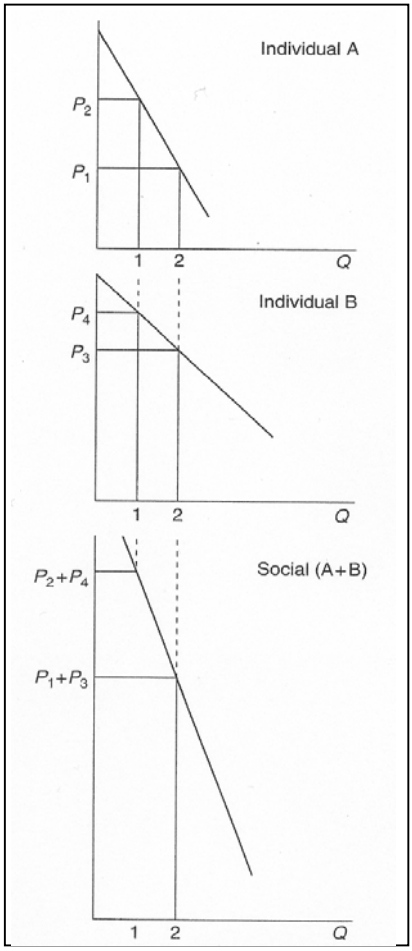

Figure 1.5. The aggregation of individual demands to social demands for a public good

A relevant question here is: once a particular public good is available, how much use should be made of that good? Additional use is socially beneficial (and so should be encouraged) whenever a potential user can derive any marginal benefit from the good, no matter how small, provided the marginal cost of that provision is zero. This latter condition will be satisfied, by definition, for a pure public good. However, in circumstances where congestion exists or rivalry between users arises, as for example where the presence of big groups of bikers to a rural area detract from other visitors' enjoyment, the good in question ceases to be a pure public good. Then limitation on use becomes efficient. The efficient use rate of an existing pure public good is illustrated in figure 1.6, where Q^* is the socially efficient level of provision. If a producer was able to extract a price, and that price were P_Q, then the level of demand would be Q'. This would result in an efficiency loss of the area indicated by B.

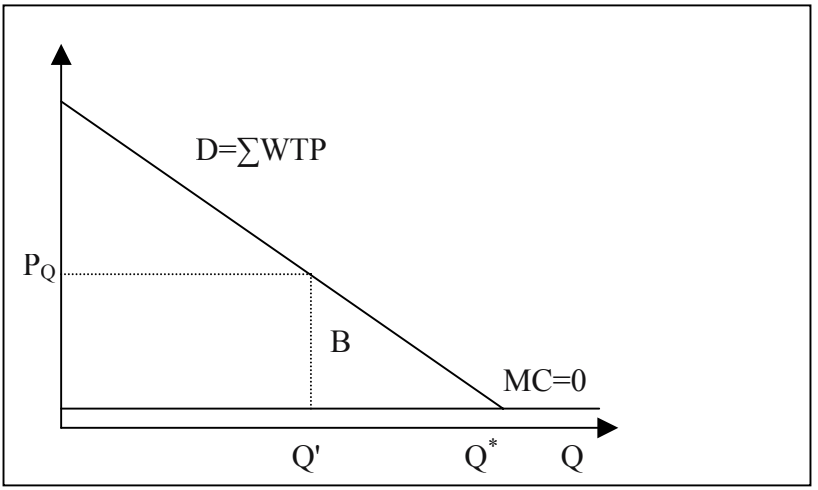

Figure 1.6. The socially efficient level of provision of a public good

We want to conclude this section by referring to two important remarks, which will be addressed in more detail throughout the rest of this work. One is that the extent to which an economy is able to reach an efficient allocation of resources will depend upon the nature of the property rights that prevail. This leads us to the second remark that government intervention in the operation of market economies offers the possibility of realising substantial efficiency gains, by eliminating or mitigating situations of market failure, though there are limitations on the ability of government to rectify inefficiencies in the allocation of resources.

3.4. Market failure

In the concluding section of this chapter it is important to emphasise on the concept of market failure once more, as externalities and public goods are two special cases of incomplete markets. It means the market fails because, in both cases, prices do not communicate society's desires and constraints accurately. Prices under- or overstate the full range of services provided by an amenity, or simply do not exist to send a signal to the market place about the value of the amenity. Market failure occurs when private decisions based on these prices, or lack of them, do not generate an efficient allocation of resources. Inefficiency implies that resources could be reallocated to make at least one person better off without making anyone else worse off. A wedge is driven between what individuals want privately and what society wants as a collective (Hanley et al, 1997). This divergence between private and social optimum, has been illustrated in figure 1.3 for a positive externality. With the assistance of that figure, a number of conclusions can be drawn about market allocations of commodities causing beneficial externalities[19]:

1. the output of the commodity is too small;
2. too little benefits are produced;
3. the prices of products responsible for the benefits are too high;
4. as long as the benefits are external, no incentives to search for ways to yield more benefits per unit of output are introduced by the market.

The economic theory approach suggests that government action could be used to restore efficiency, but other possible remedies should be explored, such as private negotiation (when the number of affected parties is small)[20] or judicial remedies (by imposing either property rules or liability rules) (Tietenberg, 1996). How society can and should reduce these forms of failure through privatisation, collective action or government intervention is an important research question throughout this work.

4. ANALYTICAL FRAMEWORK

The work on production relationships and that on externality and public good aspects can be interpreted as providing an analytical framework that defines a series of questions which should be posed sequentially in order to arrive at policy insights (OECD, 2001a). More specifically, the answers to the questions will provide guidance as to when policy intervention is needed and what the appropriate policy response should be. The answers provide a framework that will help to keep the discussion sharply focused on the key issues that have been identified. It should be noted, however, that the answers to the questions will not always be unambiguous and that the costs of assembling the required information (transaction costs) could be very high.

The framework can be summarised in three questions, which should be answered sequentially. Figure 1.7 presents this framework.

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[19] *for pollution externalities, see Tietenberg (1996)*

[20] *taking into account other possible problems, such as strategic behaviour and collusion*

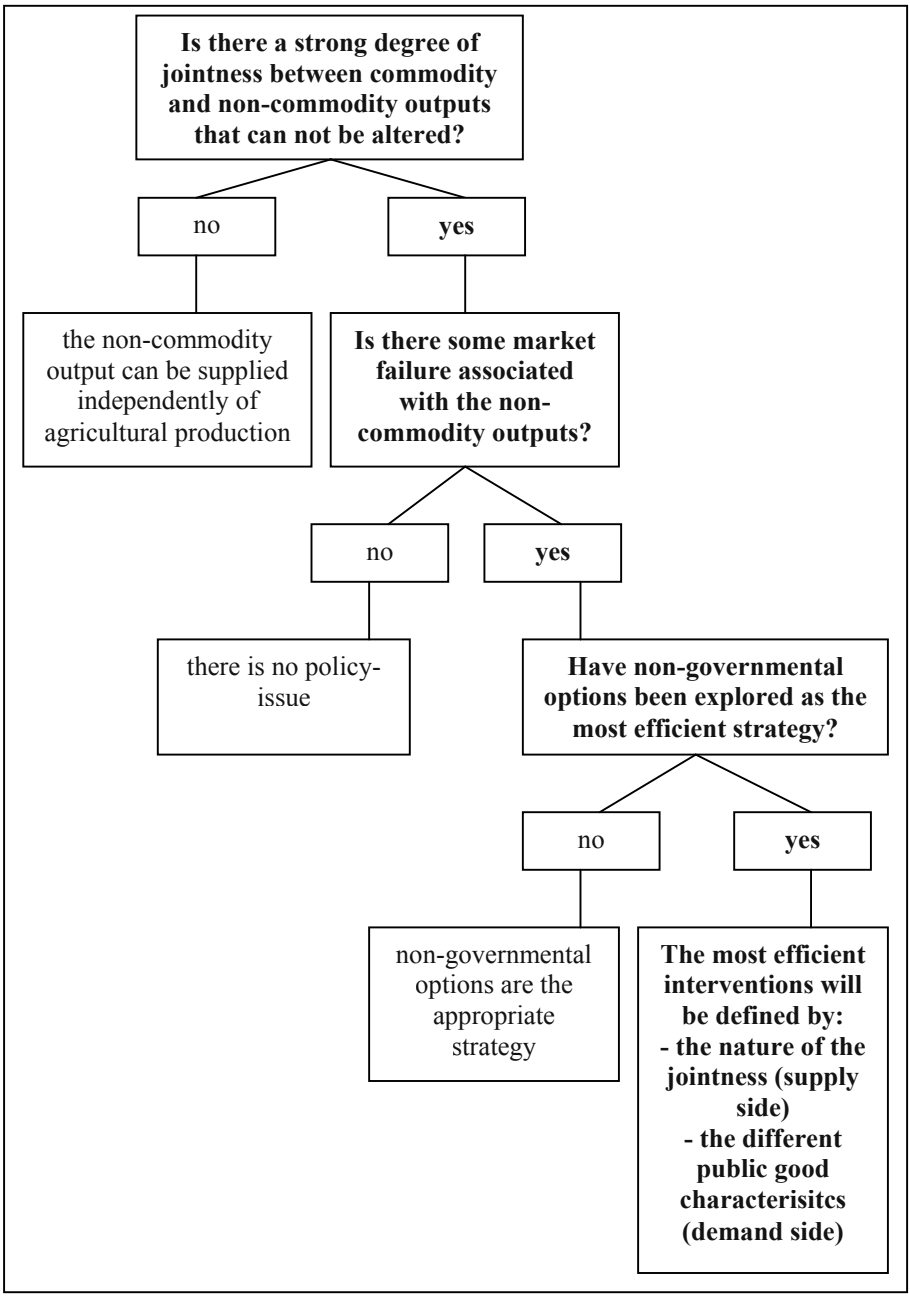

Figure 1.7. Analytical framework to analyse multifunctional outputs from agriculture

The first step in any exploration of multifunctionality is to establish the degree of jointness with commodity production. Therefore the proposed framework begins by examining whether a non-commodity output is jointly produced with a commodity, and if so, whether it can be released from this jointness. If production is non-joint, the non-commodity outputs can be supplied independently. Similarly, if production of a non-commodity output can be separated from the production of a commodity output without any cost, the non-commodity output can be supplied independently. If this is the case, policies can be established independently of agricultural production, which only target the supply of non-commodity outputs.

There are, however, non-commodity outputs that can not be released completely from jointness with commodity production. Non-commodity outputs that are jointly produced with commodities are by definition externalities, but they do not always cause market failures. In this case it is necessary to examine whether the non-commodity outputs in question are causing market failures. If not, there is no policy issue.

At the end, there may be non-commodity outputs for which both jointness and market failure have been established. In this situation it is necessary to determine if there are non-governmental options to minimise market failures. When market failures associated with externalities arise, measures are required to provide incentives to incorporate social effects into production decisions. For some types of public goods, non-governmental options may be the appropriate strategy.

Finally, and only if the answers to all these questions is "yes", then the most efficient interventions will be defined by the nature of the jointness that exists on the supply side and by the different public good characteristics of the non-commodity outputs on the demand side.

It should be recognised that the information requirements implied in answering this series of questions may be onerous. We have to keep in mind that the linkage(s) between agricultural activity and public good production is influenced by different factors (Romstad et al, 2000):

- Many public goods are site specific. What is a public good in one place, may not be looked upon as a public good in another *location*.
- What is looked upon as a public good, and how valuable it is varies from individual to individual, like for the amenity *value* of the landscape or food security.
- Having a short or long-term perspective may influence how one looks upon public goods associated with agricultural production. In addition, the public good perspective may change with *time*.
- Lack of *scientific knowledge* on the linkage between private and public good production, may make it difficult to indicate what is an "optimal" level of private good production. Lack of knowledge may also make it difficult or even impossible to point out what are public goods and what aren't.
- The *initial level* of agricultural production is central for how a change in it will influence public good provision.

Even with these practical difficulties, the conceptual framework can contribute to analysing and identifying options for future action. There remains considerable

variation between opportunities and likely directions of policy for individual nations. Contemporary processes of liberalisation and market development are creating differences between countries regarding the principal goals assigned to agriculture. In the industrialised countries there is a demand for a more multifunctional agriculture, particularly with effective ecological functions. In developing countries the debate on multiple functions relates above all to the desire to conserve a high level of local food security and a reasonable distribution of income and resources (FAO, 1999).

5. CONCLUDING COMMENTS

Based on the analytical framework, as proposed by OECD and discussed in figure 1.7, the aim of this research can be reformulated as illustrated in figure 1.8. The analyses of production, externality and public good aspects of multifunctionality

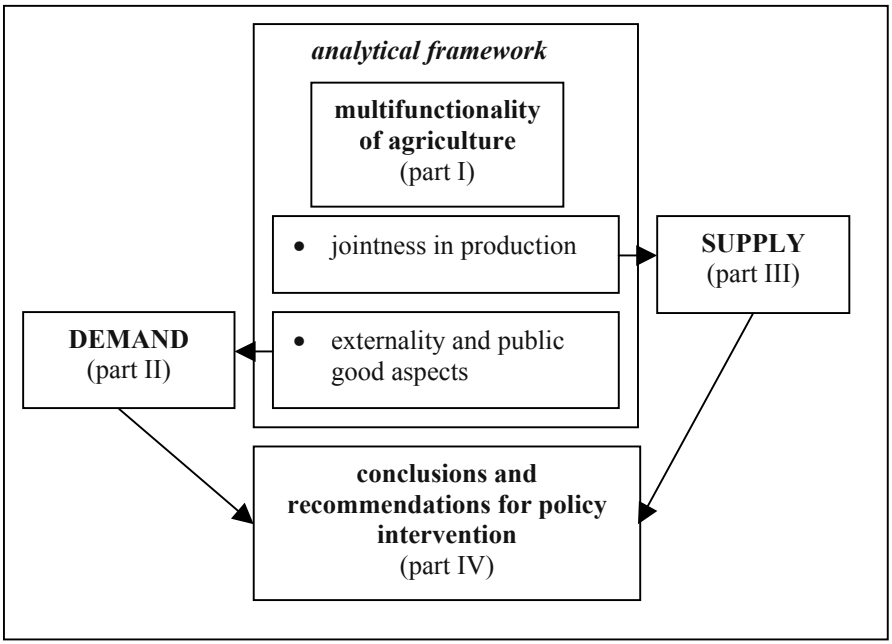

Figure 1.8. Conceptual framework of the study

(proposed in the analytical framework) complement one another in that they treat respectively supply and demand aspects. The conclusions from each element need to be combined in order to proceed to a discussion of the policy implications of multifunctionality. Examining the public good characteristics of non-commodity outputs requires information on how they are produced and how they are consumed. Determining the marginal benefits and costs of an externality requires an understanding both of supply (how it is jointly produced with a commodity) and of demand (how it is valued by society).

To be able to address the questions as formulated in the analytical framework, we need to have a good insight in both the supply and demand aspects of the non-commodity goods. Many of the multifunctional outputs of agriculture, however, do not show up in the form of immediate monetary gain: the benefits are to be found more in the quality of life than in any increment to a nation's economic output. Therefore economic valuation has to be considered, in order to demonstrate the need and importance of policy interference. This will be addressed in the following chapter.

CHAPTER 2

VALUING THE OUTPUTS OF MULTIFUNCTIONAL AGRICULTURE

1. THE MEANING OF ENVIRONMENTAL VALUATION

In environmental economics, valuation refers to the estimation of the monetary value of an environmental asset, or to a change in the level of an environmental attribute (Markandya et al, 2001). The idea of putting a money value on damage inflicted on the environment strikes many as illicit, even immoral. The justification for monetary valuation lies in the way in which money is used as a measuring rod to indicate gains and losses in utility or welfare. That is, money is the means of measurement, and must not be confused with more popular concepts about making money as an objective (Pearce and Turner, 1990).

In the specific case of multifunctional agriculture, economic valuation attempts to provide an empirical account of the value to people of the services and amenities produced by multifunctional agriculture. These value accounts serve simultaneously as a utilitarian account of the contribution of multifunctional agriculture to human welfare, and as a fount of efficient virtual prices to direct resource allocation.

2. DEFINING AND MEASURING WELFARE CHANGES

The economic concept of value has its foundation in neo-classical welfare economics (see e.g. Freeman, 1993). The basic premises of welfare economics are that the purpose of economic activity is to increase the well-being of individuals who make up the society, and that each individual is the best judge of how well off he or she is in a given situation. Each individual's welfare depends not only on that individual's consumption of private goods and of goods and services produced by the government, but also on the quantities and qualities each receives of non-market goods and service flows from the resource-environment system - for example: health, visual amenities, and opportunities for outdoor recreation.

The idea is that 'what people' want - individuals' preferences - should be the basis of benefit measurement. The easiest way to identify those preferences is to see how people behave when presented with choices between goods and services. If an individual prefers bundle *A* to bundle *B*, then bundle *A* must convey a higher level of welfare. Assuming that individuals can rank the alternative bundles, the preference ordering should have two properties. The first is nonsatiation, or the "more-is-better" property. This means that a bundle with a larger quantity of an element will be

I. Vanslembrouck & G. Van Huylenbroeck,
Landscape Amenities: Economic Assessment of Agricultural Landscapes, 27—39.

preferred to a bundle with a smaller quantity of that element, other things being equal. The second property is substitutability among the components of the bundles. This means that if the quantity of one element of a bundle, say x_i, is decreased, it is possible to increase the quantity of another element, say x_j, sufficiently to make the individual indifferent between the two bundles.

If the preference ordering has the properties described here, it can be represented by an ordinal preference function or utility function that assigns a number to each bundle as a function of the quantities of each element of the bundle. Specifically,

$$u = u(X, Q, T) \tag{2.1}$$

where X is a vector of the quantities of market goods, Q is a vector of public goods and environmental and resource services whose quantities or qualities are fixed for the individual, and T is a vector of the time spent in various activities that yield utility to the individual. This utility function is assumed to be increasing in all of its arguments and unique up to a monotonic transformation.

To simplify the exposition and notation, let us now consider an individual whose utility is a function only of private goods that can be bought and sold in the market. Assume that tastes and preferences (that is, the utility function) are given and do not change. The individual faces a set of given prices for these goods and is assumed to choose the quantities of the goods so as to maximise his utility, given the constraints of prices and a fixed money income M. The maximisation problem can be expressed as

$$\text{maximise } u = u(X) \tag{2.2}$$

$$\text{subject to } \sum_i p_i x_i = M$$

where X is the vector of quantities $(X=x_1, \ldots, x_i, \ldots, x_n)$. The solution to this problem leads to a set of ordinary demand functions

$$x_i = x_i(P, M) \tag{2.3}$$

where P is the vector of prices $(P=p_1, \ldots, p_i, \ldots, p_n)$. These are Marshallian demand curves: the quantity demanded is a function of prices and consumers' income.

Substituting the expressions for x_i as functions of P and M into the direct utility function gives the indirect utility function, that is, utility as a function of prices and income, assuming optimal choices of goods:

$$u = v(P, M) \tag{2.4}$$

According to Roy's Identity, the demand functions can also be expressed in terms of derivatives of the indirect utility function,

$$x_i(P,M) = -\frac{\partial v/\partial p_i}{\partial v/\partial M} \tag{2.5}$$

Another useful perspective on the problem of individual choice is represented by the expenditure function. Formulating the dual of the utility maximisation problem (equation 2.2) derives it. The individual is assumed to minimise total expenditure,

$$e = \sum_i p_i x_i \tag{2.6}$$

subject to a constraint on the level of utility attained,

$$u(X) = u^0$$

where u^0 is the maximum utility attained with the solution to the primal problem. Just as the solution to the utility maximisation problem yields a set of ordinary (or Marshallian) demand curves, conditional on prices and money income, the solution of the expenditure minimisation problem yields a set of functions giving optimal quantities for given prices and utility. These are Hicks-compensated demand functions that show the quantities consumed at various prices assuming that income is adjusted (compensated), so that utility is held constant at u^0. Substituting these demand functions into the expression for total expenditure yields the expenditure function. This expression gives the minimum money expenditure necessary to achieve a specified utility level, given market prices. In functional notation:

$$e = e(P, u^0) \tag{2.7}$$

where e is money expenditure and u^0 is the specified utility level. The compensated demand functions can also be found by differentiating the expenditure function with respect to each of the prices:

$$\partial e/\partial p_i = h_i(P, u^0) \tag{2.8}$$

Now consider the set of ordinary demand functions derived from the utility maximisation problem. In order to determine the functional form and parameters of these demand functions, it is necessary to know the underlying utility function, and this may not be directly observable. Suppose instead we observed an individual's behaviour and estimate the demand functions that describe the individual's responses to changes in prices and income. These functions should contain the same information as the underlying preferences. This is assured, provided that the demand

functions satisfy the so-called integrability conditions[21]. If these conditions are satisfied, the system of demand functions can be integrated to yield the expenditure function, which in turn can be used to derive the indirect and direct utility functions. In this case, it may thus be possible to utilise empirically derived descriptions of demand behaviour to obtain a complete description of the underlying preferences, as well as exact measures of welfare change for a wide range of postulated changes in economic circumstances.

In order to introduce the alternative welfare measures, we will consider the simplest case of only two goods and the welfare gain associated with a non-marginal decrease in the price of one of these goods. Five alternative measures of this welfare change have been identified in the literature. The first is the change in the ordinary consumer's surplus, explained by Marshall in 1920 (as cited in Freeman, 1993) as

> The individual derives from a purchase a surplus of satisfaction. The excess of the price which he would be willing to pay rather than going without the thing, over that which he actually does pay is the economic measure of this surplus of satisfaction. It may be called consumer's surplus.

Ordinary consumer's surplus can be measured by the area under a Marshallian ordinary demand curve but above the horizontal price line[22]. Unfortunately, the concept of consumer surplus has been shown to have a number of problems as a measure of the benefits resulting from price or quantity changes. These problems are largely a result of the fact that the ordinary (Marshallian) demand curve does not hold the level of utility or satisfaction constant, but rather holds income constant (Mitchell and Carson, 1989).

Therefore, four other measures of welfare change have been suggested (i.a. by Hicks), as theoretical measures of the ordinary consumer's surplus. Each can be defined in terms of the underlying individual preference mapping. Figure 2.1 shows two indifference curves for an individual. Assume that an environmental improvement reduces the cost of producing x_1 so that the price drops from p_1' to p_2''. In response to the price reduction, the individual shifts from the consumption bundle marked A at utility level u^0 to consumption bundle B at utility level u^1. The welfare benefit of the price reduction to this individual can be expressed in four alternative ways, defined in terms of good x_2, which is taken to be the numeraire. The units of x_2 are chosen so that the price of x_2 is equal to one. Thus, x_2 can be taken to represent income.

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[21] *these conditions require that the Slutsky matrix of substitution terms,* $\frac{\partial x_i(P,M)}{\partial p_j} + \frac{\partial x_i(P,M)}{\partial M} x_j$ *, be symmetric and negative semi-definite (see e.g. Varian, 1993)*

[22] *For a general discussion on consumer's surplus, see Varian (1993).*

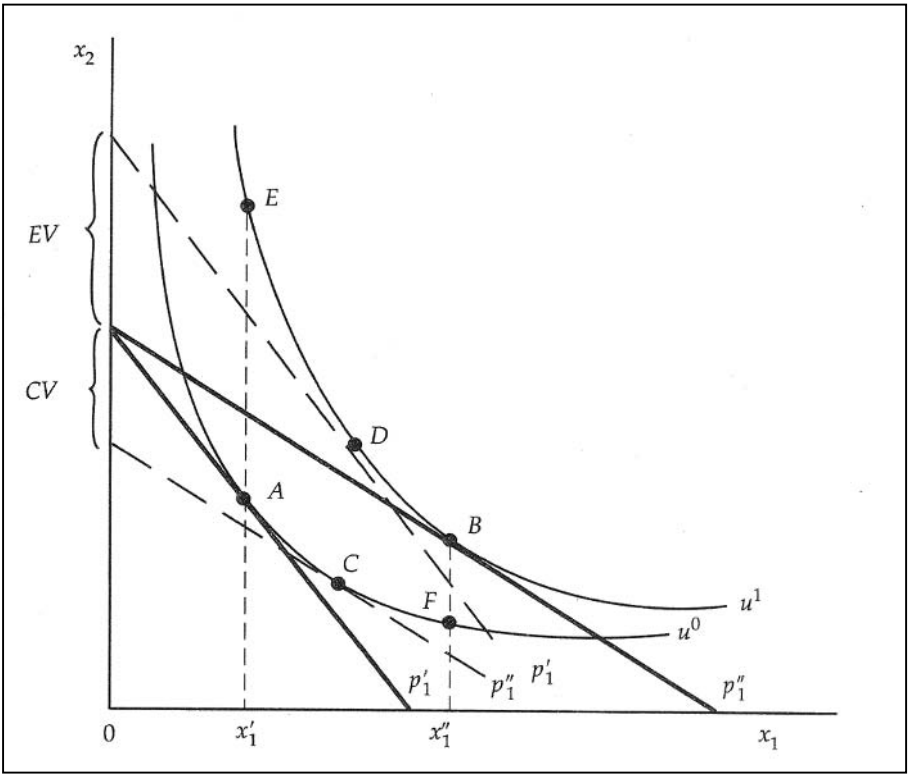

Figure 2.1. Four measures of the welfare gain from a price decrease (Source: Freeman, 1993)

The four remaining measures of welfare changes are:

1. Compensating variation (CV): this measure asks what compensating payment (that is, an offsetting change in income) is necessary to make the individual indifferent between the original situation (*A* in figure 3.1) and the new price set. Given the new price set with consumption point *B*, the individual's income could be reduced by the amount of CV and that person would still be as well of at point *C* as at point *A* with the original price set and money income. The measure CV is often interpreted as the maximum amount that the individual would be willing to pay for the opportunity to consume at the new price set. However, for a price increase, CV measures what must be paid to the individual to make that person indifferent to the price change (this will also be discussed in more detail in the following paragraph). For price decreases the CV cannot be bigger than the individual's income, but for a price increase, the CV could exceed income.
2. Equivalent Variation (EV): this measure asks what change in income (given the original prices) would lead to the same utility change as the

change in price of x_1. As shown in figure 3.1, given the original prices, the individual could reach utility level u^1 at point D with an income increase equal to EV. EV is the income change equivalent to the welfare gain due to the price change. The EV measure has also been described as the minimum lump sum payment the individual would have to receive to induce that person to voluntarily forgo the opportunity to purchase at a new price set. For a price increase, EV is the maximum amount the individual would be willing to avoid the change in price.

Note that both the EV and CV measures allow the individual to adjust the quantities consumed of both goods in response to both changes in relative prices and income levels. The remaining two measures restrict the individual to consuming a specific quantity of the good whose price has changed. Their use is therefore limited, but they are rather important with regard to public goods, as they measure welfare changes in cases of quantity changes of a non-excludable good.

1. Compensating Surplus (CS): this measure asks what compensating payment will make the individual indifferent as to the original situation and the opportunity to purchase the new quantity x_1'' of the good whose price has changed. The CS measure is the vertical distance between the indifference curves at the new quantity x_1''. This is the distance from B to F in figure 3.1. This measure is closely related to the CV measure, the only difference being the restriction on adjusting the purchase of x_1 in response to the compensating change in income.
2. Equivalent Surplus (ES): this measure asks what change in income is required, given the old prices and consumption level of x_1, in order to make the individual as well off as that person would be with the new price set and consumption point B. In figure 3.1 the ES measure is the vertical distance between the two indifference curves, holding the consumption of good x_1 at the original level, that is, the vertical distance from A to E. The ES measure is closely related to the EV measure, the only difference being in the restriction on the adjustment of the consumption of x_1 in the former case. The ES measure is larger than the EV measure for price decreases because it must include an income equivalent to the individual's welfare loss stemming from the inability to adjust the consumption of x_1 so as to equate the marginal rate of substitution with the price ratio.

Each of these concepts measures something different and has a different meaning. The compensating and equivalent measures answer different kinds of policy-relevant questions because they make different implicit assumptions about the relevant status quo. In each case, the appropriate welfare measure can be found by examining the nature of the social transaction that is implied by the policy decision at hand and by the implicit rights to the services of the environment presumed to be held by the various parties to the transaction. All of this can be summarised as follows:

Welfare measure	*Price increase*	*Price decrease*
EV-Implied property right in the change	WTP to avoid	WTA to forgo
CV-Implied property right in the status quo	WTA to accept	WTP to obtain

Because in the literature on environmental valuation the concepts willingness-to-pay (WTP) and willingness-to-accept (WTA) are very often used, the next paragraph is devoted to a closer look at those concepts.

3. APPROACHES TO MEASURING VALUES

As has been discussed above, the conceptually valid measures of welfare change are willingness-to-pay (WTP) for benefits, and willingness-to-accept (WTA) for costs.

WTP is the amount of money the individual would pay willingly to get a desired good, service or state of the world, rather than going without (Randall, 2002). In other words, it is a measure of benefit to a consumer of a change in the price, quantity or quality of a good. The maximum amount of money an individual is willing to pay to obtain a benefit or avoid a loss is usually assumed to reflect the values he/she attaches to the benefit or loss (Markandya et al, 2001).

WTA is the amount of money that would induce the individual willingly to give up the good, service or state of the world (Randall, 2002). It refers to the amount of money that an individual would be willing to accept as a compensation for suffering a loss, such as an environmental deterioration, or for not receiving a benefit (Markandya et al, 2001).

These welfare measures are readily defined in market terms - WTP is buyer's best offer, and WTA is seller's reservation price - but by no means are restricted to commodity markets. Some people are willing to pay a serious amount of money for improvements in the quality of life. Some are willing to accept a lower level of amenities if compensated with real money: some people would actually move to a less attractive location if promised a large enough payment (Randall, 2002). The relationship between the measures of consumer benefits and the concepts of WTP and WTA is shown in table 2.1. Depending on the consumer's property right position vis-à-vis the good in question, each of the four welfare measures may involve either payment or compensation in order to maintain utility at a specified level (Mitchell and Carson, 1989).

In general, WTA is equal or bigger than WTP in absolute value. For small changes in the quantity of efficiently allocated and priced goods, WTP and WTA and market price tend to converge. For drastic changes in highly valued things, WTA and WTP may diverge dramatically (Pearce and Turner, 1990; Randall, 2002).

The question of which measure of welfare change to use, WTP or WTA, has been discussed extensively in literature. It has been proved by Hanemann (1994) that there is no theoretical reason to believe that the measures will be close in value. The National Oceanic and Atmospheric Administration (NOAA) Panel who has drawn up a list of guidelines for CVM surveys recommends to use always the WTP format (Arrow et al, 1993). It is, however, dangerous, as pointed out by Harrison (cited in Holstein, 1998), to measure one thing (WTP) if the correct thing to measure

is something else (WTA). The choice between the WTP and WTA formulation is a question of property rights[23]: does the agent have the right to sell the good in question or, if he wants to enjoy it, does he have to buy it (Mitchell and Carson, 1989)? Thus, there are no theoretical arguments for using the WTP format in situations when the property rights are distributed in such a way, that the respondent has a right to the amenity in question, making WTA the correct format.

Table 2.1. Relationship between willingness to pay (WTP) and willingness to accept (WTA) compensation

WTA compensation for accepting a price rise	⇔	WTA compensation for foregoing a price fall
⇕		⇕
Compensating Variation (CV) of price rise (welfare fall)	⇔	Equivalent Variation (EV) of price fall (welfare rise)
EV of price rise (welfare fall)	⇔	CV of price fall (welfare rise)
⇕		⇕
WTP to prevent deterioration	⇔	WTP for price fall (welfare improvement)

Source: Perman et al, 1996

4. TOTAL ECONOMIC VALUE

WTP (or WTA) for an increment (decrement) in some natural resource amenity captures the *total economic value* of the prospective change. The economic value of externalities has various components. It's widely accepted that two broad categories of values exist: *use value* and *non-use value*. Use values are generated when a person uses the externality actively, typically by consuming it directly. Those who like to view the countryside, for instance, directly through recreation or indirectly through other media such as photograph and film "use" the environment and secure benefit. Use values also include *option values,* i.e. the additional value placed on a natural resource by those people who want to have the option of using the goods and services in the future. Non-use values are also described as *existence values* by many authors. The argument behind existence value is that people care about the environment not only because they, or their descendants, can get some benefit, or can avoid some sort of loss, by using or preserving environmental assets. Other authors refer to non-use values as passive use values, which captures the intuition that people may enjoy genuine satisfaction from "just knowing" that a particular state of the world (say, a cultural landscape) is being maintained in good condition.

[23] *there is a long and extensive literature on property rights in both law and economics. From the perspective of economic welfare, and valuation in particular, perceived property rights and entitlements may be more important than actual legal ones (Mitchell and Carson, 1989)*

They value the existence of e.g. the whales, a value unrelated to use, because they will probably never see whales in reality. However, contributions to voluntary organisations providing preservation, and political support for pro-preservation policies are consistent with passive use value. Others define passive use value as the value that individuals place on the non-consumptive use of a natural resource. In this sense it is rather a direct use value, like e.g. bird watching and whale watching. Non-use values also include *bequest values* as the value that an individual places on having an environmental quality available for his or her children to experience. It is based on the desire to exchange current value for increased wellbeing of one's descendant (Pearce and Turner, 1990; Markandya et al, 2001; Randall, 2002).

Following Pearce and Turner (1990), a formula for total economic value can be written as follows: total economic value = actual use value + option value + existence value. Within this equation we might also state that: option value = value in use (by the individual) + value in use by future individuals (descendant and future generations) + value in use by others (vicarious value to the individual). However, the process of putting together categorical estimates to arrive at a "total economic value" is subject to considerable misunderstanding and debate. This issue cannot be divorced from the choice of valuation method. Randall (1991) argues that either a single value statement encompassing all impact categories must be sought or categorical values must be sequenced vary carefully. To do otherwise risks double counting and overestimation.

From the discussion above, it is clear that total economic value consists of different components, which can have different interpretations, depending on the author. Differentiating use and non-use is not easy. Therefore the estimates often refer to total economic value as the sum of use value and non-use value. Not many studies have attempted to separate economic value according to use and non-use value (see i.a. Pearce and Barbier, 2000). On the other hand, some valuation methods can only measure use values, as will be seen in the following section.

5. VALUATION METHODOLOGIES

In order to complete this chapter on valuing outputs of multifunctional agriculture, a section on valuation methods has been added. This section gives a short introduction in the literature on this matter, but does not at all pretend to be complete. It serves as a completion to the concepts and theory, discussed in the previous sections. The methods used in the empirical analyses will get more attention in the following chapters.

A number of techniques are available to value non-marketable goods in economic terms. In environmental economics, two broad approaches exist in the valuation of environmental resources. Some authors classify the methods as either direct or indirect (see e.g. Pearce and Turner, 1990; Hanley et al, 1997; Markandya et al, 2001), where direct methods attempt to obtain preferences directly via survey and experimental techniques, while indirect approaches attempt to elicit preferences from actual, observed, market-based information. Other authors divide the valuation methods into two categories: those which value a commodity via a demand curve,

and those which do not (i.a. Bateman, 1993; Turner et al, 1994; Garrod and Willis, 1999).

Mitchell and Carson (1989) have offered a classification of methods for estimating values that are based on two characteristics of the methods. The first characteristic is whether the data come from observations of people acting in real-world settings where people live with the consequences of their choices, or come from people's responses to hypothetical questions of the form "what would you do if ...?" or "would you be willing to pay ...?". The second characteristic is whether the method yields monetary values directly or whether monetary values must be inferred through some indirect technique based on a model of individual behaviour and choice. On the basis of these two methodological characteristics, any method for estimating environmental and resource values can be placed in one of the four possible categories, as shown in table 2.2.

Table 2.2. Methods for estimating values

	Observed behaviour	**Hypothetical**
Direct	*direct observed*	*direct hypothetical*
	competitive market price	bidding games
	simulated markets	willingness-to-pay-questions
Indirect	*indirect observed*	*indirect hypothetical*
	travel cost	contingent ranking
	hedonic property values	contingent activity
	avoidance expenditures	contingent referendum
	referendum voting	

Source: adapted from Mitchell and Carson (1989)

With *direct observed* methods, the observations are based on the actual choices made by people who are maximising their utility, subject to the relevant constraints, and who are free to choose the quantity of the good at a given price. *Indirect observed* methods are also based on actual behaviour reflecting utility maximisation, but most of such models are based on the assumption of some kind of substitute or complementary relationship between the environmental service and marketed goods and services. The principal difference between indirect observed and *indirect hypothetical* methods is that the latter draw their data from people's responses to hypothetical questions rather than from observations of real-world choices. The fourth category, *direct hypothetical* methods, involves asking people directly about the values they place on externalities by, in effect, creating hypothetical markets (Freeman, 1993).

As discussed above, several different practical methods which can be used to measure the willingness to pay (accept) for public goods (bads) have been suggested in the literature. Since whole volumes have been devoted to the theory and practise of monetary valuation of environmental impacts, here we just offer a brief sketch of the most frequently used and/or suggested methods when it comes to valuing

multifunctional outputs of agriculture: survey techniques, travel cost methods, and hedonic approaches.[24]

5.1. Direct and indirect evidence from existing markets

While it is hard to imagine a market for multifunctional agriculture in the large, various components of it are marketed routinely This circumstance encourages proponents of revealed preference (RP) methods. Consider a diverse farming landscape. Agricultural commodities may be produced and sold. The landscape may provide catchment for water that is valued by downstream farmers and urban residents. Tourists and nature-lovers may devote real resources (money and time) to visiting the landscape. People may buy homes nearby, so as to have access to the amenities. The productivity and value of these various activities depends on the way the landscape is managed, so management decisions will generate costs and benefits that are reflected, to various degrees, directly or indirectly in markets.

5.1.1. Travel cost methods

The basic idea behind this method is that recreationists spending their money and time to visit the forest for instance, leave a trail of indirect evidence about their WTP for the services and amenities it provides. The travel cost methods attempt to tease out this WTP by valuing the recreational value of environmental resources such as parks and scenic areas. A survey of visitors to a national park can show how far they have travelled to reach the park, and it is then possible to estimate the amount they have spent (for gas, tolls, fares, and the value of time spent on travelling, plus any entry fee) to be able to enjoy the park's amenities. These data can be used to simulate a demand curve, indicating how many people are willing to visit the park at different total costs for the trip. The area under the demand curve indicates the total value of the park to its visitors (according to the theory of consumers' surplus). Important to note however, that this approach cannot represent the full ecological value of the park, nor does it capture option, existence, or bequest values.

5.1.2. Hedonic price analysis

The intuition behind this method is the following. Imagine a heterogeneous good such as a house, or an automobile. It is a reasonable hypothesis that the price of a particular house or car reflects its particular characteristics. If a statistical analysis succeeds in explaining the price of houses as a function of their characteristics, and one of those characteristics is the level of an environmental amenity, then the marginal impact of changes in the amenity level on house prices should provide evidence of amenity values. Hedonic pricing attempts to value environmental services as they relate to the value of marketed goods. For example, the value of a

[24] *for more details, I refer to, among others, Garrod and Willis (1999); Freeman (1993); Hanley et al (1997); Braden and Kolstad (1991); Hanley and Spash (1993); Bonnieux and Desaigues (1998)*

house is likely to be increased if it is situated next to a natural park. The value of a house situated next to an airport, on the other hand, is likely to be lower than that of a comparable house some distance away. By systematically examining the various attributes which determine housing values (typically, three kinds of characteristics: on-site characteristics such as the number of bedrooms, neighbourhood characteristics such as access to schools, and environmental amenities such as access to an attractive cultural landscape), it may be possible to isolate the effect of specific environmental factors, by using econometric analysis. The first derivative of the hedonic price function with respect to the environmental characteristic of interest is its hedonic price (or marginal implicit price), that measures the marginal value of the amenity. This gives a basis for an estimate of the benefits and costs associated with various environmental and land-use policies. Note that this method can only measure use values, although it has succeeded, in a fairly wide range of circumstances, in generating plausible estimates of marginal hedonic prices for environmental amenities, especially in the housing market.

5.2. Evidence from surveys - contingent valuation

If we design and ask the questions with enough care, perhaps people can provide reliable evidence of amenity values by telling us their WTP or WTA directly; or by telling us what they would do (e.g. buy/not buy, vote yes/no, ...) given well-specified choice situations constructed for them, in order to generate data that can be analysed to infer their WTP or WTA. This is the intuition behind stated preference (SP) methods. The great advantage is that the researcher controls the context choice, which opens up the possibility of estimating the total economic value, passive use value, and various relatively inaccessible use values. The potential disadvantages lie in the self-reported nature of the data: some people might seek to answer strategically, some might answer carelessly, and some might have difficulties to provide valid responses to the questions.

One such stated preference approach, and widely applied, is the contingent valuation method (CVM). This is essentially a survey method, in which people are asked how much they would be willing to pay for e.g. the maintenance of a certain natural park. The essential elements of a CV exercise are a description of the default and alternative situations and the institutional environment, the valuation question, and the policy decision rule. The valuation questions may take various forms, which has implications for the kind of econometric analyses required for estimating WTP or WTA, and for the incentives for truthful response. Contingent valuation is controversial, partly because WTP and WTA values tend to differ substantially[25], and partly because the survey technique is vulnerable to bias and inaccurate or inflated responses[26].

There is an extensive and ongoing debate concerning the potential and the limits of economic valuation of environmental costs and benefits. Some argue that pricing

[25] *a thorough discussion on this matter can be found in section 3 of this chapter*

[26] *see i.a. Carson (1991) for a further discussion on this issue and an overview of several types of biases*

the environment is inherently wrong, since money values are an inadequate measure for ecological systems. Others maintain that some valuation is essential for comparing policy options, and if done with caution will not misrepresent environmental values.

CHAPTER 3

LANDSCAPE AMENITIES FROM AGRICULTURE

1. LANDSCAPE AS A NON-COMMODITY OUTPUT FROM AGRICULTURE

As discussed in chapter 1, the concept of multifunctionality is rather broad and comprises different non-commodity outputs. In order to draw some policy-relevant conclusions, we have opted to concentrate our research on one specific output. This allows us to deepen the analysis rather than staying too general.

Landscape is one of the most commonly cited elements of the multifunctional characteristics of the agricultural sector (Cahill, 2001a). There is clearly a link between agricultural production and the landscape. However, jointness between agriculture and landscape is a complex question that requires close examination. Agriculture plays a key role in shaping the quality of landscape, as in many European countries farmers are responsible for managing more than half the land area (Barthelemy and Vidal, 1999; Caradec et al, 1999).

1.1. Definitions

Agricultural landscapes are the visible outcomes from the interaction between agriculture, natural resources and the environment, and encompass amenity, cultural and other societal values.

Environmental amenities provided by agriculture seem harder to define. According to Dillman and Bergstrom (1991), agricultural amenities are the group of aesthetic and psychological benefits generated by natural and man-made aspects of the agricultural environment. More specifically, they define amenities as the scenic value and the environmental qualities of agricultural land, which give it 'nostalgic value'. This definition is rather limited, as amenity can be explained as "the quality of being pleasant or agreeable" (Merriam - Webster's collegiate dictionary)[27]. Mitchell and Carson (1989) use the term "amenity" as a synonym for a change in public good which is valued in a benefit measurement study. In this work, the concept of amenities will be used in the context of positive externalities from agriculture.

From the definitions above, it is clear that there is some overlap between the concepts 'landscape' and 'amenities from agriculture'. In the rest of this work they

[27] *http://www.m-w.com/home.htm*

I. Vanslembrouck & G. Van Huylenbroeck,
Landscape Amenities: Economic Assessment of Agricultural Landscapes, 41—56.

will both be used, mainly as two complementary concepts, referring to the positive landscape attributes from agriculture.

Landscapes can be considered as consisting of three key elements (OECD, 2001b):

1. *Landscape structures* or appearance: including environmental features (e.g. flora, fauna, habitats and ecosystems), land use types (e.g. crop types and systems cultivation), and man-made objects or cultural features (e.g. hedges, farm buildings);
2. *Landscape functions*: such as place to live, work, visit, and provide various environmental services;
3. *Landscape values*: concerning the costs to farmers of maintaining landscapes and the value society places on agricultural landscape, such as recreational and cultural values.

Figure 3.1 gives a schematic definition of landscapes (OECD, 2001b), in which two broad types of landscape can be identified: (i) *natural* landscape formed by various biophysical forces of nature (e.g. geology, soils, climate, habitat, etc.); and (ii) man-made or *cultural* landscapes resulting from the interaction between human activity and the environment, in particular urban and agricultural landscapes. These interactions are dynamic: as technologies develop, policies and economic forces change, cultural values evolve, and populations move. The fundamental dynamic in creating and changing agricultural landscapes, however, is the need for agricultural products.

It is clear that a landscape is a combination of many components. Natural conditions and human activities have implications for many landscape attributes. The landscape is shaped by geomorphology (terrain, hydrography) and the occupation and use of the land (forestry, agriculture, urbanisation). The land and landscape are interrelated and the product of centuries of human activity. The different types of land occupation and use combined with land relief and hydrography have shaped the countryside throughout history, in tandem with demographic factors. Up until the 1960s, town and country planning largely determined the spatial development of land occupation. Over the last three decades, a major change has taken place under the combined effect of technical progress and developments in agricultural policies. Other driving forces acting on farmers include market returns, technological advances and development of new products, training, farm structures, tradition, public opinion, etc. (DGVI, 1998). It is clear that policy is only one factor and it would be wrong to conclude this is the only or main factor influencing environmental processes. However, policy is often the easiest one to influence and to some extent has to develop to keep up with other factors, particularly new technologies.

Changes in farming practices, particularly the management of inputs and irrigation, have led farmers to free themselves of the constraints imposed by the natural potential of the land. Also the CAP profoundly changed certain landscapes: ploughing up grasslands, clearing hedgerows, increasing the size of fields, leading to a general loss of diversity, etc. (Vidal, 1999). Present agricultural practices influence both natural and semi-natural landscapes and may both deteriorate and maintain these.

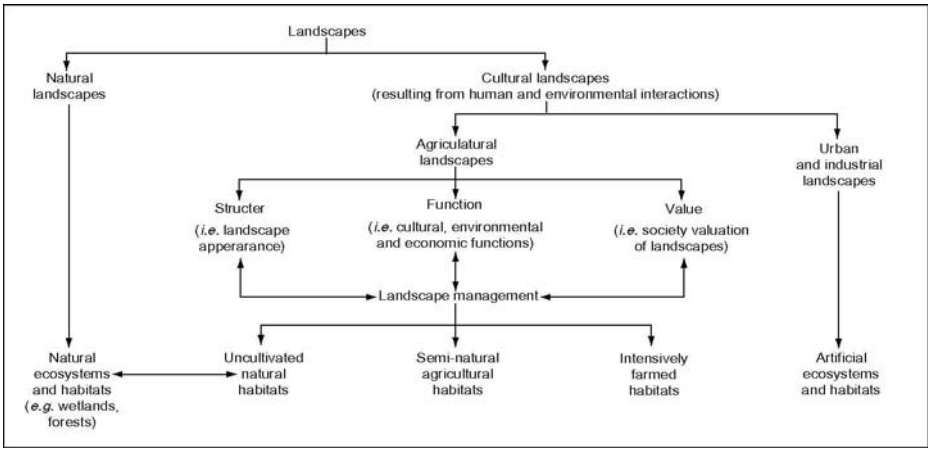

Figure 3.1. Defining natural and cultural landscapes: the agricultural context (Source: OECD, 2001b)

The value of the landscape is linked up with different components, like (Romstad et al, 2000):

- *biological diversity*: includes genetic species and ecosystem diversity, and also agrobiodiversity, which covers diversity among elements of semi-natural habitats as well as diversity of organisms in the arable field;
- *cultural and historical components:* are linked to skills and knowledge about management of the natural landscape, buildings, traditions, handicrafts, stories and music; and have historic, archaeological, practical, identity and symbolic values, among others;
- *amenity value of the landscape:* is mainly attached to the aesthetic values (beautiful to look at, because of what you see), and to a productive/"active" landscape (nice to look at because it gives signals of activity and a living society, management of natural resources and resource use);
- *recreation and access*: like going for walks, skiing, biking, camping, etc.; and
- *scientific and education interests*: cover numerous disciplines from archaeology, history, geography to plant and animal ecology, economy and architecture.

These components are of public interest at the same time as they may contribute to private economic activity, which can lead to conflict situations. There is a strong interdependency between the components, and it is often difficult to isolate them. People value landscapes based on their total impressions, and their knowledge about landscapes.

Agricultural landscapes, as such, can also be seen as "multifunctional" landscapes (Fry, 2001). They therefore need research and management that cross traditional subject boundaries. In the past, the various functions of landscape have been looked at from a series of single subject perspectives. This has had only limited success in reducing countryside conflicts. Planning and management decisions for improving crop production, biodiversity, landscape, amenity or other environmental functions cannot be made outside the context of human needs and wishes. Single subject approaches fail to incorporate this context, and, moreover, fail to consider how promoting one countryside interest will interact with others.

It is therefore important to examine relationships between landscape configurations that meet environmental goals and human perception of landscape. To attain a deeper understanding of the way (multifunctional) landscapes operate, we need to understand the nature of the interactions between different countryside interests.

1.2. Key characteristics

1.2.1. Joint product from agricultural production

Agricultural activity is central to all the components mentioned above, and they may be joint, complementary or competing in production, depending on the nature of the agricultural activity. Agricultural production affects landscapes through a combination of decisions regarding land use, commodity composition and farming practices. Structural changes, including the relocation of farms or barns out of villages into the surrounding countryside and the consolidation of land parcels into larger plots, also have their impact on the landscape. The intensification of agricultural production over the last decades has in many areas reduced landscape diversity due to the simplification of farmland structures and land features that pose obstacles to mechanisation, and the appearance of industrial-type farm buildings that contribute negatively to the landscape. To the extent that production-linked support has contributed to this development, it has also influenced the agricultural landscape (OECD, 2001a).

While consumer tastes may, to some degree, adjust to incremental changes in landscape brought about by changes in market conditions and support policies, there may also be a demand for maintaining certain landscape features or making active landscape improvements. In this context, the ease with which landscape provision can be (at least partially) separated from commodity production becomes important. Many of the point and line elements of the landscape can be provided or maintained independently of food and fibre production. This applies to agricultural structures, such as stone walls, but also to the historical monuments and other cultural heritage features. On the other hand, the large-area elements of agricultural landscapes are usually dominated by and closely linked to food and fibre production. This joint production aspect and the supply of these elements are the subject of part III.

1.2.2. Externality and public good character

The economic behaviour of farmers is guided by the prices of those inputs and outputs they buy or sell in the market. Landscape attributes are, however, not traded in the market and thus command no market price. However, for their production and maintenance, they often depend on particular styles of farming. Those attributes are typically non-excludable public goods. Farmers are prevented from charging others for the enjoyment of these attributes. On the other hand, society as a whole has no well-defined and enforceable rights over landscape attributes, and thus farmers are not charged for degrading the landscape (Santos, 1998).

The above discussion shows that levels of landscape attributes are an unintended side effect or externality of management decisions taken by farmers. This externality and public good character of the agricultural landscape, and how it is demanded by society, will be analysed in more detail in part II.

1.2.3. Need for efficient intervention

Landscapes are created by natural condition and human influence, at present and through time. Agriculture has a unique role when it comes to producing these public goods and contributing to the total value of the landscape. Still, there might be situations where one could imagine that management tasks could be taken over by nature groups or non-farm enterprises. But in many cases, farmers will have a comparative advantage in nature management, as they already have knowledge about the local environment, and are equipped with many of the tools needed for landscape management. This linkage is stronger the closer the benefits are tied to agricultural activity. Although not all landscape attributes need to be produced jointly with agriculture, there are several reasons to believe that agriculture is the most efficient supplier of most of those landscape elements. This is the main reason why the rest of this work continues to deal with landscape amenities from agriculture.

These landscape externalities are a source of market failure: too small levels of positively valued ones (with respect to socially optimal levels) will be produced by the market if this is left to act by itself. The need for efficient intervention will be touched upon in part IV.

1.3. The relationship between agriculture and landscape

As mentioned in the beginning of this chapter, and confirmed through the discussion in the previous paragraphs, the relationship between agriculture and landscape is rather complex. Following framework (figure 3.2) tries to bring different influences in this relationship into one picture:

1. Agriculture is responsible for the landscape through its primary function: the production of food, fibre and other raw materials. Through the choice of the products and production methods, farmers are "designing" the agricultural landscape. Farmers choices are influenced by several factors, such as market prices for inputs and outputs, consumers' demand for food, technological innovations,

policy measures, among others. In the past, policy measures have directed agricultural production in a certain way, which had and still have indirectly an important influence on the landscape. So was the priority of the CAP in its original phase, to increase agricultural production; protection of the rural environment was not a concern (see e.g. Brouwer and Lowe, 2000). This was not just a European phenomenon[28]. It is clear that intensive production methods have a different impact on the landscape than more extensive methods. The redirection of the CAP from market-oriented to structural policy (especially since MacSharry reforms, 1992) has already a positive impact because more attention is given to the positive externalities from agriculture, e.g. through the agri-environmental measures (2078/92), as will be discussed in part III.

2. Agriculture also benefits from an attractive landscape in several ways:
   - sale of (local) agricultural products on the farm, in local stores, markets, etc.;
   - renting accommodation on the farm (rural tourism);
   - positive "image" can stimulate the general demand for local products; etc.

   Also the influence of policy on these aspects is not negligible. These "extra income" sources for farmers can be stimulated through government intervention like promotion, subsidies, certificates, … In the case of the sale of local products, this has been analysed thoroughly in Verhaegen (2001). The tourism aspect will be addressed in part II of this work.

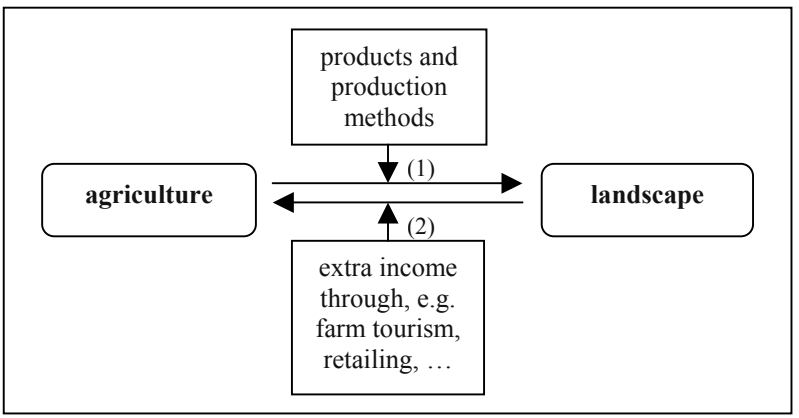

Figure 3.2. The relationship between agriculture and landscape, determined by supply of and demand for amenities

[28] *for examples in other countries I refer to Nellis (1992) for the USA or Hilts (1992) for Canada, to name but a few.*

From figure 3.2, it is clear that decisions made, both by producers (1) as well as consumers (2), have an impact on the agricultural landscape. Farmers' decision making with respect to which products to produce, which methods to use and which policy measures to participate in, directly influences the agricultural landscape. "Consumers" of the countryside, e.g. in the form of rural tourism, decide which landscape they prefer by choosing this or another destination.

Throughout the rest of this work, the decision making behaviour will be analysed from a theoretical point of view. The theoretical model is based on the model developed by Kool (1994) to analyse the buying behaviour of farmers. This model can be extended to the general case of decision making behaviour, and used in different contexts, as will be done in parts II and III. Variations in the decision making behaviour are caused by decision subject and decision maker characteristics, which can both be influenced by the general environment. The decision subject characteristics consist generally of market characteristics and subject-related characteristics. Decision maker characteristics can also be divided into two sets representing the individual and his "environment", such as household or enterprise. Thus four determinants of decision making behaviour can be proposed (figure 3.3).

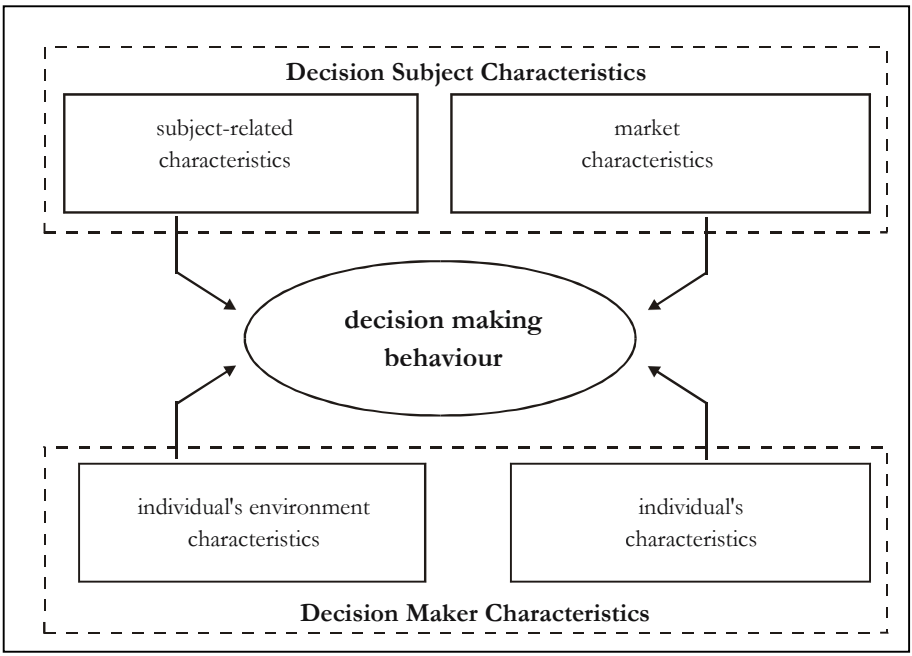

Figure 3.3. General model of decision making behaviour

This model will be used in the case of decision making by rural tourists (chapter 4) and for analysing farmers' willingness to participate in agri-environmental measures (chapter 7).

2. THE ECONOMICS OF LANDSCAPE CONSERVATION

2.1. The value of agricultural landscape

Diversity is a central concept when dealing with landscapes. Biodiversity and landscape diversity create an aesthetically valuable landscape. But landscape has various values with different characteristics. Differentiating use values from non-use values gives already a first insight in the complex structure of the value of landscape. Use values consumed by residents of an area where a specific landscape exists, differ already from those consumed by visitors. The use value for residents is the value that residents give to consuming (most probably by looking at the landscape) in their daily life, while the use value for visitors is the value that visitors give to visiting the site from time to time. Depending on the possibility of establishing exclusion mechanisms and the rivalry in use, those use values can be categorised as either public, open access or private goods. Most non-use values of landscape, on the other hand, could be pure public goods since non-excludability and non-rivalry hold perfectly. More detailed analysis could lead to differentiating non-use values consumed by residents (bequest values for future generations) from those consumed by the general population (existence values and bequest values).

2.2. Economic valuation of landscape

A general introduction on economic valuation has been given in chapter 2. Because of the specific characteristics of landscape amenities, it needs some further elaboration in this chapter.

The story of valuing landscape goes back to the 1960s, when various numerical methods of landscape evaluation were proposed, in response to the perceived need to incorporate aesthetic factors more systematically in planning and decision making (Price, 1994).

The need for valuing the landscape has mainly to do with the fact of landscape attributes being unpriced. This does however not mean they have no effect on other people's welfare. It is therefore important that public preferences for landscape amenities from agriculture, are taken into account by public decision makers, e.g. in a full cost-benefit analysis.

But there are other reasons. Also future generations deserve to inherit good landscapes within which to live their lives. Such a view is compatible with several ethical justifications for sustainable development, but it does not feature prominently in the debate on the subject. The idea underlying sustainable development is that, through the adoption of sustainable practices, future generations will enjoy a quality of life and a level of welfare comparable to those of the current generation, even though their lifestyle may be different. Two points can be made about the role of landscape conservation in sustainable development. First the restraints imposed by sustainable development objective should make landscape conservation easier, since many threats to landscape arise from resource-intensive economic activity, such as

intensive agriculture among others. Second, good landscape is often an index of environmental sustainability. A commitment to landscape conservation therefore can serve as a useful adjunct to environmental policy, reinforcing other pressures towards sustainable use of resources. Therefore policy for sustainable development should incorporate a landscape objective: at minimum to pass on to future generations a portfolio of landscape qualities at least as good as current generations enjoy (Bowers and Hopkinson, 1994).

2.3. Approaches to value the landscape amenities from agriculture

2.3.1. General approach

There are several approaches to value public benefits from agriculture (see chapter 2). The outputs are often multiple and jointly produced with private goods, which are priced in the market. The competition between environmental goods, such as landscape attributes and private goods (food and fibre) can be illustrated by the production possibility frontier G, as shown in figure 3.4 (Bonnieux and Weaver, 1996; Bonnieux and Le Goffe, 1998). It bonds the set of all technologically feasible combinations (X,Q), where X is a vector of private agricultural commodities and Q is a vector of environmental goods. The marginal rate of substitution (MRT) refers to the trade-off between X and Q. Because of declining marginal productivity of resources used for either output, G is concave to the origin and MRT is increasing. With increasing Q farmers must give up more and more X to produce an additional unit of Q. In reality, however, the form of the production possibility frontier G is more complex. In figure 3.4, the maximum production of environmental goods corresponds with zero production of agricultural commodities. This is, however, not necessarily the case. Nevertheless, figure 3.4 illustrates very well the general approach to value landscape amenities from agriculture. A more detailed picture will be addressed in section 2.3.2 and figure 3.5.

To find the Pareto efficient allocation of X and Q, the social welfare function, U(X,Q) has to be introduced[29]. Social welfare is maximised in A_0 (figure 3.4), which lies at the tangency of the isosocial curve U_0 and the production possibility frontier G. In that point, the marginal rate of substitution (MRS) between X and Q, defined in terms of social welfare, is set equal to the exchange rate between the goods defined by technology (MRT).

[29] *relies on the explanation in chapter 2*

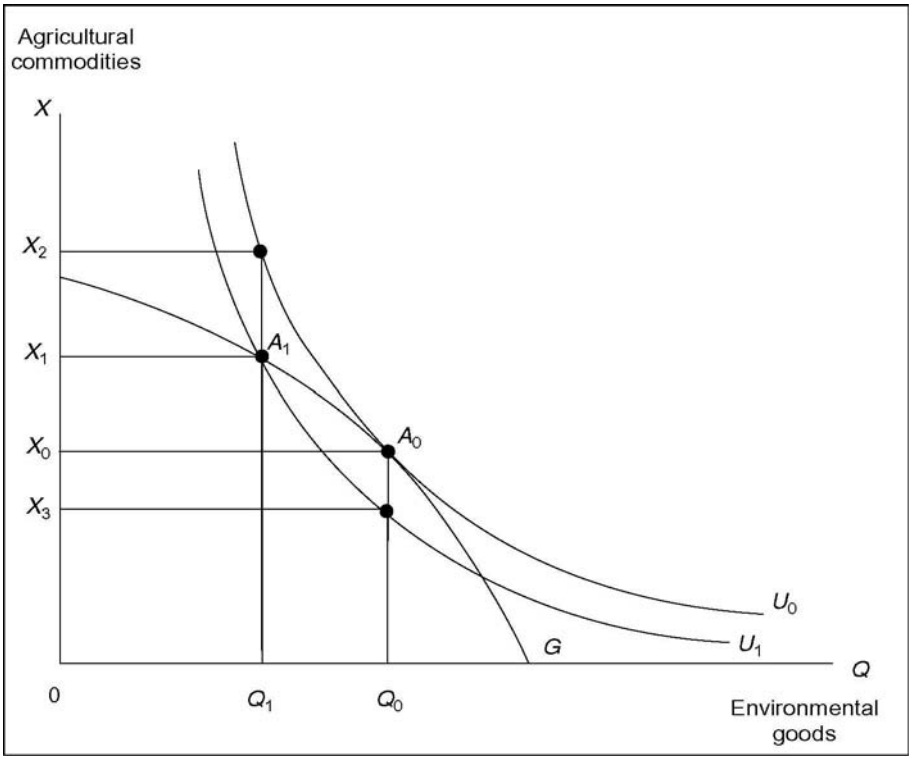

Figure 3.4. Valuation of an increase in environmental goods (Source: Bonnieux and Weaver, 1996; Bonnieux and Le Goffe, 1998)

Considering point A_1 on G, society can only achieve a level of utility indicated by the social indifference curve U_1, such that:

$$U_1 = U(X_1, Q_1) < U(X_0, Q_0) = U_0$$

In comparison with the optimal situation, there is an overproduction of agricultural commodities ($X_1 > X_2$) and an underproduction of environmental goods ($Q_1 < Q_0$). It is now important to value the difference between Q_1 and Q_0, or in other words, what is the value of an increase from Q_1 to Q_0.

A first strategy to establish this value is based on the supply side. At point A_1, farmers must give up X to produce more Q at a rate defined by the slope (MRT) of the production possibility frontier G. The change from Q_1 to Q_0 indicates that $\Delta X = X_1 - X_0$ has to be paid to farmers to produce Q_0. ΔX gives the profit forgone and therefore the minimum compensation to be given to farmers. This approach will be considered more or less in part III.

A second strategy relies on the demand side and uses the various approaches of the consumer surplus. Basically there are two possibilities in pricing an increase in Q (see also chapter 2). The first is to consider the compensating surplus (CS), such that

$$U(X_1, Q_1) = U(X_3, Q_0) = U(X_1 - CS, Q_0)$$

and

$$CS = X_1 - X_3$$

The second measure is based on the equivalent surplus (ES), defined by

$$U(X_0, Q_0) = U(X_2, Q_1) = U(X_0 + ES, Q_1)$$

and

$$ES = X_2 - X_0$$

The choice between CS and ES depends mainly on the entitlement of property rights. CS implies property rights in the status quo, so the welfare reference level is given by U_1. ES implies property rights in a state of change and so U_0 gives the welfare reference level. Under standard curvature properties shown in figure 3.4:

$$\text{MRT} \leq \text{MRS for } Q \leq Q_0$$

$$\Delta X < CS \leq ES$$

The equality holds if there is no income effect.

As discussed in chapter 2, CS is a measure of WTP to obtain an increase in Q, while ES is a measure of WTA compensation to forego an increase in Q. Therefore as $Q \leq Q_0$:

$$\Delta X < \text{WTP} \leq \text{WTA}$$

An increase in Q is valued more highly by consumers than by the farmers that produce it. When there is no income effect, WTP and WTA are theoretically equivalent. However, in empirical studies, WTA tends to exceed WTP, even when income effects are insignificant.

A third strategy is derived from the second one and is based on a surrogate market. Graphically, changes in Q are valued along the tangency of the isosocial

welfare curve U_0 and the production possibility frontier G at point A_0. This underlies both the hedonic and travel cost approach, which will be explored in part II.

Two extensions on this general approach will be discussed in more detail in the following paragraphs (2.3.2 and 2.3.3) because of their special interest for the empirical analyses.

2.3.2. Extension of the general approach

Figure 3.5 illustrates once more the joint production character of the commodity and non-commodity goods from agriculture. The approach here starts again from the knowledge that valuing the landscape is not possible through the market mechanism of supply and demand, as it is considered as a public good. It seems, however, possible to have a better insight in the problem of valuing the agricultural landscape, starting from the theory of supply and demand.

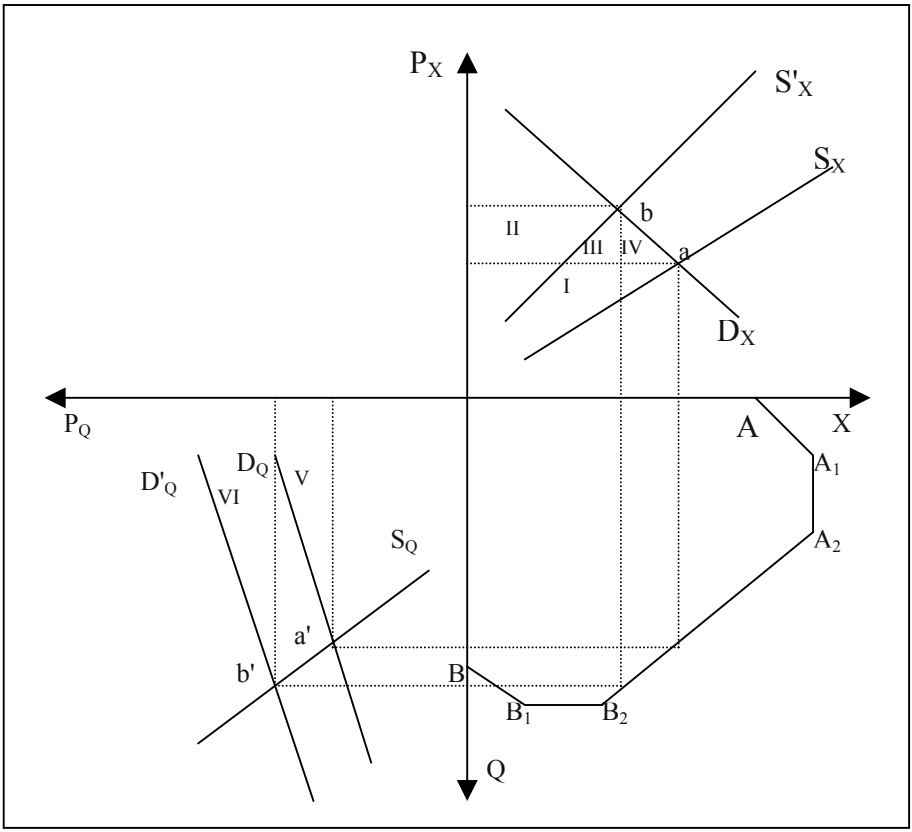

Figure 3.5. WTP and WTA for landscape attributes

In the bottom right corner of figure 3.5, the production possibility curve depicts production jointness between traditional agricultural commodities, X (such as food and fibre (F&F)), and landscape attributes, Q, and their relative trade-offs. At least five segments can be plotted, corresponding to the mutable economic nature of landscape elements. The different segments are discussed in detail in Merlo and Gatto (1996) and Mantau et al (2001). The most important segment in the framework of this analysis is segment A_2B_2, because there the "production" of landscape elements takes place at the expense of agricultural commodities and vice versa. The other segments refer to a complementary relationship between F&F and landscape.

The upper right corner of the figure illustrates the supply and demand for F&F. The bottom left corner shows the supply and demand for landscape attributes. P_Q refers to the price of landscape elements, although this can hardly be measured with the regular market mechanisms. Therefore it is rather the value measured with non-market valuation techniques. The production possibility curve is the link between both the supply of food and fibre on the one hand, and landscape on the other hand. A high supply of food and fibre corresponds with a low supply of specific landscape elements and vice versa.

Starting from the consumers' perspective, there is a certain demand (D_Q) for landscapes or environmental goods and services in general, especially for recreational purposes. Because people's preferences tend to shift towards more recreational activities in the countryside (away from the urbanised regions), there can be a shift in demand towards a higher amount of landscape amenities. This is illustrated with a shift of the demand curve (D'_Q). To meet consumer's new demand, the supply of landscape elements should increase, at the expense of agricultural commodities, because they are joint products. Therefore the supply curve S_X will shift to the left (S'_X), resulting in a new equilibrium for food and fibre (b) and landscape elements (b').

Consumer's WTP for those landscape elements can be measured by the change in consumer surplus, while farmer's WTA for the changes in their farming practices can be referred to as the change in producer surplus. Both approaches need to be compared to have a clear overall picture. From figure 3.5 it is obvious that WTP (II + III + IV or VI - V) doesn't necessarily have to be the same as the WTA (II - I) for the same goods. It is also clear that consumers' WTP can be measured in two different ways: in terms of P_X based on surrogate markets (II + III + IV) or in terms of P_Q (VI - V). Both approaches can have different results, as is shown here, and as has been discussed in the previous chapter.

2.3.3. Measuring the value of the agricultural landscape

Considering agricultural landscape as a public good, its economic value should be analysed as such. As highlighted in 2.3.1, a possible approach is based on surrogate markets, allowing to estimate the use value. One of the most important use values of the agricultural landscape is the recreational value, as has been highlighted

in 1.3. The recreational value[30] of the agricultural landscape can be defined as the value people attach to the use of the agricultural landscape for recreational activities, such as enjoying the silence and beauty by staying, walking, cycling or driving through the countryside. Chapter 4 goes more into detail into this matter.

In this framework, a rural recreation area is characterised i.a. by its agricultural landscape. Although the agricultural landscape in a particular rural area is rather heterogeneous and takes different shapes and forms, we assume it can be represented by a single index, denoted A. Such an index may take the form of a weighted sum of the shares of total land covered by the different agricultural crops (pasture, arable crops, orchards, …). The demand for the recreational site can be measured by the number of visitors it attracts each year. Consequently, the recreational value of agricultural landscape is revealed through its effect on the number of visitors. Thus, the recreational use value of agricultural landscape can be defined and measured by changes in consumer surplus associated with the varying levels of the agricultural landscape index A (Fleisher and Tsur, 2000).

The change in consumer surplus associated with a change in agriculture landscape from an initial level A^0 to a level A^1 is defined as follows. Let $N(p,A)$ denote the (Marshallian) tourism demand for the site under consideration, indicating the number of visitors when the cost of a visit is p and the agricultural landscape index is A, and let $p=D(N,A)$ be the inverse demand function. In the initial situation, with $A=A^0$, rural tourism is consumed at the level $N^0=N(p^0,A^0)$, as can be seen in figure 3.6.

The consumer surplus is then

$$CS^0 = \int_0^{N^0} D(n, A^0)dn - p^0 N^0 \text{ (the area } abc \text{ in figure 3.6)}$$

As agricultural landscape changes to A^1, N changes to $N^1=N(p^0,A^1)$ and

$$CS^1 = \int_0^{N^1} D(n, A^1)dn - p^0 N^1 \text{ (the area } dec \text{ in figure 3.6)}$$

The change in consumer surplus associated with the change $A^0 \rightarrow A^1$ is given by

$$S = CS^0 - CS^1 \text{ (the area } abed \text{ in figure 3.6)}$$

Under some 'regularity' conditions[31] (Freeman, 1993), S is a good approximation of the equivalent and compensating variations, and hence can serve as the welfare measure of the agricultural landscape change.

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[30] *for a general overview of recreation valuation, I refer to, among others, Bockstael et al (1991)*

[31] *as has been discussed in the introduction*

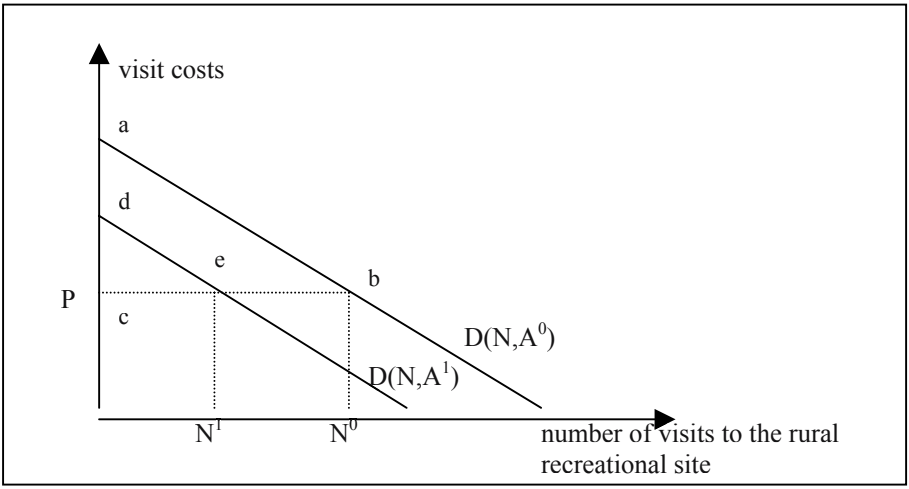

Figure 3.6. Visit demand functions with (A^0) and without (A^1) agricultural landscape (Source: Fleisher and Tsur, 2000)

2.3.4. Concluding comment

We should be careful when considering and conducting these approaches and valuation methods. A basic observation is that no method exists which is capable of assessing the full value of any environmental asset. Instead, the valuation methods discussed attempt to measure welfare changes in monetary terms for environmental public goods (see chapter 2).

As said Minter (1994) economists are notorious for disagreeing, and there is certainly no one opinion about the role of economics in relation to landscape. In fact there seems to be two main groups: those in the environmental valuation industry claim they can assist policy makers by providing information in monetary terms on public preferences concerning an environmental issue or feature. Their message is that environmental interests will be overlooked unless they are monetised. Some economists go further, saying valuation is good news for the environment, since public preferences, as measured in valuation surveys, will play its importance among other factors. In contrast many environmentalists, as well as policy advisers and researchers who don't make a living from valuation, remain sceptical and claim that most environmental features - such as local countryside and fine landscapes - are "priceless". Reliance on those valuation techniques may only give a partial picture of the environmental concerns of society as a whole. Consequently, valuation techniques are unlikely to move centre stage in environmental policy. They will remain helpful for illustrative purposes at the local level. Throughout all levels of environmental policy making, the main issues will remain ethical and political.

Therefore, as a final rider before considering the case studies, one basic observation can be made. It is very difficult, if not impossible, to value the

environment, but it must be possible to value preferences for environmental goods, such as the agricultural landscape, and so produce measures directly comparable with the values of marketed goods.

Today the temptation to escape from the turmoil of our cities into the peace and quiet of the countryside has seldom appeared more attractive and more desirable. (H. Newby, the countryside in question[32])

PART II

DEMAND FOR LANDSCAPE AMENITIES FROM AGRICULTURE

[32] *as cited in Butler (1998)*

CHAPTER 4

RURAL TOURISM

1. INTRODUCTION

Analysing the type and amount of demand that exists for landscape elements, which are jointly produced with a marketable good requires an insight in the value and marginal benefit of these elements for society. Landscape amenities from agriculture have various values with different characteristics, as has been discussed in chapter 3. The complex relationship between agriculture and landscape (see chapter 3), and the externality and public good characteristics of the agricultural landscape, result in a kind of market failure for these attributes. No market price exists for landscape elements. Therefore other valuation techniques have to be used to estimate the value of the landscape amenities from agriculture.

As shown in figure 3.2, the demand for agricultural landscape elements, consists of different aspects. One form of demand is expressed as rural tourism. Visitors attach some value to visiting an area where a specific landscape exists. By estimating that value, some conclusions can be drawn on the marginal benefits from the agricultural landscape to society.

The remainder of this chapter will give an introduction into rural tourism, as the background of the demand analysis. Focussing on the demand side of rural tourism requires, however, that some aspects of the supply side are known. Some of these aspects will therefore also be addressed in this chapter. Afterwards two different dimensions that are relevant to the discussion on the demand for landscape amenities, will be highlighted. The first dimension is to analyse the importance of agriculture in the demand for rural tourism (chapter 5). The second dimension is to focus on the recreation value of the agricultural landscape, as one aspect of the social benefits to society (chapter 6).

The hypothesis behind the first dimension is that positive externalities from agriculture have a positive impact on the success of rural tourism. By maintaining and preserving an attractive landscape, farmers can benefit in the form of rural tourism. With respect to this first dimension, a hedonic pricing method will be used to explore the importance of agriculture in the demand for agriculture. This method allows to separate the impact of different characteristics on the price for rural tourism (see chapter 2 for more details on the method).

The aim of the second dimension is to estimate the marginal benefits of rural tourism for the general public. An appropriate valuation method is the travel cost method, if the following assumption is taken into account: with some exceptions

I. Vanslembrouck & G. Van Huylenbroeck,
Landscape Amenities: Economic Assessment of Agricultural Landscapes, 59—68.

where the general population attaches a special value to a specific site, use -values are likely to be dominant over non-use values for an individual landscape site (OECD, 2001). The hypothesis behind this method is that the willingness to pay to conserve a particular landscape decreases with increasing distance from the site.

By taking rural tourism as a case to analyse these two dimensions, this part tries to make the link between the conceptual analysis (part I) and policy recommendations (part IV). The conceptual issues and results explored in this part lead to the second and third questions proposed in the framework (figure 1.7) in chapter 1:

- Is there some market failure associated with the non-commodity outputs?
- Have non-governmental options (such as market creation or voluntary provision) been explored as the most efficient strategy?

Exploration of these questions is an essential prerequisite to the discussion of policy options.

2. TOURISM IN RURAL AREAS

Rural tourism has usually involved people moving to the countryside and it has progressed from an elite group of urban people favouring a few resorts to a mass phenomenon that pervades most parts of the countryside (Butler and Clark, 1992). This chapter is concerned to explore the key issues of rural tourism, and its relation with agriculture and the landscape. A conceptual model to analyse rural tourists' decision making will be presented, before coming to an overview of rural tourism in Flanders.

2.1. Concepts and definitions

A simple way to define rural tourism may be to describe it as the subset of *tourism* taking place in *the rural area*. This leads, however, to the question of defining what is meant by rural areas. This question should be answered before coming to a definition of rural tourism.

2.1.1. Rural area and rurality

An early idea was to use "rural" to describe areas which are not "urban". Such a definition, based on available statistical and geographical data, has al least the merit of simplicity. However, the term "rural" embraces many meanings. The concept of rurality has many, often location-specific, expressions. In public debate, the 'rural' is primarily associated with transiency and remoteness[33]. Rurality is where tourists go to discover the counter-image of the city from which they long to escape. Rurality is

[33] *rural sociologists have contributed a lot of their research to defining rurality (see e.g. Mormont, 1990; van der Ploeg, 1997)*

the 'paradise lost': Macondo (Marquez, 1972) or Jorwerd, the village forgotten by God (Mak, 1996), to give two examples of contemporary literature.

Three major points seem to dominate the wider debate on rurality: (i) population density and size of settlements, (ii) land use, and its dominance by agriculture and forestry, (iii) "traditional" social structures and issues of community identity and heritage (Lane, 1994b). The second point is very interesting in the framework of our analysis. Agriculture and forestry seem to be inherently linked to the concept of rurality, and from that indirectly to rural tourism.

An important aspect that is missing in these definitions is, according to van der Ploeg (1997), an awareness that both the rural and the urban are two different aspects of civilisation. Hence, the rural is not to be seen as the opposite of the urban, but both have to be defined in relation to the opposite of civilisation, or 'wilderness'. In 'pure' nature there are no people. 'Pure' nature can be defined as nature unaffected by man, history or society. This is not the case with the rural, which is influenced by man's presence. The rural cannot be conceived of, or experienced, or constructed, without the presence of man. Therefore, van der Ploeg (1997), defines the rural as *the locus where the co-production of man and nature is located*, while the urban is the locus where the co-production of man and nature stops. Consequently, rurality is both the result and expression of this co-production, or the interaction between man and living nature, and can be defined as the process of production in which 'nature' is converted into goods and services for human consumption. Agriculture is clearly one of the forms of such co-production, but not the only one.

In more general terms, co-production combines the notion of production and consumption. Agriculture not only produces rurality, but also consumes it. Rurality is equally present in the population of the countryside, in agro-tourism, in hunting and fishing, and in the consumption of region-specific agricultural products. At the same time it means that consumption of rurality is only possible if rurality is also actively produced (van der Ploeg, 1997). It is here that the more general role of agriculture can be analysed. Rurality is an interest of society as a whole, and has become more strongly expressed as cities grow and society becomes more urbanised.

A definition of tourism in rural areas could be based on two basic criteria: (i) size and density of population and (ii) tourism accommodation supply of each locality. Typically rural areas have low population densities (Roberts and Hall, 2001). The natural and/or the farmed/forested areas dominate the built area. For visitors, rural areas give an impression of space, and of a traditional non-urban, non-industrial economy. The rural economy is strongly influenced by the market for farm and forest products. This specific character, combined with the scenic values and recreational opportunities of the countryside, attracts people from urban areas. This brings us back to the concept of rural tourism.

2.1.2. Rural tourism

Rural tourism involves travelling to and staying in rural areas. A variety of terms are employed to describe tourism activity in rural areas: agritourism/agrotourism, farm

tourism, rural tourism, alternative tourism, eco-tourism and several others, which have different meanings from one country to another, and also from one user to another (Roberts and Hall, 2001; Lane, 1994a; OECD, 1994). In general, these forms of tourism have the following aspects in common:

- be located in rural areas;
- be functionally rural, built upon the rural world's special features: small scale enterprise, open space, contact with nature and the natural world, heritage, "traditional" societies and "traditional" practices;
- permit participation in activities, traditions and lifestyles of local people;
- provide personalised contact;
- be rural in scale - both in terms of buildings and settlements - and, therefore, usually small scale;
- be traditional in character, growing slowly and organically, and connected with local families;
- be sustainable - in the sense that its development should help sustain the special rural character of an area, and in the sense that its development should be sustainable in its use of resources;
- be of many different kinds, representing the complex pattern of rural environment, economy and history;
- benefit the rural community with a high percentage of its revenue.

In this work, we concentrate on the concepts agrotourism (or countryside tourism) and farm tourism, as they directly refer to agriculture. Both concepts are often used interchangeably. However, there is a difference in both terms, as illustrated by the following definitions (Hoyland, 1982; Murphy, 1985):

- *farm tourism* refers to the provision of temporary accommodation and/or direct and indirect recreational facilities on a working farm.
- *agrotourism* refers to the provision of accommodation in an agrarian environment, where the development of the tourist enterprise has replaced the food producing function, so that the working farm criteria is no longer satisfied.

Throughout the rest of this work, the term rural tourism will be used, referring to both agrotourism and farm tourism, except when we explicitly want to stress the difference between both. As both forms of tourism are explicitly connected with the agrarian environment, the relationship between tourism and agriculture will be examined in the next section.

2.2. Rural tourism and agriculture

Conflicting opinions in the literature on the linkages between tourism and agriculture reveal the complexity of the relationship between them (Telfer and Wall, 1996). Elaborating figure 3.2 from chapter 3 on the relationship between agriculture and landscape, can help to understand this complex relationship, resulting in figure 4.1.

Agriculture can be categorised as having two separate but linked supply values for rural tourism. The first (1) is direct supply, which involves the sale of agricultural products, such as local food products, but also accommodation and other recreational activities. The second (2) is indirect supply, which involves preservation and cultivation of the landscape which acts as a backdrop or tourism resource (3). If farmers produce positive externalities, resulting in attractive landscapes, this will have a positive influence on the demand for rural tourism (4).

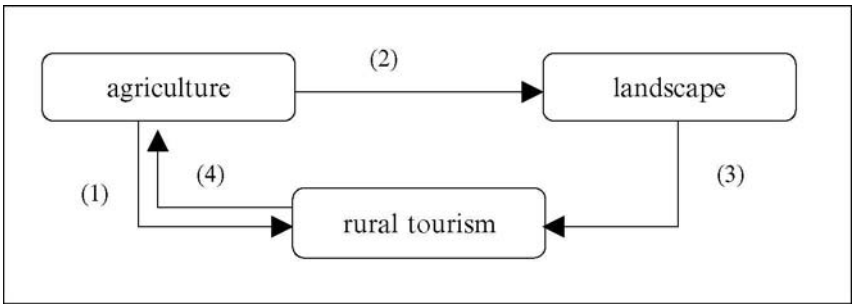

Figure 4.1. The relationship between agriculture, landscape and rural tourism

Tourism and agriculture have the potential to work together in a symbiotic relationship (1 and 4). Improvements in the transportation system can benefit agriculture through increased ease of access to potential markets, but also allows the tourists to travel and view the agricultural landscapes. Tourism promotion can focus on agricultural products which may stimulate demand, while agricultural promotion may focus on the regional landscape and lead to a growth in rural tourism.

It is clear that the production of positive externalities from agriculture can pay back to farmers, by means of rural tourism. Some remarks should be made however. Diversification into rural tourism is sometimes presented as a potential panacea for the ills of today's agriculture. First of all it should be clear that rural tourism is not possible for all farmers. Diversification into rural tourism is only possible on a limited number of farms. A Dutch study on the supply of agrotourism in the Netherlands (van Koilil et al, 1998) states that about 2% of the farms perform some kind of agrotourism. This percentage will be slightly higher in Northern European countries (up to 20% in Sweden), based on the figures already measured in the 80s (Murphy, 1985). In 1997, about 10% of the Danish farms were occupied by some form of farm tourism (Hjalager, 1996).[34]

Secondly, empirical evidence isn't that optimistic either, as e.g. shown by Hjalager (1996). His evaluation study of the EU Objective 5b programme measure for the expansion of rural tourism in some European countries shows that the financial returns of these projects are positive, but still lower than the returns yielded by traditional agriculture. A study on rural tourism in Southern Germany, conducted

[34] *it is not so easy to compare these percentages over different countries, as different definitions of farm tourism may be used*

by Opperman (1996), indicates that farm tourism provides only a small side-income, partly because of legal limitations. Also the empirical analysis of public support to small-scale tourism enterprises in rural areas in Israel (Fleischer and Felsenstein, 2000) shows that the impact of rural tourism is controversial and not always obvious. Other studies show that farm tourism is a good business and that it makes an important contribution to the local economy. The study from Slee et al (1997) for a highland region in Scotland, illustrates the possible impact of different types of rural tourism, which depend highly on the particular characteristics of the region. Their results indicate i.a. that small-scale tourism can be relatively important for the local economy as a whole, but it does not refer to the impact on farmers' income. A broader picture of farm tourism and its place in different countries is given by Nilsson (2002), who concludes that farm tourism is clearly not a good business for all.

Another remark that has to be made here, is that there are also conflicts associated with rural tourism, which can have a reverse effect on agriculture. The nature of these conflicts has been categorised by i.a. Butler and Clark (1992) as economic, environmental and social. Its seasonal character and vulnerability to bad weather, recession, bad press etc. can result in an unstable source of income. The environmental perspective has mainly to do with environmental degradation, such as, among others, water pollution, erosion of footpaths, etc. Social impacts can arise when rural tourism brings about changes in value systems and behaviour and thereby threatens indigenous identity.

From the discussion above, it is clear that farmers can play a critical role in maintaining both the basic rural economy and the scenery on which rural tourism depends. The link between agriculture and rural tourism is, however, complex and goes in both ways: farmers can stimulate the demand for rural tourism by maintaining an attractive landscape, while rural tourists can contribute extra income to farmers, by their holiday expenditures. Tourists' purchase behaviour contains thus important information on the demand for rural tourism, and indirectly on the demand for agricultural amenities in the landscape. Therefore a conceptual model is proposed in the following section. It is based on the general decision making model, as has been proposed in part I (figure 3.3). The model will be confronted with the conceptual model on farmers' decision making with regard to participation in agri-environmental measures (part III).

3. DEMAND FOR RURAL TOURISM: A CONCEPTUAL MODEL

As stated by Valentine and Gorden (2000)[35], people's consumption of products and services is influenced by the product or service environment, the human environment (such as fashion), and physiological or emotional needs.

The holiday decision is influenced by various "forces". Some of these factors are external to the individual, while others are internal. This paragraph examines these forces. Although these inhibiting factors will be explored separately, it should be noted that their effect is often a compound one. The conceptual framework (figure

[35] *cited by Roberts and Hall (2001)*

4.2) proposed here is a general one, referring to travel-purchase behaviour in general (Mill and Morrison, 1985). It will be used in the following chapters for the specific case of rural tourism.

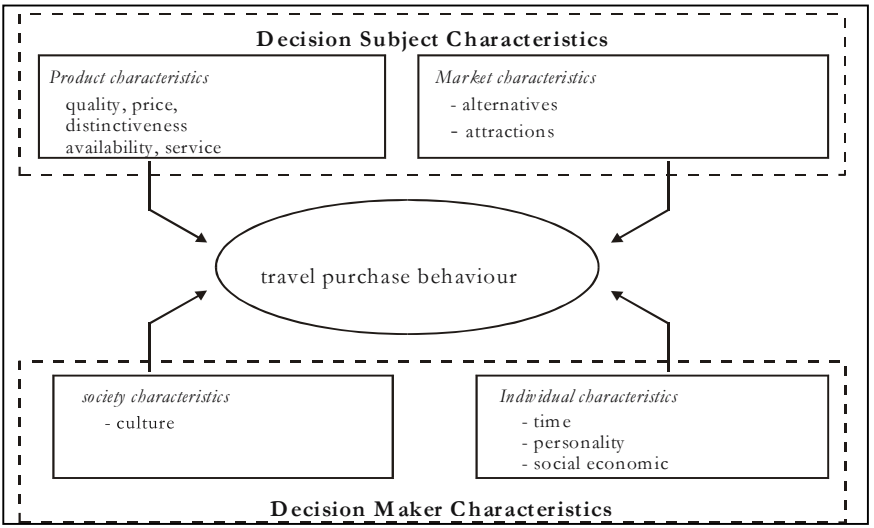

Figure 4.2. Conceptual model of an individual's travel purchase behaviour

The inhibiting factors on travel-purchase behaviour can be divided into different groups. Some factors influencing an individual's decision are related with the product as such. *Quality, price, distinctiveness, availability* and *service* all have their impact on the individual's choice. These product characteristics are embedded in a certain market, with its specific elements, such as *alternatives* and *attractiveness* of the region. Also these market characteristics have their impact on the travel-purchase behaviour.

Next to these decision subject characteristics, also some decision maker characteristics can influence the vacation decision. While an individual acts to satisfy certain needs and wishes, the way in which these wishes are satisfied is heavily influenced by forces external to the individual. As individuals, we are part of larger social groups by which we are influenced. These groups themselves are part of and influenced by the surrounding *culture*[36]. The effect of culture can be felt by the individual in different ways. A short-break holiday can be more common in certain social groups than in others. This habits will influence an individual's decision.

Apart from the characteristics from society, the individual's characteristics also have their impact. *Time*, or rather the availability of time, acts as a major inhibiting factor to tourist travel. The amount of available time and the form in which it is

[36] *culture can be defined as a "set of beliefs, values, attitudes, habits and forms of behaviour that are shared by a society and are transmitted from generation to generation (Engel et al, 1968)*

available is, in fact, a major creator of the destinations that can be visited, the modes of travel that can be used, and the activities that can be engaged in at the destination or en route. The desire to travel and the financial ability to travel are insufficient if one does not have the time to travel. *Socio-economic variables* which can have their effect on tourism demand include age, income, sex and education:

- The relationship between tourism and age has two components: the amount of leisure time available, relative to age and the type and extent of activities undertaken at various age levels (Roberts and Hall, 2001).
- Income is obviously an important inhibiting factor in shaping the demand for travel. It is difficult, however, to determine the relative importance of income per se, because this variable is interrelated with other socio-economic variables. Generally speaking, higher income is associated with higher education, with certain jobs, and with certain age group.
- There seem to be more similarities than differences between the sexes in terms of leisure participation rates. Overall, participation rates in leisure activities do not differ between men and women.
- The level of education that an individual has tends to influence the type of leisure and travel pursuits chosen. It appears that the more education people have, the broader their horizons and the more options they can consider.

Another important factor is the *life-cycle stage* (Roberts and Hall, 2001). Families evolve through a certain life-cycle. The characteristics of the family at the various stages of its life cycle offer certain opportunities or exert various pressures that affect purchase behaviour. Single people take part in a much wider variety of activities outside the home than married people do. The narrowing of the types of activities participated in, is intensified by the presence of children, shifting to "family" activities. As children leave the home, more time and money tend to be available for leisure.

An individual's *personality* also has an effect on the purchase behaviour, as most people view their vacation as an extension to their personality. Personality of an individual can be described as " the summation of the characteristics that make the person what he or she is and that distinguishes each individual from every other individual". It is clear from this definition that it is hard to isolate the impact of personality on purchase behaviour, as it is a combination of the previous mentioned factors.

We have to keep in mind however, as concluded by Roberts and Hall (2001) when analysing the demand for tourism and recreation consumption, that "the" rural tourist does not exist. The consumption of tourism is complicated by the symbolic values that have become attached to it. This is likely to be especially so with forms of rural tourism where the countryside: (i) can be seen to reflect many aesthetic and spiritual values that stand in stark contrast to the relatively common nature of urban life; and (ii) provides a suitable setting for the pursuit of a growing range of physical activities.

The conceptual model helps to better understand the demand for rural tourism and the benefits for society. This model will therefore be the basis for the empirical analyses in chapters 5 and 6. But first, a short overview of rural tourism in Flanders will be given, as the empirical analyses refer to this study area.

4. RURAL TOURISM IN FLANDERS

Rural tourism in Flanders has experienced a similar evolution as in other European countries. The growing demand for short-break holidays and day trips has resulted in an increase of the number of rural holiday accommodations. Some farmers try to follow this trend by transforming part of their farm buildings into guestrooms or holiday residences. Others rent houses, apartments or studios on non-active farms. Although different in type, all these accommodations offer a stay in the countryside.

A major problem in analysing rural tourism is data availability (Opperman, 1996), mainly due to the small scale of many operators. Although official statistics on this particular kind of tourism are missing, some information could be obtained from the Flemish Federation for Farm and Countryside Tourism. Founded in 1989, it is the most important promoter of rural tourism in Flanders. Since its foundation, its number of members has increased very rapidly, from 22 in 1990 to about 185 in 2002. An evolution of the number of members from 1990 till 2000, and the distinction between farm and countryside tourism is given in figure 4.3 (Van Mierlo and Verscuren, 2001). This amount is, however, still very limited: in 2000, about 90 farms participated in farm tourism (on a total of 40.949 farms, NIS 2001). It should be clear however that probably more farms diversified into farm tourism, but they are not all member of the Federation.

The tourism involvement takes many forms and can vary from small-scale operations (renting a spare room) to large-scale investments in renovating and modernising separate farm buildings into vacation flats and cottages; from bed and breakfast places to self-catering apartments or houses. An overview of the diverse supply in Flanders, registered with the Federation, is given in table 4.1.

Information on the rate of occupation is more difficult to get. The Federation organises a yearly, voluntary questionnaire. Although the results are incomplete and not fully reliable, they give an idea about the number of visitors. In 2000, 22.473 persons stayed in guestrooms, of which 2.124 foreigners. Most of those foreigners come from The Netherlands, followed by Germany, UK and France. July and August have the highest occupation rate (around 60%). Apartments and houses have a much higher occupation rate (around 90% in July and August). About 26.059 persons stayed in those places, of which only 1.851 foreigners (Van Mierlo and Verscuren, 2001). Calculating the occupation rates is however rather difficult, because e.g. an apartment with a maximum capacity of 6 persons, which is rented by a family of 4 persons results in an occupation rate of 80% in that period.

The rural holiday accommodations are situated all over the Flemish region. Most of them are located in the provinces of Limburg (37%) and West-Vlaanderen (34%). The other provinces, Oost-Vlaanderen (17%), Antwerpen (7%) and Vlaams-Brabant (5%) count fewer residences (Brochure Flemish Federation for Farm and

Countryside tourism, 2001). Reasons for this unequal distribution can be of all kinds. According to Murphy (1985), the location of farm tourism appears to be influenced by three factors: the level of income provided by farming, the presence of tourism resources, and the accessibility to major tourist-generating regions, determining the attractiveness of a region. West-Vlaanderen has the seaside as an extra attractive element. Limburg is rather known for its nature (heather and woods) and its flat and slated landscapes. Also the agricultural activities differ between the regions, resulting in varying landscapes

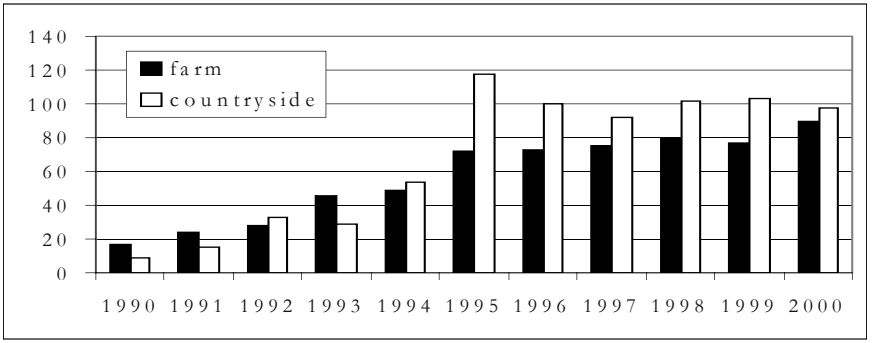

Figure 4.3. Members of the Federation, 1990-2000, and the proportion farm - countryside tourism (Source: Van Mierlo and Verscuren, 2001)

Table 4.1. Supply of rural holiday accommodation in Flanders, registered with the Federation (2001)

	number of accommodation with …	total capacity (persons/night)
guestrooms	71	142
apartments	82	492
studios	7	28
houses	36	216
total	196	878

The demand for rural tourism in Flanders is analysed in more detail in the following chapters of this work. The empirical analyses make use of the conceptual framework, developed in this chapter, which is adopted to the specific situation of rural tourism in Flanders. The main aim of the empirical analyses is to arrive at some insight into the importance of agriculture in the demand for rural tourism, and to estimate the marginal benefits to society of the landscape amenities from agriculture. Both elements are necessary to be compared with the supply side, in order to make some policy recommendations with regard to landscape amenities from agriculture.

CHAPTER 5

IMPACT FROM AGRICULTURE ON RURAL TOURISM

1. INTRODUCTION

Figure 4.1 in previous chapter already highlighted the relationship between agriculture, landscape and rural tourism. This chapter emphasises more in detail the symbiotic relationship between agriculture and rural tourism: namely, the impact of positive externalities from agriculture on rural tourism and the reverse effects. The hypothesis to be tested in this chapter is as follows:

Positive amenities from agriculture have a positive effect on the demand for rural tourism, which can be measured through analysing the prices of rural tourism.

As shown in chapter 4, there is a growing interest in rural tourism[37]. In this and the following chapter we want to investigate how important the link with agriculture is and if it is possible to put a monetary value on the contribution of agriculture to rural tourism. A growing demand for rural tourism doesn't automatically imply that there is a demand for the provision of landscape amenities by agriculture.

The conceptual model, developed to analyse the travel purchase behaviour (figure 4.2), highlighted the importance of both the "product" characteristics, as well as the decision maker (or tourist) characteristics. Following analysis will mainly concentrate on the influence of the "product" characteristics, such as price, quality, distinctiveness, etc.

The aim of the empirical analysis, presented in this chapter, is to investigate if there is an impact of agricultural activities on rural tourism in Flanders. As the positive externalities from agriculture, resulting in a certain landscape, have a public good character, there exists no market to value these benefits. Several methods can be used to measure non-market benefits (see chapter 2 for more details). The following analysis deals with the application of the hedonic pricing method (HPM). Hedonic pricing is based on the observation that goods are valued for several environmental and economic characteristics. A house e.g., is seen as a bundle of attributes, including structural, locational, environmental and economic characteristics. The hedonic pricing method (HPM) uses statistical analysis to estimate the part of the price due to each of these attributes, and hence to predict

[37] *in the meaning of farm and agrotourism (or countryside tourism)*

I. Vanslembrouck & G. Van Huylenbroeck,
Landscape Amenities: Economic Assessment of Agricultural Landscapes, 69—85.

what change in price would be associated with altered levels of attributes (Garrod, 1994).

The case of rural guesthouses is rather special: the environmental effects are partially internalised because the owners of the guesthouse, often farmers, experience the differences in prices, due to the environmental quality for which they are responsible. The aim of our research is to identify the agricultural activities which affect the profitability of rural tourism and to estimate the recreation value of agricultural landscape.

Next section briefly explains the methodology used, then an application of the method on Flemish data is presented, followed by a discussion of the results. In the final paragraph some general conclusions are formulated.

2. THE HEDONIC PRICING METHOD (HPM)

2.1. Theoretical background

Hedonic methods are based on the premise that marketable goods or factors of production are not homogeneous and differ in numerous attributes or characteristics. The HPM attempts to calculate a price for environmental goods by examining the effect of its presence on the price of the relevant marketable good. The technique of hedonic pricing has initially been developed by Griliches (1971) and others initially for estimating the value of changes in quality attributes of consumer goods.

Rosen (1974) presents a theoretical model of markets of differentiated goods. His work has given a theoretical foundation to the hedonic regressions that were already common at that time. He uses the hedonic price concept to analyse the supply and demand of characteristics differentiating products in competitive markets. He assumes that the price of the marketable good is related to the intrinsic characteristics of that good, or in other words:

$$p(z) = p(z_1, z_2, ..., z_n)$$

This price guides both consumer and producer choices regarding packages of characteristics bought and sold.

Rosen represented a consumer's action with a bid function, which represents the consumer's willingness to pay for a product:

$$\theta(z,u,y;\alpha)$$

with z: characteristics of the product
y: a variable for income
u: a level of utility
a: a vector of socio-economic characteristics of the consumer.

On the other side of the market are producers (or suppliers of the good). Their behaviour can be translated into an offer function, where Φ represents the unit price a producer can accept for the product:

$$\Phi(z,\pi;\beta)$$

with z: characteristics of the product
π: profits
β: producer's attributes.

The equilibrium price is determined by the interaction of consumers and suppliers. Obviously, consumers would prefer the lowest possible price in order to maximise their utility, u. Producers or suppliers would like the highest possible offer to be accepted, thus maximising their profit, π. The market reconciles these conflicting goals by matching consumers to suppliers. Graphically, this relationship is represented by Rosen's diagram in which the bid and offer functions are just tangent. In figure 5.1, the quantity of one of the characteristics, z_i, is shown on the horizontal axis, while the other characteristics are at a fixed level. Each consumer's bid contour represents a particular level of utility.

The level of utility increases as the bid price is reduced while holding constant the level of the characteristics. Similarly, the firm's offer price increases, ceteris paribus. The equilibrium price schedule shown is determined by the market interaction of the two groups.

Although it is important to include both consumer and producer behaviour when describing the market, for many environmental issues the most important information is contained on the demand side of the market. Fortunately, in many cases it is possible to focus on the equilibrium price and on consumers' decisions. In such cases, ignoring the supply side does not create theoretical or econometric problems (Palmquist, 1991).

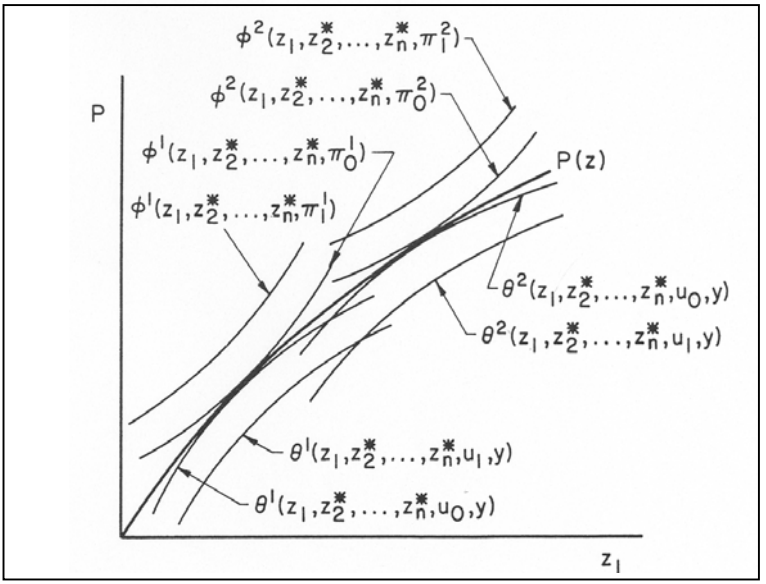

Figure 5.1. Hedonic equilibrium (Source: Palmquist, 1991)

The theoretical and practical questions raised by the environmental application of the HPM have been presented in various studies (see e.g. Bartik, 1987; Palmquist, 1991; Freeman, 1993; Bateman, 1993a,b; Le Goffe, 1996; Bonnieux and Desaigues, 1998; Haab and McConnel, 2002), all referring to the work of Rosen (1974).

A vast majority of HPM studies have looked at the property market as a reflection of surrounding environmental characteristics such as air or water quality, noise, etc. By controlling for the structural (S) (e.g. size), locational (L) (e.g. access to workplace), and other characteristics of a house, the effect of environmental (Q) characteristics upon house prices (P_h) can be isolated. The relationship between house prices and attributes of the house, location, and environmental quality (the hedonic price function):

$$P_{hi} = P_h(S_i, L_i, Q_i)$$

makes it possible to obtain the implicit price of the environment (first stage of the hedonic technique). If other information on the consumers is available, such as income and age, the (inverse) demand function relating the quantity of the environmental good to individuals marginal willingness to pay for that good, can be derived (second stage of the hedonic technique).

Once the (inverse) demand function has been isolated, a welfare change due to e.g. a change in environmental policy, can be evaluated as the area under the demand curve between the initial and final environmental quality level (Bateman, 1993a,b; Bonnieux and Desaigues, 1998; Le Goffe, 2000). Graphically, this is illustrated in figure 5.2. The relationship between the house price and the level of

characteristic q_j is shown in figure 5.2a. The shape of the function indicates that the implicit price falls as the level of the environmental quality rises. Figure 5.2b. shows the marginal implicit price of q_j, $\partial P_h / \partial q_j$. This curve shows the marginal cost of buying an increase in the quality variable q_j and (if the housing market is functioning perfectly) the marginal benefit of one unit increase in the quality variable (Freeman, 1993). A perfectly functioning market has perfect information flows and all individuals trading in the market are able to adjust their buying behaviour, moving along the implicit price curve, $\partial P_h / \partial q_j$ until the marginal value to each of an improvement in environmental quality is equal to the marginal cost of that improvement. Figure 5.2b also shows the marginal willingness-to-pay curves (inverse demand) for two individuals k and m, who have chosen utility maximising bundles of housing characteristics; these are labelled w_{jk} and w_{jm}. These curves show each individual's marginal willingness to pay for changes in the characteristics, holding utility constant. Both individuals in figure 5.2b have chosen locations where their marginal willingness to pay for q_j are equated with its marginal implicit price.

The analysis described here results in a measure of the price of and the marginal willingness to pay for q_j but does not directly reveal the marginal willingness-to-pay function. The second stage of the hedonic technique is to combine the quantity and implicit price information in an effort to identify the marginal willingness-to-pay function for q_j. This will be illustrated in the following section for the specific case of rural tourism.

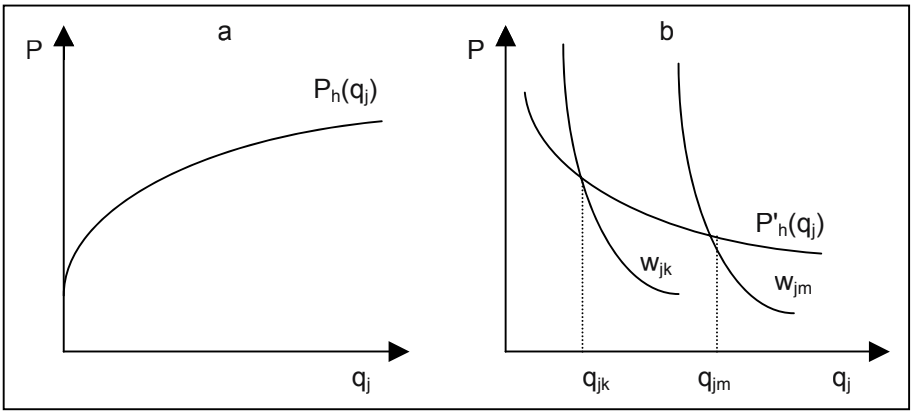

Figure 5.2. Hedonic price function, marginal implicit price function and individual willingness to pay (Source: Bonnieux and Desaigues, 1998)

Empirical applications of the HPM mainly involves the valuation of urban assets, such as noise or air quality (see e.g. Garrod and Willis, 1999 for an overview). Rural applications are more limited: the results concern forests and natural areas (Garrod and Willis, 1992a), swine nuisance (Palmquist et al, 1997) and intensive agricultural practises (Le Goffe and Delache, 1997). Other studies have used HP to estimate the

impact of amenities and production characteristics on land prices. For a selective overview of land value models, see Bastian et al (2002).

2.2. A critique of the hedonic approach

Problems related to the hedonic method and the assumptions behind it, relate to problems of individual perception, subjectivity, continuity, averting behaviour, market segmentation and the assumption of equilibrium (see e.g. Maddison, 2000). Another weakness of HPM is that it can only estimate use benefits, in particular with respect to the recreation value of the area (Garrod and Willis, 1999). HPM also suffers from several analytical problems - omissions of important characteristics, doubts about the correct mathematical specification of the model, etc. (Garrod, 1994). However, if the limitations of HPM are taken into account, HPM can reveal valuable information on the value of current landscape attributes. Therefore, the problems need to be addressed prior to confronting the model with real-world data. How the different problems are taken into account, will be shown in the discussion on the application of the case of rural tourism (section 2.3).

Individual perceptions are important because amenity values will only be reflected in price differentials to the extent that individuals are aware of differences in amenity levels and the effect that these might have (Freeman, 1993). Lack of information is a criticism which is often levelled against the use of hedonic studies to determine the amenity value of a certain good.

It is important in hedonic analysis to include all relevant variables, as variable omission can lead to biased estimates. But there is no accepted list of which environmental variables need to be controlled for. One possible response might be to include all possible variables from the outset, but the inclusion of irrelevant variables leads ton increased variance in the estimates. Furthermore, with environmental variables, problems with multicollinearity frequently arise (Freeman, 1993). It is clearly difficult to measure the individual contribution of particular variables to overall amenity levels.

To the extent that 'averting' behaviour is possible, this should be accounted for in the hedonic equation. Averting behaviour refers to the purchase of goods partly or wholly for reasons connected with reducing the direct effect of environmental disamenities on utility (Maddison, 2001). This problem is more related with the application of the method in the housing market, but is of minor concern for the application to rural tourism. Also the problem of market segmentation does not really hold in the case of rural tourism, as the case study area is rather small and diverse, so mobility is not really a problem.

Probably the most important assumption is the one of perfect equilibrium. For this assumption to hold there must be perfect information, zero transaction costs, etc. (Maddison, 2001). If the estimates are interpreted as such, taking into account the equilibrium assumption, they can be used as measures of the attractiveness of an area. There is no reason to suppose that the implicit prices derived from hedonic analyses are biased because there is no a priori reason to suppose that the extent of disequilbrium in any area is correlated with the levels of particular amenities. The

consequence of disequilibrium is likely to be an increased variance in results rather than systematic bias (Freeman, 1993).

The problems with the mathematical specification of the functional form will be touched upon in section 2.3, and a similar discussion will be held in chapter 6, concerning the travel cost method.

2.3. Application in the case of rural tourism

The objective of the case study is to identify if there is an impact of agricultural activities on the profitability of rural tourism. Therefore this research is mainly based on the demand side of the market for rural tourism. Referring to the remark made by Palmquist (1991), there is no need to model formally the supply side of this market (Freeman, 1993) since our interest is in the values of the characteristics to "buyers" of rural tourism accommodations. This means that, if we assume that the market is in equilibrium, all individuals have made their utility-maximising choices given the prices of alternative locations, and that these prices just clear the market given the existing supply of rural guesthouses and their characteristics.

Under these assumptions, the price of the *i*th rural guesthouse can be taken to be a function of the intrinsic, geographic and environmental attributes of that location. In other words,

$$P_{h_i} = P_h(I_i, L_i, Q_i) \tag{5.1}$$

is the hedonic price function with P_{h_i} the price of renting a guesthouse, and with I_i, L_i and Q_i the vectors designating the intrinsic, location and environmental attributes of guesthouse *i*.

To model the problem more formally, consider an individual who is renting guesthouse *i*. Consumers' utility is a function of the different characteristics of this lodging place, and of the consumption of other goods, represented by the vector X (with the corresponding price vector P_X):

$$U = U(X, I_i, L_i, Q_i) \tag{5.2}$$

The individual maximises $U(\bullet)$ subject to the budget constraint:

$$P_X X + P(I_i, L_i, Q_i) = R \tag{5.3}$$

The first order condition for the choice of environmental amenity q_{ij} is

$$\frac{\partial U / \partial q_j}{\partial U / \partial x} P_x = \partial P_{h_i} / \partial q_{ij} \tag{5.4}$$

The partial derivative with respect to any of the arguments, for example q_{ij}, gives the implicit marginal price of that characteristic, that is, the additional amount that must be paid by any individual or household to move to a bundle with a higher level of that characteristic, other things being equal. If this function is non-linear, the marginal implicit price of a characteristic is not constant, but depends on its initial level and perhaps the levels of other characteristics as well. In the equilibrium situation, the marginal implicit prices associated with the lodging bundle actually chosen must be equal to the corresponding marginal willingness to pay for those characteristics.

The second stage of the hedonic technique is then to combine the quantity and implicit price information in an effort to identify the marginal willingness to pay function for q_{ij}. The individual's demand price or willingness to pay for q_{ij} is a function of the level of $q_{ij,}$ and may also depend on the levels of other characteristics:

$$w_{ij} = w_{ij}(q_{ij}, Q_i^*, I_i, L_i, U^*) \tag{5.5}$$

where Q_i^* is a vector of all amenities except q_{ij}. If equation 5.5 can be identified, it can be used to estimate the welfare change of an individual associated with changes of q_{ij}, assuming other things being equal (Freeman, 1993; Bonnieux and Desaigues;, 1998).

Because in this study, only published information on the farm accommodations is used, the analysis is limited to the first step, by estimating the hedonic price function and the implicit prices of the environmental attributes, without the identification of the demand.

3. DATA

The study is based on data from rural tourism accommodations in Flanders. A sample of 196 guesthouses[38] was selected from the 5 Flemish provinces, most of them member of the Flemish Federation for Rural and Countryside Tourism.

Data are mainly coming from the brochure of the Federation for 2001. The dependent variable used in the analysis is the renting price per person per night for the 2001 summer season, as listed in the brochure. Prices of the guesthouses are fixed at the beginning of the season and not negotiated later. In most of the cases, the rate of occupancy is very high in the summer season. It is assumed that the owners fix their prices in such a way to obtain the maximum occupation. The idea is that, after some years, prices, which are the first year of existence based on some

[38] *some of them may refer to the same "residence", where they have e.g. both an apartment and some guestrooms, resulting in more than 1 "case"*

indications given by the Federation, are adjusted, notably to the demand for rural tourism.

The choice of the independent variables is based both on the conceptual model for travel-purchase-behaviour (figure 4.2) and on a thorough literature review on applications of the hedonic pricing method to value environmental amenities in general. Mainly the work from Le Goffe (1996, 2000) and Le Goffe and Delache (1997) has served as a basis for this analysis. Guesthouses are characterised by three main categories of attributes: intrinsic, geographic and environmental characteristics. The intrinsic characteristics are taken from the brochure, while proxies for some geographic characteristics have been calculated, based on information in the brochure. This means that tourists have this information, directly or indirectly, when consulting the brochure. A problem may be that some of the relevant environmental attributes are not mentioned in the catalogue. This questions the applicability of the hedonic price model, because consumers may not be able to base their choice on these attributes, due to the lack of information (see also first critique in previous section).

Two important elements may counter this argument. First of all, a guesthouse is often chosen on the basis of suggestions or recommendations by friends or relatives (mouth to mouth publicity). Secondly, clients of a guesthouse are very "faithful". A lot of them return year after year to the same place and even cottage. We therefore assume that the fame of a guesthouse is known to a significant part of the rural tourists and that consumers' choices are based on this fame (see also 4.3.2).

Table 5.1 gives some statistics describing the attributes used in the hedonic model. During the econometric analysis more attributes, which can have an influence on the demand, have been tested. Only the most significant ones have been preserved, also to avoid multi-collinearity. The issue of multi-collinearity is a classical problem in HPM studies (Turner, 1993; Freeman, 1993). Here, the Durban-Watson test has been used to test for multi-collinearity (Gujarati, 1995), together with normal probability plots, and a measurement of the variance inflation factor (Neter et al, 1996). All models presented fulfil the requirements, so no major problems due to multi-collinearity should be expected.

The intrinsic variables include the lodging capacity, the number of clovers as a measure for quality and comfort (comparable with the number of stars of hotels), and the type of cottage (farm or countryside). The lodging capacity is expressed as the capacity per room, apartment, studio or house, while the capacity of the residence refers to the total number of people that can stay in that place (sum of the capacity of all rooms, apartments, etc.). This variable can be seen as a proxy for the independence of the accommodation. People may feel different, if there can be other tourists in that place (e.g. several guestrooms), than if there is e.g. only one cottage to rent. The geographic situation of the cottages has been described by different variables, which may influence the choice of the tourist. A distinction has been made between places, with a relatively easy access to the Belgian coast (all cottages in West-Vlaanderen plus some in Oost-Vlaanderen), because this may be important for a number of tourists. The distance to the capital of the province is also taken as a proxy for the touristic value of a location. Its influence can however be both positive

(cultural activities) or negative (people from the city who want to escape from the hustle and bustle of their daily life).

The choice of environmental attributes raises more questions in the literature (see e.g. Freeman, 1993). Information on characteristics such as water quality, value for biodiversity, landscape elements, etc. is not always available or accurate. In particular, the impact of agriculture is difficult to isolate from the impact of industry. Because ecological indicators to measure externalities are lacking, a more global approach has been adopted to measure the presence of agriculture and forests, namely the area occupied in the year 2000. Each guesthouse is characterised according to the proportion of the total surface area (TSA) of its village dedicated to forest, permanent grassland, cereals, fodder crops, fruits and vegetables, as these are the main land uses in Flanders. The data on environmental attributes has been completed with statistics about livestock density, and total nitrogen excretion in the village. These variables synthesise several environmental impacts, which can not be isolated further. The presence of fodder crops implies e.g. the use of species and/or farming practices which are regarded to negatively influence landscape and/or the environment, the systematic recourse to fertilisers and pesticides, the frequent destruction of hedgerows, and a high density of dairy cattle. On the contrary, permanent grassland characterises more extensive systems which are more respectful for hedgerows, soil and water quality. At the same time, a high density of pigs or poultry causes problems of noxious odours, degradation of the landscape by livestock buildings, and pollution of air and water by manure surpluses. The latter is the reason why these intensive livestock variables have been regrouped in one variable, based on the nitrogen content of their manure. Also a variable "main agricultural activity in the commune" has been included, as we may expect that communes which are known for their pig or poultry production, will attract less tourists, and thus result in a lower price for rural accommodation. The included variable divides between communes with mainly horticulture, dairy farming, intensive pig or poultry farming, cattle farming, arable farms or urbanised communes.

4. RESULTS

Economic theory does not provide much direction concerning the specification of the functional form of the hedonic equation, although this is known for affecting implicit prices (Le Goffe, 2000). Functional forms for the hedonic price function that have been proposed or used in the literature include the linear, quadratic, log-log, semi-log, inverse semi-log, exponential and Box-Cox transformation (see i.a. Palmquist, 1991; Bonnieux & Desaigues, 1998). In most cases the functional form is determined empirically (Maddison, 2001). Model evaluation is mainly based on overall goodness-of-fit. The semi-log (log-linear) form has been widely used in hedonic price studies (Garrod and Willis, 1992b and 1999; Maddison, 2001, among others). While more complex forms may be adopted in order to maximise some goodness-of-fit criterion, such as the absolute value of the log-likelihood, there is little evidence to suggest that such analyses provide benefit estimates which are in

any practical sense better than those provided by more conventional specifications (Garrod and Willis, 1992b).

In this analysis, different functional forms found in the literature were tested. The best statistical results are obtained with the log-linear functional form, with 26,3 - 84,8% variation explained by the model (table 5.2). Three regressions are compared, differing in the dependent variable. The first one refers to the price of rural cottages only (apartments, houses and studios), while the second regression deals with guestrooms only and the third one combines them both.

The three models are highly significant, and the signs of the coefficients are in line with the expectations. There appears to be three intrinsic attributes that influence the price of the rural guesthouses significantly. There is first of all the lodging capacity per room or apartment: the higher the capacity, the lower the price per person and per night. On the contrary, the more people can stay in the residence at the same time, the higher the price (e.g. when a residence has more than one room or apartment). The quality measurement has also a significant influence, as could be expected. The more "clovers" a place has, the higher the price will be. The geographic characteristics introduced in the model, do not have a significant influence on the price.

Among the environmental attributes, five are clearly significant. The price of the guesthouse appears to be negatively influenced by fodder crop production, which can be related to intensive livestock farming. In our regions this is mainly maize and this monoculture can have a negative effect on the agricultural landscape, as perceived by the tourists. Also cereal and vegetable production seem to have a negative influence on the price of guestrooms, although this model is less robust. On the other hand the price is positively related to permanent grassland. Tourists seem to associate permanent grassland with animals in the meadow, which has a positive impact on the attractiveness of the landscape. The proportion of forests has a significant negative impact on the price. This result has been found in similar studies in France (e.g. Le Goffe and Delache, 1997). One reason for the negative sign can be that rural tourists prefer "open" space, instead of a "closed" landscape. Next to that, also the main agricultural activity of the village, varying from intensive livestock to mainly arable, has a significant impact on the price of the cottage. From the sign of this coefficient, no conclusions can be drawn yet. The impact of this variable needs some closer consideration, which results in a positive impact on prices for communes with mainly horticultural farms, while communes with mainly arable farming have a lower price. The dominance of livestock (intensive or extensive) does not result in a significant influence on the price.

Because not all variables entered in the model have a significant influence on the price, a new regression should be conducted with only the significant variables. As can be seen in table 5.3, only minor changes occur to the coefficients of the significant variables (the signs are the same as in table 5.2). The new regressions are however important to measure the price elasticities. The percentage change of the price, when the independent variable changes with 1%, ceteris paribus, is given in table 5.3. These elasticities can be calculated as follows for a log-linear function (Gujarati, 1995):

$$\log \frac{P_j}{P_i} = b_i \quad \text{or} \quad \frac{P_j}{P_i} = 10^{b_i}$$

with P_i: price of an independent variable;
P_j: price of the dependent variable;
and b_i: partial regression-coefficient.

One extra clover results in a price increase with 11,6% for apartments, studios or houses, 13,1% for guestrooms or 9,8% for the four types of lodging places together. An increase of the area of fodder crops in the commune with 1% results in a price decrease of 0,7 till 1,6%. Prices decrease with less than 1% when the area of forests in the commune is increased with 1%. From the elasticities in table 5.3, we may thus conclude that the intrinsic characteristics have the highest impact on the prices for rural tourism. However, although the influence is smaller, also the agricultural activities have a significant impact on the prices.

The adjusted R^2 are reasonable and even remarkably high when the four types of accomodation are combined. The latter has mainly to do with the big difference between prices of apartments, studios or houses on the one hand, and guestrooms on the other hand, as is explained by the dummy variable guestroom or not. In order to test the robustness of these results, we also explore some alternative regression specifications. A set of intrinsic variables are added to the model, resulting in a significant increase of R^2. Including those intrinsic characteristics in the model seems appropriate, because they can be found in the brochure, and are thus known by the tourists. Different models have been tested and the best results are given in table 5.4.

From the regressions in table 5.4, it can be seen that the price of rural cottages is also influenced by some intrinsic characteristics. The possibility of having dinner on the spot has a positive effect (+19,2%) on the price of apartments, studios or houses, and also the fact of allowing pets, results in a higher price (+11,8%). The acceptance of credit cards seems to have a very significant positive impact on the price (from +21,7% up till +47,8%). Another remarkable result is that prices for cottages are much higher in Antwerpen than in the other provinces.

The environmental characteristics, restrained in these extended models, deal with fodder crops, permanent grassland, forests and also the production of vegetables in open air. Their effect is similar to the previous models. This means that fodder crops and forests have a negative impact on price, while permanent grassland has a positive influence. Those results are also in line with findings from Le Goffe and Delache (1997), in their study for Brittany (France).

5. DISCUSSION

The HPM used in this study attempted to identify the main determinants of prices for "rural tourism", especially environmental attributes related to agriculture. The main conclusion of the analysis is that there is considerable empirical support for the hypothesis that information on agricultural activities and their environmental

attributes are contained in renting prices. Agriculture seems to play a role in the price for a holiday in a rural area. Amenities from agriculture (in terms of permanent grassland, …) have a positive influence on the renting prices. As a market equilibrium is assumed as the basis for this HP approach, this means that landscape amenities from agriculture have a positive impact on the price tourists are willing to pay. Beneficial externalities from agricultural activities, such as a nice landscape, have a significant effect on consumers' demand. This is also illustrated by the adverse impact of negative externalities from agricultural production (in terms of fodder crops, …) on the renting price.

However, like many other HPM studies, this study could not capture non-use values, as it measured only the use values of attributes of the Flemish countryside. As a demand curve was not estimated, no consumer surplus measures were included in the study, because no data on e.g. household income are available. Therefore an attempt has been made to estimate consumer surplus in a second case study, based on survey data from rural tourists in the province of Oost-Vlaanderen. This analysis will be discussed in the following chapter and should be seen as a supplement to this HP analysis.

Table 5.1. Descriptives of prices and independent characteristics, used in the HPM (n=196[a])

Variable	mean	s.e.	median	min	max
Dependent variables					
Price (ε/person/night)					
guestroom	25,24	6,01	23,55	18,59	61,97
apartment	8,41	2,89	7,67	3,93	19,48
studio	10,00	6,11	8,85	4,09	22,13
house	7,44	1,74	7,23	3,90	10,62
Intrinsic characteristics					
Lodging capacity (number of persons)					
guestroom	2,23	0,46	2,00	2,00	4,00
apartment	6,41	3,81	6,00	2,00	30,00
studio	5,2	1,79	4,00	4,00	8,00
house	7,03	3,58	6,00	4,00	24,00
Total capacity of the residence	14,67	12,00	9,00	2,00	62,00
Rating (number of clovers[b])					
guestroom	2,5	0,9	3	0	4
apartment	2,9	0,9	3	0	4
studio	3,0	0,6	3	2	4
house	3,2	1,1	4	1	4
Type (0=active farm[c]; 1=countryside)	0,49				
Geographic characteristics					
Near the seaside (0=no; 1=yes)	0,44				
Distance to capital of the province	40,13	18,48	38,00	5,00	85,00
Environmental characteristics					
Forests (% TSA[d])	8,45	8,17	6,44	0	42,91
Livestock density[e]					
pigs/ha TSA	6,14	5,49	4,85	0	34,16
poultry/ha TSA	25,89	29,72	13,69	0	183,78
cattle/ha TSA	1,42	0,66	1,31	0,08	3,18
Nitrogen[e] /ha TSA	195,42	120,04	165,86	4,96	683,88
Permanent grassland (%TSA)	22,98	10,35	23,52	0	41,06
Fodder crops (%TSA)	10,7	6,41	9,42	0	27,63
Cereal crops (%TSA)	12,42	8,24	10,25	0	35,15
Fruits (%TSA)	1,88	4,03	0,1	0	28,95
Vegetables (%TSA)	1,78	2,16	0,66	0	9,88

[a] of which 71 guestrooms, 82 apartments, 7 studios and 36 houses
[b] quality measurement is based on a basic comfort system, from 0 to 4 clovers
[c] of which 44% dairy and cattle, 37% mixed, 12% arable and other, 4% intensive and 3% fruits and/or vegetables farms
[d] Total surface area
[e] only informative, not included in the model because of high correlation
[f] figures for excretion are based on the Belgian manure action plan (www.vlm.be)

Table 5.2. OLS estimation of the hedonic price functions (log-linear model)

Variable	**cottage**	**guestroom**	**all**
Constant	0,952**	1,517**	0,959**
	(9,75)	(11,52)	(12,94)
Lodging capacity	-0,026**	-0,003	-0,024**
	(-5,92)	(-0,12)	(-6,17)
Total capacity of the residence	0,002**	0,002	0,002**
	(2,02)	(1,11)	(2,48)
Rating	0,042**	0,055**	0,037**
	(3,21)	(3,73)	(3,83)
Activity on the farm	-0,002	-0,13*	-0,003
	(-0,29)	(-2,00)	(-0,62)
Near the seaside	-0,047	0,028	-0,014
	(-1,25)	(0,80)	(-0,52)
Distance to capital of the province	-0,001	0,000	-0,001
	(-1,52)	(1,02)	(-1,25)
Forests	-0,002	-0,006**	-0,003*
	(-0,88)	(-2,27)	(-1,66)
Nitrogen /ha TSA	-0,000	0,000	-0,000
	(-0,25)	(1,08)	(-0,14)
Permanent grassland	0,004**	-0,003	0,022
	(2,10)	(-1,28)	(1,57)
Fodder crops	-0,005**	-0,009**	-0,005**
	(-1,83)	(-2,32)	(-2,21)
Cereal crops	-0,001	-0,004*	-0,001
	(-0,51)	(-1,89)	(-0,71)
Fruits	0,004	0,004	0,002
	(1,01)	(0,38)	(0,47)
Vegetables	-0,004	-0,022**	-0,007
	(-0,46)	(-2,44)	(-1,00)
Main agricultural activity in the commune	0,024**	-0,019*	0,016*
	(2,02)	(-1,69)	(1,89)
guestroom(1=yes; 0=no)*			0,405**
			(16,25)
Adjusted R²	*0,36*	*0,26*	*0,85*

* a dummy dividing guestroom from the other types of accommodation has been included in this "overall" model

Table 5.3. OLS estimation of the hedonic price functions, with significant variables (log-linear) and elasticity

Variable	**cottage**		**guestroom**		**all**	
	coef. (*t*-ratio)	elast. (%)	coef. (*t*-ratio)	elast. (%)	coef. (*t*-ratio)	elast. (%)
Constant	0,774** (13,20)		1,462** (23,17)		0,900** (18,00)	
Lodging capacity	-0,026** (-6,12)	-5,8			-0,025** (-6,39)	-5,5
Total capacity of the residence	0,002** (2,09)	+0,6			0,003** (3,07)	+0,6
Rating	0,048** (3,81)	+11,6	0,053** (4,51)	+13,1	0,041** (4,26)	+9,8
Activity on the farm			-0,008 (-1,54)	-1,9		
Forests			-0,003 (-1,59)	-0,7	-0,002* (-1,96)	-0,5
Permanent grassland	0,004** (2,79)	+1,0				
Fodder crops	-0,006** (-2,83)	-1,5	-0,007** (-3,09)	-1,6	-0,003** (-2,20)	-0,7
Cereal crops			-0,001 (-0,88)	-0,3		
Vegetables			-0,011** (-2,03)	-2,5		
Main agricultural activity in the commune	0,025** (2,68)	+5,9	-0,015 (-1,61)	-3,5	0,013* (1,85)	+3,0
guestroom(1=yes; 0=no)					0,404** (16,56)	+153,5
Adjusted R²	*0,34*		*0,25*		*0,84*	

Table 5.4. OLS estimation of the hedonic price functions, with more intrinsic variables (log-linear and log-log)

Variable	**cottage** log-linear		**guestroom** log-log		**all** log-linear	
	coef. (*t*-ratio)	elast. (%)	coef. (*t*-ratio)	elast. (%)	coef. (*t*-ratio)	elast. (%)
Constant	1,496 (9,75)		1,699 (17,91)		2,177 (33,07)	
Lodging capacity	-0,024 (-7,00)				-0,021 (-5,95)	-4,8
Total capacity of the residence					0,002 (2,17)	+0,4
Rating	0,030 (2,96)	-5,3	0,033 (3,10)	+7,8		
Forests					-0,003 (-3,06)	-0,7
Permanent grassland	0,006 (4,65)	+7,2				
Fodder crops	-0,006 (-3,25)	+1,3				
Vegetables in open air			-0,043 (-2,74)	-0,04		
creditcard (0=no, 1=yes)	0,282 (4,93)	+47,8	0,106 (4,04)	+21,7	0,130 (4,31)	+25,9
hot meals (0=no, 1= yes)	0,093 (3,53)	+19,2				
pets (0=no, 1=yes)					0,054 (3,36)	+11,8
Antwerpen (0=no, 1=yes)	0,092 (2,71)	+23,7				
distance to capital of province	-0,001 (-2,68)	-0,3			-0,001 (-2,93)	-0,3
nitrogen from cattle			-0,095 (-2,45)	-0,9		
guestroom(1=yes; 0=no)					0,373 (16,33)	-57,6
Adjusted R²	*0,53*		*0,41*		*0,86*	

CHAPTER 6

MEASURING THE RECREATIONAL VALUE OF THE AGRICULTURAL LANDSCAPE

1. INTRODUCTION

To complete the answer to the question on the importance of agriculture in the landscape as experienced by rural tourists, a second case study has been conducted. The aim of this analysis is to measure, in terms of consumer surplus, the recreational value of the agricultural landscape. The HPM analysis in chapter 5 indicated already that agricultural activities play a role in the demand for rural tourism. The analysis in this chapter will incorporate also the decision maker characteristics, as proposed in the conceptual model. By including tourist characteristics, it is possible to estimate a monetary value of the agricultural landscape as a recreational site. This value gives some information on the marginal benefits to society from landscape preservation through agriculture. The hypothesis behind following analysis can thus be formulated as:

The agricultural landscape has a non-market value for society, which can be estimated through measuring the recreational value of the agricultural landscape.

An appropriate method to estimate the value of recreational sites is the travel cost method (TCM). The logic behind this approach is that, apart from waterfalls and similar enclosable artefacts, landscape can not be purchased as such, but the cost to gain access to landscape may be an indication of people's willingness to pay (Bergin and Price, 1993). As most of the rural tourists have to travel to enjoy the landscape, the travel cost may be a good proxy.

The method itself is simple and elegant. A sample of visitors to a site, embodying certain environmental attributes, is surveyed about their place of living (origin), their mode of transport, costs incurred to visit the place, as well as some socio-economic characteristics (Bergin and Price, 1993). The trip generation function is then estimated, explaining visits by travel cost, and other explanatory variables, such as socio-economic characteristics, substitute sites, etc (Garrod and Willis, 1999).

The following section discusses the theoretical background of the travel cost method. Section 3 gives a description of the data, followed by the empirical model (section 4) and a discussion of the estimation results (section 5). Section 6 concludes the analysis.

I. Vanslembrouck & G. Van Huylenbroeck,
Landscape Amenities: Economic Assessment of Agricultural Landscapes, 87—113.

2. THE TRAVEL COST METHOD (TCM)

2.1. Approaches to recreation site modelling

TCM can claim to be the oldest of the non-market valuation techniques (Hanley and Spash, 1993). The original idea behind the TCM can be tracked back to a letter from Harold Hotelling in 1947 (reproduced in Ward and Beal, 2000) in which he suggested that the cost incurred by visitors could be used to develop a measure of the recreation value of the sites visited. However, it was Clawson (1959) and Clawson and Knetsch (1966)[39] who have developed the first empirical models. Their approach aggregates individual visitors to a recreation site into zones of origin, and then seeks to explain the variation between visitor rates from each zone by travel cost, the income of socio-economic characteristics of the residents of each zone, and the characteristics of any alternative site. From the resulting demand curve, consumer surplus per zone can be calculated. The first studies in the 1960s applied the TCM to access problems arising from policy intervention in the development of water resources and definition of land ownership. In the 1970s and early 1980s researchers saw that if the method was useful for measuring the flow of recreational services provided by natural areas, it could also serve to measure the value of these flows in response to changes in environmental quality (Font, 2000). This type of model is still widely used (e.g. Hanley, 1989; Willis and Garrod, 1991; Bateman, Garrod et al, 1996) and continues to be developed to value different kinds of recreational activities.

More recently, economists have centred their research more on the micro-economic details of the model to obtain an estimation of consumer surplus based on travel costs borne by individual visitors to an area. This means that the observations used are those of the individuals themselves rather than zonal aggregates of individuals (e.g. Willis and Garrod, 1991; Perez y Perez et al, 1996; Liston-Heyes and Heyes, 1999; Fleischer and Tsur, 2000; Font, 2000). The theoretical basis of both approaches will be discussed in the following part.

2.2. Theoretical issues

2.2.1. Micro-economic background[40]

A visitor's decision problem is choosing the combination of trips to the n-sites, X_1, …, X_n, that maximises his satisfaction from travel u(X), subject to his recreational budget constraint Y, or

$$V(P,Y) = \max u(X)$$

[39] *as cited in Bateman (1993a,b)*

[40] *For a complete discussion on benefits theory, welfare measures and TCM, I refer to Bockstael et al (1991) and Ward and Beal (2000). The article of Fletcher et al (1990) provides a good overview of some theoretical and empirical issues in TCM.*

such that $P.X=Y$.

The mathematical function $V(P,Y)=V(P_1, \ldots, P_n, Y)$ that produces the visitor's maximum satisfaction achievable at known prices and income is called the indirect utility function. The mathematical function that translates P and Y to the demanded trip mix is called the visitor's demand function: $X=X(P,Y)$.

The inverse of the indirect utility function is the expenditure function: $e=e(P,u)$, where e is the minimum income needed to sustain a given level of satisfaction, u, at site prices P. The expenditure function defines the minimum expenditure needed to achieve a known level of utility when facing known prices. It increases with higher levels of P, thus higher prices require higher minimum level of visitor expenditure to sustain a constant level of utility.

In order to compare two situations (different prices), the expenditure function can be expressed as follows:

$$e = e(P; V(P^0, Y)) = e(P; P^0, Y).$$

This interpretation is much more useful, for it measures how much money income the visitor needs at new site prices P to be as well off as facing original prices P^0 with Y to spend on recreation.

The two most commonly used welfare measures[41] are CV and EV, which are defined as:

$$CV = Y - e(P^1; P^0, Y)$$
$$EV = e(P^0; P^1, Y) - Y$$

The CV asks what income change is needed to compensate the visitor for the satisfaction change due to the price change, or in other words: CV measures actual income minus the minimum expenditure needed at new prices (P^1) to support visitor satisfaction sustained by original prices (P^0).

In contrast, the EV asks what income change at the current prices is equivalent to the proposed change in terms of its impact on the visitor's satisfaction. So the EV measures minimum expenditure needed at old prices (P^0) to support visitor satisfaction produced b new prices (P^1) minus actual income.

In TCM studies, however, the classic apparatus for measuring welfare change is consumer's surplus. If X(P,Y) is the mathematically correct visitor's demand for a single site, as a function of its price and income, then the consumer's surplus associated with a price change is measured as the area to the left of the demand curve and between those two prices. This is shown in figure 6.1 as the trapezoid-like area A+B between the prices P^0 and P^1. It is a close approximation of the theoretically correct welfare measures CV and EV, also shown in figure 6.1. The

[41] *see also chapter 2*

following relationship holds among the three for a normal good for which income elasticities exceeds zero:

$$CV < CS < EV.$$

According to Ward and Beal (2000), consumer surplus is a safe measure to use for the single site demand curve for the case of price change, and will thus be calculated in our empirical analyses.

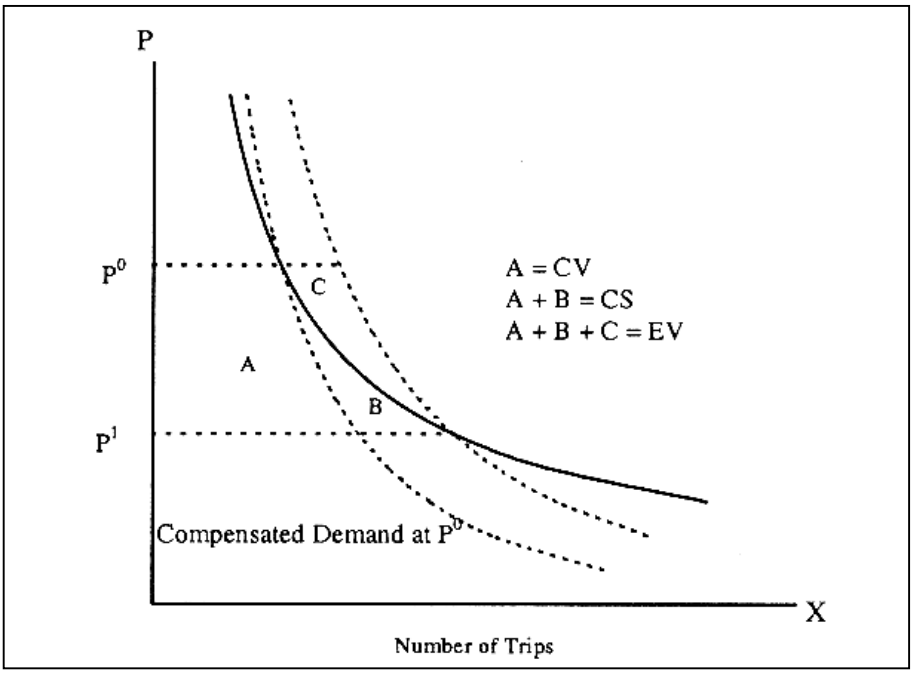

Figure 6.1. Three welfare measures from a price change (Source: Ward and Beal, 2000)

2.2.2. TCM models

The central assumption underlying all travel cost applications is that the cost of travelling to reach a site is a measure of the recreational preference that can be used to estimate demand. TCM is based on the recognition that the cost of travelling to a site is one important component of the full cost of a visit, and that, for any given site, there will usually be wide variation in travel cost across any sample of visitors to that site. The function estimated by the TCM is therefore an uncompensated ordinary demand function incorporating income effects. The obtained welfare

measure will be that of the Marshallian consumer surplus, as has been discussed in previous section.

TC methods are based on actual behaviour, making use of data on observed visits. It seeks to place a value on non-market environmental goods by using consumption behaviour in related markets. Specifically, the costs made to consume the services of the environmental asset (e.g. the costs for travelling to and staying in the countryside) are used as a proxy for the price of the asset (e.g. of the agricultural landscape). Questionnaire surveys are used to collect data on the number of visits that a household or individual makes to a site and on the cost of gaining access. Such travel-cost estimates can be used to deduce the demand for a recreation site.

In essence, the TCM evaluates the recreational use value for a specific recreation site by relating demand for that site (measured as site visits) to its price (measured as the costs of a visit). Knowledge on these expenditures is then used to estimate the values placed by visitors on environmental resources. The method assumes weak complementarity between the environmental asset and consumption expenditure. This implies that when consumption expenditure is zero, the marginal utility of the public good is also zero (Hanley and Spash, 1993). It means that if travelling to a site becomes so expensive that no one goes there any more, the marginal social cost of a decrease in the quality of that site is assumed to be zero. This assumption is more difficult to interpret in the case of the countryside, as most agricultural landscapes are not really unique, which means that visitors can drive to other places to enjoy the agricultural countryside.

A simple TCM can be defined by a 'trip-generation function' (TGF) such as

$$V = f(C, X)$$

where V: visits to a site
C: visit costs
X: other socio-economic variables that significantly explain V.

Two basic variants of this model can be distinguished, according to the particular definition of the dependent variable (see e.g. Hanley and Spash, 1993; Bateman, 1993a,b).

The *zonal travel cost method* (ZTCM) divides the entire area from which visitors originate into a set of visitor zones and then defines the dependent variable as the visitor rate (i.e. the number of visits made from a particular zone in a period divided by the population of that zone). The ZTCM approach redefines the TGF as

$$V_{hj} / N_h = f(C_h, X_h)$$

where V_{hj}: visits from zone h to site j
N_h: population of zone h
C_h: visit costs from zone h to site j
X_h: socio-economic explanatory variables in zone h

The *individual travel cost method* (ITCM) simply defines the dependent variable as the number of site visits made by each visitor over a specific period. Such an approach allows the specification of a number of individual-specific explanatory variables. The ICTM may be estimated as follows:

$$V_{ij} = f(C_{ij}, X_i)$$

where V_{ij}: number of visits made by individual i to site j
C_{ij}: individual i's total visit cost of visiting site j
X_i: all other factors determining individual i's visits

Apart from visit cost and socio-economic variables, other important explanatory variables are related to attributes of the site (e.g. quality), possible substitutes for the site, the easiness to enter the site, and so on (Freeman, 1993; Hanley and Spash, 1993; Bonnieux and Desaigues, 1998; Garrod and Willis, 1999; and others).

To estimate the demand, it is sufficient to take into account those variables. Econometric or regression analysis, is used to test the hypothesis that visitation rates depend on travel cost, i.e. visitation rates are regressed on travel cost and other socio-economic variables. The specified model of visitor behaviour should be consistent with economic theory. This theory emphasises that visitors' decisions are governed by their preferences and are limited by their time and income constraints. Thus the algebraic form of the model should reflect what is believed to be the relationship between the variables of the system under study. In addition, the analyst should expect algebraic signs of the estimated coefficients to reflect the nature of the relationship indicated by theory (Ward and Beal, 2000).

A number of algebraic forms of a TCM demand model are consistent with demand theory. Analysts are therefore faced with a variety of functional forms under which the TGF can be specified: linear, quadratic, semi-log (linear-log or log-linear), double log are the most often reported ones. None of these is theoretically superior to the others (Bateman, 1993a,b; Bonnieux and Desaigues, 1998). However, although linear relationships are the most commonly estimated and easiest to understand, manipulate, interpret and explain to managers and policymakers (Ward and Beal, 2000), its specification exhibits a constant first derivative and is therefore theoretically problematic (Bateman, 1993a,b). Log forms on the contrary may be useful for elasticity estimates and have the advantage of avoiding negative values for the dependent variable (Bateman, 1993a,b). Most researchers base their choice for the functional form on a goodness of fit criterion (such as R^2). Sometimes the log-linear model is chosen, because this model makes the calculation of the benefit measures very simple. In that case consumer surplus is the inverse of the estimated coefficient of the travel cost variable (Englin and Shonkwiler, 1995). It is clear however that different functional forms (even if they have similar explanatory power), can have highly significant impact upon the demand curve and resultant consumer surplus estimates (Bonnieux and Desaigues, 1998), because the consumer surplus is estimated by integrating under the demand curve. Hanley (1989) gives some examples of calculations, derived from different functional forms in his ZTCM

study of forest recreation. It is thus very important to justify the choice of the model, and to make some recommendations on which model to choose.

Another remark to take into consideration when conducting a TC study is that TCM surveys can only sample those individuals who actually visit a site, i.e. non-visitors are ignored. The truncation of non-visitors may bias the estimate of consumer surplus (Bateman, 1993a,b). The obtained estimates are likely to be over-estimates of the true magnitude of consumer surplus (Willis and Garrod, 1991). Further, the dependent variable is a non-negative integer implying that ordinary least-squares (OLS) estimation techniques are, strictly speaking, not really appropriate (Moons, 1999). Models that correct for problems associated with samples drawn from on-site recreation surveys are e.g. multinominal logit, maximum likelihood (ML) approaches[42]. Empirical studies come however to differing conclusions regarding the extent of variance between OLS (truncated) and ML (non-truncated) estimates of consumer surplus. Some researchers have even questioned the appropriateness of switching to ML estimation for avoiding truncation bias. Both Kling (1988) and Smith (1988) argue that although ML techniques may theoretically be more appropriate, OLS techniques produce more accurate consumer surplus estimates. Considering this and because of the limited number of responses in our survey, we decided to stick to the OLS techniques, being conscious of the fact that this may lead to biased estimates.

2.3. Problems with the TCM

There are several potential sources of bias in TCM, and the following list is not exhaustive. Criticism of the TCM mainly concerns the appropriateness of the econometrics (see 4.2.2) used in estimating the demand curve and upon the assumptions needed to evaluate travel costs appropriately (e.g. how to value time costs, how to allocate costs on multi-purpose trips, and how to deal with substitute sites) (see e.g. Bateman, 1993a,b; Heyes and Heyes, 1999).

Although the TCM, based on individual observations may be theoretically preferred because it yields more specific information on visitors and their reasons to choose a particular area and is, it may also represent some deficiencies. Smith and Kopp (1980) mention e.g. the spatial limitations of the travel cost method, as well as the paucity of multiple observations in the econometrically estimated demand curve from data on visitors, because individuals often visit a recreational area only once. Brown et al (1983) refer to the problem with fitting a travel-cost-based outdoor recreational demand function to unadjusted individual observations. This procedure does not properly account for cases in which a lower percentage of the more distant population zones participates in the recreational activity. In such cases, this may result in a biased estimate of the travel cost coefficients. A second problem, according to Brown et al (1983) is the potential for biased parameter and consumer surplus estimations because of measurement error in the individual travel cost data.

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[42] *for a more comprehensive explanation, see Bateman (1993a,b) or Bonnieux and Desaigues (1998)*

Another important point to be mentioned here is that TCM only estimates the "use value", mainly with respect to the recreational value of the area. It is thus not capable of producing any economic value estimate for non-use items such as existence value. This is because the basis of the technique is the level of use-based costs incurred by visitors in visiting a site. Next to that, TCM encounters problems of separability (people may derive utility from the trip to the landscape area as well as from visiting the area itself). To take into account these remarks, some researchers have suggested that contingent behaviour survey questions can be a valuable supplement to the observed data used in the TCM (Bateman, 1993a,b; Moons, 1999; Fleischer and Tsur, 2000). Others suggest implementing hedonic TCM (Garrod and Willis, 1999).

In the work of Heyes and Heyes (1999), the contingent activity method (CAM) has been applied in addition and comparison with CVM and TCM. The CAM relies to hypothetical questions about activities to gather information about individuals' WTP. This kind of approach will also be used in our analysis. The rationale of this model is to combine the travel cost approach with the contingent one: people are asked the extra distance they are willing to travel to stay in an agricultural area, i.e. to keep constant their level of utility. This model was mentioned in the eighties by Mitchell and Carson (1989), who named it "hypothetical travel cost".

Since its original conception by Hotelling, and in spite of its criticism, the use of TCM has proliferated in such a way that it is now the most widely applied revealed preference approach to valuing open-access recreation sites (Freeman, 1993). Since its introduction, the academic debate surrounding the method has moved on from the basic operational issues to consideration of sophisticated extensions and refinements such as the integration of leisure-time constraints (Bockstael et al, 1987), consideration of multiple destination trips (Mendelsohn et al, 1992) and multiple site demand models (Font, 2000), incorporation within wider, random utility frameworks (Freeman, 1993; Pendleton, 1999), or the development of hedonic TCM (Smith and Kaoru, 1987; Freeman, 1993; Pendleton, 1999).

It should be clear from the discussion above that the validity of TCM welfare measures will depend upon the extent to which all problems can be minimised. The review of Smith (1993) and the meta-analysis of travel cost estimates by Smith and Kaoru (1990) indicate that in the case of recreation sites, the TCM framework performs relatively well as compared with other non-market valuation techniques. Moreover, the TCM has been accorded credibility by economists on the basis that it uses observed (as opposed to hypothetical) behaviours (see e.g. Bishop and Heberlein, 1979).

To conclude this section, the statement by Walsh (1986)[43] may be a good summary: "The travel cost method is widely used to estimate consumers' surplus for recreation trips. Despite a plethora of criticism and developments of the original formulation, a carefully specified model can produce robust and realistic estimates."

[43] *as cited by Benson (1994)*

3. DATA

3.1. The survey

Data are collected by questionnaires of visitors to rural guesthouses in the Province of Oost-Vlaanderen. This region is rather heterogeneous and takes different shapes and forms. It attracts many recreationists and has about 30 holiday residences registered with the Federation for Rural and Countryside Tourism. The province has an area of about 298.167 ha, of which 155.078 ha (53%) is cultivated by agriculture and horticulture (NIS, 2001). Apart from West-Vlaanderen it is the most important agricultural province in Flanders. Its relief shows some variation. The height increases smoothly from the north (*Meetjesland*), with a height of less than 5 meter above see level, to the south (*Vlaamse Ardennen*), where 150m is reached. The most important geographical regions are:

- the Flemish Ardens (*Vlaamse Ardennen*) in the south of the province where you can find all types of farms, from mixed arable-livestock farming to specialised ornamental farms;
- the *Leie-Schelde* with very fertile soils (sand-loam), where mostly mixed arable, horticultural (vegetables and fruits) and livestock farms are found;
- the *Gentse Houtland* with sandy soils, where mixed dairy cattle - pig farms and specialised dairy cattle - pig farms dominate;
- the *Meetjesland* in the north-west with fertile polders where you can find mostly specialised arable farms and sandy soils where you can find mixed and specialised nurseries;
- The *Lokerse zandstreek* with both specialised ornamental plants as well as mixed livestock farms;
- the *Waasland* in the north-east of the province with fertile Scheldepolders in the north and sandy soils in the middle and the south with both mixed livestock farms and specialised horticultural and pig farms.

The questionnaires were carried out during the summer (July-September) of 2000 - a high tourist season. Holidaymakers were asked by the owner of rural guesthouses to complete the survey on a voluntary basis. About 108 fully completed surveys returned and were appropriate for the analysis[44]. The survey questions on the objectives of the visit, previous experience with rural tourism, general information on the region and the importance of agriculture, information on the way of travelling, and socio-economic information, such as place of residence, age, education, income, and so on.

3.2. Some descriptive outcomes

Before coming to the travel cost analysis to estimate the recreational value of the agricultural landscape, some interesting descriptive outcomes of the survey are

[44] *based on the data of the Federation, N is about 830*

discussed. These descriptive results put the TC analysis in a more coherent framework.

3.2.1. Distribution of the guesthouses

The 108 respondents stayed in 20 different rural guesthouses in the province. 40% of them stayed on an active farm, while the other 60% can be referred to as countryside tourists. The respondents are almost equally distributed between the northern (dominated by Meetjesland) and the southern (dominated by the Vlaamse Ardennen) part of the region, each accounting for about 50% of the respondents.

3.2.2. Some general results from the survey

- *previous experience*: for 64 respondents this was not their first rural holiday; 29 of them had been in Oost-Vlaanderen before, 23 had been in the region before and even 19 had stayed in the same guesthouse before. More than 95% of the respondents stated that they would (probably) return to the region in the future. This is in line with the results from Opperman (1996), who also found a high number of repeat visitors (51%) with respect to region (in Southern Germany). According to Opperman (1996), this high rate is a positive and a negative sign at the same time. On the one hand, it shows the satisfaction of visitors with the region and the hospitality of the operators. The voluntary response may be a contributing factor with tourists having a good experience being more inclined to respond. On the other hand, the region attracts only a limited number of new visitors each year.
- for 27% of the tourists, a stay in the countryside had been *recommended by friends or relatives*, while more than 90% of the respondents said they would recommend this type of holiday to friends and relatives.

Both findings confirm the hypothesis made in previous section about the fact that tourists know the place and region from friends, relatives or own experience (3.3).

- data related to the *visit* itself are summarised in table 6.1.

Table 6.1. Descriptive statistics on respondents' visit

variable	mean	s.e.	median	min	max
distance travelled (single trip)* (km)	127,4	145,6	85,5	12	996
number of nights	5	5	4	1	30
price (ε) per household per night	63,26	31,73	52,06	0	198,31

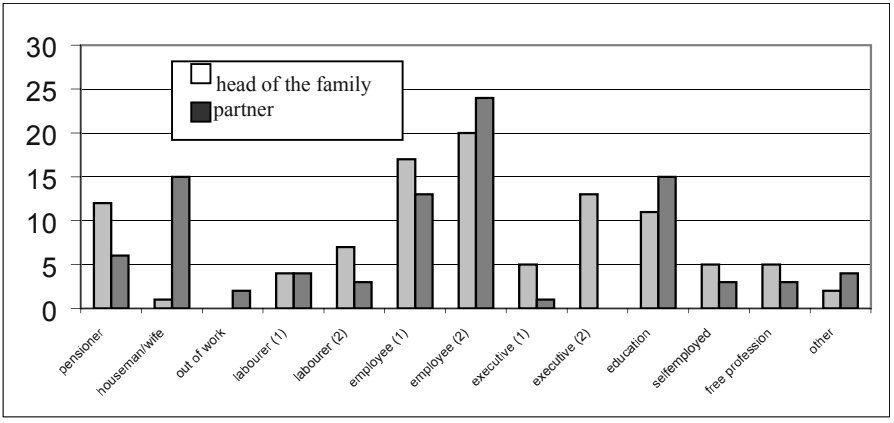
* calculated with a routeplanner (www.maporama.com)

Most of the tourists are Belgians (83,3%), all coming from the Flemish part of the country. Only a minority comes from abroad (11,1% from the Netherlands and 5,6% from France). In the study by Opperman (1996), only 3% were international visitors, which is in line with our results.

- some *socio-economic characteristics*

According to Opperman (1996) rural and farm tourists have an above average share of middle-aged families with children and a below average quota of young childless adults and elderly persons. In fact the distribution in our sample shows tow peaks, namely those groups with tow persons (31,5%) and those with four (25,9%). There were no single travellers and groups with more than six persons constitute a small minority (8,3%). The average travel party size was 4,2 persons. Thus, the typical family with children (3-6) persons was in the majority (61,1% have children with them), but also couples formed an important market segment. This is in line with the suggestions by Murphy (1985), as has been stated in the conceptual model in previous chapter, if we classify rural tourism as a "family" activity. A look at the age distribution supports the family argument. The respondents were asked to state the age for all group members. There were many persons below 21 years (41%), and between 30 and 49 years (39,4%). Only a few visitors were in their 20s (2,8%) or above 60 years (6,1%). The average age of the adults is 43.

Profession, highest diploma and income statistics from the respondents are shown in figures 6.2, which illustrates that rural tourism is mainly done by higher educated, middle-class families with diverse professions. The average monthly income is about ε 2.120 per household, which is rather low, compared with the diplomas and professions. Most rural tourists say they have a job as employee (39,4%). Murphy (1985) mentioned that participation in outdoor recreation tends to increase as the amount of education increases. This statement is also approved by our results.



(1): government/public sector/non-profitsector; (2): private sector

Figure 6.2a. Respondents' profession

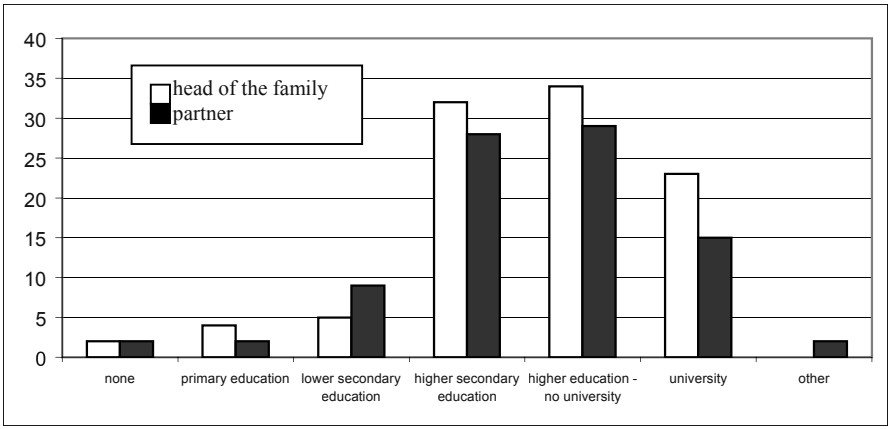


Figure 6.2b. Respondents' highest degree

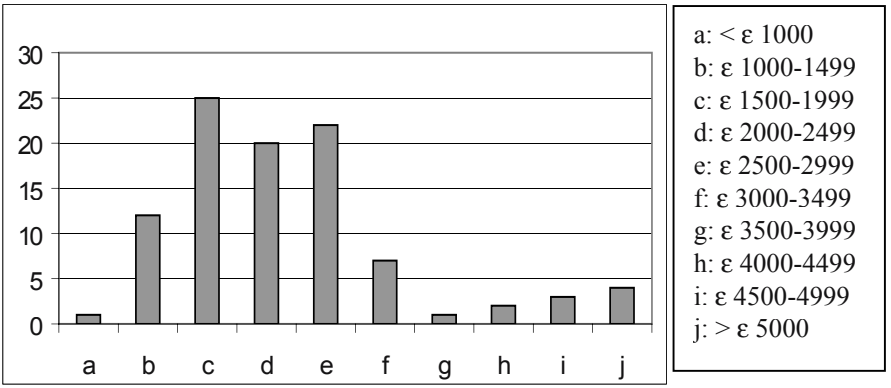


Figure 6.2c. Respondents' net monthly household income

3.2.3. Reasons for choosing rural tourism

Respondents were confronted with a list of possible reasons, that may have influenced their decision for rural tourism, on a 1 (= not important at all) to 7 (= very important) scale. Some of these reasons deal with agriculture, others with the small scale of the holiday residence, or the supply of activities in the area. Figure 6.3 gives an overview of the average answers to this question. Regrouping these reasons in following groups of arguments: (a-c) small-scale character of the holiday residence,

(d-g) agriculture, (h-j) activities in the area, (k) region, and (l) closeness to friends or relatives; and comparing the means of the different groups give some important insight in the reasons for rural tourism. The small-scale character seems to be the most important characteristic of rural tourism, and more important than the agricultural environment (t=3,3). The region in general, including the agricultural activities, is also more important than the agricultural activities as such (t=1,93). This can be explained by the fact that only 40% of the tourists stayed on an active farm. This is confirmed by an independent sample t-test: there is a significant difference (t=0,08) between the means for this variable from farm (6,0) and countryside (4,5) tourism. The activities in the neighbourhood are also positively valuated, and do not result in a significant different mean from the agricultural environment. Only the closeness to friends or relatives gets a rather minor importance.

From these descriptive results, it can be concluded that agricultural activities play an important role in the decision for rural tourism, although it is not the only influencing factor.

3.2.4. Attractive elements in an agricultural landscape

A list of landscape elements was shown to the respondents, on which they had to indicate to what extent they find those elements attractive in the agricultural landscape, on a 1 (= not at all) to 7 (= very much) scale. Figure 6.4 shows the average results.

Landscape elements, such as trees, hedgerows and also forest (as opposed to the results of the HP analysis, although the context is different) and a varying relief (especially in the Vlaamse Ardennen (score 5,5 versus 4,8 in Meetjesland, t=0.03)), get a high score from the respondents. Also the elements related with agriculture, such as animals in the fields and variability in the crops are highly appreciated. It seems that rural tourists associate an attractive landscape with agriculture, and its particular characteristics or elements.

Although the questionnaires are not the same, a study on landscape preferences in Norway (Kaltenborn and Bjerke, 2002) reveals comparable results. Their respondents expressed their strongest positive preference for wildland scenes. Next in preference were cultural landscapes and traditional farm environments (older buildings, small road, birch meadow). Landscapes showing the effects of modern agricultural practises (silo, large and open fields) were the least preferred category.

The independent sample t-test also show there is a significant difference between the northern and the southern part of the province. Agricultural activities are more important in Meetjesland (4,8 versus 4,1, t=0,03), while the region as such gets more attention in the Vlaamse Ardennen (6,1 vs. 4,5, t=0,00).

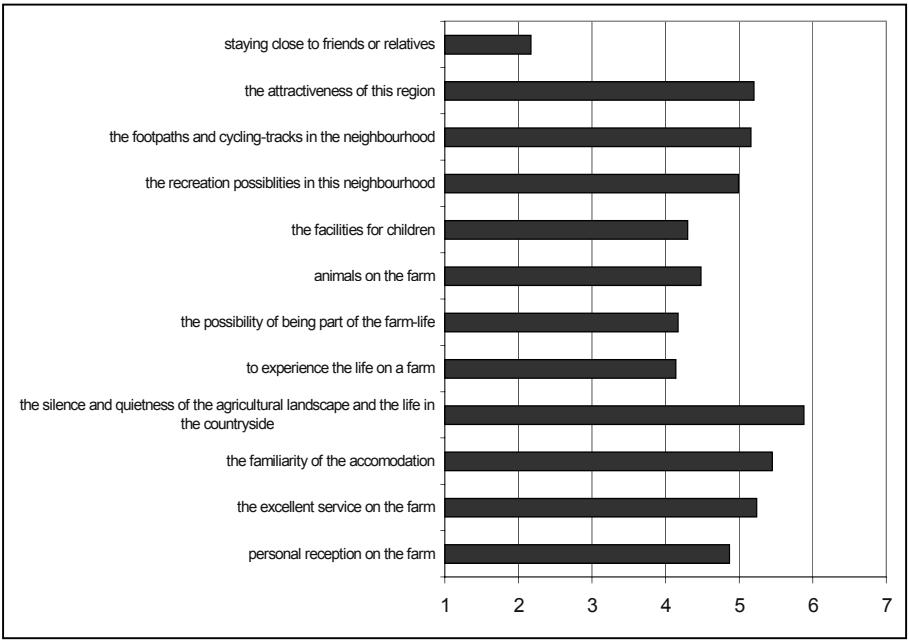


Figure 6.3. Reasons for choosing rural tourism

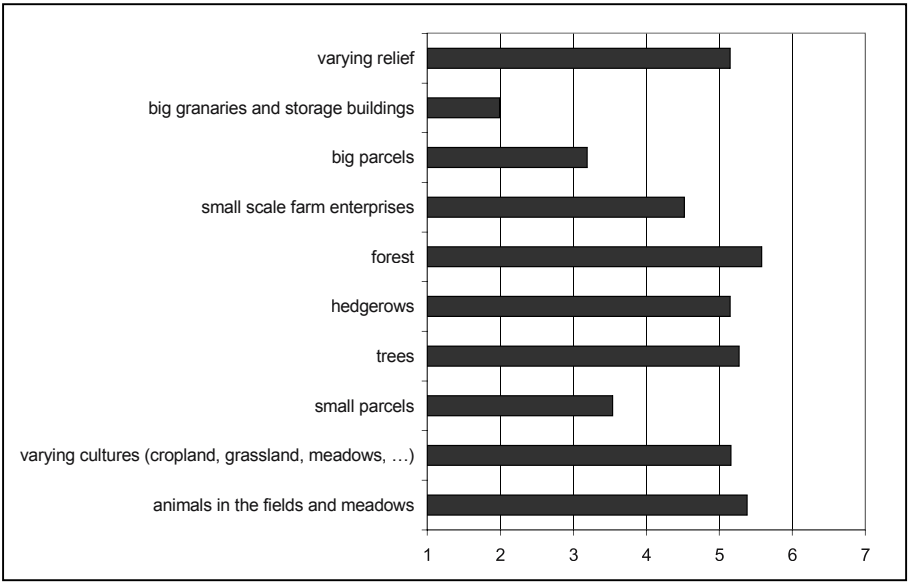


Figure 6.4. Attractive elements in an agricultural landscape

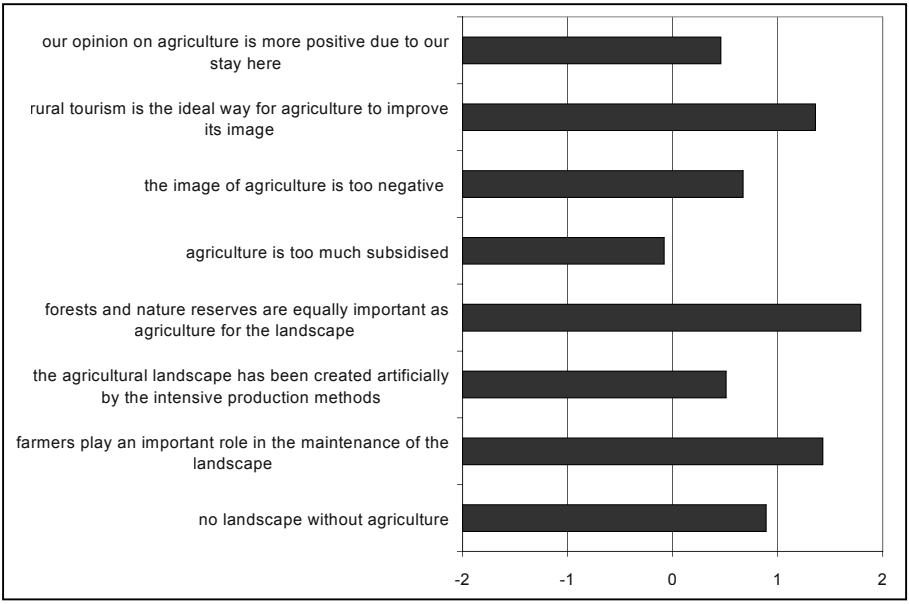


Figure 6.5. Opinion about agriculture

3.2.5. Opinion on agriculture and the relationship between agriculture and the landscape

In the general framework of this analysis it seems interesting to see how rural tourists think about agriculture in general. Respondents were asked whether they agreed or not with a number of statements on agriculture in general and its relationship with the landscape, on a 5-point scale (from -2 to +2). Figure 6.5 presents the results of this question.

The most remarkable result is the very high score (1,79) for the statement "Forests and nature reserves are equally important as agriculture for landscape". But also the statements "No landscape without agriculture" and "Farmers play an important role in the maintenance of the landscape" are valued positively (0,89 and 1,43 resp.). The statement "Agriculture is too much subsidised" gets a negative score (-0,08), which means tourists don't really agree with the statement.

An important result in the framework of this analysis is the high score (1,36) for the statement "Rural tourism is the ideal way for agriculture to improve its image", and the, however smaller, but still positive score (0,46) for the statement "Our opinion on agriculture has become more positive due to our stay here".

3.2.6. Willingness to compensate farmers for the maintenance of the agricultural landscape

In the questionnaire a kind of contingent valuation question was included, to check respondents' willingness to pay for the maintenance of the agricultural landscape. Respondents were asked if they find that farmers should be compensated for the activities they do for maintaining the landscape. If they answered positive, they were asked how much they would be willing to pay.

Do you find that farmers should be compensated for the activities they do in maintaining the landscape (maintenance of hedgerows, pillard-willows, farm beautification, ...)? yes / no
If yes, imagine a fund is established to compensate farmers for the maintenance of the landscape. On a voluntary basis you can give some money to the fund (amounts above ε 25 can be deducted from your taxes). Would you be willing to pay for this fund? yes / no
if yes, how much would you be willing to contribute per year? ……..…ε/year
or ……in your local currency /year
if no, why not? ……

This CV-question[45] has been added to this TC-survey as a kind of exploration. The question has been separated into different parts to avoid possible biases, although the open question format is subject to a lot of discussion (see e.g. Mitchell and Carson, 1989; Hausman, 1993, among others).

Results from this question can be summarised as follows: 53,6% (58) of all respondents find that farmers should be paid for this "job", but only 48,1% (28) of them are willing to contribute to the fund. Only 22 respondents answered the WTP question, resulting in a mean WTP of ε24,34/household/year. This result is especially important because the low response rate confirms the idea that it is very hard for respondents to answer a WTP question, especially in this kind of survey, without any "force" to think about the answer. The result can also be compared with findings from other researchers. Drake (1992) found that Swedish citizens are willing to pay about ε 78/year for the preservation of the agricultural landscape. Colson and Stenger-Letheux (1996) estimated a WTP of ε80,80[46]/year/household for the conservation of agricultural landscapes. Yoshida and Nishizawa (1998) calculated an average WTP of ε868,36[47] per household per year for environmental services of Japanese agriculture. Our result is much lower than findings from other researchers, although it is hard to compare because some are estimated per individual, and other per household.

Reasons for not willing to pay vary from "it is part of their job", "the government should pay" to "they get already enough subsidies (which is money from the taxpayers)".

[45] *for a general overview of the CV-method and its advantages and limitations, see chapter 3*
[46] *530 franc français*
[47] *101.225 yen*

4. EMPIRICAL SPECIFICATION AND ANALYSIS

The description of the travel cost model in section 4.2 has focussed on the underlying principles. In this section several issues of the model specification will be discussed, in relation with our analysis.

The purpose of the study is to specify a recreation demand function predicting how many visits will be undertaken by any individual to the province of Oost-Vlaanderen during a given period of time. As we are dealing with overnight visitors, the choice of the dependent variable is not straightforward. Therefore a number of alternative models (different dependent variables, ZTCM vs. ITCM, extended TCM) have been tried out as will be discussed in the following section.

The explanatory variables included in the regressions reported were selected on the basis of theory, as has been suggested in the conceptual model in chapter 4, and statistical performance. Both decision subject, as well as decision-maker characteristics are included in the model.

A general specification of the demand function for countryside visits is:

$$V_i = f(C_i, SUB_i, A_i, SOC_i, \varepsilon_i)$$

where
- V is the number of visits to the countryside;
- C is the visit cost;
- SUB is a measure of the price of possible substitutes;
- A is an agricultural landscape index;
- SOC is a vector of socio-economic characteristics of the individual; and
- ξ is a vector of independent random disturbances[48].

Some of these variables and their hypothesised influence on countryside visits, need further explanation. We will successively discuss visit cost, socio-economic attributes, agricultural landscape index and substitutes for the site.

4.1. Visit cost

The key assumption behind the recreation demand curve is that, as the total visit costs increase, the number of visits fall. Because TC analysis is mainly based on the total cost of visiting a site, it is important to decompose total visit costs into travel costs, time costs and on-site costs. An extra difficulty with our survey is that it only includes overnight visitors. The calculation of the total visit costs is based on the research of Liston-Heyes and Heyes (1999). The basic definition of total visit cost used for overnight visitor can be written as:

$$C_i = d.c + 2.(\frac{p_i}{s} + w_i.\theta.t_i)$$

[48] *we assume that the error term follows a normal distribution*

where d is the number of days spent at the guesthouse;
c is the accommodation cost per person and per night
p_i is the travel cost;
s is the size of the respondent's household during the journey;
w_i is average household wage per hour;
θ = the opportunity cost of time parameter; and
t_i = travel time.

The composite term $\theta.w_i$ represents the opportunity cost of the time of individual i, as a fraction of his hourly earnings. This opportunity cost is the benefit or utility which could be derived from doing the next best alternative activity in time spent travelling to the recreation site. The appropriate fraction θ to choose is subject to debate (see e.g. Ward and Beal, 2000). Three values were tried for θ=0, θ=0.33 and θ=0.43. The first value is the calibration implicitly 'chosen' in those studies that ignore travel time (e.g. Hanley, 1989), the second is the one originally suggested by Cesario (1976)[49] and (probably) the most commonly used (e.g. Font, 2000). The third is based on UK Government guidelines and is used in a variety of valuation studies based on UK sites (e.g; Garrod and Willis, 1992). The hourly wage rate is derived from the survey and was fixed at ε13,88 per hour for all respondents. Also the travel time has been derived directly from the survey. To calculate p_i, information was needed on the travel distance. This value has been calculated with a route-planner. The computation of the travel cost is dependent on the type of transport mode used: car, public transport, bike, or others. For respondents travelling by car, the single-trip distance was multiplied by a cost per car-kilometre[50] (fixed at the average of ε0,33 per km). Monetary travel costs for respondents travelling by public bus are computed by multiplying single trip distance by a price per passenger-kilometre, as proposed by Moons et al (2000) (fixed at ε0,13 per km). For visitors travelling by bike or on foot, we assume that monetary travel costs are zero. For other ways of transport, we use the information on monetary travel costs provided by the respondents.

Travel time is added to the other travel costs, to eliminate probable multicollinearity in regression analyses where travel cost and travel time are included as separate explanatory variables.

4.2. Socio-economic attributes

Following important socio-economic characteristics could be taken from the survey: age and composition of the household, education, profession and income. Their possible influence has been discussed in chapter 4, when dealing with the conceptual model on tourists' travel-purchasing behaviour. Next to that, we had also

[49] *as cited by Liston-Heyes and Heyes (1999)*
[50] *an extended marginal cost per kilometre was used, as has been suggested by Moons et al (2000) and includes fuel expenditures, repairs, tyres, batteries, acquisition cost and 60% of the insurance expenditure.*

information on the aim of the visit, previous experience with rural tourism and the impact of agriculture on their decision for rural tourism, which are expected to have a positive influence on the travel expenditures.

4.3. Agricultural landscape index

The assumption behind this variable is that a rural recreation area is characterised, among other things, by its agricultural landscape. Therefore a (0,1) dummy variable was introduced to estimate the importance of agricultural landscape in the decision of visiting the area. If the answer to the question "To what extent has the agricultural landscape, farm life, activities on the farm or presence of animals influenced your decision to visit the region?" was very much, this was encoded as 1, 0 otherwise. The hypothesis behind this variable is that one should expect that if agriculture has an impact on the choice for rural tourism, this has a positive effect on the value attached to the positive amenities from agriculture (measured through an estimation of the travel costs).

4.4. Substitute sites

From the TC literature it is clear that information on substitute sites is rather important. The number of visits that a person makes to a particular recreation site does not only depend on the costs of visiting that site, but also on the implicit prices of any substitute site in the region. Because we are dealing with a rather large area, it was quite difficult to include information on substitute sites. However, an attempt has been made to include a proxy for substitute sites: the province has been split into two regions, namely the northern and the southern part. This resulted in a dummy variable, referring to the differences in the two regions. This choice can be subject of discussion. Given the purpose of our exercise - identifying if the presence of agriculture influences the decision of visiting the area - we believe this proxy can give some valuable information. The northern region is more typical for its agricultural activities, while the southern part has a varying relief as its main attractive characteristic. Including this dummy variable can show if this is really experienced as such by the tourists.

5. ESTIMATION RESULTS AND ANALYSIS

5.1. Application of the zonal travel cost approach

The zonal travel cost approach was performed only on the answers of Belgian tourists, giving a sample of 90 responses. The answers from foreign visitors were not included, because of the difficulty to categorise them into zones. They will be taken into account in the individual travel cost approach (see 4.5.2).

Four candidate functional forms[51] for the trip generating function were considered: quadratic, semi-log (dependent), semi-log (independent) or log-linear, and double log. Travel costs were computed as mentioned before.

Table 6.2 presents trip-generating equations estimated from the data. (V_i/P_i) represents visits per capita from the ith zone and C_i are the travel costs per respondent from zone i. As may be seen, travel time has been included in the model in three different ways, which results in three different TGFs per functional form, referred to as a, b and c for resp. θ=0, θ=0.33 and θ=0.43. Overall the regression is highly significant and manages to explain up to 37% of the variation in the observed visitation rates. Although the percentages seem rather low, they are in line with similar ZTCM studies. Hanley's (1989) estimations of TGFs for visiting a park in Scotland resulted in adjusted R^2 varying from 24 to 37%. A disadvantage of the ZTCM is that they are forced to aggregate zonal data so that an average value of each variable is used for each zone. Averages may differ little among zones so that the coefficients of those variables may be found not to be statistically distinguishable from zero. Statistically non-significant variables are deleted from final equations used in demand estimation. Hence demand equations estimated by zonal methodology often contain no demographic variables (Ward and Beal, 2000).

The per capita consumers' surplus can be calculated from these TGF, as the surface under the demand curve. For the log-linear function, the coefficients can be interpreted as the proportionate change in the number of visits per unit change in the level of the dependent variable. In our particular case, the estimates of consumer surplus are ε 100, ε 93,46 and ε 104,06 resp. These estimates do not differ significantly from one another. From those per capita consumer surplus estimates, an aggregate consumer surplus can be calculated, by multiplying with the average number of visitors to Oost-Vlaanderen every year, 8250[52]. This results in an aggregate consumer surplus varying from ε771.045 to ε858.495 for the recreational value of the agricultural landscape of Oost-Vlaanderen, per year[53]. This is an estimate of the use value for society of the agricultural landscape in that province.

As we are dealing with a particular case however (overnight visitors instead of day-visitors), the use of the zonal travel cost approach has its limitations. Therefore an individual travel cost approach has also been used to refine and complement the results from the ZTCM. The ITCM takes more account of the inherent variation in the data, rather than relying on zonal aggregates.

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[51] *all these forms have been tested because non of these has strong theoretical ascendancy over the others (Bateman, 1993); see also 3.2*

[52] *derived as follows: 17% of the guesthouses are located in Oost-Vlaanderen and in 2000 there were about 48.532 rural tourist in Flanders (Van Mierlo and Verscuren, 2001)*

[53] *a more thorough discussion on the reliability and validity of the results will be given in section 6 of this chapter*

Table 6.2. Estimated trip generating functions

Equation	*adjusted R^2*
(1.a) $V_i/P_i = 11{,}9 - 0{,}335C_i + 0{,}0033C_i^2$	37%
(1,77) (0,12) (0,001)	
(1.b) $V_i/P_i = 11{,}9 - 0{,}266C_i + 0{,}0021C_i^2$	28%
(2,27) (0,13) (0,001)	
(1.c) $V_i/P_i = 12{,}7 - 0{,}315C_i + 0{,}0028C_i^2$	34%
(2,17) (0,12) (0,001)	
(2.a) $V_i/P_i = 13{,}2 - 2{,}14 \ln C_i$	26%
(2,81) (0,92)	
(2.b) $V_i/P_i = 14{,}5 - 2{,}4 \ln C_i$	29%
(3,13) (0,95)	
(2.c) $V_i/P_i = 14{,}7 - 2{,}44 \ln C_i$	26%
(3,44) (1,04)	
(3.a) $\ln(V_i/P_i) = 2{,}1 - 0{,}01C_i$	10%
(0,22) (0,01)	
(3.b) $\ln(V_i/P_i) = 2{,}2 - 0{,}011C_i$	22%
(0,21) (0,005)	
(3.c) $\ln(V_i/P_i) = 2{,}1 - 0{,}0096C_i$	11%
(0,23) (0,01)	
(4.a) $\ln(V_i/P_i) = 2{,}79 - 0{,}335 \ln C_i$	22%
(0,47) (0,15)	
(4.b) $\ln(V_i/P_i) = 3{,}02 - 0{,}381 \ln TC_i$	27%
(0,52) (0,16)	
(4.c) $\ln(V_i/P_i) = 3{,}00 - 0{,}371 \ln TC_i$	21%
(0,58) (0,18)	

5.2. Application of the individual travel cost approach

As discussed earlier, when dealing with overnight visitors, the choice of the dependent variable is not straightforward. Therefore the approach chosen by Bell and Leeworthy (1990) has been tried out. They are convinced that overnight visitors can be treated separately in the TCM because they face a decision problem different from that of residents or those who travel short distances (one-day visitors). The authors recognise that the 1-day trip assumption used in many TCM studies is inapplicable to those coming from significant distances. Instead of using number of visits as the dependent variable, they used annual number of days spent at the site and include two price components: the fixed cost associated with the long distance journey and the variable cost associated with a day on-site. They found that annual consumer demand by individual tourists for Florida beach days is positively related

to travel cost per trip and inversely related to on-site cost per day. Although some have argued (i.a. Font, 2000 and others cited by this author) that this model is not really a travel cost model, as the dependent variable is beach days on site, not number of trips, and because it uses on-site costs, not travel costs, the results are likely to be qualitatively robust. A similar approach has therefore been used to analyse our data.

The following demand equation for rural tourists was formulated:

$$DAYS = F(ACC, TC, SOC, AGR, OTH)$$

with *DAYS* : the days spent at the holiday residence;
ACC : the accommodation cost per night and per visitor (as a proxy for the on-site cost per day);
TC[54] : the travel cost per trip (round trip) to the holiday residence, per visitor;
SOC : includes some socio-economic characteristics;
AGR : the agricultural landscape index (as has been discussed before);
OTH stands for some other variables which can have their influence on *DAYS*, such as previous experience.

Table 6.3 presents some descriptive statistics. The choice of the variables is based on literature review, the conceptual model as proposed in chapter 4 and available data from the survey.

It is hypothesised that *DAYS* will be inversely related to *ACC* while positively related to *TC*. This latter hypothesis contradicts the TCM, which hypotheses an inverse relation between *DAYS* and *TC*. The idea behind our hypothesis is, however, that those coming from distant places will take fewer but longer visits than those closer to the site. The remaining variables are demand shifters.

The demand equation was estimated using OLS in linear, semi-log, and log-log forms. Using the goodness of fit criterion, the semi-log (dependent) form has been chosen. The results of the regression are shown in table 6.3. From table 6.3 it is clear that most of the variables were not significant at the 90% level (only travel cost (TC), quality measurement (Q) and region (R) are found to be significant). Some of these coefficients have however an interesting sign. The number of days spent tend to increase with age, lower income, and for people without children. A closer look at respondent's answers shows that older people, without children, often retired, so with a "lower" income, have more time to spend in the quietness of the countryside. That explains the signs of the coefficients. If agriculture is an important component of the choice for rural tourism, this has a negative effect on the days spent, which is opposite to our hypothesis. Previous experience, more holidays a year, positive opinion about agriculture, higher quality and farm tourism all tend to shorter stays. Rural tourism as a second holiday tends to be a short break, next to the longer

[54] *without taking into account the time cost*

holiday, often abroad. People are also staying shorter periods in the guesthouses in the southern part of the province.

Table 6.3. Descriptive statistics and OLS estimation of the individual travel cost function[*] (log-linear model)

	Descript. statistics		Estimation results	
Variables	mean	s.e.	coeff.	t-value
DAYS	5,16	4,72		
ACC (ε)	19,67	12,00	-0,013	-1,38
TC (ε)	23,88	28,30	0,007	2,20
SOC:				
- average age adults	43,45	9,5	0,0004	0,04
- children (0/1)[a]	0,61	0,49	-0,035	-0,14
- household monthly income (1/10)[b]	4,51	2,05	-0,032	-0,68
A (0/1)[c]	0,60	0,49	-0,253	-1.38
OTH:				
- previous experience (0/1)[d]	0,40	0,49	-0,076	-0,43
- only holiday (0/1)[e]	0,71	0,46	-0,215	-1,17
- general opinion about agriculture (0/1)[f]	0,70	0,46	-0,087	-0,45
- quality measurement Q (0-4)	2,96	0,89	-0,205	-1,74
- region R (1/2)[g]	1,49	0,50	-0,497	-2,10
- farm / countryside (0/1)[h]	0,42	0,50	0,078	0,45

[*] adj R^2 = 0,04; constant = 3,39

[a] 1 if there are children with them, 0 otherwise

[b] the monthly income was divided into classes:

1 : less than ε 1000
2: ε 1000-1499
3: ε 1500-1999
4: ε 2000-2499
5: ε 2500-2999
6: ε 3000-3499
7: ε 3500-3999
8: ε 4000-4499
9: ε 4500-4999
10: more than ε 5000

[c] 1 if agriculture is an important component of choice for rural holiday, 0 otherwise

[d] 0 if this is their first rural holiday, 1 otherwise

[e] 0 if this is their only holiday, 1 otherwise

[f] 1 if general opinion on agriculture is positive, 0 otherwise

[g] 1 if guesthouse is situated in the northern part of the province, 2 otherwise

[h] 0 if it concerns an active farm, 1 otherwise

The final demand equation, taking into account only the significant variables (plus ACC), is (t-values in parentheses):

$$\ln DAYS = 2{,}135 + 0{,}0082TC - 0{,}002ACC - 0{,}22R - 0{,}2Q \qquad (6.1)$$
$$(4{,}49) \quad (3{,}17) \quad (-0{,}29) \quad (-1{,}23) \quad (-1{,}9)$$
$$\text{Adj } R^2 = 8{,}1\% \qquad F = 2{,}981 \qquad N=108$$

As a proxy of price, *ACC* exhibited the hypothesised sign. *TC* is positively related to *lnDAYS*, which is consistent with the alternative hypothesis that the number of days spent at the holiday residence are actually an inferior good with respect to travel cost. This is in line with the results from Bell and Leeworthy (1990). Higher quality and stays in the Southern part of the province tend to shorter stays.

From equation 6.1 the consumer surplus, as a measure of value of the resource (the agricultural landscape), can be calculated. Consumer surplus is as the inverse coefficient of *ACC* and is equal to ε 500 per visit or ε 96,9 per visitor per day[55].

This number is most interestingly seen in the context of comparable studies. The consumer surplus numbers are higher than typical for user benefit valuations. For example Bell and Leeworthy (1990) found a day at saltwater beach is worth ε 40,96[56] as measured by consumer surplus (by using the simple linear functional form). Liston-Heyes and Heyes (1999) also report consumer surplus/day estimates varying from ε 5,36 to 39[57] for overnight visitors in the Dartmoor National Park (UK).

5.3. Application of the Contingent Activity Method (CAM)

As suggested by Heyes and Heyes (1999), our analysis has been expanded with the use of a CAM. As part of the survey, respondents were asked the maximum additional distance they would be willing to travel in order to stay in an agricultural area[58]. By converting these into monetary equivalents, we are able to derive alternative measures of consumer surplus.

The CAM exercise produced stated willingness to travel (WTT) figures, multiplied by two to capture the round trip costs implied by the 'hypothetical' distance. These are summarised in table 6.4. The initial figures were given in km and subsequently monetised as discussed above. Based on the research from Moons et al (2000), a cost per car-kilometre was taken, which takes into account fuel expenditures, repairs, tyres, batteries, acquisition cost and 60% of the insurance expenditures. This cost was calculated to be on average ε 0.33/km[59]. The round-trip distance is therefore multiplied by this average cost, and divided by the number of persons in their household.

About 63% of the respondents are willing to travel further to recreate in an agricultural environment. The average distance they are willing to travel is about 161 km, for their whole household. Having no particular reason to interpret zero WTT bids as protest votes, they are left in.

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[55] *see section 6 for a more detailed discussion on these results*
[56] *$38,46*
[57] *£3,45 to £ 25,16*
[58] *"Imagine agriculture disappears in this region, would you be willing to drive a longer distance to recreate in an agricultural environment? yes/no; if yes, how far would you be willing to drive?"*
[59] *this average takes into account different types of cars (small and big gasoline, and small and big diesel)*

Table 6.4. Willingness to travel (N=81)

	WTT[a] (km)	WTT (ε)/household	WTT/visitor (ε)
median	60,00	39,80	11,06
mean	99,16	65,78	18,89
s.e.	141,16	93,64	25,03
min	0,00	0,00	0,00
max	1000,00	663,36	132,67

[a] as stated in the survey, not taking into account the size of the household yet

The results in table 6.4 show that the WTT/household is smaller than the results from the TCMs (see also table 6.5). The WTT/visitor is even much smaller. This is, however, in line with the results from Heyes and Heyes (1999) who compared WTT, TC and WTP. We have of course to take into account the small number of responses, so the results can only be interpreted as some rough indications. It indicates, however, that one must consider if the WTT is really stated on an 'individual' basis, as was asked for in the survey. Or, as was suggested by Heyes and Heyes (1999), it should be divided by the size of the respondent's household. The idea behind this is that some of the respondents may have submitted an amount that reflects how many additional hours his/her household would have been prepared to travel to reach an agricultural environment. In this case, the correct procedure is to divide the WTT by the size of the household. Comparing our results (WTT/visitor) with the once found by Heyes and Heyes (1999), it seems that the WTT of the overnight visitors are of the same size (ε 10,60 - 31,82)[60].

One important advantage of the CAM formulation, when comparing with other valuation methods (especially contingent valuation) is that it avoids both the free-riding and the protest bias. The question is neutral in the sense of not requiring the imposition of any particular policy scenario. On the other hand, the patently hypothetical nature of the question may be dissuading the respondents from applying adequate cognitive effort to the problem. Another set of difficulties with WTT surround the conversion of answers in monetary equivalents. These are to a great extent, the same set of problems that arise in any more conventional TCM-based studies (see i.a. Randall, 1994). However, the ease with which the key WTT question can be added to any standard travel-cost questionnaire makes it a potentially attractive way of providing a supporting measure in TCM-based studies. Our exploration of the method made a first attempt to do this. It is clear that it needs some refinements in future research, but at least it gives an indication that it is indeed a possible and quite simple way of analysing recreation benefits.

6. CONCLUSIONS

This chapter has presented an empirical application of the travel cost model to value the recreational value of the agricultural landscape. The travel-cost approach is an

[60] *£ 6,81 - 20,43*

attractive methodology for valuing recreational benefits because it is based on observed behaviour.

The value of the agricultural landscape has been estimated using actual data of visitors in the province of Oost-Vlaanderen, Belgium. Different approaches of the TCM have been tested and compared to specify and estimate demand functions: ZTCM, ITCM and CAM. The consumer surplus associated with recreation is calculated. Table 6.5 gives a summary of the findings of this analysis.

Table 6.5. The recreational value of the agricultural landscape in Oost-Vlaanderen

Method	consumer surplus per capita (ε)	aggregate consumer surplus on an annual basis (ε)
ZTCM	93,46 - 104,06	771.045 - 858.495
ITCM	96,9	799.425
WTT	18,89	155.842
WTP	24,34*	

* : per household

To have a better understanding of these results, they can be interpreted as follows: a value of ε 800.000/year for the province of Oost-Vlaanderen corresponds with about ε 5,16 per ha of agricultural land, or ε 43,11 per labourer[61]. This amount is rather small, compared with farmers' income per labourer in 2000, which was ε 22.647 (Ministerie van Middenstand en Landbouw, 2001). Two remarks should be made here. First of all, our estimates reveal only the recreational value, thus should be seen as a lower bound of the value for society. Secondly, the relative importance can change considerably due to e.g. policy changes (see also chapter 10).

Our estimates were based on a visitor's survey, hence they do not account for e.g. non-use and resident's values. These latter values can be significant, as Garrod and Willis (1995) and Hanley, MacMillan, et al (1998) found in two separate studies of the ESA programme in the UK. Next to the recreational value, there are other values which can be derived from the agricultural landscape, as has been discussed in chapter 3. Those values should be added to the recreational value in order to arrive at an estimate of the total value of the agricultural landscape. Therefore, comparison of our findings with results from other studies is difficult. A good overview of recent studies can be found in Santos (2001). From his overview, it is clear that CVM is most widely used for estimating demand for landscape. There is a smaller number of examples of TCM and HP. Although comparison of the results is rather difficult, as different outputs have been valued, his overview confirms however the need to take into account the value of the landscape when making decisions on landscape conservation.

It should also be noted that our estimation suffers from flaws common to many TC studies as a result of data limitations. Validation of the estimates raises difficult questions and few answers can be found in literature. Ex post validation of TCMs

[61] *calculated from NIS (2001)-data*

can be done, either by getting new data to test the stability of the estimated elasticities statistically or on-the-ground management experiments in which the site quality characteristics are varied to see if the quality coefficients are correct (Ward and Beal, 2000).

The discrepancy between our results is of some interest. Neither measure is perfect. Stated WTP is likely to underestimate true WTP (Cummings et al, 1986; Mitchell and Carson, 1989). Respondents can be prone to strategic bias, as they may give either zero or lower than honest answers in protest at the suggestion to pay farmers for those "extra" services. These conservative figures are of some use if interpreted as "theoretical lower bounds" of the true underlying Hicksian values for the public good (Champ et al, 1997).

The CAM formulation on the other hand, avoids both the free-riding and the protest bias. The question is neutral in the sense of not requiring the imposition of any particular policy scenario. The main difficulty with WTT has to do with the conversion of the answer into monetary equivalents. These are, to a great extent, the same set of problems that arrive in any more conventional TCM-based analysis (see, among others, Ward and Beal, 2000).

Which out of the WTT, WTP and TCM is likely to yield an answer nearer the "truth" is a matter of judgement and depends upon the context. In the study reported here, the results have to be seen as an estimate of the marginal benefits to society of the agricultural landscape. The recreational value has been measured by using different non-market valuation techniques, resulting in different outcomes. They all have to be interpreted, taking into account the weaknesses of the method used. None of the answers reveals the truth, but they give a sign that the agricultural landscape has a value for society, and although this cannot be measured in market prices, its value should be taken into account when deciding on appropriate policy measures.

"... the cheapest, and indeed the only way of preserving the countryside in anything like its traditional aspect, would be to farm it" (Lord Justice Scott (1942)[62])

PART III

SUPPLY OF LANDSCAPE AMENITIES FROM AGRICULTURE

[62] *As cited in Bowers and O'Riordan (1991)*

CHAPTER 7

FARMERS' SUPPLY OF LANDSCAPE AMENITIES

1. INTRODUCTION

In many areas, farming has produced a distinctive and much appreciated countryside. Much that is valued in the rural environment is a legacy of a historical pattern of agricultural economy, particularly in Europe. The rural landscape has been shaped by past human activity, rather than being a consequence of some 'natural' force of nature. Farming may not feature in every landscape, but with a coverage of more than 42% of EU-15 territory in 1999 (European Commission, 2001), agriculture remains the main land use. Thus farmers have historically and to a large extent unwittingly been responsible for the development and stewardship of the landscape. They have provided environmental, social and amenity benefits for free, while pursuing the production of food, fibre and fuel for subsistence or for profit.

But the recent changes which have taken place in the organisation and technology of agricultural production have undermined the apparently complementary relationship which agriculture had with the rural environment. Factors principally involved have been: (i) technological change, and (ii) policy-driven changes in the area and intensity of cultivation. The use of chemicals, the restructuring of agriculture, the disposal of animal wastes and the removal of wildlife habitat and landscape features have all led to a perceived reduction in the quality of the rural environment and have reduced the values of other uses in the countryside (Hodge, 1991).

Those changes had a big impact on agriculture's role in the landscape. Traditional agriculture has perceived to contribute to the preservation of valued landscapes (e.g. meadows, grassland and heathers); landscape functions such as wildlife habitat provision; to reduced off-site effects through hydrological stabilisation; windbreaks that reduce soil displacement; and to the preservation of archaeological and architectural features (Bonnieux and Weaver, 1996). Because of the technological innovations, the role and thus the pure economic value of some of these functions have disappeared (e.g. landscape elements as windbreaks). To fully integrate environmental concerns, agricultural policy has to ensure that farming maximises its positive effects and minimises negative effects.

In marginal farming areas, preservation of the cultural landscape faces a double challenge. Not only does society desire farmers to adopt certain environmental practices, but they must remain on the land in the first place. Abandonment, or near-

I. Vanslembrouck & G. Van Huylenbroeck,
Landscape Amenities: Economic Assessment of Agricultural Landscapes, 117—135.

abandonment manifested as under-use, neglect or farm amalgamation, is a reality in parts of the EU and it is clear that when farming declines, scrub and forest encroach and the open landscape will disappear. In productive areas, farmers will be under pressure to maximise output and so enlarge farm size and remove landscape features (DGVI, 1998).

In response to growing public concern about the progressive reduction in the quality of the countryside environment, policy-makers have to give consideration, not only to the production of agricultural goods, but also to that of non-marketable public goods (Whittaker et al, 1991). That this is not just a European problem, but also a main topic in the US and other developed countries can be found in i.a. Van Kooten and Schmitz (1992), Bockstael and Strand (1994), Potter (1998), Milon and Hodges (2000), Wu et al (2000) and Claassen et al (2001).

As has been analysed in part II, agriculture should be seen as a supplier of amenities for which society has a demand. In order to meet those demands, and given the market failure in providing those public goods, signals need to be provided, e.g. by governmental institutions.

The aim of part III is to shed a light on the supply characteristics of the positive outputs of agriculture and explore the different ways of supplying the non-commodity outputs, demanded by society. The idea behind and structure of part III is as follows. The actual supply of landscape amenities has to be seen in the light of the European agricultural policy context (chapter 7), as agriculture has always been a highly influenced sector. The reform of the Common Agricultural Policy already had a big impact on the landscape. To arrive at the optimal provision of these amenities, however, both benefits and costs need to be considered. Therefore, in chapter 7, special attention is given to the possibility of costs savings due to the joint provision of outputs. Because of economies of scope, it can be assumed that the provision of these amenities can best be done by farmers. Farmers' willingness to provide these amenities, depends on many factors that will be put together into a conceptual framework. Some knowledge on farmers' decision making behaviour is very important, and will be addressed in chapters 8 and 9. The results should provide the basis for discussing the implications of multifunctionality and the supply of landscape amenities for agricultural policy reform.

2. SUPPLY OF LANDSCAPE ELEMENTS IN THE EUROPEAN POLICY CONTEXT

In chapter 3, the provision of landscape elements and the relationship with agriculture, has already been discussed. Figure 3.2 gives a schematic view on the complex relationship. As agriculture in Europe (but also in other parts of the world), is very much oriented through policy intervention, these policy measures also had an indirect impact on the agricultural landscape.

European agriculture has been shaped by the Common Agricultural Policy (CAP). The Treaty of Rome (1957) laid down the foundations of the CAP, but did not mention the environment at all. The priority at the time was to increase agricultural productivity in order to ensure farmers a satisfactory and equitable

standard of living, and to stabilise agricultural markets and farmers' income (Brouwer and van Berkum, 1996). Protection of the rural environment was not a concern. The extensive modernisation of European agriculture, stimulated by the CAP, thus took place with little regard for the environmental consequences. Increasingly, though, the CAP roused criticism for its role in driving changes in agricultural land use and farming practices that were detrimental to the countryside.

2.1. The responsibility of the CAP

Many of the environmental impacts have been ascribed to the CAP, although it would be naive to lay all the responsibility for the transformation at the feet of the European Community (Lowe and Whitby, 1997).

There have been associated changes in rural, social and economic structures and in technology with which the CAP has interacted but which would have had profound consequences without the CAP (Brouwer and Lowe, 2000). It can be argued that one effect of the CAP has been to moderate some of the detrimental pressures and, given that many of the environmental benefits from rural land management depend upon the continuity of certain practices, it is possible that without the CAP, there would have been even greater environmental losses. For example, the intensification and concentration in the pig and poultry sectors, with all their related problems of disposal of waste products, have occurred without the CAP's commodity price supports, although they have been encouraged indirectly by a common and protected market.

However, in many cases, environmental problems have been aggravated by agricultural and trade policies that distort price signals through support increasing the prices of agricultural commodities, or reducing the costs of agricultural inputs. Three broad areas of concern have been identified about the direct effects of the CAP (Brouwer and Lowe, 1998): (i) the level of efficiency of input use and the consequences of agricultural pollution; (ii) the rationalisation of farm size and structure and the consequences for rural landscapes and habitats; and (iii) the maintenance and encouragement of farming in rural areas. Especially the second and third point are of importance for our research.

A long-term objective of the CAP has been the improvement of the structure of farming. This has involved grants and technical aid to revitalise the age structure of the farming population, to modernise farms and to consolidate holdings. This has led to a considerable change and rationalisation in rural landscapes, including, for example, the spread of irrigation and drainage, and field enlargement, and the consequent loss of many traditional features and micro-habitats (e.g. hedges, trees, field margins and wet areas) (Brouwer and Lowe, 2000). The landscape elements have been declining in number, owing to changes in technology and relative prices, political measures and attitudes among farmers (although the causal mechanisms are often not easy to separate). For instance, farmers culvert ditches and remove stone walls, hedges, solitary trees and similar landscape elements to transform a mosaic of small enclosure into a few, large and easily cultivated fields. The main motive for

the rationalisation of the field layout is to decrease the costs of crop production in order to increase farm profits (Hasund, 1998).

Efforts to reform the CAP from an environmental perspective have been aimed both to overcome the negative externalities associated with production supports and to incorporate positive environmental aims into the objectives of the CAP, as will be discussed in following section.

2.2. The agri-environment challenge

The adoption of environmental prerogatives and objectives within the CAP has proved to be one of the more difficult tasks of environmental policy integration. The work of Buller (2002) gives four reasons for this lengthy and complicated process of policy integration:

1. It has taken a long time for all actors involved to understand that agricultural activities, on the one hand, and environmental quality protection and maintenance, on the other, are not intrinsically integrated.
2. Agricultural policy at the EU level is essentially a merit policy, aimed at encouraging and improving European agricultural productivity and making farming a major export sector. Integrating environmental objectives within this well-established mechanism, has proved to be a difficult and largely incremental process.
3. The relationships between agriculture, the environment and rural spaces are not only highly complex, but they are also strongly conditioned by varied cultural, historical and territorial influences.
4. The introduction of an environmental agenda after a 30-year period dominated by a policy of agricultural modernisation, intensification and productivity, has frequently be seen by farmers as well as their representatives as a challenge to their own occupational legitimacy.

An overview of the progressive integration of environmental concerns and objectives into the CAP, can be found in Whitby (1996), Lowe and Baldock (2000), Buller (2002) among others. A synoptic overview will be sketched below.

All authors more or less agree upon the fact that for the first 20 years of its history, the CAP remained almost completely divorced from environmental considerations. The need for a greater degree of integration of environmental policy into agricultural policy gradually became increasingly evident in the late 1970s and early 1980s. Nevertheless, structural policy has always been a component of the CAP, even though it has long been the poor cousin of agricultural market policy.

The 1975 Directive (268/75) on less favoured areas (LFA), whose principal objective was to maintain agricultural activities in those regions marked by structural handicaps, may be viewed as a precursor for later, more specific agri-environmental policy (Buller, 2002). Article 19 of Regulation 797/85 concerning environmentally sensitive areas, which is now Article 21 of Regulation 2328/91, was another step (Bonnieux and Rainelli, 1995). The new agri-environmental regulation (2078/92) goes further in this way. The relationship between agri-

environment schemes rewarding farmers for appropriate management and environment legislation introducing obligations on Member States and farmers is coming into focus increasingly as 2078/92 becomes a significant policy measure. At the time of agreeing the MacSharry reform package in May 1992, the EC Agricultural Council declared its commitment to make environmental protection an integral part of the Common Agricultural Policy (Baldock and Lowe, 1996). In the Commission's proposals for the CAP reforms agreed in 1992, the first objective of the CAP was reshaped as follows:

> *Sufficient numbers of farmers must be kept on the land. There is no other way to preserve the natural environment, traditional landscapes and a model of agriculture based on the family farm as favoured by society generally (European Commission, 1991, pp.9-10)*

The agri-environment regulation, Council Regulation (EEC) No 2078/92[63], provides for programmes to encourage farmers to carry out environmentally beneficial activities on their land. By recognising the costs of such activities, the programmes are also intended to contribute to the income of farmers who provide the environmental service (box 1).

Box 1: Objectives and key elements of agri-environmental programmes

Member States are required to apply agri-environment measures throughout their territories, according to the environmental needs and potential. Two broad types of environmental objectives are evident:

- To reduce the negative pressure of farming on the environment, in particular on water quality, soil and biodiversity;
- To promote farm practices necessary for the maintenance of biodiversity and landscape, including to avoid degradation and fire risk from under-use.
- The main elements which characterise agri-environment agreements are the following:
- Farmers deliver an environmental service;
- Agreements are voluntary for the farmers;
- Measures apply only on farmland;
- Payments cover the income foregone, costs incurred and necessary incentive;
- Undertakings go beyond the application of good agricultural practice.

Source: European Commission (1999)

The agri-environmental regulation emerged as one of the three 'accompanying measures'[64] to the CAP reforms, which began in May 1992 with the changes agreed to several of the most significant market regimes. In addition to the land management measures, the regulation provides for training and demonstration

[63] *in Agenda 2000, the agri-environmental measures (2078/92) are part of the Rural Development Regulation (1257/99), but in the text we will often refer to Regulation 2078/92 for reasons of convenience*

[64] *the other two being the early retirement scheme (Regulation 2079/92) and the forestry aid scheme (Regulation 2080/92) (Baldock and Lowe, 1996), all included in the Rural Development Programme (1257/99) since Agenda 2000 (Lowe and Brouwer, 2000)*

projects to promote the use of environmentally beneficial techniques and good farming practice. In practice, this is done by offering compensatory payments to farmers, either for complying with production practices aiming to reduce production intensity or requiring extra efforts for the maintenance of landscape elements. Agri-environmental programmes (AEP) are considered as the key strategy for integrating the environment into agricultural policy (Hanley and Oglethorpe, 1999)

The programme package based on Regulation 2078/92 has been the most prominent approach at EU level so far to integrate environmental aspects into agricultural policy. These substantially different agri-environmental programmes have been developed and introduced in different member states and specific regions of the European Union to give incentives to farmers for a voluntary reduction of those farming practices which have a negative influence upon wildlife and landscape (Kazenwadel et al, 1998). The basis of this approach is the contractual agreement between the state and individual farmers, who receive premiums for certain 'environmental services'. The design of the individual programmes is left to the member states or regional authorities (Billing, 1998). This corresponds to the subsidiary principle and ensures, to a certain degree, that programmes are adapted to local needs. The Regulation as such can be regarded as a kind of framework of general requirements.

2.3. Problems with the implementation of the agri-environmental measures

2.3.1. Property rights

A management agreement is basically a contract between a farmer and a government or conservation authority to manage his land in order to achieve certain environmental goals. These agreements are generally negotiated to forestall further land improvement or intensification, and inevitably they therefore require farmers to underutilise the full market potential of their land. The authorities rely on the voluntary co-operation of farmers to enter a contract, and some degree of compensation is offered to them for the financial earnings foregone. The implicit property rights assumption behind this is that farmers have the right to carry out the most profit-maximising activity on their land, irrespective of the external costs (and benefits) of doing so (Hanley et al, 1999; Whittaker et al, 1991). Property rights are indeed the overall framework, within which this and other policy tools operate (Slangen, 1992; Ferro et al, 1994). This is a very important assumption, as can be found i.a. in Bromley and Hodge (1990), Whitby (1994), Vermersch (1996) and Nuppenau (1999).

The concept of property rights is central to the notion of externalities and the idea of public goods. For a free market system to operate efficiently, and to reach a Pareto optimum, the following conditions must hold: (i) price taking behaviour by all agents; (ii) perfect information; and (iii) an efficient set of property rights (Hanley, 1998). According to Tietenberg (1996), an "efficient" structure has following characteristics:

1. *Universality*: all resources are privately owned, and all entitlements completely specified;
2. *Exclusivity*: all benefits and costs accrued as a result of owning and using the resources should accrue the owner, and only to the owner, either directly or indirectly by sale to others;
3. *Transferability*: all property rights should be transferable from one owner to another in a voluntary exchange;
4. *Enforceability*: property rights should be secure from involuntary seizure or encroachment by others.

An owner of a resource with a well-defined property right (one exhibiting these four characteristics) has a powerful incentive to use that resource efficiently because a decline in the value of that resource represents a personal loss. Farmers who own the land have an incentive to fertilise and irrigate it because the resulting increased production raises income level. If consumers want the land to be used in a different way, resulting in a loss of profits for the farmer, he has to be compensated for that loss, as he holds the property rights. In other words, it implies that if farming in a more environmentally sensitive manner imposes costs on farmers, then society must compensate them for these costs.

Clearly, many environmental resources (peace and quiet, water or air quality) violate these characteristics. In the case of landscape, for instance, condition (2) is violated, if the owner of a beautiful field cannot exclude a passerby from 'consuming' this pleasant view. This condition of non-excludability is one characteristic of a pure public good, as has been addressed in part II.

2.3.2. Transaction costs

According to Van Huylenbroeck and Whitby (1999) the main role of agri-environmental policies is to change the production conditions for farmers in favour of landscape management and conservation efforts so that they will again pay more attention to it. The agri-environmental policies should be used to stimulate farmers to deliver countryside stewardship and environmental outputs and not as a market regulation instrument because for that the stewardship instruments are too expensive, in particular in terms of transaction costs[65] (Whitby et al, 1998; Falconer and Whitby, 1999; Falconer, 2000), and not effective. Neither should these policies be used only as income transfer instruments, without delivering benefits to society. However, in case of market failure and when well targeted, these policies may be a suitable instrument to deliver agri-environmental goods.

[65] *refers to the organisational costs of economic systems, and focuses here particularly on those costs incurred in the public sector when introducing and implementing agri-environmental schemes (Falconer and Whitby, 1999)*

3. FARMERS' PROVISION OF LANDSCAPE AMENITIES

The voluntary nature of the schemes means that success depends mainly on the goodwill of farmers and uptake to voluntary incentive schemes is therefore a key determinant in their success, next to the environmental impact of the measure.

3.1. Farmers' decision making

Farmers are often assumed to maximise expected profits[66]. This means farmer will choose the activity that yields the greatest expected profits, provided that these profits exceeds the individual farmer's reservation profits. If this is not met, the farmer chooses to quit farming. But farmers' goal function may be more complex, in that they maximise expected utility instead of profits.

In the theory of farmers' behaviour it has long been emphasised that for the form of organisation - household based production - utility maximisation reflects decision making better than a purely profit oriented model (Chayanov, 1986; Nakajima, 1986). The main basis for this theory is that the observation that the farm is both a production and consumption unit and that this form of organisation brings in a trade-off between income generating activities and goods like leisure that is not considered relevant in the conventional decision making models. Our point of departure is inspired by these ideas, even though the trade-off between income and leisure is not the most relevant. Instead farmers' own utility or perception of what is a nice landscape, a nice field, a good animal welfare standard or even what it means to be a farmer is the important type of consideration. Utility maximisation makes it possible to include a wide array of considerations or elements besides income. However, its implicit choice rule - optimisation - may also be limiting[67]. Choices may also be driven by local or more uniform norms about what is appropriate behaviour, and also perceived rights may influence choices. In the farmers' communities there are many codexes concerning "good agronomy", landscape maintenance, etc. that are subject to different types of social definition and control. Next to that, changing policies means changing rules and thus the rights explicitly or implicitly involved. The above mentioned influences and their consequences have to be taken into account when analysing farmers' behaviour.

3.2. Landscape elements as joint products from agricultural production

As has been discussed in part I, the provision of landscape elements can be seen as a joint product from agricultural production. Therefore farmers' choice to produce "landscape elements" mainly depends on the choices he makes with respect to the production of commodity outputs (both the kind of products and production methods), as has been shown in figure 3.2.

An important issue here is to approach the analysis of joint production from the cost side. Jointness can yield economies in production if something inherent in the production process makes it cheaper to provide two or more commodities in a single

[66] *profits equal the sum of revenues, which could come from many sources, minus the associated costs*

[67] *see Romstad et al (2000) for a further discussion*

firm than to have them produced by different (specialised) firms. By including non-commodity outputs in the discussion on economics of scope, the concept can be relevant for the analysis of multifunctionality in agriculture (OECD, 2001). The basic question is whether the joint provision of commodity outputs and landscape elements by agriculture can procure economies of scope.

Leathers (1991) relates the notion of joint production to cost and profit by appealing the notion of economies of scope, which can be defined in a somewhat simplified manner for our purposes in the following way. For any group of outputs, $Y_1, \ldots Y_m$, there are economies of scope if:

$$C(Y_1) + C(Y_2) + \ldots + C(Y_m) > C(Y_1, \ldots, Y_m)$$

That is, if there are economies of scope, the cost of producing m products jointly, $C(Y_1, \ldots, Y_m)$, is less than the cost of producing the products separately. As these conditions do not hold when an allocable input is fixed in the short run, Leathers (1991) establishes that joint production will occur if and only if joint production is at least as profitable as non-joint production of either product. This latter condition is especially important for multifunctionality, both in terms of farmers' decision making as well as from policy intervention point of view.

In the context of agri-environmental policy, farmers are faced with market prices for their commodity goods and compensations for providing an environmental good. For farmers, there can be economies of scope due to joint production which suggest that costs can be reduced by producing a combination of both commodity and non-commodity outputs.

Next to that, in some cases, the costs for society can be lower if farmers produce the positive externalities, jointly with their agricultural products, than if other "firms" have to produce them separately. This is an important remark that has to be taken into account, when formulating policy recommendations (see part IV), as farmers should be stimulated to produce these amenities. Since the aim of management agreements is broadly in line with the perceived wider demands of society for a more considered use of rural land (as has been discussed in part II), it is possible that management-agreement type policies could attain even greater significance in the future.

It is clear that these kinds of measures are only environmentally effective if farmers participate, and if the changes in their management actions result in environmental improvement. If farmers only participate in measures, aiming at maintaining extensive and environmentally friendly farming systems and practises, rather than in those related to desintensification in terms of environmental pollution, the environmental impact will be rather low. It is after all clear that voluntary schemes, to be successful, must be attractive to farmers. Therefore it is necessary to have a better insight in farmers' decision-making, because until now it seems that the biggest levels of take-up are recorded in those schemes or tiers of schemes where constraints placed upon farmers are minimal (Buller, 2002). It can still be hypothesised that the more changes in farm management are required by a scheme, the less a farmer may be willing to participate (Wilson, 1997). This is e.g. illustrated

in the analysis of Wilson (1995), who found a very high participation rate in German agri-environmental schemes (MEKA programme), because landholders joining MEKA did not have to change farm management practises to a large extent. An important weakness of MEKA, as mentioned by the author, is that it only aims at maintaining the status quo with regard to conserving the countryside, and that it does not offer enough practical incentives for the rehabilitation of degraded ecosystems.

Because insight in farmers' uptake of these voluntary measures can be very helpful information for decision makers in order to arrive at the most efficient provision of the demanded amenities, it will be the subject of the following section.

4. FARMERS' WILLINGNESS TO PARTICIPATE IN AGRI-ENVIRONMENTAL MEASURES: A CONCEPTUAL FRAMEWORK

4.1. Literature review

Before coming to a conceptual model, it is interesting to analyse what already exists in the literature on this topic. Since the implementation of the agri-environmental programmes (AEP), a lot of research has been devoted to their costs, benefits, implementation, and to their impact on the environment, farmers' income, or upon farm development strategies, and so on. Some researchers have tried to assess the 'effectiveness' of these schemes and to establish reliable, representative, and reproducible 'indicators' to assess their environmental and socio-economic performance (Brouwer and Crabtree, 1999). Participation in schemes is a key indicator of scheme success. If farmers decide not to participate in the schemes, the question of "scheme effectiveness" becomes futile. Other indicators of AEP effectiveness (for example, environmental benefits of schemes, success as income support measures, extent of changes in farmers' attitude towards conservation through participation) only come into play once farmers have made the decision to participate (Wilson and Hart, 2000). Table 7.1 gives an overview of previous studies on farmers participation (and non-participation) in AEP. Specific focus is placed on common patterns of participation decision making across different types of agri-environmental programmes and across different regional or national boundaries.

The research conducted until now mainly differs in the measures analysed, the analysis of actual or hypothetical behaviour, the economic valuation and econometric models used, and in the hypotheses behind the model.

Table 7.1. Previous studies on farmers' participation in agri-environmental measures

Author(s)	Country	AEP	Behaviour (+ method)	Type of analysis	Influencing factors	Other remarkable results
Bateman, Diamond, et al (1996)	UK	Community Woodland Scheme	Contingent (CVM - WTA)	Linear regression	Existing profit levels and overall size of the farm	
Battershill and Gilg (1997)	UK	different 'environmentally friendly' schemes	actual participation	quantitative and qualitative analysis	physical geography, attitudes and approaches to farming, age, farm size and intensity, new holdings, succession, other sources of income, part-time farming	in the relationship between attitudes and structural circumstances, the influence of attitudes on farmers' behaviour and decision-making is stronger than any structural influence
Bonnieux et al (1998)	France	Wetland preservation	Actual and contingent	Logit	Age, education, attitude, farm size, livestock density and land use	There are differences between actual and contingent behaviour, but to some extent it may be argued that contingent behaviour predicts the actual one
Brotherton (1989)	UK	cereal, grassland and woodland schemes	hypothetical		farmer factors (essentially attitudes) and scheme factors (essentially economics)	

Brotherton (1991)	UK	Environmentally Sensitive Areas	actual participations	correlation	scheme constraints, financial attractiveness	
Crabtree et al (1998)	UK	Farm Woodland Premium Scheme	actual	A logit model was used to estimate the probability of uptake	Farm size, existing woodland area, tenure status, land use and farm type	
Delvaux et al (1999)	Belgium	Late mowing and the maintenance of quickset hedges	Actual and contingent	Logit and tobit	Agricultural region, farmers' education, environmental awareness, livestock density, share of low productive meadows	The econometric results for the adoption of the late mowing measure compared to those for the willingness to accept for a payment to adopt this measure are coherent with each other.
Dupraz et al (2000)	Belgium	Late mowing	Actual and contingent (CVM - WTA)	Logit and tobit	Agricultural region, farm type, tenure, livestock density, share of low productive meadows, farmers' education, marital status, environmental awareness, information availability and diversification towards local products	

Dupraz, Vermersch et al (2002)	Belgium	Late mowing and reduced use of farm inputs	Actual and contingent	A probit model was performed for both actual and contingent participation	Farming conditions, livestock density, share of low productive meadows, environmental awareness of the farmer's household	
Kazenwa-del et al (1998)	EU	Local initiatives for environmentally integrated farming	Actual	Empirical	Farm size, full-time farming	
Morris and Potter (1995)	UK	Environmentally Sensitive Areas (ESAs)	Actual and contingent	Empirical (cross section)	Farm size, age, previous involvement in conservation	
Morris et al (2000)	UK	Arable field margins	actual	empirical	information	
Paniagua (2001)	Spain	Steppeland cereal-growing programme	Actual	empirical	Structure of the ownership, age, farm size, full-time farming	
Sumelius (1991)	Finland	Buffer strip programme	Contingent (WTA via bidding game)	Empirical	General awareness of environmental problems, agricultural education, recent generation change, full-time farming	

Van Kooten and Schmitz (1992)	North America	North American Waterfowl Management Plan	Actual and contingent (CVM)	Logit	Availability of pasture land, farmers' attitude, age, risk averseness	
Wilson (1997)	UK	Environmentally Sensitive Areas (ESAs)	Actual	X^2-test of independence	Farm size and amount of remnant semi-natural wildlife habitats; payments offered by the scheme, information, scheme flexibility, successor status and dynamics within the district; age, education and length of residency	
Wilson and Hart (2000)	EU and Switzerland	Agri-environmental schemes	Actual	Empirical	Farm size, tenure, farm type, education, dependency on income, interscheme continuity, and information availability about schemes	
Wynn et al (2001)	UK	Environmentally Sensitive Area	Actual	A logit model was used to model the entry decision	Farmers' interest in conservation, information and the fit with the farm structure and system	Duration analysis was used to examine the relative speed with which farmers joined the scheme

- Type of agri-environmental measure

Different types of measures have been analysed. Some studies concentrated on one particular measure, while others addressed a package of measures. The measures analysed, are very different in nature. Some of them have a big impact on the environment and on the production of food and fibre (e.g. extensification of field margins, or some particular ESAs), while the impact from others on the agricultural performance can be very limited (e.g. the maintenance of hedges). The measures also differ in the level of compensation. The "economics" of the measures seem to have an important influence on farmers' behaviour (see e.g. Brotherton, 1989 and 1991). Some of the measures are very strict, while others are rather open. All these differences have their influence on farmers' participation and thus on the results and interpretation from the different analysis. The choice of the measures to be analysed highly depends on the data available and the participation rate in the study area.

- Methodological issues

Throughout the literature, there appears to be a general consensus that objectives, goals or the values of farmers are important in understanding the decisions made by farmers. However, just a variety of approaches have been used to conceptualise, define, enumerate, and assess objectives. An assortment of methods has been used to analyse them, and this can give rise to different emphases. It seems the choice of the method highly depends on the data available. Some analysed actual behaviour, while others worked with hypothetical (contingent) data. Some analyses were able to compare both actual and contingent behaviour. The econometric methods used can be divided into three main categories: (i) descriptive (empirical) analyses, (ii) linear regression and (iii) logit, tobit or probit models. The latter are able to predict farmers' probability of entering a scheme, based on the dichotomous variable (participation or not), and seems to estimate the most profound results.

- Factors influencing farmers' participation

Factors influencing farmer participation and non-participation in agri-environmental schemes are complex and not yet fully understood. Brotherton (1989, 1991) provides a useful starting point by highlighting that both "scheme factors" and " farmer factors" need to be taken in consideration when attempting to understand farmer participation in agri-environmental schemes (table 7.2).

"Scheme factors" in relation to AEP include i.a. the voluntary nature of the scheme with its possible implications for participation (Wilson, 1997). Indeed, the voluntary nature of the AEPs forms the basis for this analysis, as it is assumed that a combination of individual factors will influence participation in the scheme, rather than the dictates of policy-makers. The voluntary approach is a positive factor allowing farmers to enter and adapt to the scheme at their own pace, although it enables non-participation as well.

Table 7.2. Possible factors influencing farmers' participation and non-participation in AEP

Scheme factors:
- Voluntary nature
- Payments
- Scheme duration / length of interruption between renewal of schemes
- Scheme logistics
  - Information provided
  - Follow-up and monitoring
- Severity of change in farm management required by scheme / flexibility of scheme

Farmer factors:
- Farmer characteristics
  - Age
  - Education
  - Dependency on farm income
  - Length of residency
  - Successor factor
- Farm characteristics
  - Farm size
  - Amount of non-intensively used farmland
  - Tenure
- Information environment
- Dynamics within the farm district
  - Rate of neighbour participation
  - Follow-the-leader mentality
  - Spread of innovation
- Attitude to the environment

Source: adapted and expanded from Brotherton (1989, 1991)

Other scheme factors which can be of importance include payments offered by the scheme, duration (and the time lag involved in scheme renewal), logistics (information flow, follow-up and monitoring), and the severity of change in farm management required (which also includes "scheme flexibility") (Wilson, 1997).

"Farmer factors" are more complex. Participation may depend on individual farmer and farm characteristics such as age, education, dependency on farms for income, length of residency, farm size; tenure and amount of non-intensively used farmland (for references see table 7.1). As Morris and Potter (1995) stress "typically, it was the younger farmers, with the largest, more economically buoyant farms who tended to find schemes attractive". Kazenwadel et al (1998) found i.a. that larger farms and farmers with a strong interest in an economic and efficient long-term agricultural production participate more often in agri-environmental schemes, especially in schemes which demand considerable investments to be made.

Another interesting factor that may influence farmers' willingness to participate is the "successor factor" (Sumelius, 1991; Potter and Lobley, 1992; Wilson, 1997). It

can be argued that farmers without successors who do not need to maximise profitability of their holding for the next generation may be more willing to adopt conservation-oriented farming (Potter and Lobley, 1992).

Other factors lie outside the realm of farmer characteristics, but may also influence farmers' decision-making environment. These include, for example, what could be referred to as the "information environment" of a farmer, or the dynamics within the farm district itself, the latter including factors such as neighbours who are participating, the influential behaviour of community leaders, or the pace of innovation diffusion within a district (Crabtree et al, 1998; Wynn et al, 2001; Wilson, 1997; Wilson and Hart, 2000, Dupraz et al, 2000; Morris et al, 2000).

A final group of factors that may influence participation relates to attitudes of the farmer toward the environment (Willock et al, 1999a,b). Although the potential importance of farmer attitudes needs to be acknowledged, the relationship between attitudes and farmer behaviour is complex. As stressed by Willock et al (1999a), there is a large, diverse literature on the attitudes and objectives of farmers and the impact of these on farming vocational behaviour. Farmers attitudes identified as important range from risk aversion, innovation, diversification, off-farm work, environment, production, management, legislation, stress, pessimism, and satisfaction toward farming. Possible implications of farmer environmental attitudes and participation are discussed in several papers as can be seen in table 7.1.

This summary of the literature on farmers' attitudes, objectives (or goals) and behaviours, indicates the diversity of the research. It is clear that a model of farmers' decision making includes a large range of variables. An outline model of farmers' behaviour and decision making in general has been constructed by Willock et al (1999) (figure 7.1). This model, as well as the different factors as described above, will be used in a conceptual model, that will be developed in the following section.

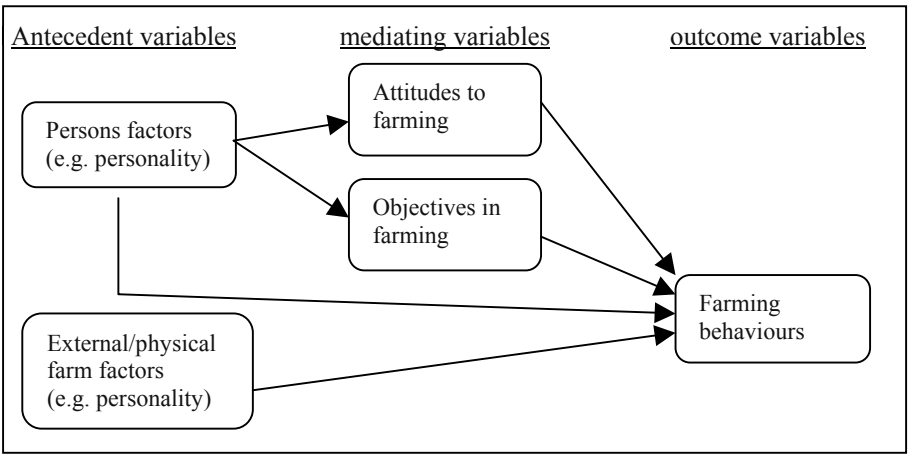

Figure 7.1. Schematic relationship among individual differences in personality traits, attitudes, objectives and behaviour (Source: Willock et al, 1999a)

4.2. Conceptual framework

Before coming to our own empirical analyses, it is important to situate the influencing factors in a more analytical framework. Therefore a conceptual model for analysing farmers' decision making towards agri-environmental schemes has been set up (figure 7.2). This model is based on the propositions made in part I of this work and is thus in line with the conceptual model on travel purchase behaviour, developed in part III.

This conceptual model (figure 7.2) incorporates multiple factors that may affect farmers' willingness to participate in agri-environmental schemes and is based on the model of farmers' behaviour and decision making in general (as presented in figure 7.1). It is hypothesised that individual farmers' willingness to participate is influenced by both the characteristics of the available schemes (decision subject) and the farmer's characteristics (decision maker).

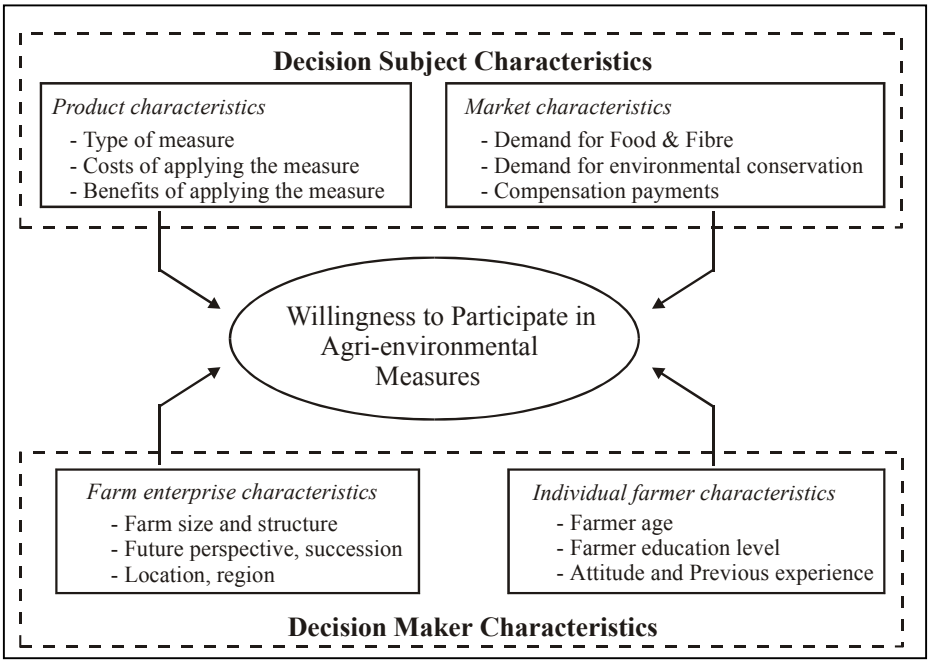

Figure 7.2. Conceptual model of willingness to participate in agri-environmental measures

The decision subject characteristics are further divided into product and market related characteristics. Product characteristics that influence farmer's participation are i.a. the required changes in practices and their effects on costs and benefits of the agricultural production. Market characteristics refer to consumers' demand for agricultural commodities and environmental goods respectively (e.g. through social pressure). The proposed compensation payment for a scheme is considered as one

parameter reflecting this demand. As will be hypothesised in the following paragraph, the decision maker characteristics can further be split into farm characteristics (location, size, …) and farmer characteristics (such as age, education, environmental attitude, …).

This model forms the basis of the empirical analyses on farmers' willingness to participate in agri-environmental measures. Before dealing with these empirical analyses, one final remark should however be made. Making sense of this analytical framework involves making some assumptions about agents' objectives, such as profit or utility maximisation. As has been discussed in section 3.1, many models are based on normative theory, which assumes that all farmers are profit maximisers. This approach may fail to account adequately for the farming behaviour of individuals, as the behaviour of farmers may not be driven only by the maximisation of profit. Thus, to understand and model the processes and consequences of farmers' decision making, one should take into account these considerations (see also 3.1).

CHAPTER 8

BELGIAN FARMERS' WILLINGNESS TO PARTICIPATE IN AGRI-ENVIRONMENTAL MEASURES[68]

1. INTRODUCTION

From the discussion in chapter 7, it is clear that farmers' decision making plays a very important role in the provision of landscape amenities. Based on the conceptual model (figure 7.2), the farmers' decision to participate in agri-environmental measures can be analysed.

This analysis differs from previous studies in that it starts from the assumption that attitude and behaviour of farmers are not only influenced by farmer and farm characteristics, but also by the characteristics of the required practices. In other words we assume that participation will vary across policies. To test this assumption the contingent behaviour of the same group of farmers towards two distinct agri-environmental measures has been evaluated. Although both measures are already applied in practice, contingent rather than actual behaviour is estimated, because at the moment of the survey (1998) both measures were only recently introduced on a small scale and no database existed coupling (non-)participation with a number of other characteristics. The main hypothesis to be tested can be formulated as follows:

Farmers' participation in agri-environmental measures depends both on the characteristics of the measure itself, as well as on farm and farmer characteristics.

Although the validity of contingent valuation studies for supply estimates has been the subject of a lot of academic debate (see i.a. Hausman, 1993; Weinschenk, 1994; Gregory et al, 1995), most researchers agree that they give at least an approximation of true behaviour. A condition for application is that, similar to consumer surveys about public goods, the contingent scenario places respondents in a hypothetical market situation, meaning that the quantity supplied is not fixed, but can be decided by the decision maker. Although this chapter will only focus on the question whether or not to participate, this condition is in the case of agri-environmental measures clearly fulfilled, because within the eligible conditions, farmers are potential sellers of environmental goods and services. They have not only to decide whether to enter in an agreement, but also what quantity to supply (either in number of landscape elements or in hectares). Moreover the hypothetical

[68] *This chapter is mainly based on Vanslembrouck et al (2002)*

I. Vanslembrouck & G. Van Huylenbroeck,
Landscape Amenities: Economic Assessment of Agricultural Landscapes, 137—154.

bias inherent in contingent valuation studies (Green and Tunstall, 1999) is minimised, because the agreements studied really exist. This also allows to confront the obtained bids with real payments offered.

The chapter is organised as follows. In section 2 a micro-economic utility model is derived, based on the conceptual model of previous chapter (figure 8.2), to better understand the economics behind participation decisions. The model allows to prove on economic grounds, that the derived utility farmers themselves will have from a measure will indeed influence their participation decision, as also hypothesised by i.a. Vatn (2001). Next, a number of basic hypotheses about farm and farmer characteristics influencing participation is derived on the basis of literature. Hereby it is hypothesised that farmers' decision behaviour is not only based on profit maximisation, but also influenced by a range of socio-economic and psychological variables (Lynne et al, 1988; Willock et al, 1999a,b).

Section 3 presents empirical evidence about farmers' contingent behaviour. To test the hypotheses, a probit model is used to determine the underlying factors explaining the individual willingness to participate of the same group of respondents in the two measures studied, which are highly different in nature. The farmers surveyed have been selected from the FADN network controlled by the Centre for Agricultural Economics. This allows to link the answer on the dichotomous choice question whether or not to participate to personal and farm structural data. After having discussed the results, this chapter concludes with a short summary of the most important results.

2. MODELLING FARMERS' PARTICIPATION IN AGRI-ENVIRONMENTAL MEASURES

2.1. Economic model

The conceptual model from chapter 7 on farmers' willingness to participate in agri-environmental measures, can be operationalised into a micro-economic modelling framework. Following Delvaux et al (1999) and Dupraz et al (2000), such a model can be based on the assumption that the utility (U) a farmer is maximising, depends both on the production of private goods resulting in a farm income (π) and on the provision of environmental goods (Q_E). These outputs can be jointly or separately produced on the basis of a given set of variably allocated inputs X and quasi-fixed inputs Z. We also assume that a minimum level of environmental goods is required in the programme. In other words, the farmer has to produce a minimum level of environmental goods, in order to get a premium (p_E). This threshold ($\overline{Q_E}$) might be higher than what the farmer would otherwise produce. Therefore, there are two models to compare: (i) with and (ii) without remuneration.

(i) In the first case the maximisation problem is:

if $Q_E = g(X_E, Z) \geq \overline{Q_E}$ the farmer solves

$$\max_{X_E, X_F} U(\pi, Q_E)$$

s.t. $$\pi = p_F' f(X_F, Z) + p_E' Q_E - w'(X_E + X_F) - r'Z \qquad (8.1a)$$

$$X_E \geq 0$$

otherwise the farmer cannot receive p_E (see (ii));
where U, f, and g are increasing concave functions and
with X_F the variable inputs/efforts allocated to food and fibre production
X_E the variable inputs/efforts allocated to environmental conservation
Z the quasi-fixed input factors (labour, buildings, machinery, total land, etc…) which are not exclusively allocated to food or environment production. This is the root of multifunctional agriculture: in this specification Z defines the farms ability to produce F&F and environment jointly.
p_F the price vector for the food and fibre produced on the farm[69]
p_E the level of compensation payments for environmental conservation efforts[1]
w the input price vector[1]
r the unit cost of the quasi-fixed input ($r'Z$ is mentioned in 8.1a for coherence only: you have to pay every year for machinery maintenance and loan reimbursement as well as for hired land, but Z is quasi-fixed, i.e. is not adjusted except in the long term).

Farmers' challenge is to choose the input level of a combination of X_F and X_E that maximises their utility and this under restriction that profit is limited to the revenues from production of agricultural commodities and participation in agri-environmental programmes (depending on the compensation payments) minus the costs for both agricultural production as environmental conservation. The Kuhn-Tucker (Mills, 1984) conditions are given by the relations (8.2), with λ being Lagrange multiplicators associated with the constraint on the production of environmental goods and services.

$$\frac{\partial U}{\partial X_F} = U_\pi (p_F f'(X_F, Z) - w) = 0 \qquad (8.2a)$$

[69] *the vectors p' and w' are the transpose matrices of the vectors p and w respectively*

$$\frac{\partial U}{\partial X_E} = U_{Q_E} g'(X_E, Z) + U_\pi (p_E g'(X_E, Z) - w) \leq 0; X_E^* \geq 0 \quad \text{and}$$

$$X_E^* (U_{Q_E} g'(X_E, Z) + U_\pi (p_E g'(X_E, Z) - w)) = 0 \tag{8.2b}$$

The choice of food and fibre input X_F is free. Moreover, it is separable from the farmer's preferences in (8.2a), i.e. determined from condition: $p_F f'(X_F, Z) - w = 0$.
(8.2b) results in

$$U_{Q_E} g'(X_E, Z) + U_\pi (p_E g'(X_E, Z) - w) = 0 \tag{8.2c}$$

implying that

$$w = (p_E + \frac{U_{Q_E}}{U_\pi}) g'(X_E, Z) \tag{8.2d}$$

The farmer uses environmental input up to the point where the unit cost of the input is equal to the sum of the value of its marginal product and the marginal rate of substitution between environmental goods and profits.
Because most of the environmental conservation efforts require a change in the food and fibre production technology, i.e. environmental goods and food and fibre are joint products with a negative trade-off. The substitution (or competition) effect between food and fibre and environmental goods and services for every input k involved in both environmental goods and services and food and fibre production is given by:

$$w_k = \left(\frac{U_{Q_E}}{U_\pi} + p_E \right) \frac{\partial g(X_k)}{\partial X_k} = p_F \frac{\partial f(X_k)}{\partial X_k} \Rightarrow \frac{\frac{\partial g(X_k)}{\partial X_k}}{\frac{\partial f(X_k)}{\partial X_k}} = \frac{p_F}{\left(\frac{U_{Q_E}}{U_\pi} + p_E \right)} \tag{8.3}$$

Following conditions, explaining the participation in agri-environmental measures, result from (8.3):

- the higher p_F (food prices), the lower the use of inputs for environmental conservation (X_E) because of the decrease in marginal environmental productivity (concavity of g) and thus the lower Q_E;
- the higher the compensation payments (p_E), or the higher the marginal utility derived from the provision of environmental goods and services, or both, the higher Q_E;

- the lower the costs or efforts (expressed as requirements of inputs, including both direct costs and transaction costs) to implement the programme, the higher Q_E;
- the higher the costs for food production, the higher the probability that a farmer will participate in the programme (higher Q_E), as higher prices for X_F make food production less attractive; or in other words: the higher the negative effect of withdrawing of input factors from food production, the lower the probability that a farmer will participate in the programme (lower Q_E), as a higher impact of inputs on food production makes a reallocation of inputs from food production to the provision of environmental goods and services less likely.

Summarising we can conclude that acceptance rate of an agri-environmental measure will be higher the lower the cost and required efforts, the lower the impact on food production and the higher the utility for the farmer himself. These hypotheses will be tested in section 3 by comparing contingent participation behaviour in two different measures. One measure has low costs, efforts and impact, and high utility, while the other measure requires relative high costs, efforts and impact, and has only a relative low utility for the farmer himself.

Derivation of the Kuhn-Tucker conditions (8.2) also allows to explain the participation choice of the farmer, which is a dichotomous choice problem:

$$w \geq \left(\frac{U_{Q_E}}{U_\pi} + p_E \right) \frac{\partial g(X_E)}{\partial X_E} \qquad \textit{and} \qquad X_E \left[w - \left(\frac{U_{Q_E}}{U_\pi} + p_E \right) \frac{\partial g(X_E)}{\partial X_E} \right] = 0$$

$$\text{If } X_E > 0 \quad \text{then} \quad w = \left(\frac{U_{Q_E}}{U_\pi} + p_E \right) \frac{\partial g(X_E)}{\partial X_E} \tag{8.4}$$

$$\text{If } w > \left(\frac{U_{Q_E}}{U_\pi} + p_E \right) \frac{\partial g(X_E)}{\partial X_E} \Leftrightarrow p_E < \frac{w - \frac{U_{Q_E}}{U_\pi} \frac{\partial g(X_E)}{\partial X_E}}{\frac{\partial g(X_E)}{\partial X_E}} \text{ then } X_E = 0 \tag{8.5}$$

From condition (8.5) it can be derived that if the agreement remuneration (p_E) is lower than the marginal cost of any input dedicated to environmental production minus the marginal utility of the environmental good, the farmer will not participate. If it is higher for some $X_E>0$ (condition 8.4), the farmer will participate and increase the input dedicated to environmental production until its marginal cost equals the marginal revenue plus environmental marginal utility.

(ii) Secondly, if $Q_E^* = g(X_E^*, Z) < \overline{Q}_E$ then the farmer will not receive p_E and has to solve the following optimisation problem:

$$\max_{X_E, X_F} U(\pi, Q_E)$$

s.t. $$\pi \leq p_F'.f(X_F, Z) - w'(X_E + X_F) - r'Z \tag{8.1b}$$

and $$Q_E = g(X_E, Z)$$
$$X_E \geq 0$$

In this case:

if $$w > \left(\frac{U_{Q_E}}{U_\pi}\right).\frac{\partial g(X_E, Z)}{\partial X_E} \quad \text{then} \quad X_E^* = 0 \tag{8.5b}$$

or if $$X_E^* > 0 \quad \text{then} \quad w = \left(\frac{U_{Q_E}}{U_\pi}\right).\frac{\partial g(X_E, Z)}{\partial X_E} \tag{8.4b}$$

The economic model confirms that participation will indeed depend on factors linked to the farm characteristics such as location, size, ... as these will influence the terms $\delta f(X_k)$ and $\delta g(X_k)$, but also on the decision maker characteristics which are comprised in the *U*-factor. However, this model does not tell us which characteristics are of importance and need to be tested. These are derived based on common sense and literature review in the next section.

2.2. Hypotheses on farm and farmers' characteristics

The above model indicates that farm and personal characteristics will be of importance, but not which characteristics in particular. However, from literature a number of hypotheses on farm and farmer characteristics can be derived. Delvaux et al (1999) and also Dupraz et al (2000) found that the programme on extensive field margins is more likely to be adopted by farmers who better understand the utility of the measure either because of their education level or because of an, in general, more positive attitude towards the environment. According to the research of Bonnieux et al (1998), there is a significant age effect, in the sense that younger farmers are more likely to enter the programme. They also find that a positive environmental attitude greatly influences the contingent choice in a positive way, while they did not find a significant effect of farm size on the probability of entering the programme. The probability of entering the hypothetical scheme decreased, however, with the level of formal education, which was positively correlated with

farm size. Drake et al (1999) conclude that the following variables positively contribute to the probability of participation: positive environmental attitude, having neighbours applying agri-environmental measures, older farmers (opposite result as the hypothesis), higher general education and previous participation in other agri-environmental measures. According to the findings of Giannakopoulos (2000), larger farm size, agricultural education, participating neighbours and younger farmers have a significant positive effect on the probability of participation.

Based on these references, the following variables are assumed to influence participation positively (cf. the econometric model in 3.3): lower age, higher education, larger farm size, previous experience with agri-environmental measures, succession perspectives of the farm (in terms of succession) and a positive environmental attitude (measured by the answer on the question: To what extent do you agree with following statement "Agri-environmental measures are in general positive for nature and landscape?"). Further, a difference in willingness to participate is assumed between Flemish and Walloon farmers (measured through the language variable), because of differences in institutional context and in knowledge about the agri-environmental programmes (as programmes are implemented at regional level and one Flemish and one Walloon measure were presented to all farmers). The hypothesis is that familiarity with a measure also positively influences participation. Farm income has not been included in the modelling because of high correlation with farm size.

Some studies also refer to risk as an influencing factor (Slangen, 1997; Sumpsi et al, 1998). Indeed, one can imagine that farmers are comparing expected utility and thus also the variance in and the certainty about the income will affect participation decisions. Alternatively, one can assume that participating farmers are partly swopping uncertain crop returns for more certain compensatory payments, while uncertainty about the time horizon of the payments and about the continuation of policies may prevent farmers to participate. As both influences are contradictory and also because of a lack of a good proxy for measuring risk perception, the influence of risk is not tested.

It is also clear that differences in opportunity costs of participation will influence uptake of measures. Farmers with e.g. an excess of labour or with higher availability of other necessary inputs, can be assumed to have a higher willingness to participate. Also for this hypothesis, no reliable proxy was available. The farm accounts give an indication of the hours worked on the farm, but this does not provide an indication whether more labour is available.

3. EMPIRICAL FINDINGS

3.1. Data and methodology

The empirical results are derived from a questionnaire used for a broader survey in the framework of an EU-project[70] on the attitude and knowledge of farmers towards

[70] *FAIR1/CT95-0709*

countryside stewardship policies (see Drake et al, 1999). Because of the broader scope of the survey, respondents were provided with information that put the programmes analysed in a broader context.

Besides general attitudinal questions on agri-environmental policies, two recently introduced measures have been proposed for evaluation to the responding farmers. The two measures are selected because it was assumed that their intrinsic differences would allow to test the hypothesis that (contingent) participation depends on the characteristics of the measure itself, alongside farm and farmer characteristics.

A first measure is one applied in the Flemish region and is called *plantation in yard (PIY) (or farm beautification)*. This measure aims at introducing plantation on the farms in order to better integrate the agricultural buildings into the rural landscape. The main objective of this policy measure is the conservation of agricultural crops, rural landscapes and related typical elements, next to the reduction of the negative impact of agriculture on landscapes and environments. It is assumed that this measure has a positive effect on farmers' utility, while its implementation does not demand high costs or efforts from the farmer.

The second measure is one applied in the Walloon region and is called *extensification of field margins (EFM) (or use of buffer strips or unsprayed field margins)*. This measure consists of different possibilities: replacement of a strip of crop land by a grass field margin, extensive cultivation of a margin around a crop field, replacement of a strip of intensive grassland or low stem orchard by an extensive grass field margin. The main objective is the reduction of the negative impact of agriculture on landscapes and environment. The other objectives are natural and semi-natural environment conservation, wildlife/biodiversity conservation, soil conservation and protection from erosion, and recreation and access to agricultural land. It is assumed that this measure has a bigger impact on farmers' income, because it lowers output, and requires more efforts from the farmer, while the benefits are especially enjoyed by the general public rather than by the farmer himself.

In order to avoid strategical overstatement to the valuation questions, an introduction encouraging respondents to carefully consider the questions (box 1 in Annex 2) has been included as a kind of social budget constraint, as has been proposed by Mäntymaa (1999). The contingent valuation literature generally recommends to use the WTP question rather than the WTA format (Arrow et al, 1993; Cummings et al, 1986). However, taking into account some kind of property right of the farmers, it is more natural to ask what minimum compensation would repay the (income) loss, rather than to ask their maximum WTP to avoid the changes. Therefore WTA seems to be conceptually the right means of valuation in this specific case. By stressing the fact that compensations are subject to a social budget constraint, imposed by an institution whose behaviour affects people's welfare (Mäntymaa, 1999), the results from these WTA questions should be comparable to WTP results, which are subject to an individual budget constraint.

The question on farm beautification (or plantation in yard (*PIY*)) was presented as a dichotomous choice question (box 2 in Annex 2). A (hypothetical) proposal was presented to the farmer who was asked if he would take part in the plantation action

under the conditions presented. Farmers were given the opportunity to indicate reasons for eventual non-acceptance of the proposed measure. The question on the extensification of field margins (*EFM*) (box 3 in Annex 2) consisted of two parts: one part was related to cropland; the other one to grassland. First the respondent was asked if he was interested to participate in this kind of agreement. If yes, he was asked to indicate the minimum amount he wanted to receive as compensation. The first question was asked to avoid protest answers on the open-ended question. Those answering the second part of the question show a real interest in participation. Although the open-ended technique can be criticised because of the possibility of strategic bias, we believe that the risk was reduced by the fact that it was embedded in a global questionnaire.

The farmers surveyed were selected by the Centre for Agricultural Economics, from the Belgian FADN/RICA farm accounting database. In total 390 Belgian farmers were interviewed of which 347 responses could be used for the descriptive analysis (180 or 52% in Wallonia and 167 or 48% in Flanders).

Both agri-environmental measures were presented to the same group of farmers. Because of missing observations to one of the two measures, the number of respondents that could be used for the econometric analysis was reduced to 303. Through using the same set of responses or valid cases, the results from both independent probit models are comparable (Alvarez-Farizo, 1999).

3.2. Empirical results

Table 8.1 gives an overview of the reported acceptance of the different measures, under the given conditions. A first observation is the high response rate. Apparently most of the farmers had no problems answering the yes/no questions. About half of the farmers agreed with the *PIY*-proposal, while only a very small part of them (11%) was interested to take part in the *EFM*-project. This already confirms the theoretical expectations of section 2, namely that a measure which has a lower impact on food production, uses fewer resources and has lower implementation costs, such as the *PIY*-measure, receives a higher willingness to participate as compared to measures with higher impact and costs such as the *EFM*-measure.

Reasons for not taking part in the proposed measures are given in table 8.2. The answers on the open-ended questions have been categorised into four groups: personal, practical, financial and other reasons. The financial reasons comprise all reasons dealing with the compensation. The practical reasons often have a financial "undertone", but do not directly refer to the compensation. Personal reasons have mainly to do with the specific situation of the farmer (e.g. age). It is clear that financial and practical reasons are most important. However, the motivations behind those reasons are totally different for both measures. The reasons for not taking part in the *PIY*-programme are rather "positive" - plantation has been done already or the measure is not applicable given the farm situation - except for those who stated that the compensation offered was too low (financial reason). The reasons for not taking part in the *EFM*-programme have a rather negative undertone. A lot of farmers do not perceive the link with protecting the environment or indicate that unsprayed field

margins are careless and a proof of bad agricultural practice. Some of them also answered that the compensation offered is too low, although this was an open-ended question, and they could fill in the compensation they found most appropriate. Therefore we think that those answers can be seen as a kind of disagreement with the programme as such, in spite of and independent of the amount of remuneration. It illustrates that a lot of farmers are still not convinced about the necessity of such measures. The big difference in reaction on both questions - the higher non-participation and negative reactions on the *EFM*-programme - and the link with farmers' characteristics are further analysed with the econometric probit model in section 3.3.

Table 8.1. Acceptance of different measures (%), (n = 347)

Measure	Yes	No	Missing
Farm beautification	51.0	47.0	2.0
Unsprayed field margins in:			
- crop land	11.5	83.6	4.9
- grassland	11.2	82.7	6.1

Table 8.2. Reasons for not taking part in the countryside stewardship measures (%)

	Farm	Extensification of field margins in:	
Reasons	beautification	crop land	grassland
Personal	22.1	13.1	16.8
Practical	31.9	49.9	46.4
Financial	32.5	20.6	19.9
Other	4.9	7.6	4.2
Missing	8.6	8.8	12.7

Because of the small number of answers on the open-ended willingness to participate question, the average elicited compensation, has no statistical value and can only be interpreted as a rough indication. It is, however, interesting to compare the obtained values with the existing compensations (table 8.3) paid in Wallonia in the framework of the agri-environmental measures (Regulation 2078/92). These compensations range from 124 to 248 ε/ha/year, depending on the kind of field margin. Farmers' WTA indicates that the current levels of subsidy payment are too low to attract many of them. As already indicated, due to the open-ended format of the question, the results can be biased by strategic behaviour of some of the respondents. On the other hand, Bonnieux et al (1998), who analysed and compared both contingent and observed behaviour of farmers towards agri-environmental measures, found some consistency between the empirical results obtained in the real and in the hypothetical context.

Table 8.3. Mean willingness to accept (WTA) versus actual compensations (ε/ha/year)

	Mean WTA	Actual compensation
Extensification of field margins in:		
- crop land	716	124 - 248
- grassland	473	124 - 248

An independent sample t-test revealed a significant higher average requested compensation for farmers who have not previously participated in agri-environmental measures (ε 810 versus 622 for *EFM* in cropland, p=0.04 and 552 versus 379 euro for *EFM* in grassland, p=0.10) This gives an indication that previous experience is positively influencing attitude towards environmental measures. This t-test is of course not saying that previous experience is the only influencing factor. Previous experience can also be linked to other factors and reduce e.g. the opportunity cost of participation.

Introduction of agri-environmental programmes with a big impact on farming practices need a good extension programme to convince farmers of the positive aspects and the necessity of the programme. Most of those projects are on a voluntary basis and from this first analysis it appears that farmers are not very much in favour of accepting the proposed changes in their farming activities. Farmers seem to experience the *EFM*-measure as an important constraint on their practices, with a negative impact on their income. According to most of them this measure only benefits the "consumers of the agricultural landscape", while some of them even doubt if this measure has any benefit at all. This is not the case with the *PIY*-measure. Farmers feel that they themselves and their family also benefit from the farm beautification programme, confirming the proposition that personal satisfaction and attitude of farmers plays an important role (see also Dupraz et al, 2000). From the reasons for non-participation it is clear that a higher compensation will not automatically lead to more participation. If the farmer doesn't see the utility of the measure, for himself or for nature conservation purposes, this kind of measures is not well accepted.

3.3. Econometric model

3.3.1. Probit model specification

Since the decision to participate in an agri-environmental policy can be considered as a dichotomous choice problem (see equations 8.4 and 8.5), limited dependent variable models can be applied for econometric estimation. This type of non-linear statistical model relates choice probability to explanatory factors. The objective is to model and estimate the probability that farmers are willing to participate on condition of specific farm and farmer characteristics. For this kind of discrete binary choice problems, probit or logit models are most appropriate (Amemiya, 1985; Johnston and DiNardo, 1997; Greene, 1997). Whereas the logit model is based on

the logistic cumulative distribution function (CDF), the probit model is based on the normal CDF. According to Amemiya (1985), the choice of which continuous probability distribution to use for producing predictions cannot be justified on theoretical grounds. For reason of convenience and previous experience, the standard normal distribution and thus the probit model is selected.

Probit modelling is used for explaining a dichotomous dependent variable with the empirical specification formulated in terms of a latent response variable, say y^*. This latent variable stands for contingent participation in the agri-environmental programmes and is defined by the structural equation:

$$y_i^* = \beta_0 + \sum_{k=1}^{K} \beta_{ki} x_{ki} + \varepsilon_i \tag{8.6}$$

with i denoting the respondent and

x_{ki}: k=1 through K independent variables that explain the phenomenon for respondent i

β_k: parameter that indicates the effect of x_k on y^*

β_0: intercept that indicates the expected value of y^* when all x_k equal to zero

ε_i: stochastic error term for respondent i.

The latent variable y_i^* is continuous, unobserved and ranges from -∞ to +∞. Variable y_i^* generates the observed binary variable y_i where:

$$y_i = \begin{cases} 1 & \text{if } y_i^* > 0 \text{, and} \\ 0 & \text{otherwise.} \end{cases} \tag{8.7}$$

Dealing with willingness to participate in a specific agri-environmental measure (table 8.1), equation 8.7 is to be interpreted as:

$$y_i = \begin{cases} 1 & \text{if the farmer is willing to participate in a specific measure} \\ 0 & \text{if the farmer is not willing to participate in a specific measure} \end{cases} \tag{8.8}$$

Implicit in the probit model is the assumption that the cumulative distribution function for the error term follows the cumulative normal distribution, denoted as $\Phi(\bullet)$. This implies that the probability of the investigated event occurring can be defined as:

$$\text{prob}(WTA_{ji} = 1) = \Phi(\Theta_{ji}) \text{ and } \text{prob}(WTA_{ji} = 0) = 1 - \Phi(\Theta_{ji}), \text{ with} \tag{8.9}$$

$$\Theta_{ji} = \beta_{j0} + \beta_{j1} AGE2_i + \beta_{j2} AGE3_i + \beta_{j3} EDU_i + \beta_{j4} LNG_i + \beta_{j5} PRP_i + \beta_{j6} ATT_i + \beta_{j7} FSZ2_i + \beta_{j8} FSZ3_i + \beta_{j9} FUT_i$$

and j=1 for the *PIY*-measure and j=2 for the *EFM*-measure. The definition of the explanatory variables is given in table 8.4. Given the mathematical form of the cumulative normal distribution function and after specifying an appropriate set of exogenous explanatory variables, the parameters β_{jk} can be estimated through maximising the value of the log likelihood function. For both models it is assumed that the same set of farmer characteristics determines the acceptance probability. The selection of variables has already been discussed in section 2. It is hypothesised that participation is increasing with lower age, higher education, previous participation, positive attitude about the environmental effects of agri-environmental programmes, increasing farm size, and better future perspectives. The language variable is, as already indicated, included as a proxy for the differences in institutional environment and knowledge between Flemish and Walloon farmers. All variables have been modelled as categorical variables.

To avoid the dummy variable trap (Greene, 1997), *AGE1* and *FSZ1* are used as reference categories and dropped from the models. Farm income is not included in the models as a separate variable, because of its high correlation with farm size.

A measure suggesting the goodness of fit of the probit models is the percentage of observations that are correctly predicted by the model (Greene, 1997). Other measures of goodness of fit of binary dependent variable models can be calculated based on the log likelihood values, like e.g. the almost R^2-analogous measure proposed by McFadden (1973), or the "likelihood ratio index".

3.3.2. Probit model results and discussion

The results of the probit analysis, including parameter estimates, corresponding standard errors and t-statistics, are given in table 8.4. The t-statistics test for the null hypothesis that the coefficient estimate equals zero. The R^2-analogous measure of goodness of fit (McFadden, 1973) is 0.12 for the *PIY*-model and 0.17 for the *EFM*-model. This is reasonable for analyses based on cross-sectional data (Greene, 1997). Alternatively, the goodness of fit is illustrated by the correct predictions' percentages, which amount to 65% and 81% for the *PIY*- and the *EFM*-model, respectively.

Willingness to participate in the "plantation in yard" measure is significantly influenced by age, education and language as farmer characteristics, as well as by farm size and potential succession. The negative signs of the estimates for the categorical age-variables confirm the hypothesis that willingness to participate in the *PIY*-measure decreases with increasing age of the farmer. With respect to farm size, contradictory to our hypothesis, the largest farms are found to be significantly less favourable to *PIY* as compared to the base and middle category. A possible explanation is that larger farms have already done some plantation around the newest buildings, or are situated in more woody regions (some parts of Wallonia).

Higher education level, Dutch-speaking (or Flanders-based), and clear succession perspectives are, as expected, beneficial to the farmers' willingness to participate in *PIY*-measures. Finally, both previous experience with and positive environmental attitude are not found to be significant determinants for explaining farmers' participation in *PIY*-measures.

A fairly different picture is found with respect to willingness to participate in extensification of field margins. Language, age, previous experience, attitude and farm size are found to be significant determinants in the *EFM*-model. The estimates of previous experience and environmental attitude have the expected positive signs, confirming that both previous experience and favourable environmental attitude positively influence willingness to participate. As expected in this case, Walloon-based farmers and larger farms are demonstrating a higher acceptance of the *EFM*-measure as compared to Flemish farmers and farms with an acreage below 75 hectare, respectively. In the *EFM* case, farmers' education and succession perspectives have no significant impact on the willingness to participate.

Because both measures have been evaluated by the same group of farmers, the differences between both probit estimations are attributable to the different nature of the dependent variables, namely the respective agri-environmental measures. Plantation-in-yard has mainly impact on the outlook of the farm. The farmer and family members are the main beneficiants from the induced beautification and derive a high utility from it, while the measure has little or no impact on agricultural performance parameters like output, production efficiency or farmers' income. This contrasts with the *EFM*-measure from which a considerable impact on agricultural performance can be expected. Meanwhile, resulting benefits and positive impact on nature and biodiversity deal with public goods and clearly extend beyond the farm gate. This explains, first, why farmers are in general more reluctant to accept this measure as it includes potential constraints on their farming activities, and second, why previous experience and environmental attitude emerge as important determinants. The perceived difference between Flemish and Walloon farmers is explained by two facts. First, as the *PIY*-policy is better known in the Flemish part and the *EFM*-measure in the Walloon part of the country, the findings confirm the hypothesis that familiarity with a measure positively influences uptake. A second possible explanation is that in general farms in Wallonia are larger in size and less intensive as compared to their Flemish colleagues, who are characterised by a smaller size but very intensive use of land and other resources. Some correlation between language and size can partly explain the opposite influence of size in the two models. The finding that farmers' education and succession perspectives have no significant impact on the *EFM*-participation, corresponds with previous findings by Delvaux et al (1999) and Bonnieux et al (1998).

Figures 8.1 and 8.2 give a graphical representation of the empirical results for both investigated agri-environmental measures. Both figures display changes in probabilities from the minimum likelihood. This minimum is constructed through setting the independent variables with a negative coefficient equal to one and those with a positive coefficient equal to zero. A maximum likelihood or upper predicted probabilities can be calculated reversibly. The dark bars indicate increases in the

probability from the minimum, attributed to unit changes in the individual explanatory variables.

Table 8.4. Empirical results from the probit analysis related to agri-environmental measures

	PIY-model			*EFM*-model		
Parameter[a]	estimate	s.e.	t-statistic	estimate	s.e.	t-statistic
Constant	0.790**	0.241	3.274	-1.809**	0.320	-5.652
AGE2	-0.296*	0.169	-1.752	-0.131	0.212	-0.645
AGE3	-1.021**	0.384	-2.661	-1.066*	0.601	-1.775
EDU	0.367*	0.204	1.795	0.030	0.234	0.127
LNG	-0.443**	0.163	-2.718	0.411**	0.202	1.936
PRP	0.145	0.173	0.836	0.408**	0.202	2.024
ATT	0.008	0.150	0.051	0.878**	0.202	4.339
FSZ2	-0.070	0.169	-0.406	0.322	0.226	1.248
FSZ3	-0.788**	0.262	-3.003	0.651**	0.300	2.171
FUT	-0.3508**	0.1649	-2.1274	-0.173	0.204	-0.849
Number of observations = 303				Number of observations = 303		
Positive observations on *PIY* = 167				Positive observations on *EFM*= 58		
Log likelihood value restricted = -225.1				Log likelihood value restricted = -148.2		
Log likelihood value unrestricted = -205.6				Log likelihood value unrestricted = -122.4		
R^2 (McFadden, 1973) = 0.1254				R^2 (McFadden, 1973) = 0.1749		
Fraction of correct predictions = 65.4%				Fraction of correct predictions = 80.9%		

significance levels: * = p<0.10, ** = p<0.05

[a] definition of variables:

AGE: AGE1 for "≤ 35 years", AGE2 for "35-60 years" and AGE3 for "≥ 60 years"

EDU: Education with EDU=0 for secondary school education (till the age of 18 years), and EDU=1 for high school or higher education (education beyond the age of 18 years)

LNG: Language discriminating between Dutch(Flemish)- and French(Walloon)-speaking farmers

PRP: Previous participation in countryside stewardship measures, experience (binary, yes or no)

ATT: Farmer's attitude about the environmental effects of agri-environmental programmes with ATT=1 referring to a favourable and ATT=0 to a neutral or unfavourable attitude

FSZ: Farm size with FSZ1 for "≤ 35 hectare", FSZ2 for "35-75 hectare" and FSZ3 for "> 75 hectare"

FUT: Future perspectives for the farm in terms of succession with FUT=0 meaning that a successor is available, while FUT=1 indicates no succession perspectives.

Comparison of both figures clearly illustrates the higher potential acceptance of *PIY*-measures as compared to *EFM*-measures. In the *PIY*-model, the minimum probability of acceptance or participation amounts to 3.5%. The graphs shows how "high education", "Flemish" and "succession" each individually double the probability of acceptance. It further illustrates the higher potential acceptance in the below 60 age groups, as well as in the below 75 hectare farm size groups (figure 8.1). The upper predicted probability of *PIY* participation amounts to 90.5%.

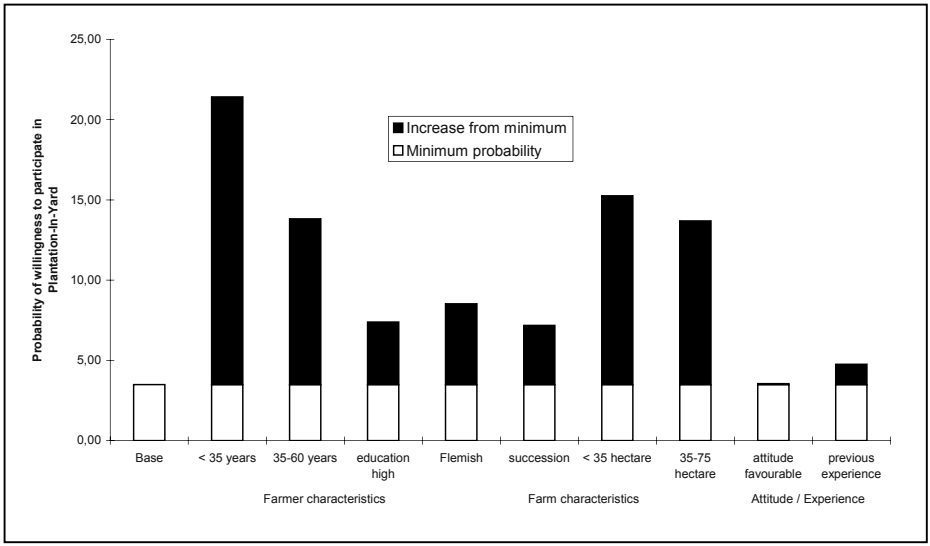

Figure 8.1. Probability of willingness to participate in Plantation-In-Yard; minimum is valid for: age >60 years, education low, Walloon, no succession perspective, >75 hectare farm size, no previous experience and unfavourable attitude towards environment preservation

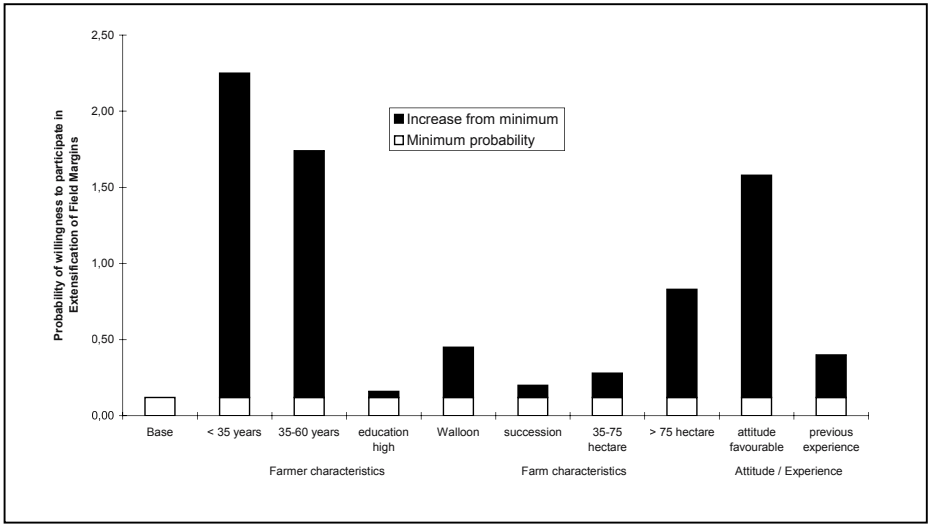

Figure 8.2. Probability of willingness to participate in Extensification of Field Margins; minimum is valid for: age >60 years, education low, Flemish, no succession perspective, <35 hectare farm size, no previous experience and unfavourable attitude towards environment preservation

With a similar procedure, the EFM-model displays the significant positive impact of age below 60 years, Walloon, farm size beyond 75 hectare, favourable attitude towards environmental preservation and previous experience with agri-environmental measures (figure 8.2). The minimum probability is near to zero, while the upper predicted probability amounts to 73.5%.

The fact that with the same explaining variables, the upper predicted probability is lower, is another confirmation of the fact that the *EFM*-measure is less well accepted than the *PIY*-measure.

4. CONCLUSIONS

Because rural landscapes are public goods, agricultural and/or environmental policies should consider this market imperfection and offer incentives to farmers to make sure that the rural landscape, desired by the public, is produced in sufficient quantity and/or desirable quality. To advise policy makers on what policy measures should be implemented, a valuation of the factors influencing farmers' decision making in relation to agri-environmental measures is of interest.

In this analysis the interest of farmers in two measures already applied on small scale, has been analysed: plantation in yard (*PIY*) and extensification of field margins (*EFM*). The empirical findings and the predictions of the econometric probit model are consistent with the developed conceptual framework, stating that both decision subject and decision maker characteristics are of importance, and with the propositions derived from economic theory. The clear differences between the two models illustrate the theoretical findings. Variables which describe farmers' attitude and previous experiences have a significant influence on the participation in the *EFM*-measure, whereas these variables are found not to be significant determinants of farmers' willingness to participate in the *PIY*- measure. On the contrary, the acceptance of the *PIY*-measure is more influenced by personal and farm characteristics. According to the theoretical model, this difference can be explained by the different nature of both measures. The *EFM*-measure has a much greater impact on agricultural performance than the *PIY*-measure, while the latter gives more personal benefits to the farmers, confirming that also personal satisfaction influences the decision of farmers about participation.

The intended research objective and the way in which the questionnaire was designed do not allow to indicate at what level of compensation a particular adoption level of the measure can be achieved. Nevertheless, the above mentioned observation, together with the result that in general younger and better educated farmers with a positive attitude toward environmental issues show more interest in conservation measures, has some practical implications. First of all because it shows that compensation rates are only one of the elements influencing uptake and secondly because the results indicate that participation rates can be influenced through education, extension and demonstration projects. When farmers can be convinced of the utility of a measure and of the fact that the real impact of a measure on agricultural output can be reduced or is not as high as initially expected, uptake will be higher. This is shown by the positive influence of previous participation.

Besides technical aspects about the environmental benefits, behavioural aspects have to be taken into account when designing measures. An example is e.g. the trade off that has to be made between the marginal utility for biodiversity of a wider field strip against the perceived loss of output for the farmer (see Ollikainen, 1999). Another example is the adjustment when deciding about the required delay in mowing date between the effect on conservation of meadow birds and the utility of the grassland for dairy farmers (Van Huylenbroeck et al, 2000). Further research should therefore concentrate both on the levels of compensation and on perceived effects of measures. The reason why real participation rates are in general still low and why farmers indicate in contingent behaviour studies much higher compensation rates than those offered, is that the calculations on which compensations are based only take into account the direct output reduction effect, but not the indirect effect on organisation of the production (e.g. timeliness costs) and private transaction costs (negotiation, contracting and control) (see i.a. Whitby et al, 1998; Falconer, 2000). Only by taking into account the behavioural elements, higher acceptance rates for agri-environmental policies can be achieved. If agri-environ-mental policies should really form the key strategy to incorporate environmental reflection into farmers' decision making, the behavioural aspects deserve more attention.

Previous analysis is based on Belgian farmers' willingness to participate in agri-environmental schemes. The two measures offered were analysed separately. In reality, however, farmers are offered a range of measures and they can decide to participate in several measures at the same time. The subject of chapter 9 is to analyse if similar factors are influencing this more complex decision-making process. As this analysis is based on European data, it is also possible to see if there are differences between countries as well.

CHAPTER 9

FARMERS' PARTICIPATION IN SEVERAL AGRI-ENVIRONMENTAL SCHEMES: A EUROPEAN PERSPECTIVE[71]

1. INTRODUCTION

The analysis in chapter 8 concentrated on farmers' willingness to participate in agri-environmental measures in Belgium. In this chapter, the analysis is based on the same conceptual framework (figure 7.1), but the context and objectives are different. The data used stems from farmers' participation in several measures in 8 European countries. Thus we are able to analyse if a similar set of influencing factors on farmers' willingness to participate can be found when farmers have the possibility of participating in more than one measure at the same time. Next to that, farmers' decision making can be compared in different European countries. The main hypothesis to be tested can thus be formulated as follows:

Farmers' participation in one or more agri-environmental measures depends both on the characteristics of the measure itself, as well as on farm and farmer characteristics, and differs between European countries.

By analysing determinants of farmers' participation in several schemes, it is possible to analyse whether the objectives of a scheme influence uptake. Based on a data set on the participation in agri-environmental measures of 1638 European farmers in eight countries, this chapter investigates what kind of farm and household characteristics do influence uptake and in how far differences can be observed between different kind of measures. Also Crabtree et al (1998) and Wynn et al (2001) concentrated on modelling farmer's participation in agri-environmental schemes in Scotland, taking into account both farm and farmer characteristics. Their approach is similar to the one used in this article as they also used logit and multinominal logit models. However, we do not restrict to the uptake decision, since we explicitly model the possible participation in several schemes. Therefore, the originality of the analysis lies in the use of a multinominal logit model, allowing to separate not only between participating and non-participating farmers but also among farmers only adopting one measure and others enrolled in different measures.

[71] *this chapter is mainly based on Dupraz, Vanslembrouck, et al (2002)*

I. Vanslembrouck & G. Van Huylenbroeck,
Landscape Amenities: Economic Assessment of Agricultural Landscapes, 155—168.

The organisation of this chapter is as follows. Section 2 specifies the economic model of farmers' behaviour. In section 3, the data is presented, followed by a discussion of the main results in section 4. Section 5 concludes the analysis.

2. MODELLING FARMERS' BEHAVIOUR

The model is based on the maximisation of farmers' utility. Hence farm and farmer characteristics are of interest. Farm characteristics determine the increment of farm profit derived by participation, while a farmer's preferences on the other hand, including his attitude towards environment, will make a difference between farms in the same situation. Accordingly, the farmer's behaviour is formalised by the maximisation of his utility function. If participation in several schemes is possible, it is expected that to decide his participation in one or several schemes, a farmer is comparing between each other the indirect utility values associated with each combination of schemes. If e.g. three schemes are proposed, there are eight different combinations including non-participation. One and only one combination is selected by every farmer.

To study the i^{th} farmer's choice we postulate random utility models, each one being associated to the m^{th} combination:

$$V_{im} = x_i' b_m + v_{im} \tag{9.1}$$

V_{im} is the indirect utility level which the i^{th} farmer associates with the m^{th} combination, x_i is the vector describing the farmer's preferences and his farm characteristics, b_m is the vector of parameters to be estimated and v_{im} is the stochastic disturbance term. Let d_{im} be the dummy variable reporting the choice of the i^{th} farmer about the m^{th} combination. His decision rule is then:

$$\begin{cases} d_{im} = 1 \\ d_{ik} = 0; \forall k \neq m \end{cases} \quad \Leftrightarrow \quad \{V_{im} > V_{ik} \quad \forall k \neq m\} \tag{9.2}$$

The econometric model is made operational by a particular choice of distribution of the disturbances. If and only if the disturbances of the different combinations are independent and identically distributed with the Gompertz cumulative distribution function $(F(v_{im})=exp(-exp(-v_{im})))$, then the probability of choosing the m^{th} combination is (Gouriéroux, 1989):

$$P_{im} = \Pr\{d_{im} = 1\} = \frac{\exp(x_i' b_m)}{\sum_{k=0}^{M} \exp(x_i' b_k)} \tag{9.3}$$

The model in equation 9.3 is the multinomial logit model. It is characterised by the independence of irrelevant alternatives. From equation 9.3, equation 9.4 is derived and holds whatever the subset of eligible combinations including m and k.

$$P_{im} / P_{ik} = \exp(x_i'(b_m - b_k)) \qquad \forall (m,k) \tag{9.4}$$

Since the model is based on the difference of expected utility levels in each pair of combinations, an indeterminacy must be removed to perform the estimation. The usual assumption $b_0=0$ solves the problem (Greene, 1997). The model is estimated using the maximum likelihood procedure. The expression of the model likelihood L is:

$$\ln L = \sum_i \sum_{m=0}^{M} d_{im} \ln \left[\frac{\exp(x_i' b_m)}{1 + \sum_{k=1}^{M} \exp(x_i' b_k)} \right] \tag{9.5}$$

The marginal effect of the explanatory variable x_{ij} is derived from equation 9.1:

$$\frac{\partial P_{im}}{\partial x_{ij}} = P_{im} \left[b_{mj} - \sum_{k=0}^{M} b_{kj} P_{ik} \right] \tag{9.6}$$

3. DATA

Data stem from a 1998-survey, which has been distributed in eight countries (Austria, Belgium, France, Germany, Greece, Italy, Sweden and the United Kingdom), as part of the research project "Market effects of countryside stewardship policies" (Van Huylenbroeck and Whitby, 1999). Available information includes a description of both the farmer (age, education, experience of farming and environmental attitude) and the farm (area, livestock, labour, income, type of farming)[72]. The sample includes 1638 farms which were eligible under the Regulation 2078/92. The average age of farmers is 45 years (standard deviation: 12 years), and on average they have 21 years of experience in farming, and 9 years of education. The sample includes livestock, mixed and permanent crops farms. Farm size ranges from 0.1 to 2230 hectares (mean equal to 57 hectares), and farmers reported from 0 to 7650 animals. In addition farm income ranges from –20,000 to 1,500,000 ECU[73] (average income is 26,000 ECU).

While 34.6% of surveyed farmers did not enter a scheme, 32.3% have entered one scheme only, 18.4% have entered two different schemes, 9.6% three and 5.1%

[72] *See Drake et al, (1999) for a comprehensive presentation of the survey and questionnaire.*
[73] *ECU = European Currency Unit before 1999*

four schemes or more. The distribution of farms according to the type of scheme is shown in table 9.1. A number of farmers selected schemes targeting the reduction of a negative externality as well as programs whose objectives include the provision of a local public good (landscape beauty) or a pure public good (biodiversity). Otherwise enrolment in organic farming is limited in the sample. In comparison, local programs usually combine a menu of prescriptions and target multiple objectives.

An overview across countries highlights significant differences (table 9.1). However, the country bias mainly results from the way in which the Regulation 2078/92 has been implemented in the eight countries. But it is also partly due to the way in which the sample was selected. Nevertheless, Austrian farmers were offered a wide range of environmental schemes whereas Greek farmers faced a limited number of opportunities.

Table 9.1. Scheme profiles according to countries (1998-survey)

Type of scheme	**Enrolled farms**		
	total sample	**relatively high number**	**no entrant**
Input reduction	444	Austria, Germany, Greece	
Landscape protection	437	Austria, Belgium, Sweden	Greece
Extensification	356	Austria, France	Greece, UK
Local programs	336	Austria, France	
Biodiversity	306	France, Germany, UK	Greece
Organic farming	145	Italy, Sweden	UK
Set-aside	30	Austria, Germany	
Others	36	France	

4. EMPIRICAL RESULTS

4.1. General results

In order to simplify the database and the econometrics, seven schemes have been aggregated in three broader categories: landscape maintenance, biodiversity protection and restriction of intensive farming practices (figure 9.1). These categories are homogeneous with respect to farmers' behaviour. Indeed, simple logit models were considered to estimate the probability of entering each scheme, and every category gathers the schemes with similar profiles. The organic farming scheme will be omitted because it is very differently designed and implemented across countries. In some cases it provides a cost-sharing assistance in order to encourage a change in technology, but it may also offer compensation based on a flat rate per hectare or per unit of livestock. So merging in the same sample all farms which participate in an organic program would lead to major inconsistencies. The simple logit models already show that the characteristics of the measures have a different impact on the probability of entering a scheme (see also table 9.3),

although these characteristics were not included in the model as explanatory variables as such.

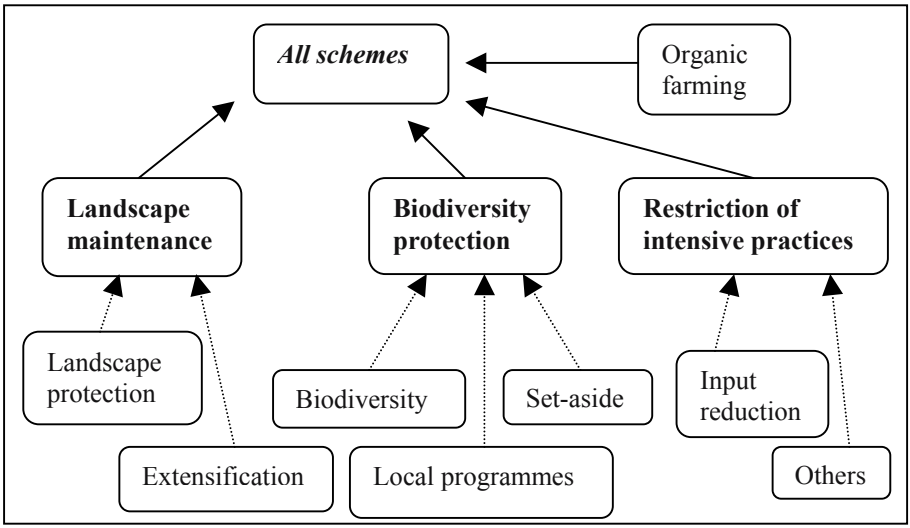

Figure 9.1. Aggregation of schemes

These three types of schemes provide eight possible combinations. The actual participation in these different combinations of schemes is given in the last column of table 10.2. Within our sample, 28% of the farmers participate in more than one scheme, 27% in only one scheme and 45% do not participate. Table 9.2 also displays the estimation results. The farmers' choices that are correctly predicted are on the diagonal of the table. As many as 54% of these choices are correctly predicted by our multinomial logit model[74]. According to these predicted values, 27% would participate in more than one scheme, 15% in only one scheme and 59% would not participate. Non-participation is overestimated and the participation in a single scheme is underestimated, while the prediction for the participation in the combination of more than one scheme is more consistent.

Despite these biases, the multinomial logit appears to give slightly better prediction of the total participation in each type of scheme than the separated estimation of simple logit models[75], especially for intensive practice restrictions (table 9.3). Only the use of a multivariate probit model provides a better estimation of uptake for each type of scheme; however, it only predicts 42% of actual choices of the farmers (Bonnieux et al, 2001).

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[74] The maximum log likelihood equals 2034. With 105 degrees of freedom and the calculated χ^2 equal to 1563, the model is highly significant

[75] The same set of explanatory variables was used in multinomial and simple logit models. All calculations have been performed with LIMDEP (Greene, 1998).

Table 9.2. The distribution of surveyed farmers according to actual and predicted combinations of schemes

Actual Y*	Predicted Y* 0	1	2	3	4	5	6	7	Total	Actual distribution of combinations (%)
0	621	14	0	6	38	18	2	45	744	45
1	25	53	4	21	8	5	2	9	127	8
2	8	10	13	4	5	6	2	5	53	3
3	32	24	3	35	10	4	0	2	110	7
4	49	14	1	7	61	23	3	1	159	10
5	81	20	0	4	24	35	1	4	169	10
6	50	6	1	2	25	8	4	0	96	6
7	94	6	3	3	4	3	1	66	180	11
Total	960	147	25	82	175	102	15	132	1638	100
Predicted distribution of combinations (%)	59	9	2	5	11	6	1	8	100	

* Y= the dependent variable of the multinominal logit, namely the set of scheme combinations
0 : Non participation
1 : Participation in the three types of schemes
2 : Intensive practice restrictions and biodiversity protection
3 : Intensive practice restrictions and landscape maintenance
4 : Landscape maintenance and biodiversity protection
5 : Landscape maintenance
6 : Biodiversity protection
7 : Intensive practice restrictions

Table 9.3. Estimated and observed participation rates

Program	Intensive practice restrictions	Biodiversity protection	Landscape maintenance
Simple logit estimation	0.21	0.21	0.30
Multinomial Logit estimation	0.27	0.21	0.31
Observed rate	0.28	0.27	0.35

4.2. Marginal effects of explanatory variables

As mentioned earlier, there are two categories of explanatory variables:

1. The characteristics of the farm include area, livestock density, area per worker, type of farming (described by dummy variables "livestock presence", "forest presence"), and agricultural training (dummies to categorise according to "Low agricultural education level" and "High agricultural education level").

2. The characteristics of the farmer's household include the farmer's age ("Under 45 years") and the farmer's general education level. The other explanatory variables describe farmers' attitude and opinions towards the environment and agri-environmental policy. The dummy variable "Environment concern" involves that the respondent ranks the environment among the three most important public policy issues. His/her opinions are more detailed with the variables "Opinion on environmental state" and "Opinion on farmers' environmental attitude". Previous participation to agri-environmental schemes and other participants' acquaintance ("Knows other participants") have a strong effect on participation probabilities.

Table 9.4 gives the marginal effects of the explanatory variables on each combination. The marginal effects on the probability of non-participation [Y=0] are the opposite effects of explanatory variables on the participation in one or several schemes.

Considering farm characteristics, the participation is favoured by the presence of forest and the presence of animals. The area has no significant effect *per se*, but lower area per worker, and lower livestock density favours participation, suggesting that more extensive farmers are more suitable for agri-environmental participation. Both highest and lowest agricultural education level have a negative effect on participation.

The age of the farmer has a negative effect and his general education level has a positive effect. This is similar to the results of the probit analysis in chapter 8. The previous participation to agri-environmental schemes and the acquaintance with other participants ("Knows other participants") have a strong positive effect participation probabilities. The farmers with "environment concern" participate more than the others, but the farmers who think there are still serious environmental problems in agricultural areas participate less than the others. In chapter 8, we have also found that both previous experience and favourable environmental attitude positively influence willingness to participate.

Except for the variable "Knows other participants", the other explanatory variables have contrasting effects on the participation in the different combinations of schemes. The effects of farm characteristics appear to be linked to the type of schemes. The presence of forest favours the landscape maintenance and all the combinations of several schemes. The presence of animals favours the landscape maintenance and biodiversity protection but discourages the participation in schemes requiring restrictions of intensive practices. Accordingly, it only favours the association of the two first type of schemes and has no effect on the associations including the third one. Higher livestock density favours the biodiversity protection, single and in association with landscape maintenance; but discourages the participation in landscape maintenance alone and the acceptance of intensive practice restrictions. The farm area favours the combinations that include restrictions of intensive practices and discourages participation in landscape maintenance. The area per worker favours the landscape maintenance and biodiversity protection but clearly discourages the participation in combinations including restrictions of intensive practices. Higher agricultural education favours biodiversity protection and

discourages landscape maintenance. Both highest and lowest level of agricultural education discourage the participation in several schemes simultaneously.

The previous participation in agri-environmental schemes has a positive effect on the participation in several schemes simultaneously, and on the single participation in biodiversity protection. All things equal, youngest farmers prefer entering no scheme or only one scheme that requires restrictions of intensive practices. They mostly avoid combinations which associate restrictions of intensive practices and biodiversity protection as well as landscape maintenance and biodiversity protection. General education favours all combinations of several schemes. It has a U-shape effect on restrictions of intensive practices.

Farmers' opinions also have contrasting effects on the participation in the different combinations of schemes. "Environment concern" favours landscape maintenance and biodiversity protection as well as their combinations with schemes requiring restrictions of intensive practices. However, it has a negative effect on the single participation in schemes requiring restrictions of intensive practices only. The opinion variables "serious problems remain in agricultural environment" and "farmers have a positive attitude towards environment" affect the combinations of schemes which associate landscape maintenance and restrictions on intensive practices, negatively and positively respectively.

These contrasting effects on the participation in different combinations of schemes illustrates once more the importance of including the characteristics of the measures in analysing farmers' behaviour.

Interesting is that inclusion of a country variable does not increase the predictive power of the results. This indicates that the model measures well underlying universal motives for participation, and that there are no significant differences between farmers' willingness to participate in different European countries.

The significance of variables which are not strictly related to farm technology, once more indicates that household characteristics, including opinions, should be considered in the micro-economic modelling of participation (Dupraz et al., 2000).

5. CONCLUSIONS

The results of this analysis confirm our earlier findings (chapter 8) about the influence of farm and farmer characteristics on the uptake of agri-environmental policies. Similar characteristics such as age, general education, and also attitude and experience have a significant influence on farmers' willingness to participate. The sign of the estimated coefficients are the same in both analyses. Also the importance of decision subject characteristics is revealed from both analyses, although these characteristics were not directly included in the models as explanatory variables. Especially the impact of the measure on agricultural performance seems to have an important influence on the participation rate (see e.g. the lower probability of participation in the extensification-of-field-margins measure (chapter 8) and intensive practice restrictions (chapter 9)).

With respect to the analysis in chapter 9, it is of special importance to compare the results with the work of Crabtree et al (1998) and Wynn et al (2000), because of

the specific similarities in design. In the analysis of Crabtree et al. (1998) on farmers' participation in a farm woodland incentive scheme, it's also been proved that the probability of participation increases with the proportion of existing woodland, as opposed to the proportion of land under agricultural use, which has a negative impact on the probability of participation. This is also in line with the analysis of Wynn et al. (2000), who found that the ESA Scheme in Scotland favours extensive farms. Previous participation in the scheme(s) and acquaintance with other participants have a positive influence on participation in our analysis, as well as in both Scottish studies (Crabtree et al., 1998; Wynn et al., 2001). Although Crabtree (1998) found that age did not significantly affect the probability of entry, both our analysis as well as Wynn et al. (2001) show a negative relationship. Older farmers seem to be less willing to participate. Environmental concern as an explanatory variable seems harder to catch. This analysis shows that farmers with "environment concern" participate more than others, while farmers who think there are still a lot of environmental problems participate less. This result is more or less in line with the analysis of Wynn et al. (2001), who found no clear picture concerning the impact of the variable designed to measure a farmer's interest in conservation. It is clear that our results are rather consistent with those of Crabtree et al. (1998) and Wynn et al. (2001), concerning the effects of farmer's attitudes and other contextual variables on farmers' uptake.

Most previous studies are limited to the uptake decision. Some consider the selection of a single scheme among a set of schemes which are offered to eligible farmers. Our paper is more ambitious since it proposes a model which takes into account the possible participation in several schemes simultaneously. First of all several variables (area per worker, livestock density, age, environment concern) significantly affect the uptake decision whereas they do not influence joint participation. Secondly the participation rate does not significantly vary with farm area. However, farmers who operate the largest farms are more likely to select several schemes. Since our model integrates the possibility of simultaneous participation, it provides a better prediction of the farmers' rate of uptake.

The results of this analysis are especially important in terms of policy design. A first important indication is that differences exist in participation characteristics among several schemes. This suggest that measures, clearly targeting specific groups of farmers and taking into account their expectations and limitations, can increase the efficiency of the policy. Effectiveness of measures can therefore be increased by better defining eligibility rules in relations to the objectives of a measure. The results suggest that eligibility rules based on farm related characteristics (presence of animals, used farm technology, ...) will result in a higher uptake than rules based on geographical designations. Restriction of intensive practices is only possible on farms with sufficient area, while more labour intensive conservation practices are more taken up by farmers with an excess of labour.

Another important result points out the importance of private transaction costs for uptake. The fact that previous knowledge and knowing other participants play an important role, indicates that information costs are still high, in particular for a first participation. A higher area per worker negatively influences uptake. It proves that participation is time consuming and depends on the opportunity cost of on farm

labour. Another indication is that younger farmers who probably spend more time in developing their farm participate less, all other things equal. This leads us to the role of education. Although not totally consistent, the results indicate that an increased general education level increases participation, in particular if this results in a higher environmental concern. Being more aware of environmental problems and possible solutions can contribute to the goal of making farmers more aware of their stewardship role and duty. The fact that general education seems to have a more influencing role than agricultural education may indicate that agricultural education is still too much technical oriented and pays not enough attention to the multifunctional role of agriculture.

Finally, this chapter illustrates the importance for policy makers to take into account that farmers have the opportunity to enter several schemes simultaneously. Indeed, due to cost complementarities, joint participation provides both private and public benefits. The fact that a relatively high number of surveyed farmers participate in more than one scheme suggests that a more individual negotiation with a tailor-made design of programmes could be an interesting approach (see the French "contrat territorial d'exploitation"). This would certainly increase participation as programmes would then fit better in the management and aspiration of farmers. Of course a negative point is the high transaction costs in negotiating and monitoring such individual tailor-made schemes. A way out may be to offer a standard package from which every farmer could select, given the particular circumstances of his farm. A package of measures, with the corresponding requirements and compensation level, from which a farmer can choose those measures, which fit into his farming practises, can be an opportunity to reach the maximum output of positive externalities at the lowest cost. It would certainly reduce the repeated cost of negotiation for each scheme. It also could decrease overall monitoring costs.

Table 9.4. Marginal effects of the explanatory variables on each combination

	Marginal effects	Standard Error	b/St.Er.	P[|Z|>z	Mean of X
			on Prob[Y = 0]		
Intercept	0.7714	0.0625	12.3480	0.0000	
Environment concern	-0.1382	0.0398	-3.4740	0.0005	0.2552
Livestock presence	-0.2215	0.0431	-5.1430	0.0000	0.6886
Area per worker	0.0016	0.0008	2.0340	0.0419	24.8633
Area	-0.0003	0.0004	-0.8840	0.3764	57.4414
Livestock density	0.0099	0.0028	3.5830	0.0003	4.2249
Less than 45 year old	0.0675	0.0339	1.9910	0.0465	0.4945
Previous participation	-0.2400	0.0503	-4.7710	0.0000	0.1557
Forest presence	-0.2184	0.0431	-5.0710	0.0000	0.2234
Negative opinion on environment state	0.0643	0.0343	1.8740	0.0610	0.5861
Positive opinion on farmers' environmental attitude	0.0186	0.0314	0.5930	0.5534	0.4683
Knows other participants	-0.4197	0.0333	-12.602	0.0000	0.6252
Low general education level	0.1640	0.0437	3.7560	0.0002	0.2460
High general education level	-0.0613	0.0370	-1.6570	0.0975	0.3724
Low agricultural education level	0.2170	0.0424	5.1190	0.0000	0.4133
High agricultural education level	0.1673	0.0447	3.7450	0.0002	0.3071
			on Prob[Y = 1]		
Intercept	-0.0251	0.0146	-1.7130	0.0867	
Environment concern	0.0067	0.0080	0.8290	0.4074	0.2552
Livestock presence	-0.0165	0.0089	-1.8440	0.0651	0.6886
Area per worker	-0.0004	0.0002	-2.2850	0.0223	24.8633
Area	0.0001	0.0000	2.0640	0.0390	57.4414
Livestock density	0.0002	0.0003	0.7560	0.4498	4.2249
Less than 45 year old	-0.0108	0.0070	-1.5490	0.1214	0.4945
Previous participation	0.0282	0.0098	2.8850	0.0039	0.1557
Forest presence	0.0439	0.0116	3.7860	0.0002	0.2234
Negative opinion on environment state	-0.0143	0.0078	-1.8480	0.0646	0.5861
Positive opinion on farmers' environmental attitude	0.0115	0.0070	1.6440	0.1001	0.4683
Knows other participants	0.0486	0.0134	3.6370	0.0003	0.6252
Low general education level	-0.0644	0.0180	-3.5730	0.0004	0.2460
High general education level	0.0142	0.0073	1.9470	0.0515	0.3724
Low agricultural education level	-0.0923	0.0182	-5.0630	0.0000	0.4133
High agricultural education level	-0.0371	0.0111	-3.3410	0.0008	0.3071

	Marginal effects	Standard Error	b/St.Er.	P[|Z|>z	Mean of X
			on Prob[Y = 2]		
Intercept	-0.0397	0.0167	-2.3790	0.0174	
Environment concern	-0.0005	0.0097	-0.0470	0.9622	0.2552
Livestock presence	-0.0029	0.0098	-0.2950	0.7680	0.6886
Area per worker	-0.0003	0.0002	-1.7190	0.0855	24.8633
Area	0.0001	0.0000	2.8490	0.0044	57.4414
Livestock density	0.0002	0.0004	0.4020	0.6880	4.2249
Less than 45 year old	0.0016	0.0072	0.2160	0.8293	0.4945
Previous participation	0.0226	0.0091	2.4730	0.0134	0.1557
Forest presence	0.0176	0.0085	2.0740	0.0381	0.2234
Negative opinion on environment state	-0.0215	0.0089	-2.4060	0.0161	0.5861
Positive opinion on farmers' environmental attitude	-0.0053	0.0072	-0.7420	0.4581	0.4683
Knows other participants	0.0281	0.0107	2.6270	0.0086	0.6252
Low general education level	-0.0335	0.0155	-2.1620	0.0307	0.2460
High general education level	-0.0060	0.0076	-0.7920	0.4285	0.3724
Low agricultural education level	-0.0262	0.0124	-2.1100	0.0348	0.4133
High agricultural education level	-0.0025	0.0087	-0.2840	0.7763	0.3071
			on Prob[Y = 3]		
Intercept	0.0140	0.0195	0.7160	0.4737	
Environment concern	0.0267	0.0117	2.2760	0.0228	0.2552
Livestock presence	-0.0152	0.0122	-1.2460	0.2127	0.6886
Area per worker	-0.0007	0.0003	-2.6680	0.0076	24.8633
Area	0.0000	0.0001	0.7030	0.4818	57.4414
Livestock density	-0.0018	0.0010	-1.8960	0.0580	4.2249
Less than 45 year old	-0.0167	0.0100	-1.6750	0.0939	0.4945
Previous participation	0.0286	0.0126	2.2750	0.0229	0.1557
Forest presence	0.0310	0.0116	2.6770	0.0074	0.2234
Negative opinion on environment state	-0.0577	0.0130	-4.4380	0.0000	0.5861
Positive opinion on farmers' environmental attitude	0.0266	0.0102	2.5940	0.0095	0.4683
Knows other participants	0.0411	0.0136	3.0160	0.0026	0.6252
Low general education level	-0.1006	0.0210	-4.7830	0.0000	0.2460
High general education level	0.0108	0.0098	1.1050	0.2691	0.3724
Low agricultural education level	-0.0792	0.0173	-4.5680	0.0000	0.4133
High agricultural education level	-0.0504	0.0141	-3.5790	0.0003	0.3071

	Marginal effects	**Standard Error**	**b/St.Er.**	**P[|Z|>z**	**Mean of X**
			on Prob[Y = 4]		
Intercept	-0.2488	0.0268	-9.3000	0.0000	
Environment concern	0.0776	0.0165	4.7040	0.0000	0.2552
Livestock presence	0.1337	0.0212	6.3130	0.0000	0.6886
Area per worker	0.0006	0.0002	2.6760	0.0074	24.8633
Area	0.0001	0.0001	0.6080	0.5430	57.4414
Livestock density	0.0012	0.0005	2.2310	0.0257	4.2249
Less than 45 year old	-0.0518	0.0138	-3.7600	0.0002	0.4945
Previous participation	0.0540	0.0168	3.2180	0.0013	0.1557
Forest presence	0.0546	0.0156	3.5080	0.0005	0.2234
Negative opinion on environment state	0.0081	0.0137	0.5940	0.5524	0.5861
Positive opinion on farmers' environmental attitude	-0.0187	0.0127	-1.4710	0.1414	0.4683
Knows other participants	0.0882	0.0183	4.8270	0.0000	0.6252
Low general education level	0.0140	0.0159	0.8820	0.3777	0.2460
High general education level	0.0335	0.0147	2.2770	0.0228	0.3724
Low agricultural education level	-0.0420	0.0157	-2.6680	0.0076	0.4133
High agricultural education level	-0.0552	0.0169	-3.2670	0.0011	0.3071
			on Prob[Y = 5]		
Intercept	-0.2635	0.0383	-6.8730	0.0000	
Environment concern	0.0344	0.0206	1.6710	0.0946	0.2552
Livestock presence	0.1549	0.0242	6.4110	0.0000	0.6886
Area per worker	0.0007	0.0004	1.6940	0.0903	24.8633
Area	-0.0004	0.0003	-1.6520	0.0985	57.4414
Livestock density	-0.0060	0.0023	-2.6780	0.0074	4.2249
Less than 45 year old	-0.0217	0.0188	-1.1540	0.2486	0.4945
Previous participation	0.0303	0.0241	1.2530	0.2102	0.1557
Forest presence	0.1190	0.0219	5.4340	0.0000	0.2234
Negative opinion on environment state	0.0205	0.0190	1.0790	0.2807	0.5861
Positive opinion on farmers' environmental attitude	-0.0125	0.0175	-0.7140	0.4755	0.4683
Knows other participants	0.0789	0.0207	3.8140	0.0001	0.6252
Low general education level	-0.0400	0.0228	-1.7480	0.0804	0.2460
High general education level	-0.0197	0.0206	-0.9530	0.3408	0.3724
Low agricultural education level	0.0764	0.0234	3.2680	0.0011	0.4133
High agricultural education level	0.0030	0.0247	0.1200	0.9044	0.3071

	Marginal effects	Standard Error	b/St.Er.	P[|Z|>z	Mean of X
			on Prob[Y = 6]		
Intercept	-0.1702	0.0251	-6.7680	0.0000	
Environment concern	0.0540	0.0145	3.7250	0.0002	0.2552
Livestock presence	0.0805	0.0201	4.0130	0.0001	0.6886
Area per worker	0.0003	0.0002	1.9120	0.0559	24.8633
Area	0.0001	0.0001	1.5660	0.1175	57.4414
Livestock density	0.0015	0.0004	3.4140	0.0006	4.2249
Less than 45 year old	-0.0002	0.0116	-0.0200	0.9844	0.4945
Previous participation	0.0516	0.0155	3.3240	0.0009	0.1557
Forest presence	0.0113	0.0143	0.7870	0.4314	0.2234
Negative opinion on environment state	-0.0011	0.0126	-0.0880	0.9301	0.5861
Positive opinion on farmers' environmental attitude	-0.0101	0.0118	-0.8560	0.3921	0.4683
Knows other participants	0.0297	0.0138	2.1550	0.0311	0.6252
Low general education level	-0.0051	0.0148	-0.3440	0.7307	0.2460
High general education level	-0.0212	0.0136	-1.5540	0.1201	0.3724
Low agricultural education level	-0.0365	0.0168	-2.1820	0.0291	0.4133
High agricultural education level	0.0006	0.0132	0.0430	0.9658	0.3071
			on Prob[Y = 7]		
Intercept	-0.0380	0.0314	-1.2090	0.2266	
Environment concern	-0.0606	0.0219	-2.7640	0.0057	0.2552
Livestock presence	-0.1130	0.0255	-4.4330	0.0000	0.6886
Area per worker	-0.0018	0.0005	-3.7660	0.0002	24.8633
Area	0.0003	0.0001	3.2960	0.0010	57.4414
Livestock density	-0.0051	0.0027	-1.8860	0.0593	4.2249
Less than 45 year old	0.0322	0.0175	1.8390	0.0659	0.4945
Previous participation	0.0248	0.0238	1.0420	0.2974	0.1557
Forest presence	-0.0590	0.0240	-2.4520	0.0142	0.2234
Negative opinion on environment state	0.0017	0.0162	0.1050	0.9166	0.5861
Positive opinion on farmers' environmental attitude	-0.0101	0.0148	-0.6800	0.4964	0.4683
Knows other participants	0.1050	0.0201	5.2290	0.0000	0.6252
Low general education level	0.0655	0.0216	3.0370	0.0024	0.2460
High general education level	0.0495	0.0186	2.6630	0.0077	0.3724
Low agricultural education level	-0.0170	0.0186	-0.9160	0.3598	0.4133
High agricultural education level	-0.0256	0.0241	-1.0620	0.2884	0.3071

"For decision-makers and political leaders, it is crucial to know what the population feels deeply.That is the only way of ensuring that rural policy does not rely to an excessive degree upon theoretical and dirigiste principles, even though it is practically impossible to overcome all opposition." *(Koning Boudewijnstichting (1997)[76])*

PART IV

GENERAL CONCLUSIONS

[76] *The Millennium Conferences 1997, Een nieuwe toekomst voor het platteland? Dossier samengesteld door J. Van der Ploeg in samenwerking met J. Kwaschin op vraag van de Koning Boudewijnstichting (Brussel)*

CHAPTER 10

CONCLUSIONS AND POLICY RECOMMENDATIONS

1. NEED FOR POLICY INTERVENTION

The general introduction in chapter 1 highlighted the fact that agriculture produces multiple inter-connected outputs. This can acquire economic relevance if this characteristic influences the way in which scarce resources are used in the economy to meet the demands of society. Moreover, the multifunctional characteristic can become policy relevant, if, among the multiple outputs generated, there are some that are welfare-enhancing or welfare reducing but for which no market exists.

In more general terms, the need for policy intervention[77] is to be found in the problem of market failure. To understand the problem of market failure, it is useful to look at the concept of market success. Within the tradition of neo-classical economics[78], a market is successful if it produces an allocation of resources such that no one can be made better off without making anyone else worse off. This state of affairs is known as a 'Pareto optimum' (see also chapter 3), or an 'efficient' allocation of resources. It can be shown that, provided a certain number of conditions are satisfied, a competitive market will tend towards a Pareto optimum. These conditions can be summarised as follows (Perman et al, 1996):

1. Markets exist for all goods and services exchanged.
2. All markets are perfectly competitive.
3. No externalities exist.
4. All goods and services are private goods; there are no public goods.
5. Property rights are fully assigned.
6. All transactions have perfect information.
7. All firms are profit maximisers and all individuals utility maximisers.
8. Long-run average costs are non-decreasing.
9. Transaction costs are zero.
10. All relevant functions satisfy convexity conditions.

Those perfect conditions only apply to a fictional world. However, proponents argue it is a useful fiction. By identifying the conditions that must be obtained if Pareto-optimality is to be achieved, we are in a clearer position to identify the causes of

[77] *many textbooks on agricultural and/or environmental economics give some insight into the need for policy intervention. I refer to Ritson (1970) or Weale (1992) among others*
[78] *see e.g. Varian (1993)*

I. Vanslembrouck & G. Van Huylenbroeck,
Landscape Amenities: Economic Assessment of Agricultural Landscapes, 171—182.

market failure when they occur. Where markets by themselves fail to allocate resources efficiently, public sector intervention offers the prospect of establishing alternative institutional arrangements. Those arrangements can, by altering behaviour, lead to more efficient patterns of resource allocation.

In case of market failure, the existence of externalities make policy intervention necessary. The characteristics of the activity involved have important implications for the design and the implementation of the correcting action. Analysing the characteristics of the provision of landscape amenities, both from supply and demand side makes it possible to take these aspects into account when formulating policy interventions.

In situations where a combination of private and public goods is produced, the standard policy recommendation is that market forces should freely determine the level of production, consumption and trade of the private goods, while any underprovision of public goods or existence of positive or negative externalities should be addressed through targeted and decoupled policy measures (OECD, 2001). Moreover, each public good objective or externality should be addressed through a separate policy instrument that influences the target variable directly. The standard recommendation corresponds to the well-known result from the theory of economic policy that, in order to simultaneously achieve a set of objectives, the number of policy instruments has to be equal to or larger than the number of goals (Tinbergen, 1970).

The challenge for this work on the provision of agricultural amenities, is to test the validity of this standard policy recommendation, taking into account additional aspects such as the simultaneous consideration of the different positive (and negative) effects of agriculture, the joint production character and the externality and public good aspects. In this chapter the information from previous parts is combined to identify the reasons why markets fail in the provision of landscape amenities and to formulate a number of policy recommendations.

2. THE ANALYTICAL FRAMEWORK RECONSIDERED

In part I (figure 1.7), an analytical framework has been proposed to analyse the characteristics of a public good jointly produced by agriculture. The discussion on multifunctionality has made clear that there is a need for a balanced approach making farmers pay for the pollution they create but also providing remuneration for the positive externalities they produce. The question of the correct policy mix is becoming more and more complex because of the need to achieve a variety of goals. Therefore the analytical framework in figure 1.7 is applied in this concluding chapter, for the specific case of landscape amenities.

The question on the externality and public good characteristics of landscape amenities has been addressed in part II, by asking:

Is there some market failure associated with the non-commodity outputs?

This question refers to the demand side of landscape amenities from agriculture. Chapter 3 has already given an indication that the "production" of landscape elements is a by-product (or externality) of the agricultural production. Because

landscape amenities can not be marketed, farmers are not directly paid for their provision. To analyse if there is market failure involved, it is important to know if there is a demand for those agricultural amenities. In other words, some insight is needed into the marginal benefits of those amenities for society. Only if there is a demand for landscape amenities, we can talk about market failure. The above question was analysed by looking at the link between landscape amenities produced by farmers and rural tourism. The empirical analysis in chapter 5 shows that rural tourism is influenced by agricultural production methods. "Beneficial" agricultural activities have a positive influence on the price of rural tourism. Rural tourists are willing to pay more for a landscape, they experience as attractive. The hedonic pricing analysis indicates that agricultural activities, perceived as non-polluting such as meadows and horticulture, play a role in the appreciation of rural landscapes. From chapter 5, we may thus conclude that there is a demand for the provision of agricultural amenities. Estimates of the recreational value of the rural landscapes in chapter 6 indicate relatively high values. Part II gives thus clear evidence of the benefits and use values society derives from the provision of landscape elements by agriculture.

Although rural tourism is a way for farmers to capture part of these benefits, not all farmers contributing to these benefits are remunerated, as not all farmers participate in rural tourism. Next to that, there is the public good characteristic of those amenities. Because of non-excludability, people can easily enjoy rural landscapes, e.g. by driving through the countryside without contributing for the maintenance of that landscape. Free-riding is thus very common. Further, the use values derived from the analysis on the influence of agriculture on rural guesthouse prices only estimated a small part of the total value for society, as explained when discussing the assumptions behind the valuation methods used. The methods are only measuring use values and do not take into account non-use values. The values estimated in chapter 6 have therefore to be regarded as lower bounds of the total marginal value for society.

Part III has addressed the question on the production jointness between commodity outputs and landscape amenities from agriculture:

Is there a strong degree of jointness between commodity and non-commodity outputs that can not be altered?

The relationship between agricultural commodities and landscape production has been analysed against the background of European policy. Present rural landscapes are the result of several influences of which the CAP and technological innovations in agriculture are very important ones. These factors influence existing production practices and systems and thus also the related joint outputs. The reform of the CAP (mainly since 1992) has put more emphasis on the joint outputs of agriculture. Agri-environmental measures provide incentives to farmers for switching towards farm systems producing a higher output of landscape amenities. Because of the voluntary nature of these measures, their success mainly depends on farmers participation. Farmers' willingness for participate in those measures is thus a crucial point in the impact of those policies on the rural landscape. In chapters 8 and 9 the factors influencing farmers' willingness to participate have been analysed. The results emphasise that both the characteristics of the measure (such as compensation,

impact on agricultural performance, …) as well as farm and farmer characteristics are important. From chapter 10 may be derived that the level of influence of the different factors is policy dependent. Of particular importance is the impact measures have on the level of agricultural output.

However, the analysis in chapter 9 shows that a combination of different measures on one farm can result in cost efficiencies, both in terms of profits foregone and implementation costs. This result indicates that although policies need to be targeted, their design should also take into account possible complementarities.

Theoretically it may be possible to de-link provision of landscape amenities from commodity provision (see e.g. Van Huylenbroeck and Vanslembrouck, 2001). However, in practice this would be very expensive. Provision by farmers will result in an economy of scope, because of the joint production character. This means that it may be cheaper for society to pay farmers to change farm practices towards a more desired combination of commodity and non-commodity outputs, than to separate production and leave non-commodity production to other providers.

The third question to be considered, before addressing the role of the government, is then:

Have non-governmental options been explored as the most efficient strategy?

Although agricultural landscapes are in principle pure public goods, in some cases, they can be marketed, e.g. through tourism or recreational activities, as discussed in part II. These kind of markets hold some opportunities for the future, if well managed, but they only reach a limited number of "suppliers". As already indicated, the attractiveness of the landscape depends on the actions of all farmers and not only of those offering accommodation or other recreational facilities. In theory, a redistribution of benefits should be organised to remunerate all farmers, contributing to the attractiveness of the landscapes. However, in practice, this is difficult to organise because of the difficulty of measuring individual contributions.

The analytical framework seems thus to indicate that policy intervention is necessary in order to supply the quantity and quality of landscape amenities, desired by society. However, not only policies based on direct payments should be considered, but also the possibility of market creation needs further attention. This will be touched upon in the next section.

3. POLICY RECOMMENDATIONS

3.1. A general remark

Before analysing possible policies for the provision of landscape amenities, it is important to remember that the analyses conducted in this research are based on the current situation. As seen, the provision of landscape elements is highly influenced by former and actual policy contexts. These policies have influenced the conditions for commodity and non-commodity production. In theory policy intervention for non-commodities should be analysed in a complete free market, where an equilibrium is established between commodity and non-commodity outputs on the basis of market prices for commodity goods. Trade liberalisation needn't therefore

be contrary to policy intervention as it could yield a situation in which the provision of non-commodity goods is less distorted than is actually the case (see Brouwer and van der Straaten, 2002).

Given this remark, we should take into account the typical characteristics of the agricultural landscape in order to see if even in a non-distorted market some intervention is necessary. As already indicated, the externality and public good characteristics can lead to problems such as free-riding and underprovision. Some intervention seems therefore justified. But this intervention should be prescriptive rather than regulatory. Public policies have to offer incentives to farmers to provide and maintain the desired landscape elements, in the first place by developing adapted market creation possibilities.

3.2. Market creation

The possibility of market creation is a very important and probably an underestimated topic in the provision of public goods. If a farmer is directly or indirectly paid for the provision of those goods, provision of amenities will be stimulated. A number of farmers are already looking for such extra income possibilities. As discussed in part II, one of the opportunities is rural tourism. It is however only one aspect of the market creation possibilities.

Another possibility is to try to exploit the joint output link between e.g. local landscape amenities and commodity goods, by introducing regional or local labels. Remuneration can then be achieved by selling traditional quality products, with the price being influenced by environmentally friendly practises. A long-established experience in this field is e.g. *appellation d'origine controlée (AOC)* of agricultural products. The problem of such labels is that they only certify the origin, but do not necessarily control if there is a real link with landscape protection. If the label does not certify that the use of landscape is subject to protective practices, there can be a problem of free riding. Labelling has, however, some promising possibilities for the future, in particular if a good controlling system can be set up.

Other possibilities include the selling of certain property rights (such as camping or hunting). This makes it possible to create added value for farmers or other business people. This measure is also linked to the provision of tourist or recreational activities, as has been discussed in previous section. The possibility of creating such rural enterprise products is extensively discussed by Merlo (2002). Agro-tourism allows remuneration and conservation of unique landscapes. Given the growth of "green consumerism" and the willingness to pay of consumers, these "markets" seem to have a future, and therefore an impact on environmental and landscape conservation. Swagemakers (2002) speaks in this context about novelty production, in which added value is obtained by deepening, widening and regrounding agricultural practices.

Those different possibilities can be grouped under the concept of diversification. A schematic flow diagram of farm diversification has been developed by Ilbery (1992) (figure 10.1). This diagram shows the different aspects of diversification. Most of them have a link with the provision of agricultural landscape amenities and

hold some potential as a kind of remuneration for their provision. For instance, farm beautification can have a positive effect on the selling of local products on the farm; or maintaining an attractive landscape with hedges and pillard-willows can have an impact on the success of rural tourism.

However, some remarks have to be made. First of all, market creation is only possible for a certain type of non-commodities, and diversification is not an option for all farms or farmers. Possibilities will not only depend on farm type and location but also on the skill and investment possibilities of the individual farmer (e.g. high skill and investment to start with on farm processing of quality products). Oversupply of this kind of commodities may also have a negative effect on the remuneration, but also on the environment. Attention has to be paid to the optimal supply of those commodities, both from an economic as well as from an environmental point of view.

Notwithstanding the potential of these market creation possibilities for real public goods, a more active policy intervention will be necessary and justified.

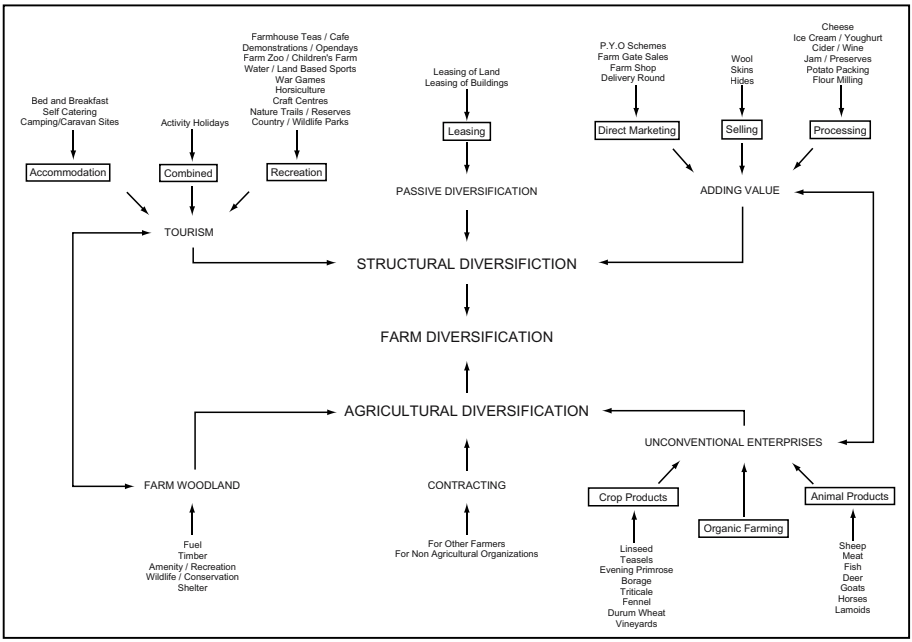

Figure 10.1. A schematic flow diagram of agricultural and structural forms of farm diversification (Source: Ilbery, 1992)

3.3. Policy options

Public intervention has to stimulate the production of landscape amenities. Although different possibilities exist to classify policy instruments, one way is to categorise them on the basis of the extent to which the state takes control over the use of land,

or in other words, takes over property rights (also see the discussion on property rights in chapter 7). Three main categories can be distinguished.

Extension and education

Possible asymmetries in the type and level of information available to farmers, many of them only having a conventional agricultural training, suggest some potential value in the dissemination of information. It is possible that farmers would favour enhanced environmental quality, but that they do not know how to provide it. The need for correct and accurate information also follows from the analyses in part III: farmers with experience in agri-environmental measures or with a positive attitude towards the environment are more probable to enter a preservation scheme.

Providing information on landscape amenity provision during the training period of young farmers will therefore have a positive effect. Further may environmental extension programmes persuade farmers of their stewardship role and wider responsibility towards environmental conservation. Indirectly this may create a more positive image of agriculture and stimulate consumers to buy more local products.

However, the scope to stimulate the provision of countryside benefits only through extension and information may be limited, because they are mainly based on voluntary provision. It is unlikely that individual farmers will be willing to bear substantial costs in order to provide benefits mainly enjoyed by other people (see also the analysis in chapter 8). As a result, this type of policy approach is likely to be most successful in encouraging farmers to make modest, incremental changes which do not affect their primary food production activities. Therefore, this kind of measures should be considered as essential, but complementary, for implementing the set of policy tools as discussed below.

Financial incentives

In environmental policy, the financial or economic instruments[79] are widely used. The choice of instruments depends upon many considerations. According to Young (1992), it is critical that, as well as being efficient, the policy package is equitable, administratively feasible, dependable and provides dynamic and continuing incentives for improvement (see annex 3). It is clear that different types of instruments can be applied, but taxes, subsidies and tradable permits seem to be the most commonly used.

In the case of the provision of external benefits, the financial (or economic) tools, following Pigou's internalisation approach, are based on the "carrot" rather than the "stick", in other words positive instruments which are aimed at convincing farmers to implement certain measures in exchange for various advantages (Merlo, 2002). According to OECD (1996), this may be called a "state pays approach". The state may seek to stimulate the provision of landscape amenities by offering

[79] *there is a suite of economic instruments that can be used to encourage environmentally positive instruments, including fees, levies and charges, deposit refunds, charge-subsidy systems, compensation arrangements, performance bonds, and non-compliance fees (Young, 1992)*

financial incentives in the form of regular payments for specified actions. This approach parallels that of taxing pollution, known as the "Polluter Pays Principle". This principle implies that private agents pay some of the costs associated with their production of negative externalities. An obvious policy question, as has been raised by Hanley, Kirkpatrick, et al (1998), is whether a symmetrically opposite principle exists for private agents who produce positive externalities, which increase the stock of public goods. Two candidate principles are the "Beneficiaries Pays Principle" (BPP) and the "Provider Gets Principle" (PGP).

The BPP, as suggested i.a. by Hanley, Kirkpatrick, et al (1998) and Gatto and Merlo (1999), is based on the assumption that farmers have property rights over their land, and implies:

1. that those who benefit from such public goods, such as day-trippers to scenic rural areas, should pay a marginal value-based fee to the providers of such goods. This fee can be on a per-trip or annual basis, or can be implemented by land purchase or leasing;
2. that these payments compensate the rural providers of public goods for the opportunity costs of public good provision. For example, the payments might compensate farmers for not intensifying production by draining wetland;
3. that the interaction of marginal willingness to pay (demand) and opportunity cost (supply) will result in an efficient level of public good provision.

However, application of the BPP is complicated. First of all, information is needed both on the demand (identification of beneficiaries) and the supply. Further, our analysis of chapter 6 indicates that beneficiaries are not very keen to pay for the provision of e.g. landscape elements. A lot of them feel this provision is part of a farmer's profession. A possible result could be a too low direct demand and thus underprovision.

An alternative principle is the "Provider Gets Principle" (PGP) (Hanley, Kirkpatrick et al, 1998). The PGP is oriented more to the supply side of rural public goods than the demand side. It involves that the public authorities identify an "appropriate" level for the supply of public goods, and are then directing public funds at the providers of these goods according to the marginal opportunity costs of supply. This means that it has to be possible to measure those costs. Next to that the principle requires (i) that the suppliers of amenities can be identified; (ii) that a way of transferring funds to the suppliers can be found; (iii) that funding is available to finance these transfers; and (iv) that an appropriate level of amenity supply can be identified.

A key difficulty arises in defining the suitable output to which payments can be linked. The payments which are made in practice tend to relate to inputs rather than outputs; for instance for planting trees and hedges. The outputs, improved landscape quality and conservation, are not as amenable to quantification. Some new approaches could be attempted in order to move towards an "output" orientation. For instance, farmers could be paid on the basis of the number of wild flowers found in their meadows. Attempts of this kind already exist in the Netherlands (Van Wenum et al, 1999). The potential of linking such payments to other output indicators is

certainly a question for further research. One of the nice features of payments on the public goods provided is that they result in direct incentives for the production of the public good.

However, one problem with this approach is that the variable to which payments are linked, does not adequately represent all aspects of the value of a desirable landscape. For instance, people do not necessarily value the number of wild flowers or bird species as such, but the entire habitat within which these flowers or birds are found. Another problem is that the output is not just the result of the efforts of one farmer. Bird species, e.g., will not come to a particular meadow but to areas which are in total attractive. A third problem is related to transaction costs of implementation and control (also see the discussion in chapter 7).

In this context it seems unlikely that a simple and standardised subsidy system could provide the full range of landscape amenities desired by society. In the current CAP, much attention has been placed on voluntary agreements between farmers and public authorities. Some features of these measures need some extra considerations, however, and can be tracked back to four attributes: (i) mandatory or voluntary; (ii) permanent or temporary; (iii) compensated or uncompensated; (iv) horizontal or vertical.

Mandatory measures have to be complied with, without any possible exception, while voluntary measures have to be accepted by the involved parties. Sometimes the difference between mandatory and voluntary measures remains vague, leading to situations where mandatory tools tend to be applied as remunerated "voluntary means with powers of compulsion". Depending on the goals and objectives of conservation, and the particular circumstances, both types of measures can be used. A negative aspect of mandatory tools, is the high administrative costs of policy implementation, requiring monitoring, control and policing (Whitby et al, 1998). Limiting property rights may also be difficult for requirements above reference levels of practices, considered as non-polluting or harmful to society. For limited zones, the combination of mandatory rules combined with payments shouldn't, however, be excluded, as this could result in a considerable decrease of control costs, compared with a voluntary but scattered adoption of certain practices. Such zoning policies may be less expensive because the decrease in property right would be automatically discounted in land prices. Parcels of land on which restrictions are put, will be less attractive when sold and thus cheaper for farmers who are able to cope efficiently with these restrictions.

With respect to the voluntary nature of the measures, Romstad (2002), among others, refer to cross compliance payments[80]. The difficulty with these instruments are that they do no provide direct incentives for producing public goods. Hence, unless care is taken in the design of such policies, undesirable allocations may result. But still, from a theoretical perspective, cross compliance has some interesting properties. Those who voluntarily subject themselves to a cross compliance scheme do so because their expected profits from participating exceeds the expected profits from not doing so. Conversely, if the expected profits from non-participation exceed the profits from participation, the farmer chooses not to

[80] *also common in the CAP (see e.g. DGVI, 1998)*

participate (see also chapter 8). This implies that the farmers with the least costs of complying with the regulations are more likely to sign up. The result is some sort of menu based system that could yield separating equilibria. Consequently, cross compliance may be a cost reducing strategy to meet certain policy targets. A cross compliance programme can be easily tailored to specific regional needs, or made to induce that a minimum level of some public good attributes is provided, they are flexible and targeted.

The duration of the measures can either be permanent or temporary. Temporary measures last a specified number of years after which they can be renewed or terminated. In general, such temporary policies are more easily accepted by farmers, because of the possibility to stop the contract, which gives them some authority. On the other hand, this kind of measures are not interesting when the objective is e.g. to restore biodiversity or reforestation, as these kinds of measures need several years to attain their goals. A possible solution is to design policies that are temporary compensated, or compensated at a diminishing rate, in particular in cases of practices which are expensive to start with.

This brings us to the third feature of the financial incentives, the compensation level. Both with mandatory or voluntary measures, compensation can be provided to meet increased costs or lower revenues for the farmer. Payments can be defined within various ranges of negotiation: from standard subsidies to graded compensation of incentives according to area, livestock units or yields, or payments negotiated with groups of participants or with individuals. The remuneration should not only take into account the extra costs for farmers, but also the benefits foregone as well as an incentive to persuade farmers. Remuneration levels need also to be compared with the associated benefits, as experienced by society. Taking into account not only the "input side" (costs), but also the "output side" (agricultural landscape) may lead to more balanced payment levels.

A fourth important issue is the use of horizontal or vertical measures. Depending on the objectives of the measure, some should be introduced, implied and controlled locally (vertically), while others can be introduced on a more general scale (horizontal measures). The biggest advantage of the local measures is that they can be better targeted to attain a very (site) specific goal, e.g. preservation of wetlands or specific landscape elements. Vertical measures can easily be adapted to particular situations, and make it easier to calculate the benefits and the costs. Horizontal measures have the advantage that, they can be introduced on a broader scale, at lower transaction costs, in particular if it concerns measures that are rather easy to control or implement. Disadvantage is that the weak targeting and general nature result in low outputs from landscape and nature provision point of view.

Public land ownership

A third policy instrument, which can be used is that the state takes over a part or all property rights. By changing the property rights over a certain piece of land, the government or local authority can introduce certain regulations, on a mandatory basis. The most extreme case, is when the government buys a piece of land. The ownership of the land by the state gives the fullest possible extent of control. The

desired objectives can be determined, taking account of all the relevant effects of land use. Such policy can be important when it concerns key sites contributing to the provision of countryside benefits: nature reserves and areas of critical landscape and recreational value. The owner might be a central government department, a government agency or a local authority. It is appropriate that the level of government at which land is owned and managed should relate to the characteristics and incidence of the benefits which are provided. This, in a sense, internalises the costs and benefits through a political system rather than a market system.

Public ownership with private management of productive assets can offer some possibilities, as the basic problem with privately owned land arises from the public good characteristics of the benefits. In the absence of any clear means of quantifying the benefits, then control of private management tends to be by means of contracts which prescribe how an area of land should and should not be managed. The most important problem might be to design a management system which both ensures the continuity of management and provision of landscape amenities, while at the same time achieving some degree of competition. These considerations suggest that public ownership is only appropriate in very specific cases: sites of specific - scientific - value, or sites where there is the least likelihood of financial gain in association with the provision of the public good.

The choice between the different policy instruments is rather difficult, as each approach has its practical and economic merits. According to Young (1992), in almost all cases, a mixed approach is necessary, so that all policy instruments, acting in concert, produce an efficient, equitable, dynamic, dependable and politically acceptable outcome.

3.4. Environmental co-operation

Related to the discussion above, institutional questions appear to be highly significant, especially in environmental policy. Policy intervention may have important institutional implications. This may result in significant transaction costs (Whitby et al, 1998), in particular when the environmental outcomes are ill-defined and difficult to measure. This is typically the case when these outcomes arise from a numerous constituency of actors, which is the case for the provision of landscape elements by farmers. Hagedorn (2002) gives a broad overview of the issues related to co-operative strategies to cope with agri-environmental problems. It is clearly a topic which needs some more attention and consideration in the future, both by academics and policy-makers. Environmental co-operation will be an important input in the discussion and implementation of agri-environmental policies in the future, as co-operative agreements seem to have essential advantages in terms of environmental effectivity and economic efficiency (Heinz, 2002).

3.5. Concluding comments

It is clear that the discussion on what measures to use, is not easily answered. In the specific case of landscape elements, different types of policies can lead to an

efficient output. From our analysis, it seems very important that both supply and demand aspects are taken into account. Also Romstad (2002) concludes that policies for promoting public goods in agriculture should be directly linked to the public goods in question. Information on both costs and benefits of the production and consumption of those goods is therefore needed. The experience and research by academics in valuing the non-market benefits from agriculture, can be of great importance here, in order to arrive at agreements which are more adapted to the specific goals.

A policy framework needs to enable those with imagination, information and adequate resources to be able to influence land uses on a sufficient scale to have the socially desired impact. But at the same time, the objective of variety in land use implies a role for a range of different agents with differing objectives and requires the whole spectrum of possible interventions. A combination of the three elements discussed above, will therefore need some closer consideration in the future. As a result of our analysis, the following framework (figure 10.2) is proposed, as an important basis to arrive at the optimal provision of landscape amenities by farmers. Although the three instruments in this triangle have their individual impact, the challenge for the future lies in the combination of the different opportunities:

- interaction between the government and the market may provide incentives for market creation, such as labelling of local products, promotion of rural tourism, investments in starting up those activities, and so on;
- interaction between the market and co-operations may find new ways in chain management, labelling, organisation of local markets, and so on;
- interaction between the government and co-operations may result in co-management, convenants, and so on.

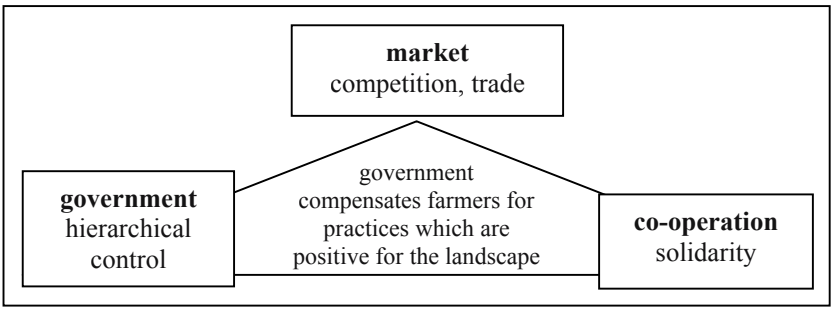

Figure 10.2. Framework for the optimal provision of landscape amenities

The future of landscape will depend on the types of policy introduced and their effectiveness. Most of the instruments introduced up till now, are voluntary and it will require several years before policy benefits appear. Consistent, efficient, but also persistent landscape-policy programmes are needed. Our analysis and discussion is therefore offered as a contribution to future debates in this vital and dynamic policy field.

ANNEX 1

Efficiency conditions in a competitive market (static conditions)

Efficiency in consumption
Utility maximisation subject to a budget constraint requires that the ratio of marginal utilities is equal to the ratio of prices. That is, for any two goods *X* and *Y*, and for an individual individuals indexed by *A* and *B*:

$$\left(\frac{U_X}{U_Y}\right)^A = \left(\frac{U_X}{U_Y}\right)^B = \left(\frac{P_X}{P_Y}\right)$$

Efficiency in production
Profit maximisation requires that the ratio of marginal products of the productive inputs is equal to the ratio of the input prices. That is, for any firm producing the goods *X* and *Y*, and using the inputs *L* and *K*:

$$\left(\frac{MP_L}{MP_K}\right)^X = \left(\frac{MP_L}{MP_K}\right)^Y = \left(\frac{P_L}{P_K}\right)$$

Production-mix efficiency
Profit maximisation in the production of any good *X* implies that

$$\left(\frac{U_X}{U_Y}\right) = \left(\frac{MP_K^Y}{MP_K^X}\right) = \left(\frac{MP_L^Y}{MP_L^X}\right) \leftrightarrow P_X = MC_X = \left(\frac{P_K}{MP_L}\right)^X = \left(\frac{P_L}{MP_L}\right)^Y$$

ANNEX 2

Box 1

Following questions require careful consideration. While answering these questions, you must take into account that once you are really participating in the agreement, the compensations will be paid out and added to your taxable income. On the contrary, if the amount you state is too low, it will probably not compensate your income loss. So please answer these questions as good as possible.

Box 2

Imagine that you can take part in a farm beautification programme:
a plantation plan, adapted to your farm situation, is proposed
you take care of the plantation
the costs of the planting material will be paid back for 75% (maximum ε 250)
the action is unique, you can only take part once
Would you, under these conditions, take part in the action? yes / no
If no, why not?

Box 3

Suppose that following countryside stewardship measure (for 5 years), on the extensification of field margins is proposed to you:

- *field margins*
  - *width of the margin: ± 4 meter*
  - *no use of fertilisers*
  - *no use of pesticides (except for problematical weeds)*
  - *the crop can be replaced by grass or corn*

Are you interested to participate in this kind of agreement? yes / no
if yes, - what is the minimum amount you want to receive before taking part?
ε……./ha margin/year
- on what percentage of your crop land would you consider this measure?
..... % of the crop land
if no, why not?

ANNEX 3

Factors that influence the selection of complementary policy instruments

- *Productive efficiency* - economic waste is eliminated;
- *Allocative efficiency* - no other resource allocation would lead to significant welfare improvement without loss to others;
- *Low information requirements* - minimal amounts of accurate information are required and the ongoing costs of updating it are minimal;
- *Administrative cost* - the system can be administered and enforced in a cost effective manner and, also, financed from available revenues;
- *Equity* - no group is unfairly disadvantaged or favoured;
- *Dependability* - the system will achieve the desired policy target, even when information about likely responses is uncertain;
- *Adaptability* - the system automatically adapts changing technology, prices and climatic conditions;
- *Dynamic incentive* - the system encourage environmental improvement, and technical innovation;
- *Continuing incentive* - improvement beyond policy target is encouraged;
- *Permanence* - the system is not vulnerable to changes in public opinion; and
- *Political acceptability* - the policy package is consistent with the previous commitments and philosophies of the parties in power and not likely to result in the loss of a subsequent election.

(*Source: Young, 1992)*

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