HOUSEHOLD VERSUS INDIVIDUAL VALUATION: WHAT'S THE DIFFERENCE?

by

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Abstract.

Standard practice in stated preference typically blurs the distinction between household and individual response valuation exercises. However, there is some theoretical debate regarding the appropriate approach and 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, both married and unmarried, we conduct a choice experiment field study to value 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 asked questions jointly. We find significant differences in risk aversion and hence values between household values calculated from joint as opposed to individual responses, with further variation between the values elicited from men and women. While throwing light on the theoretical debate, the more immediate consequence of such findings are to 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.

Introduction.

As typically conducted, the stated preference technique blurs the distinction between the individual and the household. Most commonly, 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 modelling willingness to pay (wtp) or willingness to accept (wta), but no formal distinction is made between individual and household valuation.[1]

An approach that does not distinguish between answers given by the individual and 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 Becker (1974) or unitary model of the household, 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. Income pooling is the key feature that implies an identity between the stated valuations of households and their component parts (Munro, 2005). If economic theories satisfying income pooling provide a true model of household decision-making, then individual and household expressions of value will coincide and the identity of the

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[1] As an example consider for instance, a careful and thorough recent report on valuation of bathing water quality in the UK, in which subjects receive the prompt: “Considering whether the cost of the additional measures is worth it to your household; please tell me, for each card, which scenario would you prefer to see in place in a typical British beach?” (Defra, 2002). In a quick survey of articles published in 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.

unit or sub-unit of the household which provides stated preference information is immaterial. Alternatively, even if economic theories of the household which predict equivalence between individual and household expressions of welfare are proved wrong, as a practical measure, 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.[2]

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. For instance, 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 family expenditure data is used to show the influence of the source of income on expenditure shares for consumer goods.[3] However,

[2] Alternatively, the balance of power within households may not be sensitive to small changes in the source of income, in which case for consumption changes of low value, the household may exhibit behaviour which is largely indistinguishable from that predicted by income pooling.

[3] Browning and Chiappori, (1998), reject the unitary model in favour of the cooperative or Paretian alternative, which does not predict income pooling. Other research has not been so positive in its assessment of Pareto efficiency. Jones, (1983) rejects it in household allocations in the Cameroon, as does Udry, (1996) using household farm level data from Burkina Faso, and Udry and Duflo, (2001) for farm households in the Côte d'Ivoire. In none of these cases is the unitary model supported.

a problem with interpreting the significance of this work lies in the limitations of the underlying datasets which contain information on household income, but not on wage rates. Differences in expenditure patterns may therefore be due to unobserved variation in wage rates rather than the observed variation in household income.

Given the inconclusiveness of results from household survey data, Bateman and Munro, (2003, 2005) pioneer experimental tests of household decision-making, using choices in which the identity of the income recipient is manipulated. Among other results, these prove wrong models of the household that predict coincidence between individual and household valuation measures. The results are based on laboratory-based using choices, which though real, are not the typical objects of valuation in stated preference exercises. So, to date there have been no stated preference field survey specifically designed to see if there is a significant quantitative difference between the values elicited from different component parts of a household.[4]

This paper reports on an exercise designed to provide such a test. We conduct a choice experiment to value reductions in dietary health risks. Our entire sample consists 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

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[4] In the marketing literature there is a small number of papers looking at the related issue of who has influence in household decision-making. See in particular Arora and Allenby, 1999, and Dellaert et al, 2003. In a pioneering paper and perhaps the one most related to ours, Dosman and Adamowicz, 2002, compare stated preference data over camp site features obtained from individual partners to the revealed household destination choices.

elicited from men and women.[5]

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.

II 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, indirect utility depends on their own income, their partner's income (m^1 and m^2) and the level of a public good, z. All other arguments which would typically enter the indirect utility function are suppressed for simplicity as are the details of any altruism within the household and the bargaining and allocation process.

Assume that indirect utility $V^i = V^i(z,m^1,m^2)$, i = 1,2, 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.

Note that V^i is a reduced form, in the sense that it shows the relationship between utility, z and household incomes, given the unmodelled resource allocation game that is played out within the household.[6] In other words, it embodies the assumption that in making choices individuals anticipate any readjustment of the intra-household allocation that results.

Income Pooling is:

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

[6] Smith and van Houtven, 2004, examine the problem of identifying individual preferences for public goods from household decisions in the context of the Pareto efficient household.

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 value of wtp^1+wtp^2 that the household jointly and collectively is willing to pay. However, 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.

$hwtpa = \max wtp^1+wtp^2$ s.t. $V^i(z', m^1-wtp^1, m^2-wtp^2) = V^i(z,m^1,m^2)$ 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. Given this the following can be proved:

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

Proof. (see appendix)

Proposition 2. $iwtp^1 = iwtp^2 = hwtpa \Rightarrow$ IP

Proof. (see appendix).

Together, these imply that individual wtp equals household wtp, whenever all arguments of the utility function are positive. Note that one implication of these propositions 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.[7] Thus our starting hypotheses are as follows:

H1A $iwtp^i = hwtp \quad i=1,2$

H1B $iwtp^1 = iwtp^2$

Outside of income pooling and with other definitions of hwtp the relationship between iwtp and hwtp is less clear, although there are results available for specific models of household decision-making. In Bergstrom, 2003, partners have a veto on decisions, making household wtp the *minimum* of individual wtp. We take this as our first alternative hypothesis:

H2: $hwtp=\min(iwtp^1 , iwtp^2)$

Quiggin, 1998 and Strand and Abe, 2003, analyse 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 the general case as the basis of our second alternative hypothesis:

H3: $hwtp = iwtp^1 + iwtp^2$

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

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[7] Some studies have found significant gender effects in willingness to pay (e.g. Teal and Loomis, 2000 or Diane Dupont, 2003). This does not give a clear insight into the relationship between household wtp and individual wtp, except inasmuch that clearly for at least one partner iwtp must depart from hwtp.

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.

H4: hwtp = $iwtp^T$ = hwtp.

III Design.

Given 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[8] (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; Bateman et al., 2002; Holmes and Adamowicz, 2003), 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

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[8] Sometimes referred to as choice modelling, discrete choice experiments or conjoint analysis.

focussed 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 these 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, for the choices 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[9].

Given our focus upon any difference between individual and jointly made estimates of 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. Here the shaded

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[9] 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."

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 fat reduction from a 5% drop in the average energy intake from fat.

Note that 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 costs 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%.[10] Meanwhile, attribute levels for positive tests for pesticides varied from 30% (the current figure) to 25, 20 and 15%. Following the lessons on information disclosure provided by Bateman et al, 2004, subjects were informed about all the possible attribute levels

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[10] At very low levels of fat intake, it becomes difficult to maintain a safe level of intake of all the required aspects of the human diet. The consensus (see FAO, 1994 for a set of international guidelines based upon nationally produced figures from around the globe) 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.

prior to facing the choice questions. Cost levels were £1, £2, £3.5 and £5 per capita[11] 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 factor 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.

Given that 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,

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

where COUPLE is a dummy variable taking the value 1 when a couple were interviewed together, 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. 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

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[11] Subjects were asked for their household size prior to starting 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.

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 negative for PRICE and PEST. For these variables, if we assume that η_{ij} is normally distributed then we face the possibility that for some respondents β_{ij} has the wrong sign.[12]

There are two approaches we can take when faced with this problem: 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 and PEST attributes. In practice we plot a course somewhere between these extremes by selecting a triangular specification for η_{ij} and for the PEST and PRICE variables, imposing the restriction that the distribution is bounded by zero. For the FAT variable we use the triangular distribution but do not impose the same restriction on its bounds. Though the restrictions constrain the sign of the coefficient on PRICE and PEST they still allow for perverse effects overall through interaction terms between these two attributes and the x variables.

[12] For the FAT attribute the issue is less clear cut, since although we anticipate that the average person would prefer less fat, there may be some individuals who are positive about higher fat, because of its taste attributes or at least indifferent about the fat content in the average diet.

IV 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 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 jointly formulate responses to each choice question. All subjects were interviewed in person at home.[13] [14]

We recruited 121 couples. The average age of interviewees was 41.5 with a range from 18 to 75. Mean household income was £28,500 (£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 is illustrated in figure 1 and shows a fairly common preponderance of 2 person households with most of the remaining households having 3 or 4 members. No households had more than 6 members.

Table 1 summarises some of the information from the questions about fat content in diet.

[Table 1 about here.]

Most individuals see themselves and their partners as being at or around average levels of

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

[14] In a few cases, initial questions revealed that the ‘couple’ were not partners, in which case the interviewers withdrew.

fat consumption. However, women perceive themselves as consuming relatively less fat, compared to men's perception of themselves (chi-squared test, p-value = 0.005). There was no statistically significant difference between the perception of fat consumption of men made by men and that perception made by women (chi-squared test, p-value = 0.13), but there was a statistically significant difference between women's perception of their relative fat consumption and men's perception of women's fat intake: men were less likely to perceive their partner's intake as a little below average, but more likely to perceive intake as average or very much below average. Joint interviews yield notable differences in reported consumption. In these interviews, there is still a statistically significant difference in perceptions of fat consumption between the genders (chi-squared test, p-value = 0.02).

Table 2 summarises 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 8.6 per household, indicating that most subjects were frequent purchasers of at least some of the goods. For Fat intake we added the score for the two partners. [15] 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.

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[15] For Healthy, various alternative aggregation methods were used, but none was clearly better than this simple total. Similarly with Fat Intake we tried disaggregating by gender, but given the high intra-household correlation of the scores this produced no clear improvement over the sum.

[Table 2 about here.]

Figure 4 summarises the responsiveness of subjects to the three dimensions of the choice problem. For each of the attribute diagrams 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 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). Some socio-economic variables such as education and age tend not to be significant, but in many versions of the model interactive effects between Income, Healthy and Organic 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 3 omit the large number of clearly incorrect variants explored and concentrate on two representative equations.[16]

Table 3 here.

Initially, we concentrate on the model labelled 'no target'. In this 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. The parameters for the couples treatment are all significant individually and collectively at the 10% level or lower. Holding everything else constant, being interviewed as a couple reduces sensitivity to price, fat content and pest residues (compared to a male interviewed individually). Note though that the net

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

effect of a rise in fat content is still a reduction in the probability of accepting the alternative. The parameters for the female dummy are also individually significant at the 10% level or lower and again, compared to the men interviewed individually, women are less sensitive to changes in the attributes. Overall none of the individuals have an estimated response to the Price attribute that is perverse. Eight subjects have the unanticipated sign for the pesticide and 15 show a positive response to the fat attribute in the estimates (the figures are very similar for the other equation in table 3).

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. If targeting on the answers to these three questions is successful then adding the data from the questions to the estimated model should eliminate the effects of interviewing as a couple or the gender of the n coefficients. No surprisingly, the answers to these three questions are highly correlated (i.e. in the main the person responsible for shopping, also pays for it and does the cooking and this person is usually the female partner), so we use 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 they variable was coded as zero and then the dummy was interacted with all three attributes. 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.

In the target equation the coefficients on female become less significant, but the coefficient on price is still significant at the 1% level and we reject the null hypothesis that all the coefficients on the female interaction terms are jointly zero with probability 0.000. We also reject the hypothesis that the couples interaction terms are jointly zero with probability 0.000 and two of the coefficients on the couples interaction terms are individually significant at the 10% level or lower.

In short therefore, although targeting reduces the impact of the treatments, it does not eliminate that impact.

Our discussion so far has centred 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 in difference in the values of characteristics. Figure 4 uses the target equation to summarise the marginal impact of changes in the three attributes, evaluated for the three treatments and using average 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 much closer to the figure for women on the Fat attribute. Meanwhile, male sensitivity to the attributes is consistently higher than that for women.

Figure 4 here.

This information on sensitivities is summarised also in table 4 where we again use the targeted equation. For many economists, the marginal willingness to pay figures are potentially of more interest than those for marginal values. The right hand side of the table shows these marginal values, again calculated using average values for the characteristics on the basis of the target equation. The data is also presented in figure 5. As can be seen, the wtp figures for pesticide differ significantly between treatments. With fat, men interviewed individually differ significantly in their wtp compared to couples, but there are no other significant differences in treatments.

Table 4 here.

Figure 5 here.

Overall, none of our hypotheses fare particularly well: the null of no difference between treatments is most clearly rejected. H4 (the hypothesis that targeting would eliminate the treatment effects) is also rejected. There is no evidence that household wtp is the sum of individual wtp and the hypothesis that hwtp is the minimum of individual wtp is accepted for Fat but firmly rejected for pesticides.

V Discussion.

Stated preference methods, as widely used in market research, healthcare evaluation and environmental economics are usually based on an unspoken assumption that the identity of the person with the household who expresses values does not matter for the calculation of marginal values and measures of surplus. In this paper we have examined the issue of whether stated valuations are sensitive to the component of the decision-making unit that provides the information. Our results suggest that indeed stated willingness to pay figures do depend on whether it is the partners or the individuals who provide information on values. However 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.

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 for instance document the profound importance of children's preferences in the choice of holiday destinations.

We also 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.

Given the previous evidence on income pooling, our results suggest that it would be unwise to assume a unitary household model in stated preference exercises. Our work, however does not tell us which (individual or household) is the better model in terms of providing the most accurate estimate of revealed household behaviour. 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 behaviourally-relevant values are determined. This remains the subject of further work.

Appendix.

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

Proof. By Lemma 1 the measures exist. Using the definitions for iwtp: $V^1(z',m^1\text{-}iwtp^1, m^2) = V^1(z,m^1,m^2)$, $V^2(z',m^1, m^2\text{-}wtp^2) = V^2(z,m^1,m^2)$. For hwtp: $V^1(z',m^1\text{-}wtp^1, m^2\text{-}wtp^2) = V^1(z,m^1,m^2)$ so $V^1(z',m^1\text{-}wtp^1, m^2\text{-}wtp^2) = V^1(z',m^1\text{-}iwtp^1, m^2)$ hence by IP, $hwtp = wtp^1+wtp^2 = iwtp^1$. Similarly, $V^2(z',m^1\text{-}wtp^1, m^2\text{-}wtp^2) = V^2(z,m^1,m^2)$ so $V^2(z',m^1\text{-}wtp^1, m^2\text{-}wtp^2) = V^2(z',m^1, m^2\text{-}wtp^2)$ and hence $hwtp = wtp^1+wtp^2 = iwtp^2$. From which it follows that $iwtp^2 = iwtp^1$.

Proposition 2. $iwtp^1 = iwtp^2 = hwtp \Rightarrow$ IP

Proof. Consider any $(z,m^1,m^2, \Delta m)$. Define $m^{1*} = m^1+ iwtp$, $m^{2*} = m^2$. Find z'' s.t. $\Delta m = wtp^2$ where wtp^2 is defined by the equations $V^i(z'',m^{1*}, m^{2*}) = V^i(z,m^{1*} - wtp^1,m^{2*} - wtp^2)$, $wtp^1+wtp^2 = hwtp$. By lemma 2 z'' exists. $V^1(z'',m^{1*}, m^{2*}) = V^1(z,m^{1*} - iwtp^1,m^{2*})$, so since $iwtp^1 = iwtp^2 = hwtp$, $= V^1(z,m^{1*}\text{-}iwtp^1,m^{2*}) = V^1(z,m^{1*}\text{-}wtp^1\text{-}wtp^2,m^{2*}) = V^1(z,m^{1*} - wtp^1,m^{2*} - wtp^2)$. Substituting we obtain $V^1(z,m^1,m^2) = V^1(z,m^1 + wtp^2,m^2 - wtp^2)$ or $V^1(z,m^1,m^2) = V^1(z,m^1 +\Delta m,m^2 - \Delta m)$. Repeat the argument for V^2 using z''' such that $wtp^1 = \Delta m$.

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Table 1. Perceived energy intake from fat, relative to national average.

	Individual interviews				Joint interviews	
	My intake		My partner's intake			
	Women	Men	Women	Men	Women	Men
Very much below average	14%	20%	12%	28%	20%	14%
A little below average	60%	32%	36%	32%	48%	41%
About average	20%	44%	40%	32%	28%	30%
A little above average	6%	0%	8%	4%	3%	12%
Very much above average	0%	4%	4%	4%	2%	3%

Table 2: 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.

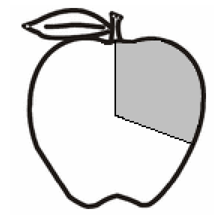
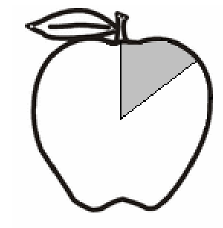
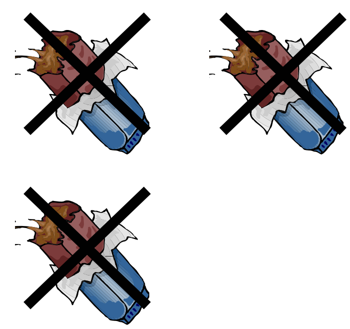
Table 3. Random parameters models.					
		No target		Target	
Variable		Coefficient	t-stat	Coefficient	t-stat
Constant		1.23***	4.71	1.32***	4.61
Pesticide risk		-0.59***	-7.17	-0.55***	-9.30
Fat content		-0.01	-0.10	-0.12*	-1.91
Price		-0.83***	-10.75	-0.94***	-11.60
Pesticide risk	x Couple	0.12*	1.92	-0.06	-0.79
Fat content	x Couple	0.10*	1.99	0.26***	3.11
Price	x Couple	0.16**	2.14	-0.18	-1.48
Pesticide risk	x Female	0.25***	3.28	0.06	1.05
Fat content	x Female	0.11*	1.69	0.18***	2.86
Price	x Female	0.32***	3.86	0.17**	2.12
Price	x (Size-2)	-0.12***	-4.63	-0.08***	-3.17
Pesticide risk	x Healthy	0.03***	3.58	0.029***	4.35
Fat content	x Healthy	-0.04***	-4.35	-0.028***	-3.55
Fat content	x Income	-0.19	-0.25		
Pesticide risk	xDM			0.15**	2.18
Fat	xDM			-0.13*	-1.81
Price	xDM			0.40***	3.34
Scale factors	Constant	0.82***	3.21	2.05*	6.34
	Pesticide risk	0.59***	7.17	0.55***	9.30
	Fat content	0.48***	8.84	0.52***	9.35
	Price	0.83***	10.75	0.94***	11.46
Log-likelihood (LL)		-682.83		-680.77	
LR test 1 (p-value)		0.000		0.000	
LR test 2 (p-value)		0.000		0.000	

Notes: standard errors in parentheses; 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,

Table 4. Comparisons of coefficient values and marginal values (targeted equation).

	Coefficients			Marginal WTP		
Pesticide	Female	Male	Couple	Female	Male	Couple
Values	-0.888	-0.372	-0.306	0.224(0.027)	0.395 (0.048)	0.321 (0.017)
Versus male (p-value)	0.000***			0.000***		
Versus Couple (p-value)	0.000***	0.167		0.000***	0.072*	
Fat	-0.163	-0.308	-0.157	0.243(0.057)	0.327(0.042)	0.200(0.039)
Versus Male (p-value)	0.000***			0.504		
Versus Couple (p-value)	0.909	0.003***		0.805	0.011**	
Price	-0.671	-0.942	-0.788			
Versus Male (p-value)	0.058*					
Versus Couple (p-value)	0.148	0.043**				

(standard errors in parentheses)

	‘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

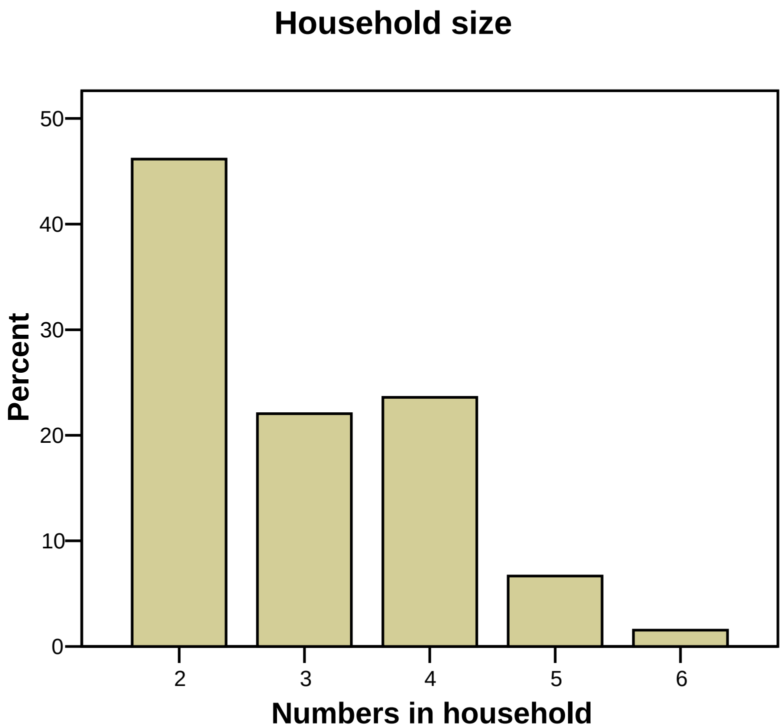


Figure 2 Household size.

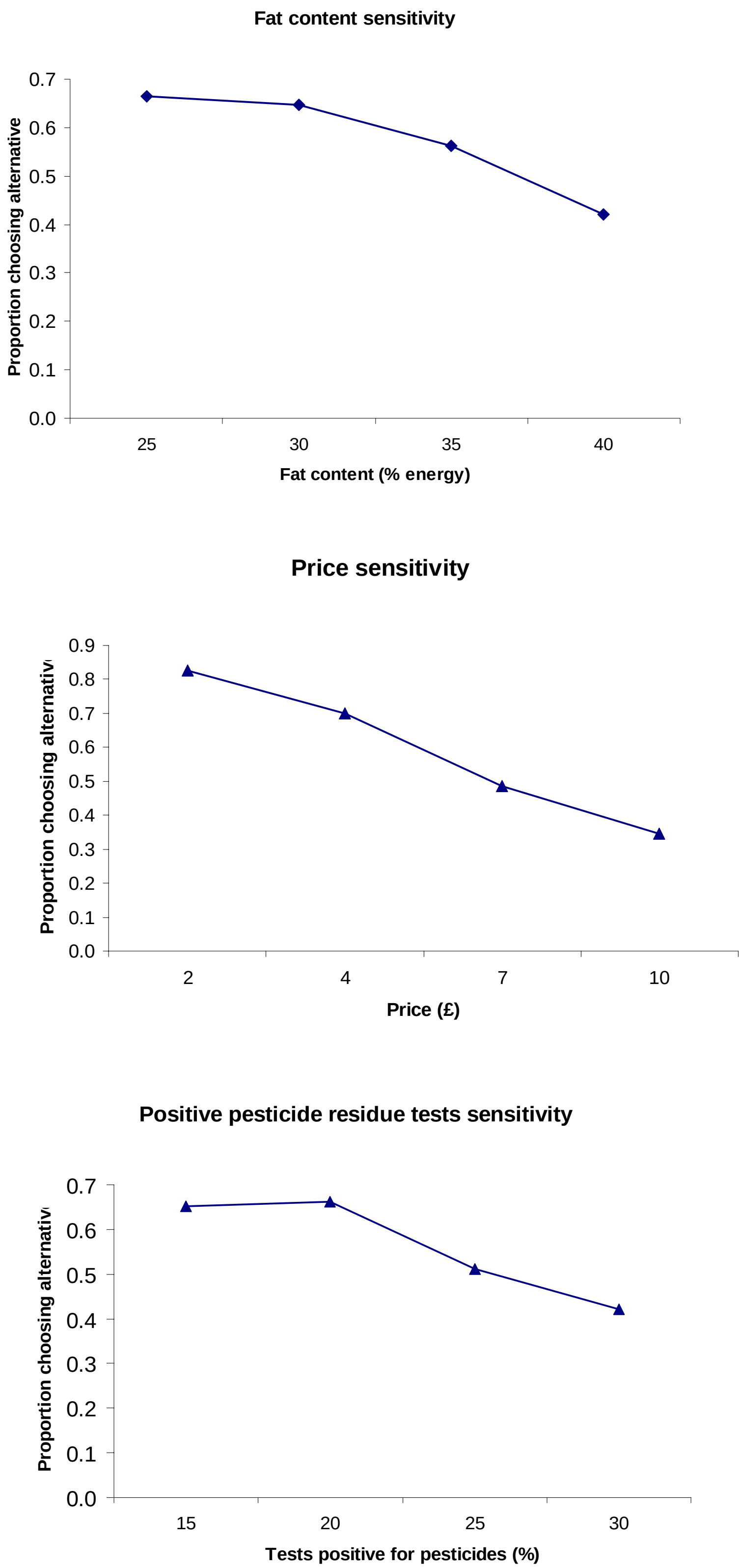


Figure 3 Sensitivity to the attributes (whole sample).

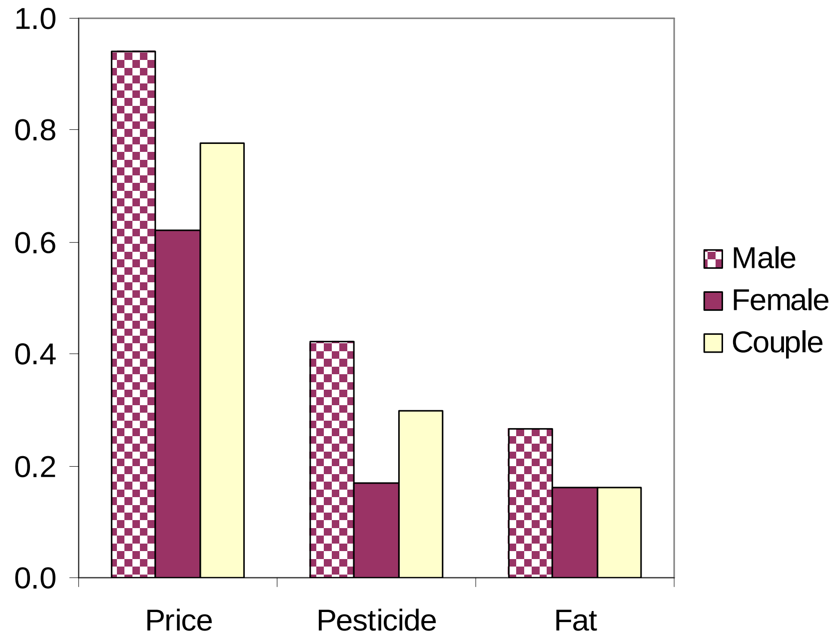


Figure 4. Absolute Marginal values