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The Value of EU Agricultural Landscape

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Acronyms

AHP	Analytical Hierarchy Process
BT	Benefit Transfer
CA	Conjoint Analysis
CAP	Common Agricultural Policy
CE	Choice Experiments
CM	Choice Modelling
CVM	Contingent Valuation Method
DC	Closed-ended Question
GNP	Gross National Product
GDP	Gross Domestic Product
NOAA	National Oceanic and Atmospheric Administration
O/E	Open-ended Question
RP	Revealed Preference
SP	Stated Preference
WTA	Willingness to Accept
WTP	Willingness to Pay

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Executive Summary

This study estimates the value of EU agricultural landscape. Landscape is one of the key public goods produced by agriculture. Farmers, by being involved in the production of traditional commodities, confer benefits on society by maintaining and creating rural landscapes through a combination of activities covering land use decisions, crop composition, and farming practices.

Over the last few decades there has been a great deal of research in scientific literature attempting to value agricultural landscape. As landscape is a non-traded good its financial value cannot be observed and thus is not available from traditional statistical sources. The literature therefore most often applies a *stated preference* (SP) approach by using survey-based methods to uncover societies' *willingness to pay* (WTP) for landscape. The vast majority of studies evaluating agricultural landscape in EU and non-EU regions find that society positively values agricultural landscape. However, an important shortcoming of these studies is that nearly all studies on landscape valuations are concerned with valuing specific landscape in a particular location. There are few studies that aim to aggregate the results for EU Member States or for the EU as a whole.

The study uses available evidence on WTP from scientific literature to estimate the value of EU agricultural landscapes by applying a meta-approach. The meta-approach combines evidence from the literature with the aim of estimating the benefit transfer (BT) function for WTP. The BT methodology is based on the idea of using existing valuation studies, which value the landscape of specific regions, and it transfers valuation information from these regions to build the benefit estimate in other regions for which valuation data are not available. The estimated transfer function is then used to calculate the landscape value for different land types, for MS and for the whole EU. The final database contains 33 studies providing 96 WTP estimates. The database covers studies from 11 European and 3 non-European countries for the period 1982 to 2008.

The estimated per hectare value of EU agricultural landscape varies between 134 €/ha and 201 €/ha with an average value of 149 €/ha in 2009. Grassland and permanent crops report higher mean values (200 €/ha) than arable land (117 €/ha). Furthermore, the calculations indicate that the total value of EU landscape in 2009 is estimated to be in the range of €24.5 –

36.6 billion per year, with an average of €27.1 billion, representing around 8 percent of the total value of EU agricultural production and roughly half of the CAP expenditures.

Introduction

Besides producing traditional commodities (e.g. food and fibre), the agricultural sector also supplies several other goods to society such as landscape, environment, biodiversity, food security. Most of these outputs convey the characteristics of public goods[1] (OECD, 2001; Meister, 2001). They are *non-excludable* and *non-rival* in consumption. In principle consumers cannot be excluded from enjoying the benefits from them, and the addition of further consumers does not necessarily reduce their availability to consumers who already enjoy them. In general, the 'public good' status of the non-market agricultural outputs leads to market failure. The market is often inefficient at delivering an optimal production level, allocation and distribution of agricultural public goods to society (OECD, 2001; Meister, 2001; Cooper Hart and Baldock 2009).

Market failure has motivated many governments to design support programmes which aim to improve the provision of agricultural public goods. Several countries, particularly developed ones, implement policies which support farmers in maintaining rural environment, landscape and other societal benefits. In the EU context, since the 1990s there has been a significant shift in the emphasis of the Common Agricultural Policy (CAP) in this direction. Instead of supporting commodity prices, the policy reforms have been redirected to integrate environmental aspects into the agricultural support programmes. Different measures have been introduced (e.g. cross-compliance, agri-environmental schemes; less favoured area payments, Natura 2000) in order to give incentives to farmers to reduce farming practices which may have a negative impact on nature and landscape conservation. The recent European Commission communication on the future CAP, "The CAP towards 2020", aims to further strengthen and enhance these environmental objectives of the CAP (European Commission 2010).

Landscape is one of the key public goods produced by agriculture. Farmers, by being involved in the production of traditional commodities, confer benefits on society by

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[1] Pure public goods are goods that meet the following two criteria: (i) *Non-excludability*: a good is non-exclusive if it is physically or institutionally impossible, or very costly, to exclude individuals from consuming the good. This implies that no-one can be excluded from consuming the good. (ii) *Non-rivalry*: 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. This implies that it is optimal not to exclude anyone from consumption of this good because there is no additional cost to accept another consumer while the individual/social benefit deriving from the increased consumption stays constant or increases (e.g. Mas-Colell, Whinston and Green 1995).

maintaining and creating rural landscapes through a combination of activities covering land use decisions, crop composition, and farming practices.

Agricultural landscape is a complex good. The European Landscape Convention defines landscape as "an area, as perceived by people, whose character is the result of the action and interaction of natural and/or human factors" (Council of Europe 2000). Agricultural landscape is the visible outcome of the interaction between agriculture, natural resources and the environment, and encompasses amenity, cultural and other societal values. According to the OECD (2000), landscape can be considered as consisting of three key elements (i) *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); (ii) *landscape functions*: such as places to live, work, visit, and provide various environmental services; and (iii) *landscape values*: concerning the costs for farmers of maintaining landscapes and the value society places on agricultural landscape, such as recreational and cultural values. The value of the landscape is determined by different components, such as: *biological diversity* (e.g. genetic species and ecosystem diversity, agrobiodiversity,); *cultural and historical components* (e.g. management of the natural landscape, buildings, traditions, handicrafts, stories and music), *amenity value of the landscape* (aesthetic value,); *recreation and access* (e.g. outdoor recreation, skiing, biking, camping) and *scientific and education interests* (e.g. from archaeology, history and geography to plant and animal ecology, economy and architecture) (Romstad et al, 2000; Vanslembrouck and van Huylenbroeck 2005).

In the last few decades there has been a great deal of research attempting to value (to place a price on) agricultural landscape (e.g. Drake, 1992; Garrod and Willis, 1995; Hanley and Ruffell, 1993; Pruckner, 1995; Campbell, Hutchinson and Scarpa 2005; Johns et al. 2008). As landscape is a non-traded good its monetary value cannot be observed and thus is not available from traditional statistical sources. The literature therefore most often applies a stated preference (SP) approach by using survey-based methods to uncover consumers' willingness to pay (WTP) for landscape. The vast majority of these studies find that society positively values agricultural landscape. However, an important shortcoming of these studies is that nearly all studies on landscape valuations are concerned with valuing specific landscape in a particular location. There are few studies that aim to aggregate the results for EU Member States or for the EU as a whole.

The objective of this study is to estimate the value of EU agricultural landscape. The valuation of EU agricultural landscape is relevant at least for two reasons: (i) it provides information on the societal value generated by the agricultural landscape and (ii) from a policy making perspective, it can identify the proportionality of resources allocated to the conservation of rural nature and landscape relative to the benefits generated by it.

We apply a meta-approach by estimating a benefit transfer function based on existing studies on landscape valuation. More precisely, we review the literature estimating WTP for agricultural landscape. The final database in this paper contains 33 studies providing 96 WTP estimates. The database covers studies from 11 European and 3 non-European countries for the period 1982 to 2008. This paper is one of the first attempts to apply a meta-analysis to a non-market valuation of agricultural landscape particularly in the European context. Several meta-analyses of non-market valuation studies have been conducted in the literature, such as for the recreational value of natural resources (e.g. Kaoru 1990; Shrestha and Loomis 2001; Rosenberger, Loomis and Shrestha 1999), forest ecosystems services (e.g. Barrio and Loureiro 2010); urban open space (Brander and Koetse 2007); cultural goods (Noonan 2003); wetland ecosystem services (Brander, Florax and Vermaat 2006); air quality (Smith and Huang 1995); and for testing methodological approach and valuation theories (Murphy, et al. 2003; Schlapfer 2006; Meyerhoff, and Liebe 2010).

The estimated benefit transfer function is used to calculate the value of EU landscape. We calculate landscape by land type (grassland/permanent crops and arable land), by MS and for the EU as a whole for the period 1991-2009. Our calculations indicate that the value of EU landscape in 2009 is around €27.1 billion, representing around 8 percent of total agricultural output. This figure is comparable with the EU support level, representing roughly half of the €49.2 billion CAP payments allocated to farming sector in 2009.

1. Valuation of agricultural landscape

Economic valuation involves placing a monetary value (price) on the agricultural landscape. According to the neo-classical economics framework, the price of a good reflects the consumer's willingness to pay for the last increment of that good. In this context, the value (price) of landscape is determined by the marginal (monetary) utility of an additional unit that it generates to consumers. Theoretically appropriate measures to calculate the economic value of landscape are *compensating variation* and *equivalent variation* (Bergstrom 1990; Vanslembrouck and van Huylenbroeck 2005).

Following Bergstrom (1990) and Vanslembrouck and van Huylenbroeck (2005), assume that the consumer derives utility $U(M,G)$ from composite goods M and landscape G. Additionally assume that the price of a composite good is one and is held constant but that the quantity of landscape is changed exogenously by one unit implying $U^0(M,G)$ and $U^1(M,G+1)$ which represent utility levels before and after the increase in the quantity of landscape, respectively. The value of landscape G can be measured using indirect money measure for consumers' utility change, i.e. the compensating variation (ΔMC) and equivalent variation (ΔME) of income defined as, respectively:

(1) $U^0(M - \Delta M^C; G+1) = U^0(M; G)$

(2) $U^1(M - \Delta M^E; G+1) = U^1(M; G)$

Rearranging the expressions (1) and (2), the monetary equivalent of the landscape value can be expressed as:

(3) $\Delta M^C = M(U^0, G+1) - M(U^0, G)$

(4) $\Delta M^E = M(U^1, G+1) - M(U^1, G)$

The price of landscape measured in terms of *compensating variation, ΔM^C*, (*equivalent variation*, ΔM^E) is equal to the amount of additional money the consumer would need to give up (to be compensated) in order to reach its utility before (or after) the increase in the quantity of landscape.

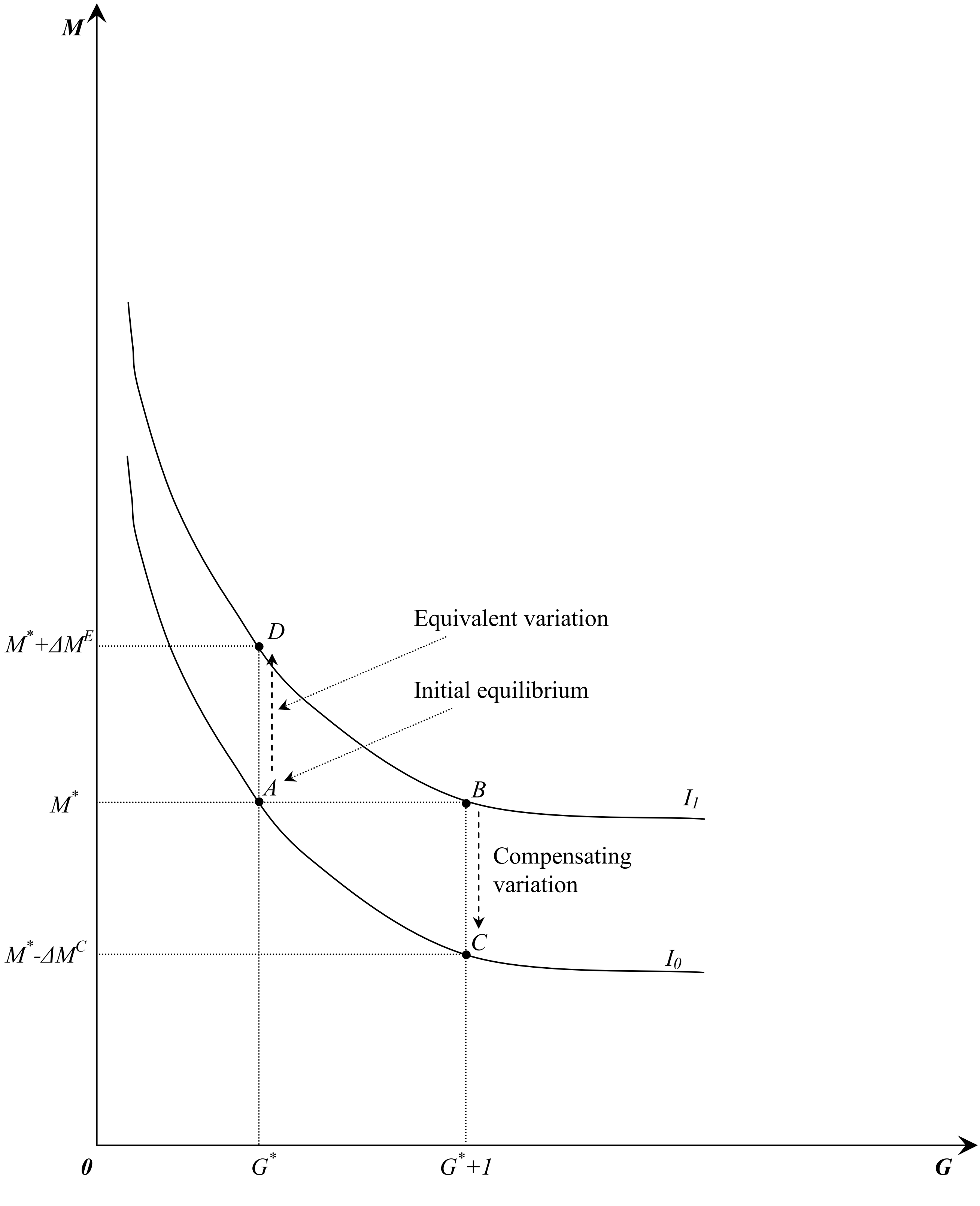
This is illustrated in Figure 1. The vertical axis shows the quantity of composite good M and the horizontal axis shows the quantity of landscape G. The initial bundle of the two goods (M^*, G^*) is given along the indifference curve I_0 at point A. An exogenous increase in the supply of landscape (by one unit) implies higher utility to the consumer, causing an upward shift in the indifference curve to I_1. This shift implies a move from the initial bundle of composite good and landscape at point A to a new bundle at point B. The *compensating variation* of the landscape is equal to the amount of additional money, ΔM^C, the consumer would need to give up in order to return to the initial indifference curve (to move from B to

C), i.e. to move from I_1 to I_0. In other words, ΔM^C represents the consumer's willingness to pay (WTP) for the increase in landscape from G^* to G^*+1 (i.e. to secure a new level of public good G^*+1 while keeping the consumer at original utility U^0).

The *equivalent variation* of landscape is equal to the amount of additional money, ΔM^E, the consumer would need to be compensated in order to reach the indifference curve I_1 (to move from A point D), i.e. to move from I_0 to I_1. In order words, ΔM^E represents the consumer's willingness to accept (WTA) compensation to forego the increase in landscape from G^* to G^*+1 (i.e. to reach a new level of utility U^1 while remaining at the original level of public good G^*).[2]

[2] Note that *compensating variation* and *equivalent variation* will be equal if landscape and the composite good are perfect substitutes. If they are imperfect substitutes their values will differ and the divergence will expand with the degree of substitution decrease or with income elasticity. Shogren (1994) showed that if the imperfect substitutability or positive income elasticity of public goods hold, the WTA will exceed the WTP.

Figure 1. Value of public good



2. Estimation methodologies

The absence of a market for landscape implies that there is no immediately observable price. The objective for economic valuation in this context is to provide the relevant *willingness to pay* (WTP)[3] for landscape. Two general techniques are applied: *revealed preference* (RP) and *stated preference* (SP). The *revealed preference* approach relies on measuring actual behaviour of individuals with respect to the valued good by observing expenditure incurred on landscape related activities. This approach can be used to uncover only the use value[4] of the good because the revealed expenditure behaviour in general represents the individuals' costs of using (consuming) a particular good. The most prominent examples of this approach include the hedonic price approach and travel cost methods (e.g. Zander et al., 2005; Smith and Kaoru 1990).

A more appropriate approach for valuing landscape is the SP technique. The underlying principle of the SP is based on creating a hypothetical market situation for landscape. More precisely, individuals are asked to disclose their WTP for landscape (usually using a survey technique) in that hypothetical market situation. The advantage of SP is that it can uncover both *use* and *non-use values* of landscape. Non-use values tend to be important in certain contexts, including for agricultural landscape. SP techniques are therefore capable of being more comprehensive than revealed preference techniques (Swanwick, Hanley and Termansen 2007).

There are two types of SP techniques applied in the empirical literature: Contingent Valuation Method (CVM) and Choice Experiments (CE). The CVM seems to be most widely used for

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[3] Throughout this paper, all the arguments made for WTP are also valid for willingness to accept compensation (WTA).

[4] According to the Secretariat of the Convention on Biological Diversity the total economic value of agricultural landscape can consist of *use value* (direct, indirect and option value[4]) and *non-use value* (SCBD 2001, 2007). *Direct use value* is the value derived from direct use or interaction with landscape (e.g. recreation, scenery). This is linked to activities, such as leisure, tourism, residence or other activities associated with a landscape, which result in direct benefits for the individuals undertaking these activities. *Indirect use value* relates to the indirect benefit streaming from the landscape. For example, an attractive agricultural landscape may attract tourists to the region thus generating indirect benefits for the owners of the tourist resort located in the landscape's vicinity. *Option value* is a type of use value in that it relates to future use of the landscape (option value is also sometimes classified as a non-use value). Option value arises because individuals may value the option to be able to use the landscape some time in the future. *Non-use value* is derived from the ongoing existence of landscape (existence value), or from conservation for future generations (bequest value). Non-use value does not result in a direct or indirect benefit to consumers of landscapes but may be motivated by, for example, religious, spiritual, ethical or other intrinsic reasons.

estimating demand for agricultural public goods (e.g. Drake, 1992; Garrod and Willis, 1995; Hanley and Ruffell, 1993; Pruckner, 1995; Willis and Garrod, 1992 and 1994; Zander et al., 2005; Bergstrom et al., 1985; Dillman and Bergstrom, 1991; Kline and Wichelns, 1996; Hoehn and Loomis, 1993; Mitchell and Carson, 1989). However, more recent valuation studies tend to use the CE (e.g. Hanley et al. 1998; Campbell, Hutchinson and Scarpa 2005; Johns et al. 2008; O'Leary et al. 2004; Moran et al. 2007; Arriaza et al. 2008). The key difference between the two SP approaches is that the CVM values a particular public good and tends to provide information on preferences for the whole good rather than for a specific aspect/feature of it. On the contrary the CE breaks down the public good into attributes and evaluates preferences over attributes[5] (Garrod and Willis 1999; Swanwick, Hanley and Termansen 2007).

In this paper we consider only studies which use the SP technique for landscape valuation due to the abovementioned reasons. Another reason for using only the SP-based studies is that theoretically they provide an appropriate Hicksian measure for valuing landscape as compared to, for example, the hedonic and travel cost approaches which provide a less exact Marshallian measure for landscape valuation (Smith and Pattanayak 2002).[6]

2.1 Findings form empirical literature

The landscape valuation studies are summarised in Table 1. In general, studies find that individuals' WTP is positive, implying that the landscape generates benefits for society. However, the WTP varies strongly depending on landscape type, methodology, type of survey, type of respondents surveyed, etc.

Drake (1992) used the CV method to assess values ascribed to Swedish agricultural landscape by asking respondents their WTP, via income tax, for preventing half of all agricultural land from being abandoned and cultivated with spruce forest. Based on a sample size of 1089 respondents from all over Sweden, a mean WTP of SEK 468 (68 ECU) per person per year was estimated. They found that average WTP varied by region but that the variation was not significant. Regions dominated by agriculture showed higher levels of WTP for landscape.

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[5] Note that the sum of attributes' values could exceed or could be smaller than the value of the whole good.

[6] The difference between the Hicksian and Marshallian welfare measures is that the former is constructed by keeping constant a given utility level whereas the latter keeps constant a given income level. Both valuation measures are equal if the income effect is inexistent or very small.

Stronger variation was found for landscape types. Respondents showed greater WTP for grazing land, by 91%, and for wooded pasture, by 141%, relative to land cultivated with grains.

Alvarez-Farizo et al. (1999) find that the WTP for environmental improvement of landscape declined with decreasing familiarity with the site in two regions in Scotland: bids were highest for residents or visitors, and lowest for those who had no prior information about the study site. Significant non-use values were found, in that those neither living in nor visiting the sites had positive WTP amounts which were significantly different from zero at the 95% confidence level. Moreover, residents had a higher WTP than non-residents, although the difference was not statistically significant.

Garrod and Willis (1995) also estimate the use and non-use WTP to maintain the current ESA landscape in England. The estimated WTP of the general public who have not visited an ESA region and who likely derive non-use value from landscape[7] was £21 per household and year. On the other hand, respondents who visited the ESA regions and who may have both use and non-use value from landscape (i.e. respondents) show higher WTP, between £30 and £45.

Marangon and Visintin (2007) value landscape in a wine-producing area located in the Italian/Slovenian border region. They found that there was a considerable difference in the way Italians and Slovenes valued the rural landscape. While Italians considered the development and extension of vineyards to be very important in counteracting the abandonment of rural areas, Slovenian respondents preferred a more diverse landscape (composed of crops and plantations dominated by small farms which create a landscape with a high biodiversity) to a vineyard dominated one. This difference in preferences for landscape could be due to the political and historical past of the countries. The past regimes of the former Yugoslavia imposed policies oriented towards the intensification and industrialisation of agriculture, leading to the destruction of historical and cultural landscapes, which may have reduced the supply of these landscape features to society.

Arriaza *et al*. (2008) value several attributes of multifunctional mountain olive growing in Andalusia in Spain (i.e. landscape and biodiversity, prevention of soil erosion, food safety and farm abandonment). They find that women value the multifunctionality of these agricultural

[7] Actually these respondents may have option use value (e.g. from potential future visit) from landscape.

systems more highly than men. Likewise, young people, large families, people living in large cities and/or brought up in rural areas are more in favour of the provision of these public goods. Conversely, income level was not statistically significant in determining landscape value.

Willis and Garrod (1992) value agricultural landscape in the Dales National Park in the UK. In their survey they ask respondents (visitors and residents) to rank their most preferred landscapes from eight alternatives. Their results reveal that the overwhelming preference of both visitors and residents was for today's landscape (for 50% of respondents). The conserved landscape, which is very similar to today's landscape, was also a popular first choice (for 30% of respondents). The other landscape types (i.e. semi-intensive and intensive agricultural landscapes, abandoned agricultural landscape, sporting landscape, wild landscape and planned agricultural landscape) were rarely ranked as the most preferred.

Loureiro and López (2000) investigated the preferences of tourists for the local cultural landscape in the Ribeira Sacra region of Galicia (Spain). 173 tourists were interviewed and asked to choose between two alternative types of cultural landscape, with a number of attributes such as: preservation of traditional customs, food products, and rural settlements; protection of the local environment; protection of the traditional agro-forestry landscape; and preservation of the historical-cultural heritage. The WTP for each attribute (€ per day) was estimated as follows: History: 22.39, Tradition: 7.45, Environment: 32.47 and Agri-forestry landscape: 24.44. The study concludes that visitors value the attributes they experience (for example the wildlife, the landscape and historical sites) more highly than local traditional products (for example local wines and foods).

Non-European studies reveal similar patterns of landscape valuation by society as the European studies (e.g. Bergstrom, Dillman and Stoll 1985; Bowker and Didychuk 1994; Walsh 1997; Kashian and Skidmore 2002; Ozdemir 2003). Changa and Ying (2005) value rice fields for their water preservation and landscape protection functions in Taiwan. Their results show that an average household in Taiwan is willing to pay $1777.92 NT (about US $50.80) to maintain paddy rice fields which is equivalent to 3.57 times the market value of rice production in Taiwan.

Moon and Griffith (2010) measure the willingness to pay to compensate farmers for the supply of various public goods associated with US agriculture. The estimated mean WTP was

$515 per person annually.[8] The aggregation of individual WTP across U.S. taxpayers above 20 years old amounts to $105 billion of the agricultural public goods value in 2007, which is about one-third of the value of total farm production ($300 billion). Furthermore, Moon and Griffith (2010) find that respondents not favourable to government involvement in agricultural markets are less predisposed to pay for agricultural public goods. In contrast, respondents who support the idea of farmland conservation programs are more willing to pay taxes to ensure that the agricultural sector continues supplying the public goods.

[8] Note that this estimated WTP is for multiple agricultural public goods (for multifunctional agriculture) where landscape is one component of it. Further note that the estimated WTP represents willingness to pay for continuing to support agricultural public goods that offset the negative environmental effects of farming.

Table 1: Summary table of landscape valuation studies

Author	Method	Sample / year of survey	Type of landscape: value	Unit	Region	Survey type
Drake (1992)	CVM (O/E)	Two surveys: 1089 members of the general public from all Sweden; 152 members of the general public from Uppsala county/ 1986	WTP for the preservation of Swedish agricultural landscape relative to 50% of agricultural land being covered with spruce forest: - all Sweden survey: 468.5 SEK (68 ECU) for all landscape types - Uppsala survey: 729.4 SEK for all landscape types - Uppsala survey: grain production: 100 index; grazing land 191 index; wooded pasture 241 index	SEK per person per year	Sweden	Face to face
Borresch *et al.* (2009)	CE (DE)	420 from residents /2007	Shift from intensive arable cultivation (status quo) to: - grassland dominated landscape: 48.48 - to "multifunctional" landscape: 87.68 - to high price scenario (with higher rate of cereals area): -16.43 - to intensive scenario (with larger fields): -13.17	€ per household and year	Wetterau region, Hesse (Germany)	Face to face
Marangon and Visintin (2007)	CVM (DE)	Italy: 360 residents, Slovenia: 236 residents and non-residents / 2006	Shift from status quo vineyard landscape to - abandonment of production and loss of traditional landscapes (Italy): 72 (Collio), 113 (Colli Orientali del Friuli) 375 (whole region). - parcel consolidation and loss of traditional landscapes (Slovenia), residents: 239, non-residents: 38	€ per household and year	Italy: Collio and Colli Orientali del Friuli; Slovenia: Brda	Face to face
Marangon, Troiano and Visintin (2008)	CVM (DE)	Italy: 200 residents, Slovenia: 200 residents / 2006	Shift from traditional olive landscape to abandonment of production and loss of traditional landscapes: 25.59 for combined border region.	€ per household and year	Italy: Collio and Colli Orientali del Friuli; Slovenia: Brda	Face to face
Bateman and Langford (1997)	CVM (O/E)	310 general public, residents and visitors/ 1991	WTP for preservation of multifunctional wetland (low lying) area (mostly an ESA) against saline flooding: -visitors: 25.65-27.86 - non-visitors: 12.29 - all respondents: 23.29	£ per household and year	Norfolk Broads (UK)	Mail
Cicia and Scarpa (2000)	CVM (DE)	344 tourists /1997	Shift from current landscape to landscape characterised by abandonment of agricultural production: 60-80	€ per hectare of cultivated land and per year	Cilento National Park (Italy)	Face to face
Miskolci (2008)	CVM (O/E)	408 members of the general public from the region /n.a.	WTP for formation and maintenance of rural landscape: (9.71*12)=116.52	CZK per person and year	South-East NUTS II Region (Czech R.)	Likely face to face
Kubickova (2004)	CVM (O/E)	1114 members of the general public, 207 residents and 120 visitors/ 2003	Shift from current landscape to landscape characterised by abandonment of agricultural production: - General public: 268.17 - Residents: 245.83 - Visitors: 235.18 - All sample: 262.21	CZK per person and year	White Carpathians Area (Czech R.)	Face to face
Krumalova (2002)	CVM (O/E)	1000 members of the general	Marginal value of WTP for landscape enhancement: 142	CZK per person	Czech R.	Likely not face

		public / n.a.		and year		to face
Pruckner (1994)	CVM (O/E)	4600 tourists/ 1991	WTP for landscape-cultivating activities: 9.20	Austrian shilling (ATS) per person per day	Austria	Face to face
Campbell, Hutchinson and Scarpa (2005)	CE (DE)	402 members of the general public / 2003-2004	WTP for two actions (A Lot Of Action (L-A) and Some Action (S_A)) relative to the status-quo situation (No Action) aimed at improving the landscape attribute for: - Mountain land, L-A: 92.63; S_A: 45.18 - Landscape with cultural heritage, L-A: 62.76; S_A: 41.93 - Landscape with Stonewalls, L-A: 84.01; S_A: 54.69	€ per adult person per year	Ireland	Likely face to face
Campbell, Hutchinson and Scarpa (2006)	CE (DE)	600 members of the general public / 2003-4	WTP for two actions (A Lot Of Action (L-A) and Some Action (S_A)) relative to the status-quo situation (No Action) aimed at improving the landscape attribute for: - Pastures, L-A: 89.58; S_A: 80.37 - Landscape with hedgerows, L-A: 53.38; S_A: 19.86 - Landscape with wildlife habitats, L-A: 91.82; S_A: 51.63	€ per adult person per year	Ireland	Likely face to face
Bullock and Kay (1997)	CVM (DE)	1350 members of the general public from Southern and Central Scotland; 150 visitors /1994	WTP for landscape characterised by extensified grazing relative to the status-quo of intensive grazing for - General public: 83 - Visitors: 69	£ per household and year	Central Southern Uplands (Scotland, UK)	Postal, face to face and self competition
Alvarez-Farizo et al. (1999)	CVM (O/E)/	Breadalbane: 302, Machair: 358 members of the general public, residents, and visitors /1994-1996	WTP for preservation of traditional agriculture with ESA which will generate environmental improvements of landscape relative to current situation: - Breadalbane (average): 25.21 - Breadalbane (postal): 23.50 - Breadalbane (face to face): 19.80 - Machair (coastal plain on five islands) (postal and face to face): 13.44 - Both regions combined: 36.00	£ per household and year	Breadalbane, in Highland Perthshire, and Machair in the Western Isles (Scotland)	Face to face and postal
Johns et al. (2008)	CE (DE)	Between 300 and 345 members of the general public/ 2005	WTP for marginal change in landscape attributes relative to the current situation: -North West: 7.68 -Yorkshire and the Humber: 18.64 -West Midlands: 7.44 -East Midlands: 41.81 -South West: 20.59 -South East: 19.85	£ per household and year	Seven severally disadvantaged areas from England (UK)	Face to face
Hanley *et al.* (1998)	CVM and CE (DE)	CVM: 235-325 members of the UK general public; residents, and visitors; CE: 256 residents and visitors /1994-1996	WTP to maintain ESA scheme which will generate environmental improvements of landscape relative to 'no ESA' situation: - CVM, general public (mail): 47, general public (face to face): 60, visitors: 98. - CE (face to face): 107.55 (quadratic model), 182.84 (linear model).	£ per household and year	Breadalbane, in Highland Perthshire (Scotland)	Face to face and mail
O'Leary *et al.*	CE (DE)/	600 members of the general	WTP for two actions (A Lot Of Action (L-A) and Some Action (S_A))	€ per person per	Ireland	Face to face

(2004)	Nine study	public/2003	relative to the status-quo situation (No Action) aimed at conservation or enhancement of landscape attribute for: - Mountain land, L-A: 61; S_A: 39 - Landscape with cultural heritage, L-A: 70; S_A: 39 - Landscape with stonewalls, L-A: 52; S_A: 21 - Pasture landscape: L-A: 43; S_A: 30 - Landscape with wildlife habitats/biodiversity, L-A: 77; S_A: 23 - Landscape with hedgerows, L-A: 37; S_A: 0	year		
Yrjölä and Kola (2004)	CVM (O/E)	1375 members of the general public/ 2002	WTP for multifunctional agriculture including landscape: 93.81	€ per person per year	Finland	Computer interviewing system
Bonnieux and Le Goff (1997)	CVM (DE)	400 residents/1995	WTP for restoration of landscape, biodiversity and ecological functions relative to the current situation: 199-303	French Franks (FF) per household and year	Cotentin in Lower-Normandy (France)	Face to face
Willis and Garrod (1992)	CVM (O/E)	300 residents and 300 visitors/ 1990	WTP to preserve today's landscape relative to the abandoned landscape (abandoned agricultural production): - residents: 24.05 - visitors: 24.56	£ per household and year	Yorkshire Dales National Park (UK)	Face to face
Garrod and Willis (1995)	CVM (O/E and SE)	1845 members of the general public/ 1993; 279 +250 residents and visitors from South Downs/ 1992	WTP to maintain the current ESA landscape (i.e. ESA relative to no ESA scheme): Open-ended question: - residents: All English ESA landscape: 67.46; South Downs ESA landscape: 27.52 - visitors: All English ESA landscape: 94.29; South Downs ESA landscape: 19.47 - general public: 36.35 (All English ESA) Closed -ended question: - general public: 138.37 (All English ESA)	£ per household and year	South Downs, England (UK)	Face to face
McVittie *et al*. (2005)	CVM (DE)	190 members of the general public and residents/ 2004;	WTP to maintain multifunctional upland agriculture including landscape: 46.985 (general public and residents)	£ per household and year	England (UK)	Postal
Moran et al. (2007)	CE (DE)/	673 members of the general public/ 2003	WTP to enhance landscape appearance relative to current landscape: 27.49 WTP to enhance public access to landscape relative to current situation: 29.43	£ per person and year	Scotland (UK)	Face to face
Haile and Slangen (2009)	CVM (DE)	180 residents/ 2005	WTP for management of nature, landscape, monumental farm buildings and the creation of access to farmer's lands through AES: 64.50	€ per household per year	Winterswijk (Netherland)	Postal
Vanslembrouck and van Huylenbroeck (2005)	CVM (O/E)	108 visitors/ 2000	WTP for maintenance of agricultural landscape (maintenance of hedgerows, pillard-willows, farm beautification, etc.): 24.34	€ per household per year	Oost-Vlaanderen province (Belgium)	Completed on a voluntary basis
Tempesta and Thiene (2004)	CVM (O/E)	253 visitors/ 2003	WTP for conservation of mountain meadows: 3.25	€ per person per year	Cortina D'Ampezzo (Italy)	Face to face

Hasund, Kataria and Lagerkvist (2011)	CE (DE)	Arable land survey:1163, Grassland survey: 1474; members of the general public/2008	Marginal WTP for landscape feature relative to reference landscape feature: - linear and point field elements of arable land: (-11) -240 - permanent meadows and pastures: 89-224	Marginal WTP SEK per person per year	Sweden	Mail
Bowker and Didychuk (1994)	CVM (O/E)	93 visitors/ n.a.	WTP for preservation of agricultural land against development: between 49.07 and 86.20	US $ per household per year	Moncton, New Brunswick, (Canada)	Face to face
Chang and Ying (2005)	CVM (DE)	906 members of the general public/ 2001	WTP to maintain paddy rice fields for their water preservation and landscape protection functions: 1777.92 NT $ (about 50.80 US $)	NT/US $ per household per year	Taiwan	Computer assisted telephone interview
Moon and Griffith (2010)	CVM (DE)	1070 members of the general public/ 2008	WTP to support multifunctional agriculture through subsidies relative to no subsidy situation: 515	WTP US $ per person per year	US	Online survey
Rosenberger and Walsh (1997)	CVM (DE)	171 members of the general public/1993-94	WTP to protect ranch land open space: - Steamboat Springs valley: 72-121 - Other valleys in Routt County: 36-116 - Routt County: 107-256	WTP US $ per household per year	Routt County (US)	Postal
Bergstrom, Dillman and Stoll (1985)	CVM (O/E)	250 members of the general public/1981-82	WTP for agricultural landscape protection against urban/industrial development: 5.70-8.94	WTP US $ per household per year	Greenville County, South Carolina (US)	Postal
Kashian and Skidmore (2002)	CVM (O/E)	630 Muskego property owners /1998	WTP for agricultural landscape preservation against urban development: 64	WTP US $ per household per year	Muskego, Waukesha County (US)	Postal
Ozdemir (2003)	CA (DE)	173 residents/ 2002	WTP for Conservation Easement Programs aimed at protecting agricultural land from development: 123-207	WTP US $ per household per year	Maine (US)	Postal
Beasley, Workman and Williams (1986)	CVM (DE)	119 residents/ 1983	WTP for protecting agricultural land against: - moderate levels of housing development: 76 - housing dominated landscape: 144	WTP US $ per household per year	Palmer and Wasilla, South-Central Alaska (US)	Face to face

Notes: Contingent Valuation Method (CVM); Choice Experiments (CE) Choice Modelling (CM); analytical hierarchy process (AHP); Conjoint Analysis (CA)

Closed-ended question (DC); open-ended question (O/E).

3. Methodology

We apply the Benefit Transfer (BT) approach to estimate the value of EU landscape. The BT methodology is based on the idea of using existing valuation studies and it transfers valuation information from these studies to build the benefit estimate for other study areas, i.e. to study areas within other MS in our case. Its main advantage is that it can be used to value landscape for cases when there is no opportunity to conduct a primary study due to time or resource constraints. According to Lima e Santos (2001, p. 32) there are several ways to carry out benefit transfers such as: (1) transfer of an unadjusted WTP value, i.e. use of a WTP estimate exactly as it is in the original study; (2) transfer of an adjusted value, e.g. using a GNP ratio between the original study and the new study; or (3) transfer of a WTP function, estimated from original studies and applied for a new region using the same functional form but using the specific values of independent variables from the new region.

3.1 Application of the Benefit Transfer

In this paper we apply the third approach by using a meta-approach to estimate the benefit transfer function. Through the meta-approach we combine the results of several studies which estimate WTP for agricultural landscape. The main aim is to estimate the benefit transfer function for WTP from these existing valuation studies. We regress the mean WTP collected from the available studies over a number of independent variables. The estimated transfer function allows us to obtain the valuation of landscape specific to EU regions and landscape type. The estimated transfer function is then used to calculate the value of landscape for the whole EU.

The meta-analysis as a benefit transfer tool provides several advantages over a simple point estimate, or average value transfer. First, it utilizes information from a greater number of studies providing more rigorous measures of landscape value. Second, methodological and other differences between studies can be controlled when econometrically estimating the transfer function by including variables describing study characteristics in the regression. Third, by varying the independent variables at the levels specific to the evaluated region/landscape, the values obtained are region/landscape specific.

While meta-analysis is a conceptually sound approach to BT, the quality of the original studies and of the reported results in the original studies is a critical factor in determining the quality of the meta-analysis. For example, Schlapfer, Roschewitz and Hanley (2007) compare the difference in WTP for landscape protection in Switzerland calculated from a contingent valuation survey and the WTP obtained from actual referendum voting behaviour. Their results indicate that hypothetical WTP magnitudes obtained from the contingent valuation survey may overestimate the actual WTP expressed through the actual referendum voting choices. This could be due to the hypothetical bias embodied in the CVM approach where respondents' WTP expression of preferences over a hypothetical situation with no budgetary implications potentially leads to biased answers and strategic responses (e.g. to a more socially acceptable response such as a positive response to a valuation question - yea-saying behaviour - although they may not be willing to pay the amount that is asked). This may indicate that our results will overestimate the value of landscape if the original studies indeed suffer from a similar bias. The ability of a meta-model to capture value differentiation between different regions, income groups, and/or other relevant variables depends not only on the quality of the original studies, but also on the availability of studies. One main limitation of the meta-analysis is the lack of an adequate number of studies for certain regions and landscape types. The availability of more studies may result in more robust results, leading to a more accurate estimation of the benefit transfer function. In our sample of European landscape valuation studies, the UK and Irish regions tend to be overrepresented whereas Western, Central and Eastern European continental regions tend to be underrepresented[9].

Several meta-analyses of non-market valuation studies have been conducted in the literature (e.g. Kaoru 1990; Smith and Huang 1995; Loomis and Shrestha 1999; Shrestha and Loomis 2001; Brander, Florax and Vermaat 2006; Rosenberger, Brander and Koetse 2007; Barrio and Loureiro 2010). In a pioneer paper, Smith and Kaoru (1990) reviewed the literature of travel cost recreation studies carried out between 1970 and 1986 in the USA. Lima e Santos (2001) tested the performance of various transfer benefits approaches (e.g. unadjusted value, adjusted value, multiple-study averages, meta-model) for agricultural landscape and showed that meta-analysis performed rather well in predicting original estimates. Similarly, Shrestha and Loomis (2001) test the meta-analysis for international benefit transfer of the valuation of the outdoor recreational resources. They estimated the benefit transfer function from the US data and apply the estimated function to test the prediction accuracy of recreation activity values in other countries. The average percentage error of the meta-predictions was 28%.

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[9] For example, for Eastern European countries only studies from the Czech Republic and Slovenia are

The key data used in this paper come from 33 existing studies on landscape valuation (Table 1). We consider only studies which use a stated preference approach in estimating the WTP for landscape per annual basis. After cleaning for outliers, the final data set contains 96 (74 European and 22 non-European) WTP observations[10]. Multiple observations are extracted from several studies because they report alternative results due to the use of split survey samples targeting different respondents, landscape types and/or testing different survey designs. The database covers studies from 1982 to 2008. The WTP values from all studies were adjusted for inflation from their original study year (not publication year) values to the 2009 price level and where necessary they were converted to Euro.

3.2 Model Specification

The dependent variable in our meta-regression equation is a vector of WTP values. Following other studies performing meta-regression (e.g. Brander, Florax and Vermaat 2006; Barrio and Loureiro 2010; Meyerhoff and Liebe 2010), the explanatory variables are grouped into three different categories including the study's characteristics, X_s, the landscape characteristics, X_l, and the site and socio-economic characteristics, X_s. The estimation model corresponds with the following equation:

$$WTP_i = \beta_0 + \beta_s X_{si} + \beta_l X_{li} + \beta_e X_{ei} + \varepsilon_i$$

where, β_0, β_s, β_l and β_e are regression coefficients, ε_i is an independently and identically distributed (i.i.d.) error term and subscript *i* stands for study index.

The description of variables is provided in Table 2. The dummy variable *household* controls whether the WTP is measured per person (=0) or per household (=1) (Barrio and Loureiro 2010). We reviewed only studies which report WTP values per person/year or per

available.

[10] By way of comparison Brander and Koetse (2007) use 73 observations from 20 studies for valuating urban open space; Murphy, et al. (2003) use 83 observations from 28 studies for testing hypothetical bias in contingent valuation studies; Schlapfer (2006) uses 83 observations from 64 studies for a meta-analysis of estimating the income effect of environment-related public goods; Smith and Huang (1995) use 86 observations from 50 studies for meta-analysis of air quality valuation; Barrio and Loureiro (2010) use 101 observations from 35 studies for meta-analysis of forest ecosystems services; Noonan (2003) use uses 129 observations from 65 studies for a meta-analysis of valuation of cultural goods; Meyerhoff, and Liebe (2010) use 254 observations from 157 studies for analyzing the determinants of protest responses in environmental valuation studies; Shrestha and Loomis (2001) use 682 observations from 131 studies and Rosenberger, Loomis and Shrestha (1999) use 741 observations from 163 studies for meta-analysis of recreational value of natural resources.

household/year. Studies reporting WTP in other units (e.g. per visit/day) were excluded because insufficient data were available to convert the original values into per person or household values. The variable *sample* represents the number of respondents included in the survey.

Table 2: Variable description

Variable	Description
wtp	Dependent variable. WTP value in Euro (in 2009 price level)
wtp_usd	Dependent variable. PPP-adjusted WTP value (US$ and in 2009 price level)
Study characteristics	
household	= 1 if the WTP unit is per household; 0 otherwise, if the unit is per person
year_survey	Year of survey
sample	Number of respondents
scenario_large_change	= 1 if the valued landscape quantity/quality change is large (e.g. a lot of action, production abandonment); 0 otherwise for small change in landscape quantity/quality (e.g. some action, parcel consolidation; preservation of landscape in general, intensification/ extensification)
general_public	= 1 if WTP is for general public (average consumer); 0 otherwise (i.e. resident, visitor)
ce	= 1 if choice experiment is used in sample; 0 otherwise
closed_ended	= 1 if dichotomous question format is used in sample; 0 otherwise
facetoface	= 1 if surveys are conducted face to face; 0 otherwise
weight_region	Number of studies valuing landscape in a given region
Landscape characteristics	
protected_area	= 1 if the study area (or main part of it) belongs to protected region (e.g. LFA, ESA, national park, Nature 2000, denominations of origin); 0 otherwise.
small_area	= 1 if the study values small/specific area/region; 0 otherwise (i.e. if the valued area is large, e.g. NUTS region, big geographical region, country)
multifunctionality	= 1 if the landscape value is embedded in the valuation of multifunctionality (i.e. the study values multifunctionality and landscape is one component of it); 0 otherwise
feature_mountain	= 1 if the study values mountainous (highland) landscape; 0 otherwise
feature_lowland	= 1 if the study values low land landscape; 0 otherwise
feature_grassland_permanent	= 1 if the study values (predominantly) grasslands and/or permanent crops; 0 otherwise
feature_specific	= 1 if the study values landscape specific feature such as cultural heritage, wildlife habitats/biodiversity/flora and fauna, hedgerows or stonewalls; 0 otherwise
Site and socio-economic characteristics	
gdp_capita_r	Gross domestic product per capita of the year of the survey in € (in 2009 price level)
gdp_capita_usd	Gross domestic product per capita of the year of the survey in US$ (in 2009 price level)
uaa_person	Utilised agricultural are (UAA) per person
region_noneurope	= 1 if the study is conducted non-European region; 0 otherwise

According to the neo-classical economics framework, the price of a good reflects the willingness to pay for the additional quantity/quality of the good, i.e. for small changes in landscape in our case. We have attempted to measure the magnitude of the landscape change valued in the studies included in this paper by introducing a dummy variable *scenario_large_change*. The variable takes value 1 if the valued landscape quantity/quality change is large. The variable is defined as a change affecting all key aspects of agricultural landscape. A change in landscape has been considered large in cases when the study valued a scenario where for example a lot of action was envisaged on landscape improvement/change or when a production abandonment scenario was assumed. A change in landscape was considered small (i.e. *scenario_large_change* = 0) when the study valued a scenario with some action undertaken on landscape improvement/change, parcel consolidation, preservation of landscape, or intensification/extensification of farm activities.

With the dummy variable *general_public* we control for the type of respondents surveyed because the use and the non-use value of landscape may differ between the respondents. For example, visitors and residents may derive higher use value from the landscape and hence their WTP may exceed the value of an average consumer (i.e. *general_public*=1) who should have a lower use value from landscape because it includes both users (e.g. visitors) and non-users (e.g. non-visitors) of landscape (Garrod and Willis 1995).

Similarly to other meta-studies, we introduce variables *ce* and *closed_ended* to take into account the methodological variation between studies (Schlapfer 2006; Meyerhoff, and Liebe 2010). The dummy variable *closed_ended* takes value 1 if a closed-ended question format for valuation questions was used, and zero otherwise, i.e. if an open-ended question format was used. Kealy and Turner (1993) examined the differences between open- and closed-ended question formats for valuation questions and found that these two ways of asking the valuation question lead to significantly different WTP for public goods (Kealy, Turner 1993, p. 327). The closed-ended WTP values were found to be always higher than the open-ended answers, irrespective of the specification of WTP functions (see also Bateman et al. 1995). We also differentiate between the Choice Experiments technique (*ce*=1) and other type of elicitation techniques (e.g. CVM).

The dummy variable *facetoface* takes value 1 if surveys are conducted via face-to-face interviews and zero otherwise. According to the guidelines of the National Oceanic and Atmospheric Administration (NOAA) on the use of CVM in natural resource damage assessments, face-to-face interviewing is likely to yield the most reliable results (Arrow et al., 1993). Other covariates describing study characteristics include a year of survey variable (*year_survey*) and a variable counting the number of studies valuing landscape in a given region (*weight_region*).

We include several dummy variables on landscape characteristics in the regression in an attempt to more accurately reflect the heterogeneity in the landscape types valued in the studies.

An important methodological problem when estimating the benefit transfer function is related to the additivity problem of individuals' utility functions. For a utility function to be additive the goods should be mutually utility independent (i.e. the attribute/good *i* is utility independent of the attribute/good *j* if preferences over *i* do not depend on the levels of *j*) (Fishburn, 1982; Keeney and Raiffa, 1993). In other words, the sum of partial utilities for each attribute of landscape is equal to the total utility of the complex good.[11] This can also be extended for the whole consumption basket of individuals: i.e. the sum of partial utilities for all goods included in the basket is equal to the total utility of the basket. However, the value of landscape usually depends not only on its own quantity but also on the quantity of other agricultural public goods (e.g. food security) as well as on private goods (e.g. car). In general, the willingness to pay for landscape decreases with its provision thus valuation varies considerably with total quantity supplied. Additionally, market prices and quantities of other goods cause substitution or complementarity effects.[12] Most landscape valuation studies do not take into account substitution and complementarity relationships (Lima e Santos 2001). The quantities and underlying economic situation of evaluation case studies vary strongly by study. These variations (level of landscape, substitution and complementarity) cause problems for the benefit transfer and for the aggregation of landscape valuations over regions. For example, if a valuation of landscape is estimated in region 1, where there are other agricultural public goods also available, then the transfer of this estimate for valuating the landscape (of the same quantity) in region 2, where there is zero supply of other agricultural public goods, will lead to an undervaluation (overvaluation) of region 2's landscape if landscape and other public goods are substitutes (complements). Most valuation methods are prone to this bias, usually leading to overstatement of the value of landscape (Lima e Santos 2001). Hoehn and Randall (1989), who used a single-household general-equilibrium model, have showed that substitution and complementarity do not cancel out in the presence of a

[11] Some recent studies support the idea that the additive form can be regarded as a reliable proxy of real utility functions for the valuation of environmental goods (Adamowicz et al., 1998; Hanley et al., 1998; Colombo et al., 2006; Jin et al., 2006 or Mogas et al., 2006).

[12] Two public goods *A* and *B* are substitutes (complements) when the marginal value of *A* is reduced (increased) by an increase (decrease) in the level of *B*.

large number of public goods. As the number of outputs becomes large, the valuation of public goods leads to overvaluation, i.e. the substitution effect tends to prevail in large number cases. Additionally, several evaluation studies which jointly value several multiple public goods suggest that substitutes are more frequent than complements (Lima e Santos 2001).

One way of addressing the additivity problem is by using a valuation approach which jointly valuates landscape as whole, thus automatically taking into account substitution/complementarity effects. We attempt to control this problem by distinguishing whether the study values landscape as whole or a specific landscape features individually (*feature_specific*).[13] Additionally, we include the variable *multifunctionality* to account for the cases when landscape was incorporated into a valuation of a basket of multiple agricultural public goods. The aim was to take into account the possible existence of substitution/complementarity effects of landscape with other agricultural public goods (Table 2). However, it must be noted that in the framework of the present study we are not able to completely address the additivity problem related to the substitution/complementarity effects between landscape and private goods (i.e. for the whole consumption basket) . Therefore the results of this paper should be interpreted in light of this shortcoming.

In order to measure the heterogeneity of the landscape valued in the studies, we include several landscape specific variables in the regression. We consider landscape features such as mountainous land (*feature_mountain*), lowland (*feature_lowland*), grassland and permanent crops (*feature_grassland_permanent*), protected area (*protected_area*) and the size of area valued (*small_area*). The variable *protected_area* reflects the possibility of a higher value derived from landscape located in special areas such as in national parks, Nature 2000, LFA, or in other protected regions (Table 2).

Finally, the site and socio-economic variables include the income level as measured by the gross domestic product per capita at the time of the survey (*gdp_capita*) and the geographical location of the valued landscape (*region_noneurope*). Another relevant variable is the utilised agricultural area (UAA) per person which may proxy for the landscape abundance (*uaa_person*).

[13] Note that the variable *feature_specific* might be correlated with dummy variable *ce* which takes value 1 if choice experiment is used by the study and zero otherwise (i.e. for CVM).

The data sources for WTP values, variables on study characteristics and landscape characteristics are the existing valuation studies reported in Table 1. Inflation and exchange rates used to convert the WTP to the 2009 price level and to Euro, respectively, are extracted from the Eurostat and the OECD. The data on GDP per capita are extracted from Eurostat and supplemented with data from the UN National Accounts Main Aggregates Database. Data on utilised agricultural area per person are calculated based on the data collected from Eurostat, the FAO and the UN National Accounts Main Aggregates Database. Note that variables *gdp_capita* and *uaa_person* do not represent the actual values of respondents of the study surveys because in most cases they are not reported. Instead we use average values corresponding to the country in which the study was conducted.

The descriptive statistics of model variables are reported in Table 3. The average WTP for the whole sample and the European sample are 90 and 78 €/year, respectively. The simple average indicates that the difference between the WTP/household and the WTP/person is not significant. The average WTP/household is 96 €/year whereas the average WTP/person is 81 €/year. Studies estimating WTP/household are 60 percent of the total, whereas the rest of the studies estimate WTP/person (40 percent). The average sample size is 391 respondents. For the descriptive statistics of the rest of the variables included in the regression see Table 3.

Table 3: Summary statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
wtp (household & person)	96	90.27	78.35	5.02	362.79
wtp europe (household & person)	74	77.54	66.05	5.02	336.19
wtp household	58	96.18	76.08	10.53	299.87
wtp person	38	81.25	81.89	5.02	362.79
Study characteristics					
household	96	0.60	0.49	0	1
year_survey	96	1998	7.31	1982	2008
sample	96	391	282	62	1375
scenario_large_change	96	0.42	0.50	0	1
general_public	96	0.63	0.49	0	1
ce	96	0.38	0.49	0	1
closed_ended	96	0.64	0.48	0	1
facetoface	96	0.68	0.47	0	1
Landscape characteristics					
protected_area	96	0.50	0.50	0	1
small_area	96	0.39	0.49	0	1
multifunctionality	96	0.14	0.34	0	1
feature_mountain	96	0.35	0.48	0	1
feature_lowland	96	0.08	0.28	0	1
feature_grass_permanent	96	0.53	0.50	0	1
feature_specific	96	0.26	0.44	0	1
Site and socio-economic characteristics					
gdp_capita	96	29366	8958	8189	46027
uaa_person	96	0.80	0.64	0.04	2.36
UK and Ireland	96	0.54	0.50	0	1
Rest of Europe	96	0.23	0.42	0	1
Non-Europe	96	0.23	0.42	0	1

4. Empirical Results

We estimate an ordinary least squares (OLS) regression model with the Huber-White adjusted standard errors clustered by each study. A similar approach has been used in several meta-regressions (e.g. Brander, Florax and Vermaat 2006; Lindhjem, 2007; Barrio and Loureiro 2010; Meyerhoff and Liebe 2010). This approach allows corrections for correlation of errors within the observations of each study (Barrio and Loureiro 2010). The presence of multicollinearity was tested and judged not to be a serious problem in our dataset.[14] However,

[14] The correlation coefficients are significantly smaller than the 0.8 or 0.9 suggested by Gujarati (2003) and Kennedy (2003) to be indicative of the presence of multicollinearity if the coefficients exceed these values.

we estimate several regression models to account for potential multicollinearity among some of the variables.

The meta-regression results are reported in Table 4. Consistent with other similar studies, we estimate a semi-log model: the dependent variable and continuous independent variables (*gdp_capita_r*, *uaa_person*, *sample*) are log-transformed (e.g. Brander, Florax and Vermaat 2006; Meyerhoff and Liebe 2010; Barrio and Loureiro 2010). We estimate two sets of models; for the full sample (models 1-7) and for the European sub-sample (models 8-14). The full sample includes both European and non-European studies, whereas the European sub-sample includes only studies valuating European landscape.

Overall the estimated coefficients are fairly consistent in terms of sign and magnitude across all models except for some coefficients which are statistically not significant (e.g. *feature_mountain, feature_lowland, log_uaa_person, region_noneurope*). Roughly over half of the variables are statistically significant in determining the WTP value and the models explain approximately 50 to 60 percent of the WTP variation. For the most part, the signs of the variables in the model presented in Table 4 are consistent with the theoretical expectations and past research results as discussed above.

Table 4: Meta-regression results (dependent variable: log_wtp)

	Full sample							European sub-sample						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
household	0.228	0.258	0.261	0.229	0.0960	0.288	0.224	0.521	0.539	0.402	0.567	0.523	0.652	0.520
log_sample	-0.0980	-0.0881	-0.0873	-0.0979	-0.0763	-0.0808	-0.0975	-0.0901	-0.0841	-0.0763	-0.0975	-0.0491	-0.0535	-0.0961
scenario_large_change	0.344**	0.336**	0.354**	0.344**	0.0714	0.339**	0.367**	0.471***	0.468***	0.472***	0.472***	0.361**	0.465***	0.484***
general_public	0.387*	0.407*	0.367	0.387*	0.314	0.392*	0.400*	0.547*	0.560*	0.514*	0.540*	0.413	0.577**	0.574**
closed_ended	0.922***	0.896***	0.928***	0.923***		0.947***	0.946***	0.742***	0.727***	0.690***	0.741***		0.778***	0.770***
facetoface	0.806***	0.815***	0.773***	0.806***	0.857***	0.818***	0.846***	0.806***	0.811***	0.752***	0.789***	0.819***	0.856***	0.853***
ce	-1.891***	-1.859***	-1.883***	-1.891***	-1.480***	-1.886***	-1.852***	-1.696***	-1.675***	-1.700***	-1.693***	- 1.310***	-1.688***	-1.669***
weight_region		-0.180							-0.0984					
small_area	-0.431*	-0.433	-0.387*	-0.431*	-0.368	-0.413	-0.417	-0.326	-0.325	-0.332	-0.339	-0.229	-0.246	-0.295
multifunctionality	0.625*	0.638*	0.657**	0.626*	0.608	0.614*	0.627*	0.371	0.388	0.404	0.356	0.357	0.351	0.395
feature_mountain	0.0241	0.0428		0.0240	0.338	0.0591	-0.110	-0.214	-0.203		-0.220	-0.0411	-0.187	-0.325
feature_lowland	0.190	0.194		0.190	0.480	0.190	0.0783	-0.0792	-0.0790		-0.0858	-0.0681	-0.128	-0.175
feature_grass_permane nt	0.517***	0.529***	0.507***	0.517***	0.741***	0.484**	0.545**	0.370**	0.380***	0.395**	0.358***	0.451**	0.292	0.393**
feature_specific							-0.314							-0.241
protected_area						-0.194							-0.334**	
log_gdp_capita_r	1.553***	1.590***	1.570***	1.552***	2.141***	1.461***	1.584***	1.215**	1.236**	1.355**	1.179**	1.633***	1.051*	1.247**
log_uaa_person				0.00163							0.0487			
region_noneurope	0.137	0.131	0.0550	0.134	0.548*	0.0145	0.0411	0	0	0	0	0	0	0
Constant	-12.38**	-12.79**	-12.58**	-12.36**	-18.24***	-11.47**	-12.65**	-9.046	-9.290	-10.51*	-8.579	-13.28**	-7.507	-9.340
Observations	96	96	96	96	96	96	96	74	74	74	74	74	74	74
R-squared	0.582	0.583	0.581	0.582	0.488	0.587	0.590	0.537	0.537	0.531	0.537	0.469	0.556	0.543

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Although the variable *household* is not statistically significant, the results imply that when the WTP is measured per household its value tends to be higher than if measured per person. This also holds for the variable *scenario_large_change* indicating that a larger change in the quantity/quality of the valued landscape leads to higher WTP. The corresponding coefficient is significant for both the full sample and the European sub-sample. As expected, the *closed_ended* question format leads to a statistically significant higher valuation of landscape. Also, studies implementing face-to-face interviews generate higher WTP, whereas studies applying a choice experiment elicitation approach (*ce*) lead to lower values of WTP. Because studies using a choice experiment approach tend to use a closed-ended question format, we have excluded the variable *closed_ended* in model 5 (full sample) and model 12 (European sub-sample) to test the robustness of the results. The variable *general_public* has an unexpected positive and statistically significant sign for most estimated models. This could be due to the fact that direct users (such as residents and visitors) may be better able to divide benefits between those from the landscape they directly gain from and those from other landscapes. Thus they may elicit their true WTP for the specific landscape covered by the studies. On the other hand, the general public may find it problematic to disentangle benefits from a specific landscape from their valuation of all country landscapes and thus may instead overstate the WTP by providing overall WTP for the whole country landscape not only for the one covered by the studies.[15] This behaviour may generate higher WTP for the general public than for the direct users. However, there may be other reasons which may explain the unexpected sign of the variable *general_public* such as the identification problem of the use and non-use value in the considered studies.

From the set of variables describing landscape characteristics only *feature_grass_permanent* and *multifunctionality* are statistically significant. The former variable is significant for both samples, the latter only for the full sample. This indicates that landscape covered with grass and permanent crops is valued more highly than the average landscape or other type of

[15] In a similar line of argument, Bergstrom, Dillman and Stoll (1985) find that the informational structure of the contingent market affects valuation of landscape by US respondents. Respondents who did not receive information on the specific benefits of landscape protection against urban and industrial development have a WTP which is higher by approximately $5.29 than those who did receive this benefit information. Their results indicate that without benefit information, respondents are unable to separate amenity value from other benefits such as food supply, local economic benefits, and/or economic development.

landscapes.[16] Studies which value landscape jointly with other agricultural public goods also find higher WTP, i.e. the coefficient associated with the variable *multifunctionality* is positive. Furthermore, studies which value landscape in small and/or specific regions/areas (*small_area*) imply lower WTP compared to studies valuing the landscape of large regions/areas. However, its coefficient is statistically not significant for majority models. This variable may be correlated with the variable *feature_mountain* because often small and/or specific study regions tend to be located in mountain areas (e.g. Willis and Garrod 1992; Alvarez-Farizo et al. 1999; Tempesta and Thiene 2004; Marangon and Visintin 2007). In models 3 and 10 we test the robustness of the results in this respect by excluding variables *feature_mountain* and *feature_lowland* from the regression.

The coefficient of the GDP per capita variable (*log_gdp_capita*) is positive and highly significant – suggesting an elastic effect of income on the value of landscape. The variable proxying for the abundance of landscape (*log_uaa_person*) and the regional variable *region_noneurope* are not statistically significant.

In Table 5 we report results for the PPP-adjusted WTP[17] to control for differences in price level across countries. The results are fairly consistent in terms of sign, magnitude and significance with the results reported in Table 4, except for the GDP per capita. The magnitude of the coefficient corresponding to *log_gdp_capita_usd* is lower due to the fact that PPP tends to be correlated with income level and thus takes away some of the WTP variation.

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[16] Note that the baseline landscape for *feature_grass_permanent* is the average of landscape and arable land. Due to insufficient observations we are not able to identify the difference in the WTP for arable land.

[17] The values for purchasing power parity (PPP) are extracted from the IMF database.

Table 5: Meta-regression results for PPP-adjusted WTP (dependent variable: log_wtp_usd)

	Full sample							European sub-sample						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
household	0.140	0.176	0.149	0.124	-0.00343	0.195	0.136	0.443	0.460	0.302	0.514	0.416	0.579	0.443
log_sample	-0.104	-0.0918	-0.0972	-0.105	-0.0914	-0.0878	-0.104	-0.0997	-0.0937	-0.0898	-0.110	-0.0600	-0.0645	-0.106
scenario_large_change	0.354**	0.345**	0.361**	0.354**	0.0680	0.345**	0.376**	0.469***	0.466***	0.470***	0.469***	0.363*	0.459***	0.482***
general_public	0.354	0.377	0.339	0.353	0.270	0.359	0.365	0.510*	0.522*	0.471*	0.503*	0.339	0.546**	0.532*
closed_ended	1.007***	0.976***	1.007***	1.002***		1.024***	1.031***	0.798***	0.783***	0.749***	0.796***		0.830***	0.824***
facetoface	0.759***	0.771***	0.736***	0.764***	0.803**	0.772***	0.795***	0.774***	0.779***	0.723***	0.749***	0.782***	0.821***	0.813***
ce	-1.831***	-1.793***	-1.827***	-1.830***	-1.307***	-1.829***	-1.794***	-1.642***	-1.621***	-1.654***	-1.635***	-1.225**	-1.630***	-1.616***
weight_region		-0.225							-0.0997					
small_area	-0.446*	-0.449*	-0.418*	-0.442*	-0.413	-0.425	-0.435*	-0.342	-0.343	-0.373	-0.357	-0.272	-0.258	-0.319
multifunctionality	0.641*	0.658*	0.665*	0.638*	0.609	0.631*	0.643*	0.368	0.386	0.392	0.347	0.347	0.351	0.388
feature_mountain	-0.00353	0.0184		-0.00186	0.283	0.0355	-0.127	-0.224	-0.212		-0.232	-0.0466	-0.197	-0.322
feature_lowland	0.113	0.115		0.113	0.381	0.122	0.00983	-0.117	-0.118		-0.124	-0.126	-0.155	-0.200
feature_grass_permanent	0.505***	0.519***	0.500***	0.506***	0.726***	0.479**	0.528**	0.365**	0.374**	0.387**	0.349**	0.432**	0.298	0.383**
feature_specific							-0.283							-0.207
log_gdp_capita_usd	0.917**	0.965**	0.942**	0.934*	1.402***	0.847**	0.939**	0.610	0.632	0.744	0.559	1.035*	0.457	0.627
log_uaa_person				-0.0152							0.0693			
protected_area						-0.177							-0.313*	
region_noneurope	0.229	0.221	0.188	0.258	0.673*	0.121	0.141	0	0	0	0	0	0	0
Constant	-5.826	-6.369	-6.106	-6.015	-10.64**	-5.139	-6.023	-2.728	-2.986	-4.126	-2.064	-7.044	-1.285	-2.872
Observations	96	96	96	96	96	96	96	74	74	74	74	74	74	74
R-squared	0.568	0.569	0.567	0.568	0.445	0.572	0.574	0.525	0.525	0.519	0.526	0.442	0.543	0.530

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

5. Valuation of EU landscape

In this section we calculate the value of EU landscape based on the estimated benefit transfer function in the previous section. We use the 14 benefit functions as estimated in Table 4. We consider all 14 models to test for the sensitivity of the results with respect to the estimated parameters. We calculate the landscape value by land type and by EU Member State (MS) and then we sum over all land types and over all MS to obtain the value for the whole EU.

The independent variables included in the benefit transfer function are set to the values reported in Table 6. The independent variable *household* is set to zero because we attempt to obtain the WTP per person from the benefit transfer functions. The values of variables *gdp_capita* and *uaa_person* vary by MS. Following the guidelines of NOAA, we set the value of the dummy variable *closed_ended* to zero so that the WTP reflects the value of the open-ended question format.

Table 6: The values of independent variables on the benefit transfer function

	Value	Note
household	0	per person
log_sample	5.7	average sample size
scenario_large_change	0	small scenario
general_public	1	general public
closed_ended	0	open question format
facetoface	1	face to face interview
protected_area	0	not protected area
ce	0	not ce methodology
small_area	0	large area
multifunctionality	0	no multifunctionality
feature_mountain	0	average landscape
feature_lowland	0	average landscape
feature_grass_permanent	varies by land type	
feature_specific	0	not specific feature of landscape
log_gdp_capita	varies by MS	
log_uaa_person	varies by MS	
weight_region	0.37	average value
region_noneurope	0	Europe
Constant	1	

The objective of the paper is to estimate both the use and non-use value of agricultural landscape. For this reason we consider the WTP of the general public (we set the variable *general_public* to 1) which is composed of residents/non-residents and visitors/non-visitors and so likely captures both values. We treat all beneficiaries in a given region equally by assuming that all have the same WTP. For an accurate measure of WTP one would need to control for the distribution of population types because the use and non-use values vary strongly between different types of consumers. The WTP depends on whether consumers are residents or non-residents and whether they are visitors or non-visitors with respect to the valuated agricultural landscape. One proxy to control for these effects is to take into account the distance of consumers from the landscape. The WTP may decrease with the distance (distance-decay effect) as residents located in the proximity of agricultural landscape may find both use and non-use value, whereas non-residents may derive mainly non-use value from the landscape.[18] We do not have sufficient evidence to control for these effects, which may bias our result. However, the bias should be low if the original studies used for the estimation of the transfer function are based on a well designed representative survey which may result in an accurate general public valuation of agricultural landscape.

We set variables *feature_mountain* and *feature_lowland* to zero as we cannot distinguish between mountain and low land in our dataset (Table 6). We consider two land types: grassland/permanent crops and arable land. As a result, the value of the land type dummy variable *feature_grassland_permanent* varies depending on the type of land valued. For grassland/permanent crops we set *feature_grass_permanent* equal to one, whereas for arable land we set *feature_grass_permanent* to zero. Note that due to insufficient observations on the WTP for arable land landscape, we were not able to identify the difference in WTP in comparison with an average landscape. For this reason, we set the WTP of arable land equal to the WTP of an average landscape (i.e. we set the variable *feature_grass_permanent* = 0). This may lead to a slight overestimation of landscape value derived from arable land because the WTP of an average landscape may be composed of both grassland and arable land. For the values of the rest of the variables used in BT see Table 6.

[18] For example, Bateman and Langford (1997) find that the WTP for preservation of low-lying wetland area (which is mostly an ESA) against saline flooding in the Norfolk Broads (UK) declined from a mean value of £39/household/year at a distance of 20 km, to £13.90 at a distance of 110-150 km away from the Broads area.

From the transfer benefit function we obtain an estimate of WTP per person/year which varies by land type (grassland/permanent crops and arable land), and MS (because of the variation in the GDP per capita, UAA per person and the land use structure). To obtain the WTP per hectare/year, we multiply the estimated WTP per person/year by the population density (persons between 15 and 74 years old per hectare of agricultural land).[19] Then the landscape value for MS is obtained by multiplying WTP/ha by the total number of hectares distinguished by land type. The EU landscape value is the sum over 27 MS WTP estimates.

Using the estimated benefit transfer functions from Table 4, we obtain 14 WTP values. Table 7 and Table 8 report the minimum, maximum and mean WTP values by MS, weighted average value for the whole EU and for three years (1991, 2000 and 2009). Table 7 shows the WTP per hectare for grassland and permanent crops and arable land. Table 8 presents the WTP per hectare for UAA (i.e. the average for all land) and the total WTP value in million Euro. The WTP per hectare values vary strongly between MS. As explained above, the variation is determined by land use structure, population density and GDP per capita. Consistent with the estimated BT function, the WTP for grassland and permanent crops show higher value than the arable land WTP (Table 7). The WTP for UAA is in between these two values as it is a weighted average of the WTP of grassland and permanent crops and the WTP of arable land (Table 8).

As reported in Table 7 and Table 8, the estimated mean WTP per hectare for the EU in 2009 is 200, 117 and 149 €/ha for grassland/permanent crops, arable land and UAA, respectively. Their minimum and maximum values vary between 13 percent below and 52 percent above the mean value, respectively. The WTP values are positively correlated with GDP per capita. The highest WTP for agricultural landscape is observed in richer old MS, whereas poorer Eastern new MS show much lower WTP levels for the period 1991-2009. MS with a high population density (such as Belgium, Luxembourg, the Netherlands and Malta) report a significantly higher WTP per hectare than other more land abundant countries.

According to the results reported in Table 8, the total average value of EU agricultural landscape represents €19.8 and €27.1 billion in 1991 and 2009, respectively, which accounts for approximately 6 and 8 percent of the total value of EU agricultural production. Our

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[19] Land use data were extracted from Eurostat and FAO, the GDP per capita from Eurostat and the UN National Accounts Main Aggregates Database, and population data from Eurostat. Consistent with other studies, we take into account only population in the age group 15 to 74 years old.

sensitivity analysis shows that the total WTP is in the range of €17.8 – 25.1 billion and €24.5 – 36.6 billion in 1991 and 2009, respectively. The year-to-year variation in the total WTP value is mainly due to the year-to-year change in the GDP per capita and land use. The country level total WTP is determined mainly by the size of the country in terms of the total agricultural area. Countries endowed with agricultural land report higher landscape value than less land endowed countries.

In general, our estimates are comparable with values available from other studies. For example, according to Drake (1992) the total value of landscape in Sweden in 1986 was €0.485 billion which is comparable to our mean estimate of €0.677 billion in 1991. Yrjölä and Kola (2004) estimate the value of agricultural public goods in Finland at €0.354 billion in 2002 which is a more conservative value than our estimate for landscape only (€0.334 billion in 2002). The calculations of McVittie et al. (2005) indicate that the total value of public goods in upland agriculture in the UK in 2004 amounts to between 0.906 and 1.568 billion Pounds (between €1.336 and €2.310 billion). This however is not directly comparable to our estimate (€5.1 billion in 2004) because first we valuate only landscape in the UK and second we cover the entire agricultural area. Krumalova (2002) a estimates slightly higher value of landscape in the Czech Republic for 2001: between 3.9 and 4.9 billion CZK (between €0.114 and €0.144 billion) compared to our estimate of €111 billion for the same year. Moon and Griffith (2010) estimate the net WTP for agricultural public goods (total value of public goods minus negative environmental effects) in the US at $105 billion (€77 billion) in 2007 representing around one-third of the value of total agricultural production. This US figure is not directly comparable to our estimated value for the EU but both numbers are comparable in terms of the magnitude.[20]

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[20] Note that our WTP estimates are reported at the 2009 price level, whereas the values reported from the literature are in current prices. Further note that where necessary we have converted the original values from local currency to Euro at the current exchange rate.

Table 7: The estimated value per hectare WTP for grassland and permanent crops and arable land (€/ha/year in 2009 prices)

	Grassland and permanent crops									Arable land								
	1991			2000			2009			1991			2000			2009		
	Min	Mean	Max	Min	Mean	Max	Min	Mean	Max	Min	Mean	Max	Min	Mean	Max	Min	Mean	Max
Belgium	427	497	706	546	677	1097	620	786	1322	275	312	378	380	422	523	434	489	630
Bulgaria	0.1	1	3	1	3	8	5	11	20	0.04	1	2	0.4	2	6	2	7	15
Czech R.	3	9	19	18	30	49	74	87	114	1	6	14	9	20	36	39	56	85
Denmark	163	194	328	219	281	541	236	306	600	109	121	156	153	174	258	165	189	286
Germany	326	386	590	385	471	772	377	456	734	215	241	281	265	293	368	256	285	350
Estonia	2	6	12	6	11	20	23	30	42	1	4	9	3	7	15	11	19	31
Ireland	25	28	33	77	91	158	106	129	234	15	18	25	51	57	75	73	80	111
Greece	40	48	65	60	69	85	148	164	210	20	31	48	34	44	64	89	104	133
Spain	46	52	62	70	78	93	116	130	177	28	33	46	42	49	66	71	82	101
France	122	139	203	152	175	276	141	164	265	77	87	103	98	109	131	92	102	126
Italy	212	241	351	240	273	398	287	331	482	134	151	180	151	171	204	184	207	247
Cyprus	82	97	130	173	195	228	343	382	497	41	62	97	104	124	170	209	241	308
Latvia	2	5	10	4	9	17	12	19	29	1	3	7	2	6	13	6	12	22
Lithuania	1	4	8	2	6	11	11	18	28	1	3	6	1	4	8	5	11	21
Luxembourg	317	407	761	582	892	2238	884	1510	4317	222	252	363	407	543	1066	623	910	2057
Hungary	3	8	16	9	17	29	22	31	46	1	5	12	4	11	22	11	20	34
Malta	320	441	663	913	1059	1398	1094	1259	1619	152	284	495	472	676	1044	587	802	1209
Netherlands	453	528	750	648	824	1394	764	1003	1795	292	331	402	453	512	664	534	622	855
Austria	155	177	268	200	239	399	238	291	502	99	111	129	134	149	190	164	181	239
Poland	2	6	13	10	20	34	24	36	56	1	4	10	5	13	25	11	23	42
Portugal	40	50	70	79	91	113	94	108	131	19	32	52	44	58	84	54	68	97
Romania	0	2	6	1	4	9	6	13	24	0	1	4	0	2	6	3	9	18
Slovenia	20	31	49	96	112	147	168	190	222	9	20	36	50	72	110	101	120	166
Slovakia	2	6	13	7	16	30	59	70	95	1	4	10	3	11	22	28	45	71
Finland	158	185	302	193	229	379	201	243	413	104	116	144	129	143	181	137	151	197
Sweden	248	312	569	285	362	668	249	301	504	173	193	271	199	225	318	170	187	240
UK	180	200	267	321	399	688	243	279	407	109	126	158	225	248	328	155	175	208
EU	114	128	180	160	188	296	173	200	304	68	77	93	94	106	127	104	117	137

Table 8: The estimated total WTP and per hectare WTP for UAA (in 2009 prices)

	UAA (WTP in €/ha/year)									Total WTP (million €)								
	1991			2000			2009			1991			2000			2009		
	Min	Mean	Max	Min	Mean	Max	Min	Mean	Max	Min	Mean	Max	Min	Mean	Max	Min	Mean	Max
Belgium	353	391	496	444	518	740	506	603	896	486	538	682	620	723	1,033	690	823	1,224
Bulgaria	0.1	1	2	0.5	3	7	3	8	17	0.3	4	13	3	15	37	16	42	83
Czech R.	2	7	16	11	22	40	50	64	93	8	29	67	48	96	170	178	228	329
Denmark	115	126	170	158	181	277	171	199	313	320	352	474	419	480	735	452	525	827
Germany	260	288	382	305	348	493	297	335	462	4,459	4,937	6,543	5,203	5,941	8,407	5,010	5,657	7,802
Estonia	1	4	9	3	8	16	15	23	35	2	6	13	3	8	16	14	21	33
Ireland	23	26	32	71	83	138	98	116	202	102	118	142	316	369	614	410	486	846
Greece	32	40	57	48	57	75	111	126	150	165	208	297	276	324	424	423	480	572
Spain	37	43	54	55	63	76	93	104	128	1,107	1,284	1,614	1,401	1,602	1,936	2,121	2,372	2,907
France	98	108	141	121	135	187	110	122	170	2,969	3,291	4,279	3,606	3,999	5,555	3,867	4,285	5,977
Italy	172	190	247	198	218	285	238	263	344	3,014	3,336	4,333	3,087	3,412	4,460	3,178	3,512	4,586
Cyprus	57	74	109	131	151	192	253	286	341	8	10	15	19	22	28	31	35	41
Latvia	1	4	8	3	7	15	8	15	24	3	10	21	4	11	23	15	27	44
Lithuania	1	3	7	1	4	9	7	13	22	3	10	23	4	14	30	18	35	60
Luxembourg	275	339	586	493	716	1647	764	1226	3249	35	43	74	66	96	222	100	160	425
Hungary	2	6	13	5	12	23	13	22	37	12	40	85	30	72	136	77	130	213
Malta	165	296	508	567	747	1109	731	904	1301	2	4	7	6	7	11	8	9	13
Netherlands	391	439	573	547	663	1016	639	796	1284	771	865	1,129	1,077	1,304	2,001	1,228	1,529	2,468
Austria	134	150	210	175	202	313	207	243	388	467	522	731	592	683	1,059	657	771	1,231
Poland	1	4	11	6	14	27	14	26	45	19	83	199	110	261	497	222	412	707
Portugal	27	39	60	65	76	100	83	96	121	113	162	246	254	297	390	306	353	445
Romania	0	2	5	1	3	7	4	10	20	4	25	70	9	43	107	58	141	271
Slovenia	17	28	45	83	98	134	143	164	201	14	24	39	43	51	69	67	77	94
Slovakia	1	5	11	5	13	25	38	52	78	3	11	27	12	31	60	73	101	151
Finland	104	116	145	130	144	183	138	153	200	265	295	368	287	318	405	318	350	460
Sweden	186	213	322	210	242	362	185	204	278	624	716	1,080	625	719	1,077	566	625	853
UK	154	171	213	285	343	555	217	241	331	2,599	2,895	3,598	4,417	5,307	8,582	3,483	3,873	5,303
EU	88	98	124	124	138	194	134	149	201	17,764	19,816	25,055	23,596	26,205	36,749	24,487	27,060	36,597

6. Conclusions

The present paper provides a meta-analysis of agricultural landscape valuation studies. Specifically, information from more than thirty European and non-European studies on landscape valuation has been gathered, and through the estimated benefit transfer function the paper attempts to calculate the value of EU landscape for the period 1991-2009. Overall, the meta-regression results imply that the main drivers of landscape values to society are income level and landscape type. Also, methodological differences between studies significantly determine the landscape valuation elicited by respondents.

The estimated meta-regression allowed us to use valuation information of agricultural landscape from the existent studies to build the benefit estimate for EU landscape. According to our estimates, the WTP in the EU varies between 134 and 201 €/ha with an average value of 149 €/ha in 2009. Furthermore our calculations indicate that the total value of EU landscape in 2009 is estimated to be in the range of €24.5 – 36.6 billion per year, with an average of €27.1 billion, representing around 8 percent of the total value of EU agricultural production. The relevance of the order of magnitude can be expressed by comparing this figure with the actual level of agricultural subsidies. The total value of CAP payments in 2009 was around €49.2 billion (European Commission 2011) amounting to €270 per hectare. The value of agricultural landscape as estimated in this paper is lower than the present CAP support level. However, agriculture produces multiple public goods which we do not take into account in our paper. We value only one agricultural public good, i.e. the agricultural landscape. Accounting for the complete set of agricultural public goods, the overall non-market benefit of agricultural landscape might be larger. Additionally, one needs to account for negative externalities of agricultural activities to provide a complete valuation analysis of non-market benefits and costs generated by the agricultural sector.

The results reported in this paper must be interpreted in light of the limitations which WTP data extracted from existing valuation studies impose on the meta-analyses. Although we have attempted to control for various aspects of the heterogeneity in methodologies used in the valuation studies, we may not have been able to fully address all shortcomings which ultimately affect our valuation of EU landscape. Particularly important shortcomings, besides those discussed in the paper, relate to the representativeness of the regional coverage of the valued landscape, local specificity of valued landscape, differences in elicitation methodology and differences in valuation scenario. Some EU regions are not well represented in the literature whereas others are better represented. New MS and some Western and Central European regions tend to be underrepresented whereas studies from UK and Ireland are more abundant. Many studies value a specific landscape in a given location and/or socio-economic context limiting its extrapolation to other regions. Differences in the methodological approach between studies may pose problems of the comparability of results between studies. The difference in the valuated scenario (e.g. marginal value of landscape versus the value of a large change in the quantity/quality of landscape) is an additional factor which may create a problem for comparability of landscape valuations between studies. These issues are beyond the possibility of the present paper but would need to be tackled to provide an improved estimation of the value of EU agricultural landscape generated to society. Addressing these shortcomings is a promising area for future research.

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Abstract
The present paper provides a meta-analysis of agricultural landscape valuation studies and, through the estimated benefit transfer function, projects the value of EU landscape. The analyses are based on information from more than thirty European and non-European studies which use a stated preference approach to uncover society's willingness to pay (WTP) for agricultural landscape. Our calculations show that, the WTP in the EU varies between 134 and 201 €/ha with an average value of 149 €/ha in 2009. Furthermore the calculations indicate that the total value of EU landscape in 2009 is estimated to be in the range of €24.5 – 36.6 billion per year, with an average of €27.1 billion, representing around 8 percent of the total value of EU agricultural production and roughly half of the CAP expenditures.

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