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Public preferences for rural policy reform: Evidence from Scottish surveys

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Abstract

Agricultural reform across the European Union has focussed debate on how agriculture delivers wider rural objectives. We undertake economic valuation and multicriteria studies to explore public preferences for rural policy. The results suggest simultaneous preferences for both environmental and social benefits, notably locally grown food, water quality, wildlife habitats and maintaining rural communities. The public assigned greatest weight to locally grown food, which is closely linked to them as a direct-use and is also routinely transacted for. The multicriteria study yielded a different preference ordering potentially arising from the differing elicitation methods indicating a possible drawback of the approach employed.

Key words: Rural policy, Public preferences, Scotland.

Alistair McVittie ,Dominic Moran and David Elston

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Les choix publics en faveur de la réforme de la politique rurale: des preuves provenant des enquêtes menées en Ecosse.

McVittie et al.

A travers l’Union européenne, le débat sur la réforme agricole a porté sur la façon dont le secteur agricole peut réaliser des objectifs ruraux de plus grande envergure. A partir des évaluations économiques et des études à plusieurs variables, cet article cherche à examiner les choix publics en faveur de la politique rurale. Les résultats laissent supposer des préférences simultanées pour des avantages écologiques et sociaux, notamment pour les produits alimentaires du pays, la qualité de l’eau, l’habitat de la faune et de la flore, et le maintien des communautés rurales. Le grand public a accordé une plus grande importance aux produits alimentaires du pays qui se rapportent étroitement à lui pour des raisons de consommation immédiate et au fait qu’ils

sont de première nécessité. L'étude à plusieurs variables a laissé voir un classement différent qui pourrait s'expliquer par les diverses méthodes d'obtenir les réponses, ce qui pourrait indiquer un inconvénient de la façon employée.

Politique rurale / Choix publics / Ecosse

Öffentliche Präferenzen bei der Reform der Politik für ländliche Gebiete: Belege aus Erhebungen in Schottland

Alistair McVittie, Dominic Moran and David Elston

Abstract

In der Agrarreform der Europäischen Union hat sich die Debatte darauf konzentriert, wie die Landwirtschaft zur Verwirklichung von breiteren Zielen für ländliche Gebiete beitragen kann. Mit Hilfe von einer ökonomischen Bewertung und Multikriterien-Studien untersuchen wir die öffentlichen Präferenzen in der Politik für ländliche Gebiete. Aus den Ergebnissen geht hervor, dass gleichzeitig ein Nutzen für die Umwelt und für die Gesellschaft gewünscht wird, insbesondere was die Faktoren der vor Ort erzeugten Lebensmittel, der Wasserqualität, der Biotope und des Erhalts ländlicher Gemeinschaften anbelangt. Den größten Stellenwert räumte die Öffentlichkeit vor Ort angebauten Lebensmitteln ein, was für sie eng mit einer direkten Nutzung verknüpft ist und sich auch routinemäßig in Transaktionen niederschlägt. Aus der Multikriterien-Studie ging eine unterschiedliche Reihenfolge der Präferenzen hervor, was eventuell durch eine abweichende Erhebungsmethode verursacht wurde und auf eine mögliche Schwäche des verwendeten Ansatzes hinweisen könnte.

Key words:
Politik für ländliche Gebiete, Öffentliche Präferenzen, Schottland

Preferencias del público por la reforma de la política rural: el ejemplo de estudios escoceses

Alistair McVittie, Dominic Moran and David Elston

Abstract

La reforma agrícola de la Unión Europea ha centrado el debate sobre cómo puede la agricultura cumplir objetivos rurales más amplios. Con ayuda de una valoración económica y estudios de varios criterios, analizamos las preferencias del público con respecto a la política rural. Los resultados

indican preferencias simultáneas tanto para los beneficios medioambientales como sociales, especialmente en los alimentos producidos localmente, la calidad del agua, el hábitat silvestre y la conservación de las comunidades rurales. El público valoró sobre todo los alimentos producidos en la comunidad porque están estrechamente vinculados a un uso directo y negocian habitualmente con ellos. Del estudio de varios criterios se obtuvo un orden de preferencias diferente, posiblemente debido al uso de diferentes métodos de encuesta, lo que podría indicar que el enfoque usado presenta desventajas.

Key words:
Política rural, Preferencias públicas, Escocia

JEL classifications: Q0, Q18, Q51, R0

Introduction

In a recent paper, KEATING and STEVENSON (2006) considered the evolution of regional rural policy from one focussing traditionally on agriculture to one encompassing wider rural development objectives. While driven from the European Union, the post devolution implementation of this change in Scotland has intensified the debate about how to delineate agricultural and rural policies, and the potential for complementarity in policy outcomes across Scottish regions. This debate has focussed largely on the balance of funding to be dedicated to agri-environmental schemes, and whether the emphasis on multifunctional agriculture is sufficiently transversal in delivering other social outcomes in rural areas. Much less discussion has focussed on whether policy objectives are matched with public expectations and whether public preferences might imply separate agri-environment and social policies or a policy approach that is spatially discriminating.

A more general review of the literature on rural reform reveals a lack of substantial links between this reform debate and public preferences. HALL et al. (2004) reviewed published evidence on how agri-environmental reforms might be matched to measured public preferences. The basic policy challenge faced in the reform process is that multifunctional agriculture lays greater emphasis on the supply of non-market goods, but that market failure handicaps the design of efficient policy that matches supply and demand. While government policies attempt to approximate assumed public preferences, an increasing emphasis on evidence-based value for money in

all spending decisions suggests that some attention should be paid to the explicit measurement of public demand and the use of demand information in the budgetary process (BRUBAKER, 2004). Overall HALL et al. concluded that public preferences had never been consistently canvassed as part of the agenda of agri-environmental reform, and that the totality of existing studies provides only a partial evidence base for informing the trade-offs that might be relevant in policy design. This conclusion can be qualified by the fact that the task of summarising and conveying the range of issues and conjectures about agricultural reform is in fact highly complex, and that a single survey method is unlikely to yield a complete view of preferences. The paper did suggest that certain methods in combination could be worthwhile exploring to derive a consistent preference ranking.

Accordingly the aim of this paper is to report on extensive survey work applying the identified methods to determine the preferences of the general public in relation to agri-environmental reform in Scotland. This study starts from the premise that in all likelihood the public's preferences for the range of market and non-market outputs are not well formed. Few people routinely transact the range of public and private goods or have an idea of the relevant trade-offs. From this basis, this study employs a range of methods, first to identify the range of issues and preferences, and then to determine an empirical ordering of public preferences that might be used to validate policy choices. The surveys explored trade-offs between the economic and environmental outputs from agriculture, whether these preferences are consistent across distinct regions of Scotland, and whether monetary and

non-monetary preference elicitation methods would generate equivalent preference weightings for the attributes considered.

The paper is structured as follows. In the next section we provide background to the policy reform agenda and the methods that we use to elicit policy preferences. This is followed by details of an application in Scotland comprising the sequence of design and administration phases stage; focus groups, survey design implementation and results. The results are presented for two separate methods prior to a conclusion.

The demand for agricultural and countryside outputs

In common with other EU member states, Scottish agriculture is in transition as the system of agricultural support is re-appraised. The reduction in production-related support payments and a move towards stewardship schemes and farm-specific land management contracts has led to wider debate about the purpose of sector support and the role of public preferences in determining the forms of aid that are extended to farmers. This debate has dovetailed with other public concerns arising from a series of food and animal related health scares. Overall the public has been sensitised to the wider impacts of agriculture on the rural environment and the fact that there are some unavoidable trade-offs to be considered as part of the policy design process.

The Scottish Executive's "A Forward Strategy for Scottish Agriculture" (SCOTTISH EXECUTIVE, 2001) and CAP reforms have placed greater emphasis on both the provision of environmental goods and measures for rural development. Emphasis on non-market goods, both environmental and social, marks a change from traditional support for market production. There are many stakeholders in the outcome of this change and it is important to understand the views that the public might assign to policies designed to deliver combinations of outputs.

As part of the evolution of agri-environmental policy, governments have attempted to demonstrate the benefits of reform using an array of methods to measure the value of public goods from agriculture. Some research has also been directed towards the characterisation of the variety of public goods and other benefits such as rural employment, local foods and the economic and social vibrancy of rural communities. While environmental economic techniques have been used to reveal the values attached to specific public goods, few studies have attempted to gain insights into the nature of trade-offs that are inherent in public preferences over the range of policy outcomes. For example, how much more is the public willing to pay for water quality relative to rural employment and or the production of local food?

While noting the importance of the question, HALL et al. (2004) suggested that the existing body of studies eliciting public preferences did not provide a clear answer to the basic question of what the public wants from agriculture and the countryside. A wide range of stakeholder views and priorities was

manifested in existing studies on both general opinion surveys and those more focussed on measuring preferences using monetary or non monetary weighting criteria. The theoretical (mainly neoclassical economic) basis of monetary valuation was argued to provide a more robust set of preferences because they generally presented respondents with real trade-offs that were not apparent in the unconstrained choices of opinion polls. Moreover, the use of neoclassical valuation methods in the design and evaluation of central government policy (e.g. Treasury Green Book[1]), provides a strong rationale for concentrating on these findings and the extent of coverage of the issues addressed. The downside of the neoclassical approach is that monetary valuation is difficult for environmental goods. Adding a monetary variable to multi-attribute policy choices increases the complexity of the task that survey respondents must perform. Irrespective of its hegemonic position in government appraisal, considerable criticism has been directed at the potential biases in preference elicitation using neoclassical methods (MUNDA, 1996). These criticisms vary in the extent to which they challenge the underlying theoretical validity (SPASH, 1998; ROSENBERGER et al 2001), and the extent to which they advance plausible alternatives for evaluating trade-offs (TOMAN, 1998). Theoretical criticism tends to lead to the use of alternative deliberative of multicriteria methods as aids to decision making. For many who maintain the underlying theoretical basis of the neoclassical approach, the claims made for stated preference methods, and contingent valuation in particular, are in excess of their actual validity. The psychological assumptions inherent in the design of some contingent valuation scenarios in particular have been heavily criticised, (KAHNEMAN et al., 1993).

In response to some of these criticisms, recent developments of non-market valuation methods have lead to the increasing use of choice modelling (LOUVIERE et al., 2000). Derived from conjoint analysis, choice modelling responds partly to some of the perceived weaknesses in contingent valuation scenarios by deconstructing complex scenarios into packages of constituent attributes from which public preferences can be determined (BULLOCK et al., 1998; HANLEY et al., 1998; CAMPBELL et al., 2007). The evolution of choice modelling or experiments is shared across several disciplines including marketing (ERDEM and WINER 2002), and transportation (BEN-AKIVA and LERMAN 1985). The study by LAYTON and BROWN (2000) considering public preferences for mitigation of climate change is similar to the current study in terms of the policy scale considered.

This study follows this trend by applying choice experiments to the question of public preferences for agri-environmental support. In addition, we consider the merits of a second method that is less exacting in terms of its links to economic theory and statistical rigour, yet allows us to frame the same choices in a less constrained way. We use a variant of multicriteria analysis called the Analytical Hierarchy Process (AHP). The AHP was originally proposed by Saaty (SAATY 1990), and has since been applied to a variety of marketing, industrial design and public policy decision making contexts (WIND and SAATY 1980; BERRITTELLA et al., 2007). The method allows us to set up a range of preference choice sets without including a price attribute. Respondents make pairwise comparisons between policy attributes and

levels. From these observed choices, preference weights or scores can be derived. The AHP does not directly include a valuation of respondent preferences. But in a novel innovation, this study asked an additional open-ended CV question at the end of the AHP. The resulting WTP values are then dissaggregated using the weights derived from the AHP exercise. The objective here is to contrast alternative methods of valuing the individual attributes revealed in the respondent's choice pattern. While we do not necessarily expect the methods to converge in terms of the implicit values of features, we would expect relative preferences to be stable. Both AHP and CE can be improved by the use of focus groups to help in the preliminary definition of attributes.

An application

In an attempt to improve the performance of both CE and AHP, the study adopted a four-stage process to define the relevant policy attributes. The four stages comprised an initial literature review, focus groups across Scotland, an initial ranking survey to narrow down the focus group output, and a main survey phase.

The sample frame for the study comprised the adult population of Scotland. Within Scotland the regional breakdown used was broadly a South, Centre and Northern split. We also used Scottish Executive Urban Rural Classification (SCOTTISH EXECUTIVE, 2003) definitions to define an urban

and rural respondent split. This stratification corresponded approximately to an a priori expectation about the level of exposure to, and familiarity with, the effects of agri-environmental policy across the population. We might, for example, expect some differences between urban and rural respondents. These could include stronger preferences for rural development policies, or higher values across all rural policy objectives amongst rural respondents. This might be corroborated by the regional split, with the central belt being more urbanised than either the south or north.

Focus groups

Six focus groups of between seven and nine participants were held, spread over three locations as indicated in Table 1. Focus group discussions were moderated by a professional market research company and lasted for 1½ hours. Discussions were based around a pre-prepared topic guide developed from a literature review (see HALL et al., 2004). The focus group discussions allowed an in depth exploration of participant opinions, and provided a selection of topics to explore in population-based studies. In particular the range of economic and environmental attributes that underlie public attitudes towards the countryside and related economic and environmental trade-offs. Specific focus was on the role of farming in the countryside and whether participants associated many rural public goods with the presence and practice of farming. If farmers were identified as the suppliers of goods, should they be compensated and on what basis?

INSERT TABLE 1 HERE

In terms of public awareness of the issues the findings were enlightening. In the first instance the link between farming and the countryside was not always spontaneously drawn. But when a link was drawn it is generally a positive association. Participants considered that other agencies beyond agriculture (e.g. the Forestry Commission) were also regarded as having some responsibility for the countryside.

Participants also recognised that in the current economic climate, farmers were burdened by extra responsibility. Participants felt that public subsidy was justified if farmers were trading off production and thus their own livelihoods for the supply of public goods. In order to finance the aid to farmers, any price increases on food were widely rejected in favour of taxation to try to prevent the less well off being adversely effected.

Opinion was divided on the basis for distributing public funding to farmers. A number of options for allocating funding were discussed. These included allocation according to the number of visitors to an area, by area with the most potential for supplying environmental and social goods, or by discounting areas where financial aid would have little perceived impact

Overall, the small number of focus group participants suggested some preferences for changing the status quo mix of outputs, and a willingness to

pay for these changes through general taxation. The empirical questions that followed were: did the general public support these changes and would they be prepared to pay for them? These questions were the basis of a wider quantitative survey of the general public.

Because the range of issues covered in the focus groups were still very wide, the output of these was then drafted into a small scale preliminary rating survey that was sent by mail to a different group of 170 respondents who were representative of the Scottish public. This survey allowed us to determine a short list of the range of statements made in the groups. At this point of the process an open-ended CV question was also included to gain a feel for the range of payments that might bound the overall willingness to pay for favoured policy changes. This information would be necessary for the design of the more focussed choice experiment.

Two wider public surveys were then undertaken. The first applied a choice experiment (CE) the second combined the AHP and CV.

Choice Experiments (CE)

In the choice experiment framework individuals are typically presented with 4 to 8 choice sets representing hypothetical scenarios consisting of a number of policy attributes. Each of these attributes has a number of varying levels, one of which typically represents the status quo, or current policy situation. Respondents are asked each time to indicate their preferred option in each

set. If the comparison is done on a pairwise basis then respondents must indicate whether they prefer choice set A or B. For example, one policy attribute for agri-environmental conservation might be wild plant species with three levels ('stay the same', 'increase by 10%', 'decrease by 10%'). The attribute levels in the choice sets are varied to allow the researcher to infer the attributes that significantly influence choice, the implied ranking of attributes, marginal WTP for changes in attribute level, and WTP for a program which changes more than one attribute simultaneously.

When well-designed, CE provide a statistically efficient means of estimating WTP for marginal changes in a range of attributes that are of policy interest such as endangered status, location of reserves, and habitat management. The design of the survey and its administration are more complex than conventional surveys of public opinion. As in any choice experiment, the initial task was to:

- select the attributes (characteristics) of the resource management problem
- select the levels which these attributes could take in the experimental design, and
- select the levels and distribution of the “price tags” to be attached to the policy scenarios.

The selection of attributes and their levels was influenced by the focus group discussions, the preliminary rating survey and in terms of their practical link to policy. The latter decision criterion was judged by a substantial input from a Scottish Executive project steering group that provided observations on the

link between attributes and their practical policy relevance. Statistical efficiency is the final criterion that helps define the attribute set and levels. This means that for a given sample size, which is normally predetermined by budgetary limits, there is a limit on the number of attributes and their levels that can be used to define a set of choices that each respondent can realistically cope with. The five attributes finally selected and their respective levels are summarised in Table 2.

INSERT TABLE 2 HERE

This mix of attributes is intended to capture the most relevant features of the public perception of the trade-offs between different public goods. Note that the inclusion of environmental, landscape and rural development attributes reflects the current emphasis on multi-functional agriculture within policy development. Box 1 presents the attribute levels as described to respondents. Whereas previous valuations of agri-environment policy have considered specific features and in some cases quantitative changes, this study has taken a broader, qualitative, view. This was primarily due to constraints placed on the size of design, and the burden we could realistically place on respondents. However, it offers flexibility in policy response within these attributes and provides trade-off information between broad strands of rural policy. A further attribute was included on the targeting of farm payments, with levels of either “towards environmental and landscape benefits” or “towards social benefits”. Such spending can be spread in either a “wide and shallow” across all farm types or areas or in a “narrow and deep”

manner to maximise policy benefits over a more limited range of farm types or areas. Targeting represents the latter approach and was considered to be an important policy relevant output of the study.

INSERT BOX 1 HERE

These attributes and levels were then combined into a series of two-way choices (see Box 2). In each pair, the respondent was offered two alternative policy designs and asked which they preferred. If the respondent preferred neither of these options, they were then asked which was their least preferred option, thus implying a preference for the other alternative. This essentially forced a choice. Whereas some studies specifically offer a "neither" option, i.e. a preference for the status quo, this approach allowed the greatest statistical efficiency given the restrictions faced regarding sample sizes. It should be noted that only 4% of responses (not respondents) were for the "neither" option, a further 2% were "don't know".

INSERT BOX 2 HERE

Regarding option A and option B of the choice set as distinct, the three levels within each attribute give six pairs of different levels, one of which must be selected for the design to have full efficiency for the main effects. With four such attributes, this leads to $6^4 = 1296$ combinations, and allowing each of the six price levels to be associated with each option gives a full choice set of $6^6 = 46656$ questions. Choosing to give each respondent six questions would

therefore require 7776 respondents. In order to reduce this to a more realistic size, we sifted the set of questions by a factor of 36, resulting in 1296 choice sets, hence six questions for each of 216 respondents in each of the three sample regions. The method of reduction used ensured a design that is still balanced in the respect that each of the 6^4 combinations of levels of the policy attributes occurs exactly once, and each of the 6^2 combinations of price levels occurs 36 times. A combination of Latin squares was used to group the 1296 choice sets into groups of 6 for the respondents in as balanced a way as possible. Note that the 1296 choice sets were all distinct, a departure from the common practice of selecting a small number of questions that allow estimation of main effects under the assumption that interactions are absent and then gaining adequate sample size by replication of this same small number of questions (see for example FOSTER and MOURATO, 2000; VINEY et al., 2005). The experimental design was 93.2% efficient for estimation of main effects, which were uncorrelated. See STREET and BURGESS (2005) for a discussion on the determination of the efficiency of experimental designs.

A small pilot study (106 respondents) was conducted to see how well the exercise performed. This exercise used price levels of £5, 10, 20, 40, 70, and 100. Analysis of these data suggested that while balanced choices were being made, the options carrying the highest WTP prices were being chosen more frequently than expected. This high acceptance provided evidence that we could go to higher price levels and so for the full survey the price levels

used were £5, 10, 25, 50, 100, and 200. In each case an approximate doubling of prices was maintained in going from one level to the next.

The same design was repeated in each of the study areas: South, Central, and North. The South region consisted of the Borders and Dumfries and Galloway; the Central area consisted of the Central Belt; and the North region incorporated Aberdeenshire, Moray, Inverness, and Caithness.

The surveys were administered by a market research company using face-to-face interviews during July and August 2003. Three samples were used to cover the South (225 respondents), Central Belt (224) and North (224) of Scotland. In total including the pilot survey, 673 responses were collected. Within each of the samples, a quota was used to ensure representativeness in terms of gender, age, social grade and urban or rural residency.

The Analytical Hierarchy Process (AHP)

AHP is a variant of a family of methods collectively termed multicriteria analysis. The method uses a number of pairwise comparisons between quantitative or qualitative criteria to assess the relative importance of each criterion. These can be arranged in a hierarchical manner known as a value tree to form sets of attributes and qualities (levels) within these attributes. The simplicity of the AHP approach is that unlike conjoint methods such as choice experiments, the qualities (or levels) of different attributes are not directly

compared, thus removing the need for complex survey designs and associated impacts on sample size. Indeed, the AHP can be applied to single person expert samples (DUKE and AULL-HYDE, 2002). The majority of the small number of existing applications of AHP to environmental and natural resource management issues have involved small samples of experts, resource managers and stakeholders (DUKE and AULL-HYDE, 2002). The aim having been to reach consensus on management decisions and priorities in a manner similar to Delphi exercises, but in a way that also elicits the relative "utilities" of different management options.

Respondents first make pairwise comparisons of the qualities (or levels) within each attribute before comparing each of the attributes. Direct comparisons are not made between the qualities of different attributes; instead their relative weights are inferred from the weights obtained from the attribute level comparisons. Cognitive burden may also be reduced as comparisons are between two qualities or attributes rather than a larger bundle of attributes and levels. As a consequence respondents are less likely to adopt a simplistic choice heuristic such as concentrating disproportionately on one attribute as may be the case in CE (SWAIT and ADAMOWICZ, 2001).

The pairwise comparison is framed in the form of a question: how important is option A relative to option B? Where the options are individual attributes or levels. The responses to these questions are typically coded along a nine-point scale as set out in Table 3. If, for example, B is considered to be much more important than A, then the reciprocal of the relevant rating is assigned

(i.e. $^1/_7$ as opposed to 7 if A were strongly more important than B). As it is assumed that a respondent is consistent in judgements about any one pair of criteria, this use of the reciprocal allows only $n(n-1)/2$ comparisons to be made where there are n criteria. The ratings, and their reciprocals, are then collected in a comparison matrix:

$$\begin{bmatrix} 1 & 7 & 9 \\ 1/7 & 1 & 2 \\ 1/9 & 1/2 & 1 \end{bmatrix}$$

Weights are then estimated which are consistent with the relativities between the attributes or qualities contained in the matrix. Although there is consistency in the judgements made between any pair of criteria, this is not guaranteed in judgements between pairs, so the estimated weights aim to provide the "best fit" for the observations (DTLR, 2000). This can be achieved by calculating the geometric mean of each row and normalising these by dividing by the sum geometric means for each row. For the above matrix the weights would be:

	Geometric mean			Weight
Criterion 1	$(1\times 7\times 9)^{1/3}$	=	3.9791	0.7926
Criterion 2	$(1/7\times 1\times 2)^{1/3}$	=	0.6586	0.1312
Criterion 3	$(1/9\times 1/2\times 1)^{1/3}$	=	0.3816	0.0760
Sum		=	5.0193	1.000

INSERT TABLE 3 HERE

In comparison with the rigorous CE design, the AHP format is less exacting. The attribute levels used were the same as for the CE, with an additional rural development level: “Preserve rural character”. This level represents a more general rural development aim not necessarily associated with agriculture. Constraints on the number of levels in the CE due to design and sample sizes do not apply with the AHP. Thus a wider range of attributes/levels can be considered. However, the length of task we can realistically expect respondents to engage in remains an issue in common with the CE. The AHP questionnaire was administered to a separate sample of 169 respondents throughout Scotland using face-to-face interviews. As with the CE a sample quota based on gender, age, social grade and urban or rural residency was employed.

Choice experiment results

The choice set data were analysed using a generalised linear model in GenStat. The response variable is binary (A vs. B) and so a binomial error structure is used, with logistic link function. This estimation method is numerically identical to the binary logit model. We asked respondents answering neither (4% of choice occasions) to then identify the option they least preferred, thus inferring their preferred option, thus we had a binomial rather than multinomial response. The terms are fit in such a way that allows the levels within each attribute to be compared with each other. So estimated effects can be produced for the differences 2 vs. 1 and 3 vs. 1 (1 being current

practices) and also 3 vs. 2. The statistical significance of each effect was assessed using the corresponding t-statistic. By forming ratios of these estimates to the estimated price coefficient, we can estimate the monetary value represented, i.e. how much, on average, a person is willing to pay for one option over another.

Inclusion of "current practice" levels for each attribute allows prices to be interpreted as how much the public are willing to pay for an attribute level as compared with the current situation and also allows comparisons to be made of the size of effects between attributes as well as within. For example, the estimated coefficient, and hence implicit price, for 2 vs. 1 represents the extent to which respondents prefer a policy offering level 2 of the attribute over the current policy situation represented by level 1. As "current practices" are included in all policy attributes we have a baseline that allows us to compare directly preferences for different attributes.

Table 4 shows results for the basic model for each of the study areas separately. As there were no significant differences between the three areas, we also present the results for the combined sample. Price can be included in the model as a factor with discrete levels, or as a continuous variable, using either a linear or a log scale. Investigations showed that a continuous linear scale was the most suitable, with the added advantage of ease of interpretation. In each case the difference between the "current practice" level and either level two or three is positive and significant at the 5% level. This demonstrates that in each case the public prefers both of the new policy levels

to the status quo. Therefore we can say that there are positive public preferences for new policies consisting of combinations of the attributes considered. The dummy codes used to estimate the comparisons of levels were then respecified by changing the omitted level to obtain the estimates of levels 3 vs. 2 with associated standard errors. The models are otherwise identical to those previously estimated due to the additive nature of the estimated parameters.

INSERT TABLE 4 HERE

The extent to which preferences are expressed between the policy levels is indicated in the coefficients for the 3 vs. 2 comparison, i.e. the relative preferences for two policy levels within each attribute. Differences were only statistically significant for preferences between the promotion of locally grown food and maintaining farming communities. This was the case in each of the regions and in the combined sample. These results related to comparisons within regions rather than between regions. A test of differences between regions was undertaken by interacting region with the combined model. This is discussed below with results presented in Table 6.

From the information given in Table 4 we can use the relative sizes of the estimated differences between attribute levels and the price coefficient to calculate how much, on average, a person is willing to pay for the difference between attribute levels. Table 5 shows these estimated values and, because

price was included in the model as a linear term, these are directly in pounds. The implicit prices allow us to compare the relative preference for each of the attribute levels both within and between attributes. There is also additivity amongst the implicit prices. For example the difference in prices between moving from “current practices” to level 2 and from “current practices” to level 3 is the same as the difference between levels 2 and 3. For example, in the South region for the environment attribute, 2v1= £56.81, 3v1=£55.68 and 3v2=-£1.13, i.e.

£56.81 - £55.68 = -£1.13 .

It should be noted that the calculation of the implicit prices by dividing the attribute level comparison coefficients by the inverse of the price coefficient inflates the errors inherent in those estimated coefficients. Consequently, more precise comparisons of relative preferences should be obtained directly from the estimated coefficients in Table 4.

INSERT TABLE 5 HERE

The results presented thus far have considered only the effects of the attributes and levels on the choices made by respondents. Also of interest are the effects of the socio-economic profile of the respondents. Table 6 summarises these effects together with other tests of the general specification of the choice experiment.

The mean deviances (likelihood ratio statistics) for the attribute main effects are all highly significant except in the case where the combined sample has been interacted with sample region. This indicates broad consistency in the results across the regions, and that the consistent, cross-region effects are only slightly modified by the sub-group effects described below.

The effects of interactions between attributes are all non-significant, and the "additivity within attribute" test indicates that attribute level coefficients are additive, i.e. 2v1 = 3v1 – 2v3. "Order" tests whether there was an observable effect due to the order in which attributes were presented ("Environment", "Landscape & Access" and "Rural Development" were rotated across the design). This was only significant in the South region and where the combined sample was interacted with region. Overall we can conclude that there little evidence for an order effect. "Study" tested whether there was an effect between the pilot and full studies, this was only the case in the North.

The effects of the socio-economic variables were much smaller than for the main effects of the attributes and the presence of significant effects was not consistent across the analyses. Neither socio-economic group, the number of children in the household, nor whether the respondent lived in a rural or urban area was found to have significant influences on choice. The most consistent effect was that of income, with increased income being associated both with a reduction in preference for enhancing water quality and with a reduction in preference for maintaining farming communities. Conversely, although there was evidence for an effect of working status on preference, the significant

interaction with region indicates statistical evidence that the effect of working status was not consistent across the country. For example, the preference expressed by full-time workers and retired workers for promoting locally grown food in the north was roughly equal, whereas in the south full-time workers expressed a much greater preference for locally grown food than did retired people.

INSERT TABLE 6 HERE

A number of the attitudinal questions were asked prior to the CE exercise, primarily to encourage respondents to begin thinking about the trade-offs inherent in agri-environment and rural development policy. The results of these were factor analysed using principal components analysis. This technique finds linear combinations of the attitudinal questions that best group the respondents. Eight factors were extracted from the data, which accounted for 59% of the total variance for the attitudinal questions. The results of the factor analysis and abbreviated versions of the attitudinal questions are presented in Table 7.

INSERT TABLE 7 HERE

Initial analysis of the effects of these factors on choices made revealed that only two factors had a significant effect. An alternative approach was then taken using the respondents' average scores for each of the questions within each of the factors; this balanced out the number of questions contributing to

each factor, which had initially varied between 1 and 6. This resulted in a conceptually similar but simpler analysis, in which the average scores for the factors were interacted with the attribute levels. This yielded the results presented in Table 8. where full model outputs and factors that has an insignificant effect on choice are omitted for brevity. These interaction effects should be added to the main effects estimates presented in Table 4. The results of this analysis show that:

- Respondents who scored highly on factor 1, associated with a positive attitude to rural development, did indeed prefer rural development policies. The negative coefficient for enhanced public access (-0.1038) when added to the main effects coefficient for public access (0.1351, Table 4) indicates neutrality amongst these respondents for improved access.
- Respondents who felt that there would be negative impacts if farming were to cease, factor 2, also had the strongest preferences for rural development.
- Respondents with positive attitudes to environment and landscape, factor 4, had strong preferences for the relevant attributes and also the targeting of payments towards these benefits.
- Respondents who scored highly on factor 5, associated with feelings that farm payments are too high and have negative impacts, are less in favour of rural development payments and prefer targeting environmental benefits. Of the four factors, it is only amongst these respondents that attitudes have significant impact on price. In this case the negative interaction term when added to the negative price term suggest greater

price sensitivity. This could be interpreted as resistance to paying further money to farmers.

INSERT TABLE 8 HERE

AHP results

Table 9 presents the results for the AHP; environment and water quality was the highest weighted attribute, followed by rural development and then landscape appearance and access. Quality weights were calculated from the within attribute comparisons. These were then multiplied with the attribute weights to determine overall weightings for each quality. The targeting of payment attribute was assessed separately and not interacted with the other attributes. The purpose being to determine preferences for different targeting options for the other attributes.

INSERT TABLE 9 HERE

The weights were calculated on an individual level and then averaged to give a single score across the sample. This approach allows the use of bootstrapping techniques to estimate confidence intervals for the AHP weights and hence determine whether differences in weights can be considered to be statistically significant.

Bootstrapping involves re-sampling with replacement from the observed data in order to build up a whole population of sample means, giving us a measure of how much uncertainty there is about the actual sample mean. In this case we based calculations on the 127 respondents who gave complete responses to all the pairwise comparisons. We speculate that this lower level of task completion arises from the length of the AHP pairwise comparison task. From the 127 complete responses the sample average can be calculated to give the point estimate of each weight. We can then sample with replacement from these 127 individuals to create another set of 127 weights. We then calculate the mean of this new sample. We repeat this a large number of times, here 9999, in order to build up a population of sample means. If the weights are then ordered by size, quoting the 250th and 9750th weights gives a 95% confidence interval for the mean. This can be done simultaneously for all attributes/qualities.

The confidence intervals for the attributes indicate that there are significant differences between the different attributes. This pattern is reflected for the qualities with weights for wildlife habitats and water quality being significantly different from those for the rural development qualities but not each other. The rural development qualities, with the exception of “rural character” form a second grouping that are not significantly different from each other, but have significantly higher weightings than for the landscape and access qualities.

Following the AHP exercise respondents were asked if they would be willing to pay additional annual taxes for their most preferred package of the policy

options presented in the AHP. Seventy said yes, 88 said no and 11 did not know. Respondents who said yes were asked the maximum amount they would be willing to pay from a list of possible amounts presented on a show card ranging from £1 to £126+, 15 respondents were unable to select an amount. This means that 55 respondents were able to state a WTP figure. Respondents who said they would not be willing to pay additional taxes were asked which of the following list presented in Table 10 described their decision.

INSERT TABLE 10 HERE

Options 1 to 3 in Table 10 reflect a genuine zero response, in that they reflect an inability to pay or a lack of strong preferences for the policy package. The remaining options reflect protests at the payment vehicle – alternatives such as higher food prices may have elicited a WTP response. For the purposes of analysis, genuine zero bids are added to the stated WTP bids. Several respondents stated more than one reason for not being willing to pay additional taxes, if these included both a genuine zero and a protest then the respondent was considered to be protesting for analysis purposes. Overall, there were 16 genuine zero bids, meaning that 71 respondents were included in the WTP analysis. Mean and median WTP was £37.55 and £20 respectively. The WTP responses were distributed as shown in Table 11

INSERT TABLE 11 HERE

The CVM question was included in the AHP with the aim of decomposing stated WTP according to the stated preferences for policy options considered in the AHP. The AHP results presented above were based on an aggregate calculation of attribute and quality weights. For this analysis those weights were calculated on an individual basis. The calculations were carried out in the same manner as before, but repeated for each respondent who stated a WTP amount or genuine zero. This allowed individual WTP amounts to be decomposed according to the overall weightings given to each quality.

Table 12 presents the results of this analysis. The implied preference orderings and relative strengths from the WTP analysis differ slightly from those derived from the previous AHP analysis. This arises from the restriction of the analysis to those respondents who were able to state a WTP figure or genuine zero WTP.

INSERT TABLE 12 HERE

Comparison of preference ordering between methods

A question of interest is whether preference orderings are consistent across the two methods employed here. Direct comparison between the estimated coefficients in the CE model and the AHP weights is not possible due to incommensurate scales. However, we can consider the extent to which preferences between policy levels differ within each of the methods. Figure 1

illustrates the coefficients for a) the CE model and b) the AHP weights together with their associated 95% confidence intervals. Note that although the axis scales on the figure are superficially similar they are not in fact commensurate. For the CE results the scale reflects the estimated coefficients, whereas for the AHP the scale reflects the relative weights which sum to 1. Consequently direct comparisons cannot be made across the two parts of the figure, instead the implied rankings and significant differences between attribute levels should be used to compare methods. In each part of the figure the policy levels are grouped where difference between those levels are not significant. For the CE, "promote locally grown food" is the most preferred and significantly so compared the next group that consists of water quality, wildlife habitats and rural communities. In the AHP case, water quality and wildlife habitats form the most preferred group, with weights that are significantly different from those for the next group consisting of rural communities and local food. Public access and landscape appearance form the least preferred group for both methodologies.

INSERT FIGURE 1 HERE

The reason for the differences in preference orderings is not immediately clear; although these are driven primarily by the weight of the environment attribute relative to both rural development and landscape and access in the AHP. We speculate that the differences arise in the preference elicitation methods. In the CE, trade-offs between different policy levels occur simultaneously and in a manner more obvious to the respondent. Whereas in

the AHP the trade-offs are made within attributes and then between attributes. Consequently, respondents in the AHP exercise do not get the opportunity to directly trade-off policy levels such as “promote locally grown food” and “improve water quality”. The question of which is more valid method also arises. From an economic theory perspective the CE has been developed from established consumer theory (see for example LANCASTER, 1966). Whereas there are some issues with the theoretical underpinning of the AHP, for example with respect to the 1 to 9 rating scale used in the pairwise comparisons. Specifically, there is no internal consistency within this scale (i.e. a score of 3 for A relative to B and of 5 for B relative to C implies that A should score 15 relative to C, but this is beyond the 1 to 9 scale); also the descriptions of importance linked to the scale have no theoretical basis.

Ultimately it might not be possible to empirically test the validity of the AHP beyond tests of convergent validity with other methodologies such as CE or other multicriteria approaches. However, our decision to use AHP in this study was driven by an interest of exploring a method that did not require the same stringent experimental design or sampling resources needed for a statistically valid application of CE.

Conclusions

The results of the CE show that overall the “promotion of locally grown food” is the most preferred policy option, with the exception of the Central region

where “enhanced water quality” was most preferred. However, analysis of the estimated confidence intervals for the implicit prices (see Table 5) suggests that the differences between the preferences for the attribute levels are not significant when compared to preference over the status quo. There are several noteworthy issues to be highlighted here. The first unsurprising point is that respondents’ highest value is for the policy level that has the most direct consumptive attributes, i.e. locally grown food. This is also the policy level for which the public has the most ready ability to directly transact for in existing markets through purchases of either Scottish branded products or through increasingly popular farmers’ markets. Local food issues have also received widespread media coverage in recent years. We are unsure whether this is a conclusion that relates solely to food or whether it may generalise to other directly consumed benefits such as health. Existing evidence on this is mixed; for example DZIEGIELEWSKA & MENDELSOHN, (2005) use a contingent valuation of air pollution change in Poland and find that health ecosystem damages can be almost as significant of predicted health benefits.

Although landscape and public access are also directly consumed these are not easily transacted for. Furthermore, we speculate that the relatively low (but significant) preferences for these policies reflect a view that these are reasonably well provided and are therefore less of a priority. This conclusion is backed up by the findings of concurrent Scottish Executive research (NFO SYSTEM THREE, 2003) in which 87% to 95% of survey respondents indicated that improved access to the countryside would not change their level of use of different types of agricultural land for recreation.

A second issue is that the public have preferences for both environmental and rural development policy aims, and that no one particular strand of policy should be promoted to the exclusion of others. This provides evidence in support of the current reconfiguration of agricultural policy and support towards both of these aims, i.e. multifunctional agriculture. Third, there was no significant differences in preferences between any of the three regions studied suggesting that a nationally based policy is appropriate. Finally, there were no significant differences in preferences between urban and rural respondents indicating that there is no gulf between town and country over the provision of rural public goods.

The preference orderings resulting from the AHP differ from those of the CE, with the environment attribute being more favoured than rural development. We can speculate that by simultaneously presenting respondents with all the attributes, the CE more explicitly emphasises the nature of the trade-offs being made, whereas these trade-offs are merely inferred from the AHP. This is a potentially serious drawback in the application of AHP as respondents are not aware of the potential effects of some pairwise comparisons; essentially decisions are being made in the absence of full information. This issue could be avoided in small scale applications involving experts where weightings could be revisited following calculation; however this would be impractical in larger public surveys as undertaken here.

Furthermore, the AHP only estimates weights relative to other attributes or levels. In CE, where the attributes are qualitative, utility is estimated relative to a single alternative level (typically a "no policy" status quo level[2]). Consequently the AHP weights do not actually inform practitioners of preferences for any individual policy measure. The advantage of the CE in respect is clear in that it allows decision makers to evaluate small subgroups or individual policy measures, i.e. preferences for an attribute are independent of those for other attributes. We would therefore conclude that despite the greater resources needed to implement it the CE approach is preferable to the AHP.

In terms of WTP there are clear differences between the CE and AHP. These are consistent with a priori expectations given the elicitation methods employed. Even under the somewhat unorthodox method used for the open-ended question, existing evidence leads us expect to see lower WTP with the open-ended method used in the AHP (LOOMIS et al., 1997). The sample size involved precluded a more rigorous referendum format. Increasing the sample size of an AHP to accommodate a referendum format CV would diminish the potential advantage of AHP over CE in terms of reduced sampling resource requirements. Furthermore, the CE has an advantage in that the policy and price attributes are simultaneously available during the valuation scenario, rather than relying on an ex post decomposition of WTP values.

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References

BEN-AKIVA M. and LERMAN S. (1985) *Discrete Choice Analysis: Theory and Applications to Travel Demand Applications to Travel Demand*, MIT Press, Cambridge, MA.

BERRITTELLA M., CERTA A., ENEA M. and ZITO P., (2007) *An Analytic Hierarchy Process for The Evaluation of Transport Policies to Reduce Climate Change Impacts*, Fondazione Eni Enrico Mattei, Working Paper number 2007.12.

BRUBAKER E.R. (2004) Eliciting the Public's Budgetary Preferences: Insights from Contingent Valuation, *Public Budgeting and Finance*, Spring 2004: 72-95

BULLOCK C.H., ELSTON D.A. and CHALMERS N.A. (1998) An Application of Economic Choice Experiments to a Traditional Land Use - Deer Hunting and Landscape Change in the Scottish Highlands, *Journal of Environmental Management* 58: 335-351.

CAMPBELL D., HUTCHINSON G. and SCARPA R. (2007) *Using Choice Experiments to Explore the Spatial Distribution of Willingness to Pay*, University of Waikato Department of Economics working paper 6/07 ftp://mngt.waikato.ac.nz/RePEc/wai/econwp/0706.pdf

DTLR (2000) *DTLR multi-criteria analysis manual*, Department for Communities and Local Government (formerly Department of Transport, London and the Regions), London, UK. http://www.communities.gov.uk/documents/corporate/pdf/146868.pdf

DUKE J. and AULL-HYDE R. (2002) Identifying Public Preferences for Land Preservation Using the Analytic Hierarchy Process, *Ecological Economics* 42(1): 131-145

DZIEGIELEWSKA D.A.P. and MENDELSOHN R. (2005) Valuing Air Quality in Poland, *Environment and Resource Economics* 30(2): 131-163

ERDEM T. and WINER R. (2002) Introduction to the Special Issue on Choice Modelling, *Marketing Letters* 13(3): 157-162

FOSTER V. and MOURATO S. (2000) Valuing the Multiple Impacts of Pesticide Use in the UK: A Contingent Ranking Approach, *Journal of Agricultural Economics* 51(1): 1 – 21

HALL C., MCVITTIE A. and MORAN D. (2004) What Does the Public Want from Agriculture and the Countryside? A Review of Evidence and Methods, *Journal of Rural Studies* 20(2): 211-225

HANLEY N., MACMILLAN D., WRIGHT R., C. BULLOCK, SIMPSON I., PARSISSON, D. and CRABTREE B. (1998) Contingent Valuation Versus Choice Experiments: Estimating the Benefits of Environmentally Sensitive Areas in Scotland, *Journal of Agricultural Economics* 49(1): 1-15.

KAHNEMAN D., RITOV I., JACOWITZ K.E. and GRANT P. (1993) Stated Willingness to Pay for Public Goods: A Psychological Analysis, *Psychological Science*, 4: 310-315.

KEATING M. and STEVENSON L. (2006) Rural Policy in Scotland after Devolution, *Regional Studies* 40(3): 397-407

LANCASTER K.J. (1966) A New Approach to Consumer Theory, *Journal of Political Economy* 74, 132-157

LAYTON D. and BROWN G. (2000) Heterogeneous Preferences Regarding Global Climate Change, *The Review of Economics and Statistics* 82(4): 616-624

LOOMIS J.B., BROWN T., LUCERO B. and PETERSON G. (1997) Evaluating the Validity of the Dichotomous Choice Question Format in Contingent Valuation, *Environmental and Resource Economics* 10: 109–123.

LOUVIERE J., HENSHER D. and SWAIT J. (2000) *Stated choice methods: Analysis and application*, Cambridge University Press, Cambridge, UK.

MUNDA G. (1996) Cost-benefit Analysis in Integrated Environmental Assessment: Some Methodological Issues, *Ecological Economics* 19 (2): 157-168.

NFO SYSTEM THREE (2003) Public Attitudes to Access to the Countryside, Report to the Scottish Executive and Scottish Natural Heritage http://www.scotland.gov.uk/Resource/Doc/47034/0014760.pdf

ROSENBERGER R., PETERSON G., CLARKE A. and BROWN T. (2001) *Dispositions for Lexicographic Preferences of Environmentall Goods: Integrating Economics, Psychology, and Ethics*, Research Paper 2001-12, Regional Research Institute & Division of Resource Management, West Virginia University http://www.rri.wvu.edu/pdffiles/rosenberger2001-12.pdf

SAATY T.L. (1990) How to Make a Decision: The Analytic Hierarchy Process, *European Journal of Operations Research* 48: 9-26

SCOTTISH EXECUTIVE (2001) A Forward Strategy for Scottish Agriculture, Scottish Executive Environment and Rural Affairs Department, Edinburgh, UK.

SCOTTISH EXECUTIVE (2003) Scottish Executive Urban Rural Classification http://www.scotland.gov.uk/Publications/2004/06/19498/38787

SPASH C.L. (1998) Investigating Individual Motives for Environmental Action: Lexicographic Preferences, Beliefs and Attitudes. in: LEMONS J., WESTRA L. and GOODLAND R. (Eds) *Ecological Sustainability and Integrity: Concepts and Approaches*, Kluwer Academic Publishers, Dordrecht, The Netherlands: 46–62.

STREET D.J. and BURGESS L. (2005) *The Construction of Optimal Stated Choice Experiments: Theory and Methods*, John Wiley & Sons Inc, Hoboken, New Jersey, United States

SWAIT J. and ADAMOWICZ W. (2001) The Influence of Task Complexity on Consumer Choice: A Latent Class Model of Decision Strategy Switching, *Journal of Consumer Research* 28(1): 135-148

TOMAN M. (1998) *Sustainable Decision-making: The State of the Art from an Economics Perspective*, Discussion Paper 98-39, Resources for the Future, Washington D.C . http://www.rff.org/Documents/RFF-DP-98-39.pdf

VINEY R., SAVAGE E. and LOUVIERE J. (2005) Empirical Investigation of Experimental Design Properties of Discrete Choice Experiments in Health Care, *Health Economics* 14: 349-362

WIND Y. and SAATY T.L. (1980) Marketing Applications of the Analytic Hierarchy Process, *Management Science* 26(7): 641-658

Endnotes

1 http://greenbook.treasury.gov.uk/

2 In the case of quantitative attributes the utility is estimated for a unit change in the attribute. Policy changes are then evaluated in terms of the quantity change from the status quo or other relevant counterfactual.

Table 1: Overview of the focus groups, including location and principal participant characteristics.

Group Number	Gender	Age	Location	Date
1	Mixed	20-34	Inverness	11/12/02
2	Mixed	35-55	Inverness	11/12/02
3	Mixed	20-34	Edinburgh	12/12/02
4	Mixed	35-55	Edinburgh	12/12/02
5	Mixed	20-34	Jedburgh	14/01/03
6	Mixed	35-55	Jedburgh	14/01/03

Table 2: Attributes and levels used in the Choice Experiment

Attribute	Level 1	Level 2	Level 3
Environment	Current practices	Enhance wildlife habitats	Enhance the quality of lochs, rivers & wetlands
Landscape and access	Current practices	Enhance landscape appearance	Enhance public access
Rural development	Current practices	Maintain farming communities	Promote locally grown food
Targeting of payments	Current practices	Towards social benefits	Towards environmental & landscape benefits
Additional annual taxes (six levels)	(pilot) £5 £10 £20 £40 £70 £100 (main study) £5, £10 £25 £50 £100 £200		

Table 3: Scoring system used to determine relative importance between AHP criteria.

Rating	Explanation of relative importance
1	Two options are equally important
2	Between 1 and 3
3	Chosen option is slightly more important
4	Between 3 and 5
5	Chosen option is moderately more important
6	Between 5 and 7
7	Chosen option is much more important
8	Between 7 and 9
9	Highest possible degree of importance of chosen option over the other

Table 4: Choice experiment results by region and for combined sample (standard errors in parentheses)

	South			Central			North			Combined sample		
	2v1[a]	3v1[b]	3v2[c]	2v1	3v1	3v2	2v1	3v1	3v2	2v1	3v1	3v2
Environment	0.2606*	0.2554*	-0.0052	0.2511*	0.3001*	0.049	0.1912*	0.2081*	0.0169	0.2338*	0.2537*	0.0198
t statistics	6.15	6.02	-0.12	5.92	7.08	1.16	4.54	4.94	0.4	9.58	10.4	0.81
Landscape/Access	0.169*	0.2184*	0.0494	0.0717**	0.1059*	0.0343	0.1405*	0.0824*	-0.058	0.1262*	0.1351*	0.0088
t statistics	3.99	5.15	1.17	1.69	2.5	0.81	3.34	1.96	-1.38	5.17	5.54	0.36
Rural development	0.2326*	0.39*	0.1573*	0.1834*	0.2624*	0.079**	0.276*	0.3712*	0.0952*	0.2298*	0.3397*	0.11*
t statistics	5.49	9.2	3.71	4.33	6.19	1.86	6.56	8.82	2.26	9.42	13.92	4.51
Targeting	0.0995*	0.1505*	0.0509	0.1214*	0.1359*	0.0144	0.097*	0.1337*	0.0367	0.1062*	0.1391*	0.0329
t statistics	2.35	3.55	1.2	2.86	3.21	0.34	2.3	3.18	0.87	4.35	5.7	1.35
Common standard error		(0.0424)			(0.0424)			(0.0421)			(0.0244)	
Constant		0.0551			0.1566*			0.0364			0.0821*	
		(0.0597)			(0.0596)			(0.0592)			(0.0343)	
t statistics		0.92			2.63			0.61			2.39	
Price		-0.0046*			-0.0045*			-0.0048*			-0.0046*	
		(0.000687)			(0.000687)			(0.000686)			(0.000395)	
t statistics		-6.68			-6.53			-6.96			-11.62	

[a] 2v1: coefficient for moving from status quo to second level
[b] 3v1: coefficient for moving from status quo to third level
[c] 3v2: coefficient for moving from second level to third level
* Significant at the 5% level
** Significant at the 10% level

Table 5: Implicit prices for different attribute levels.

	South			Central			North			Combined sample		
Estimated values (£)												
	2v1[a]	3v1[b]	3v2[c]	2v1	3v1	3v2	2v1	3v1	3v2	2v1	3v1	3v2
Environment	£56.81	£55.68	-£1.13	£55.97	£66.90	£10.92	£40.03	£43.56	£3.54	£50.94	£55.27	£4.31
Lower 95% CI	£36.30	£35.19	-£19.96	£35.28	£44.57	-£7.42	£21.92	£25.20	-£14.07	£38.94	£42.90	-£6.03
Upper 95% CI	£87.34	£86.16	£17.59	£86.99	£101.61	£31.60	£64.60	£68.84	£21.59	£65.70	£70.70	£14.92
Landscape/Access	£36.84	£47.61	£10.77	£15.98	£23.61	£7.65	£29.41	£17.25	-£12.14	£27.49	£29.43	£1.92
Lower 95% CI	£18.31	£28.06	-£7.30	-£2.63	£5.19	-£11.06	£11.98	£0.02	-£31.23	£16.84	£18.76	-£8.45
Upper 95% CI	£61.39	£75.50	£31.03	£37.31	£46.09	£27.63	£51.41	£37.00	£5.04	£39.56	£41.70	£12.42
Rural development	£50.71	£85.02	£34.29	£40.88	£58.49	£17.61	£57.78	£77.71	£19.93	£50.07	£74.01	£23.97
Lower 95% CI	£30.95	£60.70	£16.06	£21.65	£37.29	-£0.62	£38.16	£55.32	£2.93	£38.20	£60.03	£13.51
Upper 95% CI	£79.21	£124.02	£58.55	£67.44	£90.58	£39.31	£86.70	£112.50	£40.08	£64.63	£92.04	£35.76
Targeting	£21.69	£32.81	£11.10	£27.06	£30.29	£3.21	£20.31	£27.99	£7.68	£23.14	£30.31	£7.17
Lower 95% CI	£3.60	£14.31	-£7.01	£8.44	£11.58	-£15.60	£3.05	£10.59	-£9.70	£12.59	£19.50	-£3.18
Upper 95% CI	£43.71	£57.41	£31.36	£50.80	£54.95	£22.82	£40.89	£50.04	£26.38	£34.95	£42.84	£17.95
Standard errors	2v1	3v1	3v2	2v1	3v1	3v2	2v1	3v1	3v2	2v1	3v1	3v2
Environment	13.03	13.02	9.49	13.22	14.59	9.88	10.87	11.11	9.03	6.82	7.08	5.32
Landscape/Access	10.95	12.08	9.70	10.12	10.38	9.79	10.01	9.38	9.19	5.78	5.84	5.31
Rural development	12.30	16.23	10.81	11.65	13.63	10.14	12.37	14.60	9.42	6.73	8.17	5.66
Targeting	10.16	10.94	9.71	10.75	11.01	9.72	9.59	10.01	9.14	5.69	5.95	5.38

[a] 2v1: price for moving from status quo to second level
[b] 3v1: price for moving from status quo to third level
[c] 3v2: price for moving from second level to third level

Table 6: Effects of socio-economic and other factors on the choice experiment results: mean deviances and p-values.

		South		Central		North		Combined sample - main effects		Combined sample - interactions with region	
	Degrees of freedom	Mean deviance	p-value	Mean deviance	p-value	Mean deviance	p-value	Mean deviance	p-value	Mean deviance	p-value
Attribute main effects	8	20.49	<0.001	13.95	<0.001	16.41	<0.001	48.63	<0.001	1.14	0.307
Price	1	46.89	<0.001	44.79	<0.001	51.32	<0.001	142.12	<0.001	0.05	0.955
Additivity within attribute	4	1.71	0.144	0.88	0.477	0.15	0.963	0.11	0.978	1.31	0.232
Interactions between attributes	24	1.21	0.216	0.69	0.866	0.87	0.641	1.11	0.32	0.84	0.781
Order	45	1.77	0.001	0.98	0.507	1.07	0.347	1.16	0.216	1.35	0.015
Study (pilot vs. full)	9	1.23	0.27	1.48	0.149	0.63	0.768	1.83	0.057	0.88	0.6
Socio-economic variables:											
Gender	9	1.66	0.093	1.02	0.419	0.5	0.876	0.98	0.454	1.11	0.334
Age (7 groups)	54	0.92	0.637	1.3	0.067	1.31	0.061	0.85	0.773	1.34	0.01
Class (4 groups)	27	1.08	0.35	0.89	0.623	0.62	0.937	0.68	0.889	0.98	0.509
Children in household (6 groups)	45	1.05	0.382	0.85	0.713	1.14	0.243	1.05	0.385	1.02	0.437
Working (11 groups)	90	1.82	<0.001	0.83	0.849	1.8	<0.001	1.33	0.025	1.57	<0.001
Education (5 groups)	36	1.58	0.014	0.92	0.599	1.09	0.332	1.1	0.307	1.26	0.066
Income (linear)	9	1.09	0.362	2.36	0.012	2.21	0.019	2.86	0.002	1.39	0.123
Rural/Urban	9	1.07	0.382	0.94	0.493	0.81	0.606	0.91	0.515	1.05	0.394

Table 7: Interaction effects of attitudinal factors on attribute coefficients (t statistics in parentheses).

	Factor			
	"Rural development"	"Negative impact if farming ceased"	"Environment"	"Negative impact of subsidies"
Enhance wildlife habitats	0.0323	-0.0074	0.1148*	0.0044
	(0.66)	(-0.2)	(2.47)	(0.14)
Enhance water quality	0.0416	-0.0203	0.1011*	0.0332
	(0.86)	(-0.54)	(2.19)	(1.06)
Enhance landscape appearance	-0.0263	0.0236	0.1074*	-0.033
	(-0.54)	(0.63)	(2.34)	(-1.06)
Enhance public access	-0.1038*	0.019	0.1649*	0.019
	(-2.12)	(0.51)	(3.57)	(0.61)
Maintain farming communities	0.1113*	0.0699**	0.0413	-0.0722*
	(2.31)	(1.87	(0.90)	(-2.33)
Promote locally grown food	0.2296*	0.1504*	0.0621	-0.1104*
	(4.64)	(3.97)	(1.34)	(-3.48)
Target social benefits	-0.0294	0.0027	0.0168	0.023
	(-0.61)	(0.07)	(0.37)	(0.74)
Target environmental benefits	-0.079	-0.0442	0.1163*	0.0534**
	(-1.63)	(-1.18)	(2.54)	(1.71)
Price	0.000206	0.000803	-4.4E-05	-0.00142*
	(0.27)	(1.29)	(-0.06)	(-2.84)

* Significant at the 5% level
** Significant at the 10% level

Table 8: AHP results, within attribute and overall weights and implied ranking of attribute levels (95% confidence intervals for attribute and overall quality weights in parentheses).

Attribute	Quality	Attribute	Quality	Overall	Rank
Environment		0.475 (0.432 - 0.517)			
	Improve wildlife habitats		0.441	0.209 (0.177 - 0.242)	2
	Improve water quality		0.559	0.265 (0.233 - 0.298)	1
Landscape and access		0.170 (0.146 - 0.195)			
	Improve landscape appearance		0.440	0.075 (0.063 - 0.087)	6
	Improve public access		0.560	0.095 (0.076 - 0.115)	5
Rural Development		0.356 (0.310 - 0.403)			
	Preserve rural character		0.188	0.067 (0.057 - 0.078)	7
	Promote locally grown food		0.388	0.138 (0.114 - 0.164)	4
	Maintain farming communities		0.424	0.151 (0.126 - 0.178)	3
No targeting of payments		0.154 (0.128 - 0.182)			3
Targeting towards environmental and landscape benefits		0.380 (0.340 - 0.421)			2
Targeting towards social benefits		0.466 (0.425 - 0.508)			1

Table 9: Reasons for zero WTP response

Reason	Number
I cannot afford to pay	12
This is not a priority for me	9
I am not very interested in this matter	3
I object to paying higher taxes	44
The government should pay for this from existing taxation	28
Pay enough tax already	9
Other	4

Table 10: Distribution of WTP amounts.

WTP	Number
£0	16
£1	1
£2	3
£5	5
£10	4
£20	8
£26	1
£40	7
£52	10
£60	4
£93	1
£104	5
£125	1
£126+	5

Table 11: Mean decomposed WTP figures for attribute qualities.

	Mean WTP
Overall WTP	£37.55
Improve wildlife habitats	£6.89
Improve water quality	£8.66
Improve landscape appearance	£1.73
Improve public access	£2.88
Preserve rural communities	£2.70
Promote locally grown food	£6.49
Maintain farming communities	£7.61

Box 1: Descriptions of attribute levels presented to respondents.

Improving wildlife habitats:
Farmers would receive additional payments to improve both the quantity and quality of wildlife habitats on their land. For example, work might include the planting or restoration of features such as hedgerows or field margins that act both as habitats and as "corridors" between areas of uncultivated land.

Improving the quality of lochs, rivers and wetlands:
Farmers would receive additional payments for actions such as the creation of strips of uncultivated land alongside watercourses to reduce the risk of pollution from pesticides, fertilisers and animal waste.

Improving public access to the countryside:
Farmers would receive additional payments to improve public access, for example, through the maintenance of paths, stiles and the provision of signposts.

Improving landscape appearance:
Farmers would receive additional payments for undertaking work such as the restoration of features like dry stone walls or traditional farm buildings. They can also be paid for environmental features such as woodlands and hedgerows, which have landscape impacts too.

Maintaining farming communities:
Farm policy would have the aim of maintaining farming communities and supporting rural employment. This would involve encouraging young farmers to stay in the industry and ensuring the viability of traditional smaller farms, which might be done through setting up local co-operatives to allow farmers to share machinery and labour.

Promoting locally grown food:
Farm policy would support efforts by farmers to promote their produce in local markets and to develop schemes such as labelling to add value to their products in wider markets.

As well as the above options, farm payments can be targeted in the following two ways:

1. Where social and economic benefits are greatest, for example in the number of jobs being created or protected.
2. Where environmental and landscape benefits are greatest, for example in areas where there is potential for a higher number of different animals.

Box 2: Example of choice experiment scenario.

"Imagine if the only way to improve the management or the amount of these landscape features was through an increase in annual taxation paid by your household, the revenue from which would only be spent on improving these features. We would like you to consider the following sets of policy options and in each case tell us whether you prefer option A or option B".

	A	B
Environment	Current practices	Enhanced wildlife habitats
Landscape and access	Enhanced public access	Enhanced landscape appearance
Rural development	Promoting local food	Maintain farming communities
Targeting	Towards social benefits	Towards environmental and landscape benefits
Additional annual taxes	£30	£75

Which option do you prefer?

A ☐
B ☐
Neither ☐

If neither, which option did you least prefer?

A ☐
B ☐

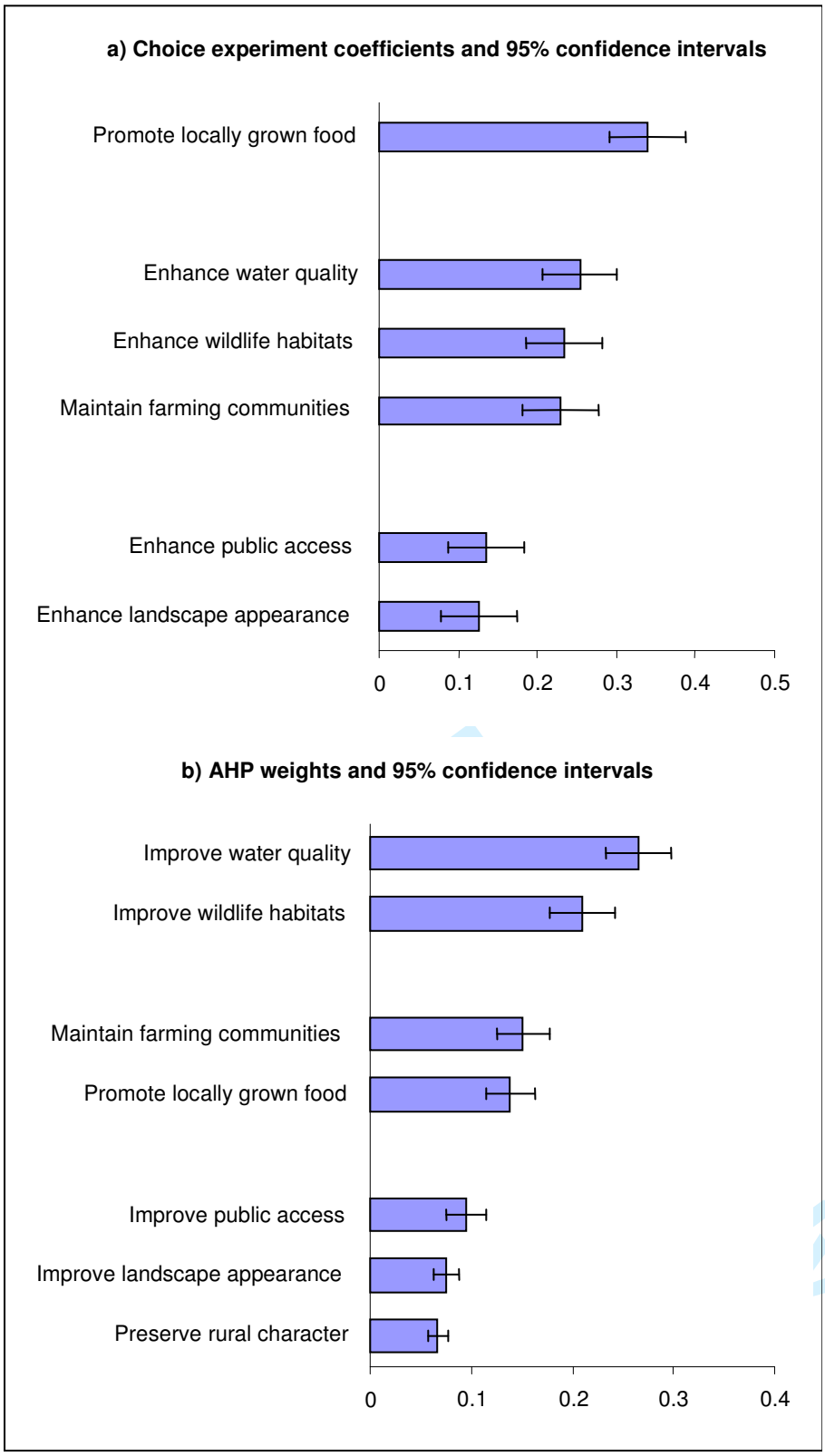

Figure 1: Choice experiment coefficients and AHP weights with associated confidence intervals and preference groupings.