HOUSEHOLD VERSUS INDIVIDUAL VALUATION:

WHAT'S THE DIFFERENCE?

by

Ian J. Bateman

School of Environmental Sciences and CSERGE,

University of East Anglia,

Norwich NR4 7TJ,

UK

and

Alistair Munro.*

(Corresponding author. Email to alistair-munro@grips.ac.jp):

National Graduate Institute for Policy Studies, 7-22-1 Roppongi, Minato-ku, Tokyo, 106-8677, Japan.

Running head: Household versus individual valuation.

HOUSEHOLD VERSUS INDIVIDUAL VALUATION: WHAT'S THE DIFFERENCE?

Abstract.

Standard practice in stated preference typically blurs the distinction between household and individual responses, but without a clear theoretical or empirical justification for this approach. To date there have been no empirical tests of whether values for say a two adult household elicited by interviewing one randomly selected adult are the same as the values generated by interviewing both adults simultaneously. Using cohabiting couples, we conduct a choice experiment field study valuing reductions in dietary health risks. In one treatment a random individual is chosen from the couple and interviewed alone; in the other treatment, both partners are questioned jointly. We find significant differences in household values calculated from joint as opposed to individual responses, with further variation between the values elicited from men and women. Our results question the assumption, implicit in common practice, that differences between individually and jointly elicited estimates of household values can effectively be ignored.

Keywords: Household values, choice experiment, contingent valuation, food and health risks.

JEL Codes: C920, D130, D80.

This paper reports on research designed to examine the relationship between individual and household measures of valuation in a stated preference setting. We test particular theories about individual and household willingness to pay and, specifically, we test whether it matters that stated preference exercises are almost universally conducted with individuals rather than with all the adult decision-makers in a household. Our starting point is the observation that, as typically conducted, the practice of stated preference blurs the distinction between the individual and the household. Normally, in face-to-face exercises, an adult is picked at random from the household and asked to provide information on the valuation of a change in a public or private good. In some methods (e.g. mail-based surveys), no control is placed over who answers the valuation questions. In both types of case, data on household composition and size may be obtained and used in modeling willingness to pay (WTP) or willingness to accept (WTA), but no formal distinction is made between individual and household valuation.[1]

Not distinguishing between answers given by the individual and the household may be justifiable on two grounds. First, in some economic theories the choices made by the household as a whole and those made by individuals within the household are identical. For instance in the unitary model of the household (e.g. Becker (1974)), incentives are aligned in such a way that individuals act as if they are maximizing a household utility function. The unitary model exhibits the more general property of income pooling, meaning that choices made by the household are independent of the source of income. If income pooling is satisfied then individual and household expressions of value coincide and the identity of the unit or sub-unit of the household which provides stated preference information is immaterial (Munro, 2005). The alternative justification for ignoring the distinction between individual and household is empirical: the difference between measures of value elicited from individuals and the household may be so small as to justify the existing standard practice. As an example, household willingness to pay might be a simple average of the individual willingness to pay figures for the adults within the household, in which case a random selection of subject would provide a consistent estimate of household WTP. Alternatively, the balance of power within households may not be sensitive to small changes in the source of income, in which case for small consumption, the household may exhibit behaviour which is largely indistinguishable from that predicted by income pooling.

The evidence to date is mixed on the most appropriate model of the household, but it is largely against the unitary model of the household and income pooling (Alderman et al, 1995). Using the natural experiment provided by a reform of the UK tax and benefit system, Lundberg et al. (1997) reject income pooling, showing instead that expenditure on goods such as men’s and women’s clothing are sensitive to the source of household income. Their results are supported by Browning and Chiappori (1998) and Phipps and Burton (1998) where non-experimental family expenditure data is used to show the influence of the source of income on expenditure shares for consumer goods. Meanwhile, Bateman and Munro, (2003), pioneer experimental tests of household decision-making, using choices in which the identity of the income recipient is manipulated. They too find against income pooling. So, on the face of it, equivalence between household and individual valuation looks unlikely. To date though there have been no stated preference field survey specifically designed to see if there is a significant difference between values elicited from component parts of a household.[2]

This article reports on an exercise designed to provide such a test. We conduct a choice experiment to value changes in food risks using a sample of cohabiting couples, both married and unmarried. In one treatment a randomly selected individual is chosen from the couple and takes part in a face-to-face interview, providing responses on behalf of the household. In the other treatment, both partners are asked household choice questions jointly, again in a face-to-face interview. We find significant differences in the values elicited from the two treatments. Moreover, the values elicited from couples are not a simple average of those elicited from men and women.[3] Our paper therefore suggests that at least from some goods, there can be significant differences in the values elicited from the household as a whole and from its various components.

Theory.

In this section we outline the theory that frames the exercise. A fuller version can be found in Munro (2005). Consider a two-adult household where for each individual i = 1,2, preferences are defined over a vector of privately consumed goods, a vector of household goods (i.e. public goods local to the household) and a public good. Indirect utility, V^i = $V^i(z,m^1,m^2)$, i = 1,2, depends ultimately on a person's own income, their partner's income (m^1 and m^2) and the level of a public good, z. V^i is therefore a reduced form, in the sense that it shows the relationship between utility, z and household incomes, given the unmodeled resource allocation game that is played out within the household. It also embodies the assumption that, in making choices, individuals anticipate any readjustment of the intra-household allocation that results. For simplicity in this formulation, all other arguments which would typically enter the indirect utility function (e.g. prices) are suppressed. The theory is perfectly compatible with altruism. For instance we could write utility $V^i = V^i(v^1(z,m^1,m^2), v^2(z,m^1,m^2))$, where the lower case v^is were the private utilities of the partners, but this could still ultimately be written as $V^i = V^i(z,m^1,m^2)$.

Assume that indirect utility has the following properties:

i. all arguments are essential. e.g. $V^i(0,m^1,m^2) < V^i(z,m^{1'},m^{2'})$ all, z, m^1, m^2, $m^{1'}$, $m^{2'}$.

ii. V^i is strictly increasing in all arguments when all arguments are strictly positive.

iii. V^i is continuous in all arguments.

Income Pooling (IP): for all i, m^i, z, say that the household income pools for Δm when $V^i(z,m^1-\Delta m, m^2+\Delta m) = V^i(z,m^1,m^2)$ i=1,2.

For $z' > z > 0$ we define individual willingness to pay ($iWTP^i$) as follows:

$iWTP^1$: $V^1(z',m^1-iWTP^1, m^2) = V^1(z,m^1,m^2)$,

$iWTP^2$: $V^2(z',m^1, m^2-iWTP^2) = V^2(z,m^1,m^2)$.

Individual WTP is therefore the maximum amount that the household member is willing to pay to receive the increase in the value of the public good. This definition corresponds to the typical format of standard stated preference exercises.

Household WTP (hWTP) is then defined as the maximum payment that the household jointly and collectively is willing to pay. Whereas the theory of individual valuation is extensive and largely settled, there is no coherent body of valuation theory for the multi-agent household, principally because for some models of allocation, household indifference curves may not exist (Samuelson (1956))). As such, to write down an indirect utility function for the household and to define hWTP formal in a manner analogous to the definition for iWTP is to assume already some properties of intra-household allocation that may not be true.

Munro (2005) uses the following possible formal definition of hWTP, which we label as hWTPa in order to make clear its specific nature.

$hWTPa = \max WTP^1 + WTP^2 \text{ s.t. } V^i(z', m^1 - WTP^1, m^2 - WTP^2) = V^i(z, m^1, m^2) \quad i=1,2.$

In other words, hWTPa is the largest amount of money which can be extracted from a household for an increase in the public good, subject to the constraint that each individual is no worse off than in the situation without the change. From this Munro (2005) proves:

Proposition 1. For z', $m^i > 0$, IP $\Rightarrow$ $iWTP^1 = iWTP^2 = hWTPa$

Proposition 2. $iWTP^1 = iWTP^2 = hWTPa \Rightarrow$ IP

The intuition behind these propositions is straightforward. When a household pools all income, the identity of the person who pays for goods does not matter. So the effect on individual utility of paying say, £10 for an environmental improvement, is the same on all members of the household whether it is person 1 who pays, person 2 or the household collectively. Conversely if preferences between different combinations of the good z and payments never depend on the identity of the payee and the interviewee then this amounts to a definition of income pooling.

The propositions provide a benchmark model. One implication of them is that with a sample of couples we can test for income pooling using either the difference between the iWTP of the partners or by using the difference between the iWTP of one partner and that of the household.[4] However, our central concern here is in the relationship between iWTP and hWTP and for this crucial relationship, the propositions provide explicit guidance.

Let us relabel our sample members by f (=female) or m (=male), then our starting hypotheses are as follows: [5]

H1A $iWTP^i = hWTP \quad i=m,f$

H1B $iWTP^m = iWTP^f$

Outside of income pooling and with other definitions of hWTP there are a few results available, for specific models of household decision-making. In Bergstrom, (2003), for instance partners have a veto on decisions, making household WTP the *minimum* of individual WTP. We take this as our second hypothesis:

H2: $hWTP=\min(iWTP^m , iWTP^f)$

Quiggin, (1998) and Strand, (2007) analyze WTP in the context of the Pareto-efficient household and find that in general hWTP equals the sum of individual WTP except where altruism between partners is confined to consumption of private goods, in which case hWTP is less than the sum of iWTP. We take their general case as the basis of our third hypothesis:

H3: $hWTP = iWTP^m + iWTP^f$

We noted above that using iWTP might be an acceptable proxy for hWTP if, on average iWTP is approximately equal to hWTP. We use this suggestion for our fourth hypothesis:

H4: $hWTP = 0.5(iWTP^m + iWTP^f)$

An alternative to the random selection of interviewee is a method in which the researcher first identifies the relevant decision-maker in the household and interviews them. This method is often implicit in, for example, surveys where anglers are asked about their valuation of lakes and fish-stocks. An explicit example is Hensher et al, (2004), where the household was first asked about decision-making responsibilities with regard to utility payments in order to target the questionnaire. One way to make sense of this approach is to see it as a means of eliciting hWTP without interviewing all householders collectively. Let $iWTP^T$ be the WTP figure elicited from the target. If the targeting process is accurate and reliable, then $iWTP^T$=hWTP. We take this as our final hypothesis, to be tested using information from questions asked about responsibility for food purchase choices.

H5: hWTP = $iWTP^T$.

Design.

In the light of the above theory we design an experiment to test our hypotheses using a dual treatment design applied to a sample of established couples. In one treatment both partners are interviewed together, providing joint estimates of household WTP; in the other treatment one partner is chosen at random and interviewed separately.

Given the stated preference nature of our study the obvious methodological choice was between the contingent valuation (CV) and choice experiment (CE) approaches. Although our design and consequent results should be applicable to both formats, recent interest in the CE approach (Adamowicz et al., (1999); Louviere et al., (2000); Bennett and Blamey, (2001)), combined with its high statistical efficiency and a growing bank of policy applications, made this the preferred methodological basis for our study.

In order to enhance the credibility and robustness of the valuation scenario, the experiment focused upon a highly familiar private good; the household weekly food shopping purchases. Specifically subjects were asked valuation questions trading increases in the weekly household shopping bill in return for improvements in two health-related attributes of food. After facing background questions on food shopping and attitudes to healthy eating, the subjects were introduced to the following food-attributes:

1. the percentage of instances in which UK government samples of supermarket food tested positive for pesticide residues;
2. the percentage of energy obtained from fat for an average UK diet.

The subjects were given information about the health risks of fat content and pesticide residues as well as basic information about current UK average levels for the two attributes. They were told that changes in food production methods could alter the values of these two attributes. These changes were potentially costly, but they would require no change to food shopping habits on the part of consumers. So, subjects were asked to imagine no change to their shopping habits, but to consider reductions in fat content and the level of positive tests for pesticide residues[6].

Given our focus upon the difference between individual and household WTP, we wished to avoid other sources of choice complexity and therefore adopted arguably the simplest format of CE task, that being a choice between a constant ‘status quo’ (SQ) and a varied ‘alternative’ state. Figure 1 shows a typical choice faced by a subject. The shaded area in the apples showed the percentage of instances in which positive residues for pesticides would be found in government tests. Each of the chocolate bars represents approximately the reduction from a 5% drop in the average energy intake from fat.

Figure 1 here.

The design and wording of these choices was identical across treatments – both groups of respondents were asked “which would you choose?” out of the two options available in each choice. The only difference in scripts was that, when couples were interviewed together they were told that they had to make an agreed choice. Prior to the choice questions, all respondents were reminded that,

> "When you are considering these questions do think carefully about whether your household really would prefer to pay for the alternative, or would prefer to continue purchasing other things that are important to you. Remember that the cost of the alternatives schemes is money which would be coming out your pocket and that would mean there would be less money for you to spend on other purchases that you might like to make."

Attribute levels for the percentage energy intake from fat varied from 40% (the current figure) to 35, 30 and 25%.[7] Meanwhile, attribute levels for positive tests for pesticides varied from 30% (the current figure) to 25, 20 and 15%. Subjects were informed about all the possible attribute levels prior to facing the choice questions. Cost levels were £1, £2, £3.5 and £5 per capita[8] increases in weekly food shopping bills, giving 64 possible alternative consumption bundles. Four of these bundles are clearly dominated by the status-quo (i.e. cost increases for no changes in consumption). Because we wished to control for all possible interactive effects a full factorial design was used, with the dominated bundles excluded. Four variants of the questionnaire were therefore used, with each subject facing 16 questions and with four questions repeated across more than one sub-sample in order to test for order effects in the data.

The utility model.

Since the status-quo and alternatives differ only in the values of the three attributes, we concentrate on utility equations of the basic form:

$$U_j = \alpha + \beta_{1j} PRICE + \beta_{2j} PEST + \beta_{3j} FAT + \varepsilon_j + \upsilon$$

where Uj is the utility of the jth participant, PRICE, PEST and FAT are the values for the price, pesticide residue and fat content attributes respectively and the random element υ follows an extreme value distribution. The coefficients β_{ij} have the functional form,

$$\beta_{ij} = \beta_{0i} + \beta_{iM} MALE + \beta_{iF} FEMALE + \sum \beta_{ik} x_{kj} + \eta_{ij}$$

where MALE is a dummy for the interviewed, FEMALE is a dummy for the case where the woman is interviewed alone, x_{kj} are the values of the other k^{th} characteristic for the subject j and η_{ij} is the random term. In general we do not have a clear prior for the coefficients on the characteristics. For instance, compared to other consumers, regular purchasers of organic foods might place a higher weight on the opportunity to obtain a lower level of tested residues in the typical food basket. Alternatively, as buyers of foodstuffs which are certified free of non-organic pesticides, they may place a lower value on pesticide reduction because they are not buying the 'typical' basket anyway.

The elements ε_j, and η_{ij} allow the parameters to be potentially random. We take a normal distribution for ε_j, but choosing a functional form for the η_{ij} is more problematic since we have strong priors that β_{ij} are non-positive for PRICE, FAT and PEST. For these variables, if η_{ij} is assumed normally distributed then we face the possibility that for some respondents, β_{ij} has the wrong sign. There are two approaches we can take: since the prime task of the research is to compare treatments, we could ignore the sign issue and choose a general form even if it produces a large numbers of wrongly-signed coefficients. Alternatively following the advice of Hensher and Greene, (2003), we could impose restrictions on the distributional forms for η_{ij} that ensure that no individual has an intuitively perverse response to changes in the PRICE, FAT and PEST attributes. In practice we plot a course somewhere between these extremes by selecting a triangular specification for η_{ij} for the FAT, PEST and PRICE variables and imposing the restriction that the triangular distribution is bounded by zero. The restrictions constrain the sign of the coefficient on PRICE, FAT and PEST, though they still allow for perverse effects overall through interaction terms between the attributes and the x variables.

In our questionnaire we have three questions about control of shopping and cooking in the household, which ask respondents to identify the pattern of responsibility for food choices, for payment for the shopping and for cooking. We use this information to test hypothesis H5. If targeting on the basis of answers to the three questions is successful then including variables based on these questions to the estimated model should eliminate the apparent explanatory power of knowing whether the respondent was male, female or a couple. Not surprisingly, the answers to these questions are highly correlated - in the main the person responsible for shopping, also tends to pay for it and does the cooking, so we use only the question about the identity of the main food shopper. For the purposes of estimation this is coded as 1 if the couple were interviewed jointly or if the individual interviewed answered that they bore responsibility for food purchase decisions. Otherwise the variable was coded as zero. The dummy was then interacted with all three attributes. [9]

Results.

The sample was constructed from a population of households who had previously agreed to be put on a database of potential subjects for experiments and surveys executed by the University of East Anglia. All couples on the database were contacted by phone and all subjects were interviewed at home. Prior to the interview respondents were randomly allocated to one of the two treatments: individual or couple interview. When a household was selected for the individual treatment, the conventional survey approach was followed in which a prior rule for choosing one person at random for the interview was used. In the couples treatment both partners were interviewed together and asked to make choices jointly.[10]

The sample is 142 couples, 70 of whom were interviewed jointly. The average age of interviewees was 41.5 with a range from 18 to 75. Mean household income was £28,500 (at the time of the survey £1 ≈US$1.76 ≈ €1.46) and mean weekly expenditure on food was £77 – with a minimum of £20 and a maximum of £200. The distribution of household size shows a typical preponderance of 2 person households (50% of the sample) with most remaining households having 3 (20%) or 4 (23%) members. No households had more than 6 members.

Table 1 summarizes some of the household characteristics variables. In this table, Healthy and Fat intake are derived variables. In the case of Healthy: for each of six common foods (e.g. milk), subjects were asked if they were regular purchasers, infrequent purchasers or never purchased low fat varieties (e.g. skimmed or semi-skimmed milk). Subjects received a score of 2 for each good they purchased regularly and 1 for each foodstuff bought infrequently and the values summed over all six goods. The average score was 5.74 per household, indicating that most subjects were purchasers of at least some of the goods. For Fat intake we coded each individual as 1-5 (where 1 = significantly below average fat intake and 5 = significantly above average intake) and added the score for the two partners.[11] Around 41% of subjects stated that they were regular purchasers of organic foods. Those who did not purchase regularly most commonly stated they saw no clear benefits from organic foods. Those who did purchase most commonly stated that it tasted better and it was better for the environment.

[Table 1 about here.]

As a preliminary, we examine the internal consistency of the stated choices for men, women and couples. Our specific check is a comparison of all pairs of questions where a) the alternative bundle X in one question strictly dominates the alternative bundle Y in the second question and b) Y is chosen in the second question. By transitivity, X should then be chosen in the first question. We find consistency rates of 95.2% for women, 95.8% for men and 93.5% for couples. All of these rates suggest a good level of understanding amongst our participants and none of them differ from each other at 1% significance levels.

Figure 2 summarizes the responsiveness of subjects to the three dimensions of the choice problem. The values depicted are an unweighted average over all the values of the other two attributes. This explains the slight upward kink in the diagram for pesticides which like the other two, is otherwise downward sloping.

We tested for order effects and found no evidence of them and so we pool the data from the four variants. In the regressions, all of which are estimated using 200 Halton draws for the simulation (Train, 1999), we experimented with a number of specifications, including non-linear interactions between the attributes (which turn out to be insignificant) and random parameters for the interactions between treatment and attributes (which were also not significant). In the main, socio-economic variables such as age tend to be highly insignificant, but in many variants of the model interactive effects between Healthy on the one hand and the attributes for fat content and pesticide residues on the other hand can be significant. For simplicity and to focus on the main purpose of the paper, the selected results in Table 2 concentrate on three representative equations.[12] We discuss the sensitivity of our main results to specification at the end of this section.

Table 2 here.

The third of the equations (labeled 'Target') is the focus of our results and their interpretation. It includes the interaction terms between whether the respondent was a decision-maker (DM) and the three attributes. The other two equations are for comparison. In the model the attribute variables, pesticide residues, fat content and price, have negative signs and they are highly significant (i.e. at or below the 1% level). The hypothesis that the parameters are not random is also rejected at the 1% level for each of the random parameters individually. To evaluate whether the equation accords with our priors about the impact of price, pesticide risk and fat content, we employ the methods of Train, 1999, using the respondent choice data to estimate conditional estimates of the marginal impact of changes in price, fat content and pesticide risk for each subject. Overall none of the respondents have an estimated response to the Price attribute that is perverse. Four subjects have the unanticipated sign for fat attribute and 13 show a non-negative response to the pesticide attribute in the estimates (the figures are similar for the other equations in Table 2).

We now turn to the impact of the treatments. Out of the parameters for the individual treatment, two are significant. A likelihood ratio test rejects the null that collectively the variables add no explanatory power to the model (p =0.015). Holding everything else constant, being interviewed individually raises sensitivity to price and fat content, but reduces sensitivity to pesticide residues (compared to being interviewed as a couple). Note though that the net effect of a rise in price or fat content is still a reduction in the probability of accepting the alternative at the mean of the attribute parameter. The fat and price parameters for the female treatment are positive and significant at the 1% level or lower. So, compared to the men, women are less sensitive to changes in the fat and pesticide attributes. Collectively the female terms are significant at the 1% level.

One DM coefficient is significant (pesticide risk), while a likelihood ratio test of the joint hypothesis that all parameter values are equal to zero gives a p-value of 0.13, suggesting that their joint explanatory power is limited. Comparing the first and third equations to understand the impact of adding the DM variables we can see that the main effect is to reduce the significance of the individual and female variables, but as we have seen, not to the extent of eliminating the explanatory power of the treatment effects in the Target equation.

It is theoretically possible that differences between treatments are purely due to differences in the scale variable (Swait and Louviere, (1993)). Direct observation of the variance terms is not possible, so we consider this hypothesis by indirect means, using the Swait-Louviere test. In all cases the restriction that the parameter vectors (excluding constant) for treatments are equal after optimal scaling is rejected at the 1% level. This leads us to reject the hypothesis that differences in results across treatments are due to differences in scale, so we set aside this hypothesis in what follows.

Our discussion so far has centered on the significance of individual coefficients, but of course some of the values of the other terms in the estimated equations vary between treatments because of difference in the sample values of characteristics. Figure 4 uses the Target equation to summarize the marginal impact of changes in the three attributes, evaluated for the three treatments and using average sample values for the relevant characteristics. As can be seen, on average the sensitivity to the attributes for couples lies about halfway between that for men and women for the Pesticide and Price attributes, but it is the extreme figure (though close to the estimate for women) on the Fat attribute. Meanwhile, male sensitivity to the attributes is consistently higher than that for women.

Figure 3 here.

Figure 4 summarizes this information in a slightly different form. For each of the attributes in turn, the figure plots the results of a kernel regression using the conditional estimates for the marginal impact of changes in the attributes.[13] The modes of these plots follow the pattern of Figure 3, but the distributions are quite different.

Figure 4 here.

The information on the marginal changes in values is summarized also in table 3 where we again use the Target equation. For pesticide risk, the marginal values from the three treatments all differ from one another at a significance level of 10% or lower. For fat, the male value is significantly different from both the couples and the female value at a 0.1% significance level or lower, but the figures for female and couples treatments are not significantly different. The picture is similar for the price attribute, where again the male figure is the outlier, differing significantly from the values elicited from females and couples.

Table 3 here.

For many economists, the marginal willingness to pay figures are potentially of more interest than those for marginal values. The right hand side of Table 4 shows the marginal WTP values, again calculated using average values for the characteristics on the basis of the Target equation. The WTP figures for pesticide are similar for male and couples treatments, with both significantly different to the figures for women interviewed alone. In fact the figure for women is barely half that for the couples interviewed. With fat, there are again major differences between treatments with couples having a WTP figure that is only 53% of that for men. This difference is significant (p-value < 0.001 using the delta method), but the gaps between men and women and between women and couples are not significant.

Having summarized the results we consider the performance of our five hypotheses on the relationship between individual and collective expressions of WTP. Table 4 presents two-sided Wald tests for the five hypotheses and their components. Overall, none of our hypotheses fare particularly well: for H1 the null of no difference between treatments is most clearly rejected and with it the unitary model. Meanwhile H2, the Bergstrom hypothesis, is rejected for pesticide though accepted for fat. H3, arising from some forms of the collective model of the household, proposes that household WTP equals the sum of individual WTP, but this rejected for both fat and pesticide. H4 supposes that hWTP equals the average figure for iWTP, but again this is clearly rejected for both goods. Finally, H5 was the hypothesis that hWTP is equal to the value which would be obtained by targeting an identifiable decision-maker. This is rejected at the 1% level for pesticide and at the 10% level for fat.

Table 4 here.

The immediate cause of this raft of rejections is clear: for each good, the couples treatment leads to the extreme outcome, but whereas for the fat attribute couples provide the lowest WTP value, with the pesticide risk couples are at the other extreme. Theories based around the notion that couples are an average of their partners therefore do not fare well. Meanwhile, other theories that work for one good then tend to struggle with the other good. We speculate about deeper causes of this result in the final section.

Discussion.

Stated preference methods, as widely used in market research, agricultural and environmental economics are usually based on an unspoken assumption that the identity of the person in the household who expresses values does not matter for the calculation of marginal values and measures of surplus. In contrast, our results suggest that indeed stated willingness to pay figures do depend on whether it is the couple or the individuals who provide information on values. We use data on household responsibilities to test for the efficacy of targeting as a strategy to sidestep the problem of interviewing whole households. While this attenuates the gaps between household and individual expressions of value, there are still significant differences. The different results for fat and pesticide risk suggest that there is no general rule which governs the relationship between the valuations given by the parts of the household and that given by the whole.

The differences between the answers given by individuals and those offered by couples may arise from a number of factors. As the extensive research in psychology has emphasized (see Kerr et al 1996 for a survey), the decisions made by groups may not be an average of those made by their component individuals. Frequently, groups make more extreme decisions than those made by individuals. Bateman and Munro, 2005, for instance find couples making more risk averse choices when facing tasks together compared to when the partners faced the same decision-making tasks alone. Secondly, making choices as a couple offers opportunities for the exchange of information, about the good in question, but also about partners' preferences. This may also be a potential source of differences in valuations, particularly when the goods to be valued are unfamiliar.

Given the accumulated evidence on income pooling, our results suggest that it would be wise to abandon the unitary household model in stated preference exercises.[14] Our work, however does not tell us which respondent (individual or household) is the better subject in terms of providing the most accurate estimate of revealed household behavior. Many decisions may not be taken by the household collectively – they may be delegated or taken unilaterally by partners. Hence refining the practice of stated preference may not only involve delving deeper into the relationship between household and individual willingness to pay, but may also require accurate means for predicting where in the household behaviorally-relevant values are determined.[15] This remains the subject of further work possibly through the use of revealed preference data alongside stated preference data from households and their component parts. However, as an interim measure practitioners and policy makers might wish to include a sub-sample of jointly-interviewed householders in stated preference exercises.

As a final point, it is also worth noting that in our data we have concentrated on the two adult members of the household; in the majority of the sample children were also part of the family group and there is plentiful evidence that, at least for some groups, children are influencers of household choices. Dosman and Adamowicz, 2006, for instance document the profound importance of children's preferences in the choice of holiday destinations.

References.

Adamowicz, W. L. Boxall, P., Louviere, J.J., Swait, J. and M. Williams, 1999, Stated preference methods for valuing environmental amenities, in Bateman, I.J. and Willis, K.G. (eds.) *Valuing Environmental Preferences: Theory and Practice of the Contingent Valuation Method in the US, EU and Developing Countries*, Oxford University Press, Oxford, 460-479.

Alderman, H. Chiappori P.A., Haddad L, Hoddinott J, Kanbur R, 1995,Unitary Versus Collective Models Of The Household - Is It Time To Shift The Burden Of Proof, *World Bank Research Observer* 10 (1): 1-19 Feb.

Arora, N. and G. M. Allenby, 1999, Measuring the influence of individual preference structures in group decision-making, *Journal of Marketing*, 25(November), 476-487.

Bateman, I. J. and A. Munro, 2003, Testing economic models of the household: an experiment, *CSERGE working paper, University of East Anglia.*

Bateman, I. J. and A. Munro, 2005, An experiment on risky choice amongst households., *Economic Journal*,, 115(502) March C176-C189.

Becker, G. S., 1974, A theory of social interactions, *Journal of Political Economy*, vol. 82 (6), 1063-1093.

Beharry, N. and R. Scarpa, 2006, Joint *vs* separate decisions with taste variation: exploring responses of couples in choice experiments for coastal water quality valuation in Tobago, Paper presented at the Third World Congress of Environmental and Resource Economists, Kyoto, Japan, 3-7 July, 2006

Bennett, J. and Blamey, R. (Eds)., 2001, *The Choice Modeling Approach to Environmental*

Valuation. Edward Elgar, Cheltenham.

Bergstrom, T. 2003, Benefit cost analysis and the entanglements of love, U.C. Santa Barbara.

Browning, M. and P-A. Chiappori, 1998, Efficient intra-household allocations: a general characterization and empirical tests. *Econometrica* 66 (6), 1241–1278.

Dellaert, B. G. C. Prodigalidad, M., and J. J. Louviere, J.J., 1998, Family Members' Projections of Each Other's Preference and Influence: A Two-Stage Conjoint Approach, *Marketing Letters*, 9 (2), 135-146,

Dosman, D., and W. Adamowicz,, 2006, Combining Stated and Revealed Preference Data to Construct an Empirical Examination of Intra-household Bargaining, Review of Economics of the Household, 4, 15-34.

Dupont, D. P., 2004, Do children matter? An examination of gender differences in environmental valuation, *Ecological Economics*, 49(3): 273-286.

FAO, 1994, *Fats and oils in human nutrition: Report of a joint expert consultation,* Food Agricultural Organization, Rome.

Hensher, D. A. and W.G. Greene, 2003, The mixed logit model: the state of practice, *Transportation*, 30(2), 133-176.

Hensher, D. A. Shore, N. and K. Train, 2004, Households' Willingness to Pay for Water Service Attributes, *Environmental and Resource Economics*.

Jones, C. W., 1983, Mobilization of women's labor for cash crop production: a game theoretic approach, *American Journal of Agricultural Economics*, 65 (5), pp. 1049-1054.

Kerr, N. L. MacCoun, R. J., Kramer, G. P., 1996, Bias in judgment: Comparing individuals and groups. *Psychological Review*. Oct Vol. 103(4) 687-719.

Louviere, J. J. Hensher, D and Swait, J., 2000, *Stated Choice Methods: Analysis and Application*, Cambridge: Cambridge University Press.

Lundberg, S. J., R. A. Pollak and T. J. Wales, 1997, Do Husbands and Wives Pool Their Resources? Evidence from the United Kingdom Child Benefit, *J. of Human Resources*, Vol. 32, No. 3. (Summer), pp. 463-480.

Munro, A., 2005, Household willingness to pay equals individual willingness to pay if and only if the household income pools, *Economics Letters*.

Phipps, S. A. and P. S. Burton, 1998,What's Mine is yours? The influence of male and female incomes on patterns of household expenditure, *Economica*, 65, 599-613.

Quiggin, J., 1998, Individual and household willingness to pay for public goods, *American Journal of Agricultural Economics.*, 80, 58-63.

Samuelson, P. A., 1956, Social Indifference Curves, *The Quarterly Journal of Economics*, Vol. 70, No. 1. pp. 1-22.

Swait, J. and Louviere, J. J., 1993, The Role of the Scale Parameter in the Estimation and Comparison of Multinomial Logit Models, *Journal of Marketing Research* 30, 305-14.

Strand, J., 2007, Public-good valuation and intra-family allocation, *Environmental and Resource Economics, December*, 38, 527-543.

Teal, G. A. and J. B. Loomis, 2000, Effects of gender and parental status on the economic valuation of increasing wetlands, reducing wildlife contamination and increasing salmon populations, *Society and Natural Resources* , 13 (1): 1-14 Jan-Feb.

Train, K., 1999, Halton Sequences for Mixed Logit, Department of Economics, University of California, Berkeley.

Table 1: Household characteristic variables.

Variable	Comment
Healthy	Categorical variable:
Organic	Dummy variable: value = 1 for households which regularly purchase organic food.
Fat intake	Categorical variable from 2-10 indicating perceived fat intake of couple relative to national average (= 6 on the scale).
Spending	Average weekly expenditure on food shopping (£)
Income	Categorical variable from 1-8 depending on household monthly income
Education	Categorical variable from 1-4 depending on educational level.
Size	Number of individuals regularly living in the household.
Couple	Dummy variable: value = 1 if the interview took place with both partners together.
Female	Dummy variable: value =1 if the interview took place with a female partner alone.
DM	Dummy for decision maker for food purchases; takes value = 1 if couple interviewed together or if individual interviewed and answers that s/he is wholly/usually responsible for food shopping decisions.

Table 2. Random parameters models.

Variable		No target Coeff.	t-stat	No couple Coeff.	t-stat	Target Coeff.	t-stat
Constant		1.14***	4.51	1.02***	4.43	1.06***	4.34
Pesticide risk		-0.44***	-9.88	-0.45***	-9.96	-0.44***	-8.92
Fat content		-0.31***	-6.96	-0.23***	-5.25	-0.27***	-5.81
Price		-0.91***	-12.12	-0.71***	-12.66	-0.77***	-11.28
Pesticide risk	x Couple	-0.01	-0.17			-0.09	-1.21
Fat content	x Couple	0.19***	4.91			0.17***	2.66
Price	x Couple	0.25***	3.25			0.25*	1.92
Pesticide risk	x Female	0.08	1.51	0.13***	2.74	0.06	1.07
Fat content	x Female	0.16***	3.07	0.05	1.41	0.16***	2.78
Price	x Female	0.42***	4.22	0.23***	3.37	0.38***	3.84
Price	x (Size-2)	-0.07*	-1.87	-0.16***	-5.50	-0.18***	-6.24
Pesticide risk	x Healthy	0.02***	3.87	0.01	1.67	0.01	1.49
Fat content	x Healthy	-0.01	-1.26	-0.02***	-2.85	-0.02***	-2.82
Pesticide risk	xDM			0.15***	3.29	0.21***	3.28
Fat	xDM			0.18***	4.57	0.05	0.92
Price	xDM			0.17***	2.89	0.01	0.10
Scale factors	Constant	1.35***	5.56	0.56*	1.83	0.71***	2.34
	Pesticide risk	0.44***	9.88	0.45***	9.96	0.44***	8.92
	Fat content	0.31***	6.96	0.23***	5.25	0.27***	5.81
	Price	0.91***	12.12	0.71***	12.66	0.77***	11.28
Log-likelihood (LL)		-748		-750.4		-745.19	
LR test 1 (p-value)		0.000		0.000		0.000	
LR test 2 (p-value)		0.000		0.000		0.000	

Notes: p-values are for chi-squared statistics; DM = decision maker; LR = likelihood ratio; LR test 1: no coefficients; LR test 2: no randomness in parameters.

*** = significant at 1% level

** = significant at 5% level

* = significant at 10% level

Table 3. Comparisons of marginal values and marginal WTP (targeted equation).

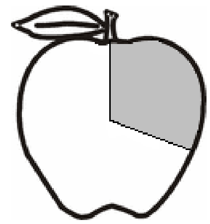
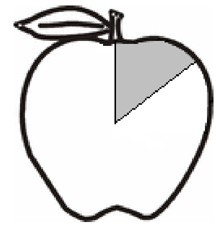
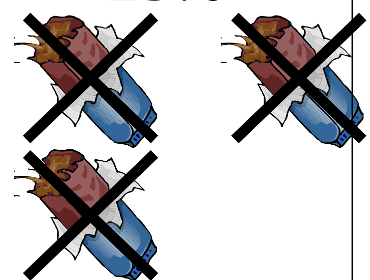
	Coefficients			Marginal WTP		
Pesticide	Female	Male	Couple	Female	Male	Couple
Values	-0.113	-0.354	-0.262	0.211	0.384	0.398
				(0.079)	(0.053)	(0.040)
Wald tests.						
Versus male (p-value)	0.000***			0.054*		
Versus Couple (p-value)	0.005***	0.072*		0.030**	0.820	
Fat						
Values	-0.150	-0.352	-0.133	0.281	0.382	0.201
				(0.077)	(0.044)	(0.036)
Wald tests.						
Versus Male (p-value)	0.001***			0.243		
Versus Couple (p-value)	0.725	0.000***		0.329	0.000***	
Price						
Values	-0.534	-0.921	-0.660			
Wald tests.						
Versus Male (p-value)	0.000***					
Versus Couple (p-value)	0.188	0.000***				

Notes: standard errors for WTP in parentheses; *** = significant at 1% level; ** = significant at 5% level; * = significant at 10% level

Table 4. Wald Tests of hypotheses (p-values).

Hypothesis.	***Pesticide***	***Fat***
H1A. $iWTP^f$= hWTP	0.030**	0.243
H1A $iWTP^m$= hWTP	0.820	0.000***
H1B $iWTP^f$= $iWTP^m$	0.054*	0.329
H2 hWTP=min($iWTP^m$, $iWTP^f$)	0.030**	0.243
H3 hWTP=$iWTP^m$ + $iWTP^f$	0.053*	0.000***
H4. hWTP = 0.5($iWTP^m$ + $iWTP^f$)	0.009***	0.090*
H5: hWTP = $iWTP^T$	0.007**	0.10*

*** = significant at 1% level; ** = significant at 5% level; * = significant at 10% level

	‘No Change’	‘Alternative A’
Percentage of positive tests for pesticides in food	30% 	15% 
Percentage average fat content in food	40%	25% 
Addition to your weekly household food shopping bill	£0	£4.00

	Choose ‘No Change’	**Choose Alternative A**
Which would you choose? (*tick one box only*)		

Figure 1. A Typical Choice Question

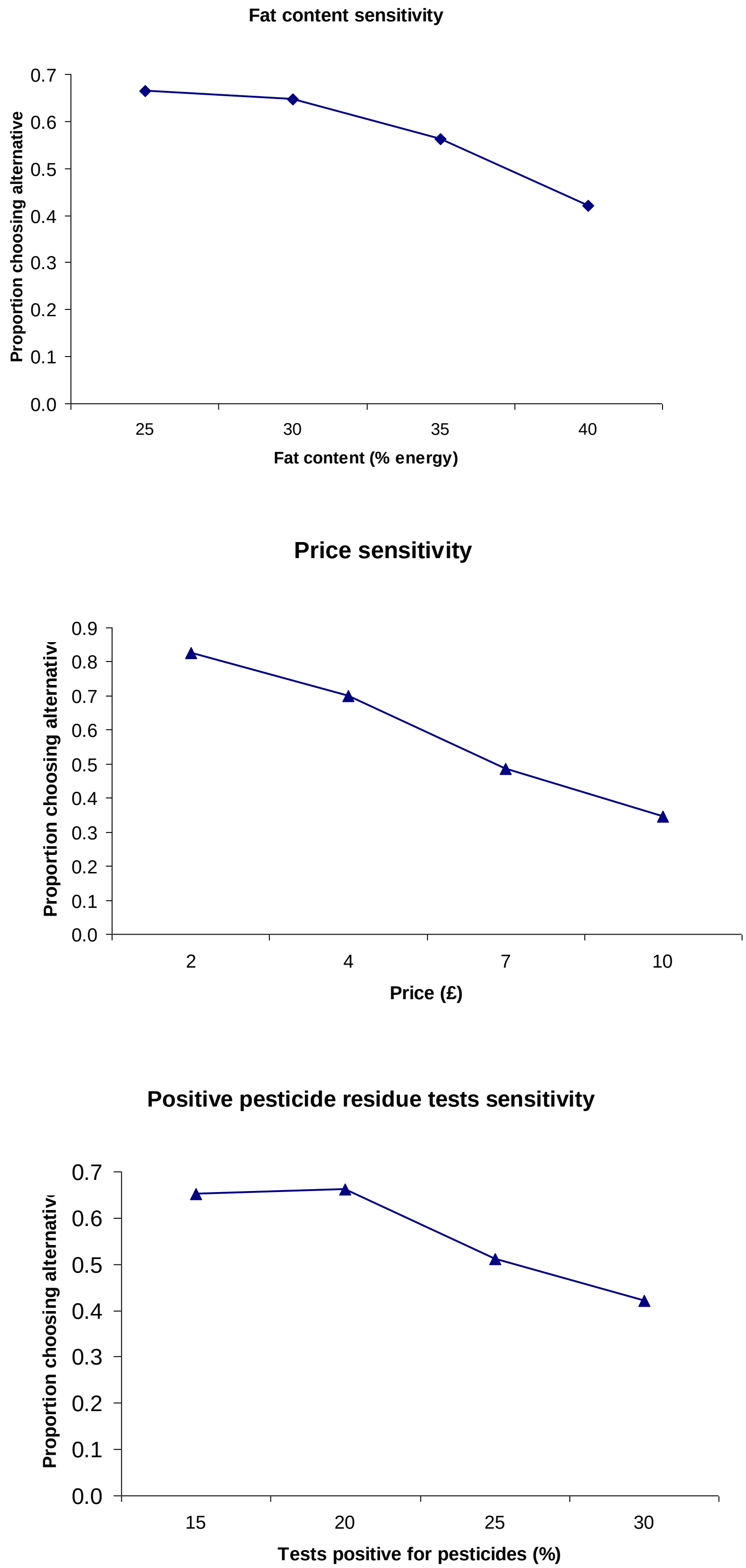


Figure 2 Sensitivity to the attributes (whole sample).

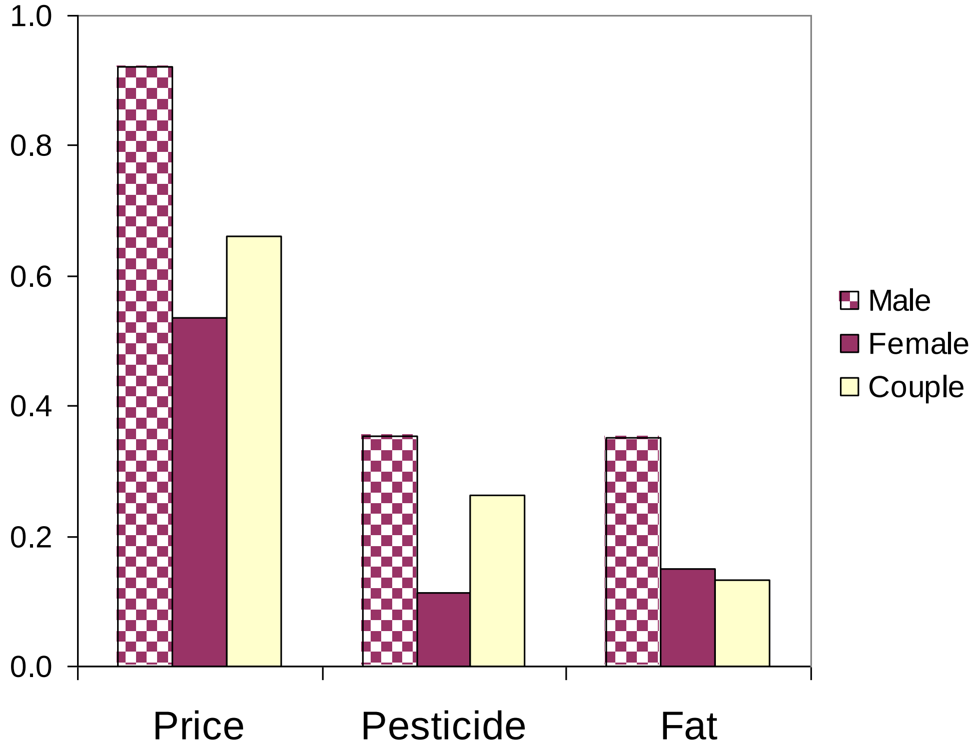


Figure 3. Absolute Marginal values

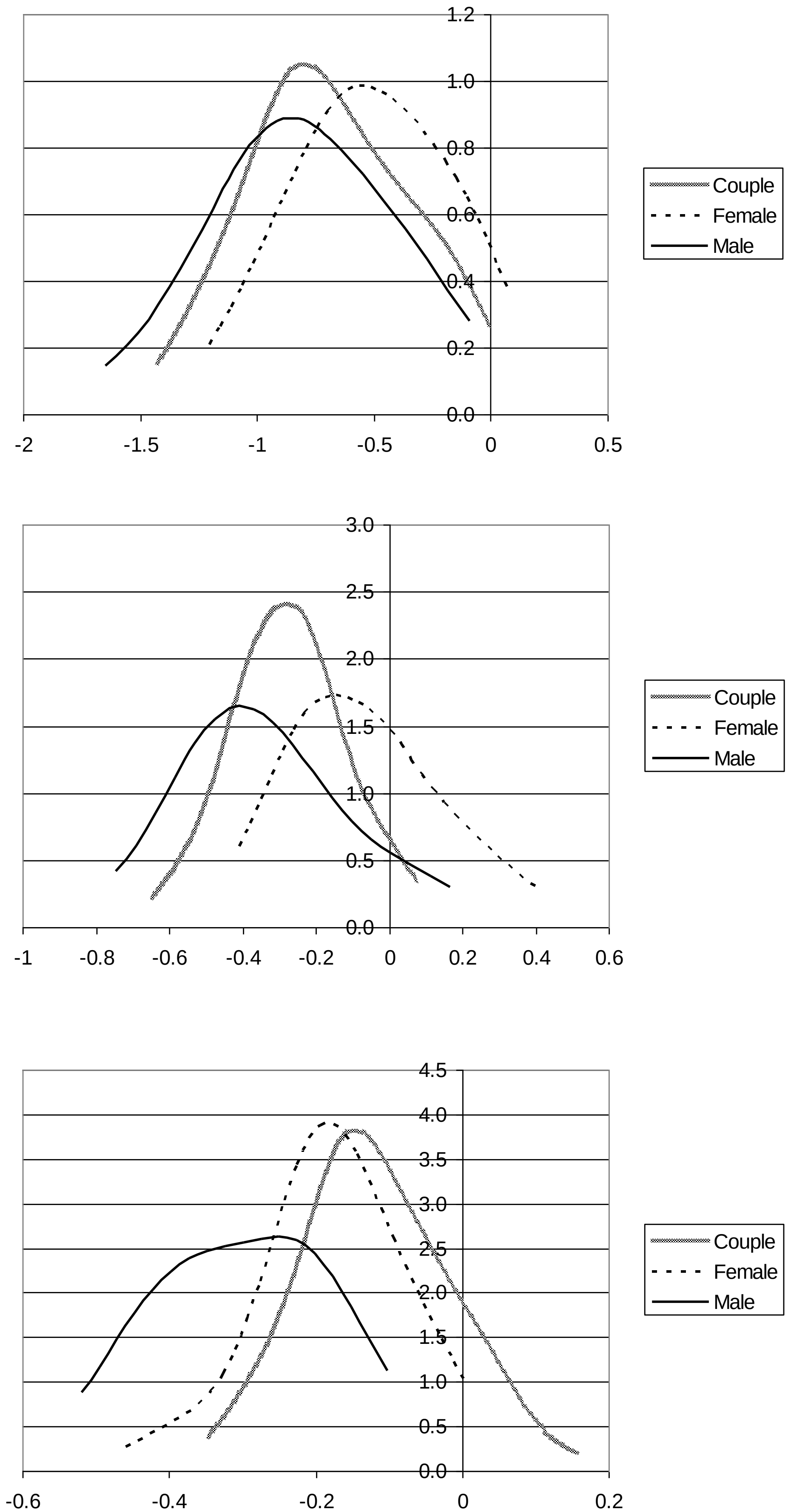


Figure 4. Fitted Conditional Distributions of Marginal values (Price, Pesticide and

Fat)

* Acknowledgements: The authors are grateful to participants in the 2005 Applied Environmental Economics Conference, London and EAERE 2005, Bremen conference as well as Riccardo Scarpa for useful comments. The work reported here was supported by ESRC grant nos. m545285002 and RES-000-22-2081.

[1] In a quick survey of two leading environmental economics journals in 2005 we found 8 out of 13 valuation papers mixed references to the individual respondent with the household's valuation.

[2] In the marketing literature there are a few papers looking at the issue of who has influence in household decision-making but without a focus on testing particular theories (Arora and Allenby, 1999, and Dellaert et al, 1998). In a pioneering paper, Dosman and Adamowicz, 2006, compare stated preference data over camp site features obtained from individual partners to the revealed household destination choices. Beaney and Scarpa, 2006, examine persuasion and agreement within couples in the context of attributes of a tropical island holiday.

[3] The final sample consisted only of heterosexual couples.

[4] Some studies have found significant gender effects in WTP (e.g. Teal and Loomis, 2000 or Dupont, 2004). This does not say much about the relationship between household and individual WTP, except that clearly for at least one partner iWTP must depart from hWTP.

[5] It is worth being explicit: rejection of the first of these hypotheses does not imply rejection of income pooling, since hWTP may in fact differ from hWTPa.

[6] For example, in the case of fat we stated that: "One way to reduce fat intake would be to encourage food manufacturers to reduce the amount of fat in the food they produce and to

encourage them to make more ‘low fat’ products. If this was pursued across a wide range of foods, fat intake could be reduced without a major change in our shopping habits - the typical shopper would continue to buy the same or similar products, but they would contain less fat.”

[7] At very low levels of fat, it becomes difficult to maintain a safe diet. The consensus (see FAO, 1994) is that this minimum is at or below 15% of daily energy intake for an adult. Our range of figures is comfortably above this estimate, so that all the reductions in fat intake used in the survey are health risk improvements.

[8] Subjects provided their household size prior to the interview. Interviewers were given questionnaires with cost figures adjusted for household size. For example, if the household size was 4, the cost levels seen by the subject would be £4, £8, £14 and £20 respectively.

[9] Note that if no individual states that s/he is the person responsible for shopping (perhaps because the responsibility is shared) then the resulting variables would be perfectly collinear with the variables that interact couple with the attributes.

[10] In addition a small number of subjects were approached in public places. It became apparent from feedback from the interviewers that a proper separation of partners could not be reliably achieved. As a result we dropped these data from subsequent analysis.

[11] For Healthy, alternative aggregation methods were tried, but none was clearly better than this simple total.

[12] We also try non-interactive dummies for couples and female, but these are not significant in the presence of interactive effects.

[13] The smoothing procedure embodied in the kernel regressions leads to the slight exaggeration of the numbers of individuals with positive marginal values in the figure.

[14] Our work also suggests the differences in results routinely obtained from stated and revealed preference may be partly down to differences in the identity of the decision-maker.

[15] It is tempting to assume that mailshots are a solution in the sense that the choice of respondent is then endogenous to the household. The danger is that the person selected to answer the survey may not in fact be the person who would be responsible for making the real decision.