Discussion Paper Series

2006 – 02

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HOUSEHOLD VERSUS INDIVIDUAL VALUATION:

WHAT'S THE DIFFERENCE?

by

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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.

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 [7] 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, [25]). 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 unit or

[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, [12]). 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.

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. [23] 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, [10] and Phipps and Burton [26] where family expenditure data is used to show the influence of the source of income on expenditure shares for consumer goods.[3] However, a problem with interpreting the significance of this work lies in the limitations of the underlying

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[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, [10], 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, [21] rejects it in household allocations in the Cameroon, as does Udry, [32] using household farm level data from Burkina Faso, and Udry and Duflo, [33] for farm households in the Côte d'Ivoire. In none of these cases is the unitary model supported.

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, [4], [5] 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 but without a focus on testing particular theories. See in particular Arora and Allenby [3] and Dellaert et al, [13]. In a pioneering paper, Dosman and Adamowicz, [14], 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 [25]. 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.

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

[6] Smith and van Houtven [28] examine the problem of identifying individual preferences for public goods from household decisions in the context of the Pareto efficient household.

Income Pooling (IP) is: 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 [27]). 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 [25] 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 (see [25]

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

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

Although in practice we are interested in hwtp and not hwtpa, the propositions provide a benchmark model for the paper, demonstrating the link between the empirically suspect income pooling on the one hand and the equivalence of household and individual measures of wtp on the other. One implication of the 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] However, our central concern here is on the relationship between iwtp and hwtp and for this relationship, the propositions provide guidance in one specific situation.

Let us relabel our sample members by f (=female) or m (=male), then our starting hypotheses are as follows: [8]

H1A $iwtp^{i} = hwtp \quad i=m,f$

H1B $iwtp^{m} = iwtp^{f}$

Outside of income pooling and with other definitions of hwtp the relationship between iwtp and hwtp is less clear, although there are a few results available for specific models of household decision-making. In Bergstrom, [9], for instance partners have a veto on decisions and household wtp is the *minimum* of individual wtp. We take this as our second hypothesis:

H2: $hwtp=\min(iwtp^{m} , iwtp^{f})$

Quiggin, [27] and Strand and Aabø, [30] analyse wtp in the context of the Pareto-efficient

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[7] Some studies have found significant gender effects in willingness to pay (e.g. Teal and Loomis, [31] or Dupont, [15]. 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.

[8] 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.

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 empirical 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, [19] 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: $hwtp = iwtp^T$.

III 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[9] (CE) approaches. Although our design and consequent results should be applicable to both formats, recent interest in the CE approach (Adamowicz et al., [1]; Louviere et al. [23], Bennett and Blamey, [8], Bateman et al., [4], Holmes and Adamowicz, [20], 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 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[10].

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

[10] For example, in the case of fat we stated that: “One way to reduce fat intake would be to

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 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

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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."

figure) to 35, 30 and 25%.[11] 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[12] 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.

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

[11] 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.

[12] 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.

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 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, FAT 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.

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, [18], 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} 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 three questions are highly correlated (i.e. in the main the person responsible for shopping, also tends to pay for it and does the cooking), 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 the variable was coded as zero and then the dummy was interacted with all three attributes. [13]

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 initial phone call, respondents were randomly allocated to one of the two treatments:

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[13] 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.

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.[14] [15]

We recruited 121 couples of whom 70 were interviewed jointly and 28 women were interviewed separately. 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 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

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[14] 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 that data from subsequent analysis.

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

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 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. [16] 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 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

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[16] 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.

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, [32]), 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 (ditto). Some socio-economic variables such as education and age tend not to be significant, 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. In some alternative specifications, we also find significant interactive effects with Organic and Income variables, but for simplicity and to focus on the main purpose of the paper, the selected results in Table 3 concentrate on three representative equations.[17]

The third of these equations (labelled '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, [32] using the respondent choice data to estimate conditional estimates of the marginal impact of changes in price, fat content and pesticide risk for

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

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 pest attribute in the estimates (the figures are similar for the other equations in Table 3).

We now turn to the impact of the treatments. Out of the parameters for the couples treatment, two are significant. A likelihood ratio test rejects the null that collectively the couples variables add no explanatory power to the model (p =0.015). Holding everything else constant, being interviewed as a couple reduces sensitivity to price and fat content, but reduces it for pest residues (compared to a male interviewed individually). 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 significant at the 1% level or lower and, compared to the men interviewed individually, women are less sensitive to changes in the fat and pesticide attributes, but more sensitive than the men to changes in price. Collectively the female terms are significant at the 1% level.

Table 3 here.

Out of the DM variables, one is significant (pesticide risk), while a likelihood ratio test of the joint hypothesis that all parameter values are equal to zero gives a probability 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 their main effect is to reduce the significance of the couples and female variables, but as we have seen above, not to the extent of eliminating the explanatory power of the treatment effects in the Target equation.

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 of difference in the sample 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 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 4 here.

Figure 5 summarises 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.[18] As can be seen, the modes of these plots follow the pattern of Figure 4, but the distributions are quite different.

Figure 5 here.

The information on the marginal changes in values is summarised also in table 4 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 4 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

[18] 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.

equation. The mean wtp values are also compared visually in figure 5. As can be seen, 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), but the gaps between men and women and between women and couples are not significant.

Figure 6 here.

Having summarised the results we consider the performance of our five hypotheses on the relationship between individual and collective expressions of wtp. Table 5 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.

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. A theory that works for one good therefore tends to struggle with the other good. We speculate about deeper causes of this result in the final section.

Table 5 here.

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 in 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.

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.

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 emphasised (see Kerr et al [22] 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, [5], 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 previous evidence on income pooling, our results suggest that it would be unwise to assume a unitary household model in stated preference exercises.[19] 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 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..

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

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[19] Our work also suggests that at least in part, the large number of differences in results obtained from stated and revealed preference exercises may be down to differences in the identify of the decision-maker.

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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.

Variable		No target Coeff.	No target t-stat	No couple Coeff.	No couple t-stat	Target Coeff.	Target 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	9.96***	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: 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 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***				

(standard errors in parentheses)

Table 5. 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*

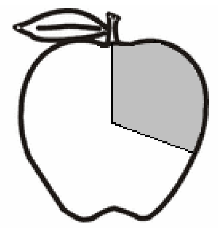
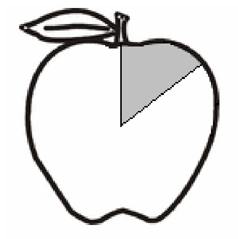
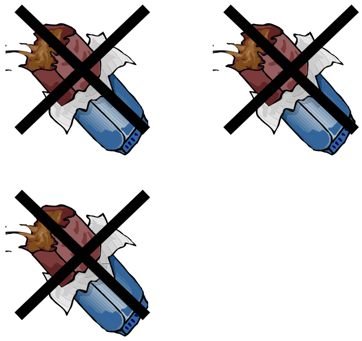
		‘No Change’		**‘Alternative A’**
Percentage of positive tests for pesticides in food		30% 		15% 
Percentage average fat content in food		40%		25% 
Addition to your weekly household food shopping bill		£0		£4.00
		Choose **‘No Change’**		**Choose** **Alternative A**
Which would you choose? (*tick one box only*)				

Figure 1. A Typical Choice Question

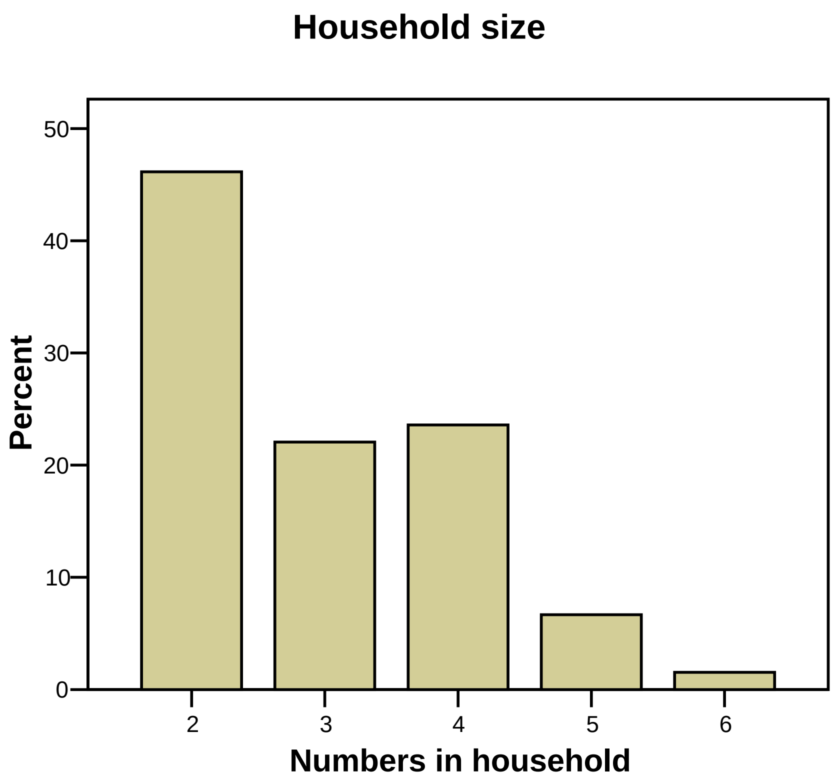


Figure 2 Household size.

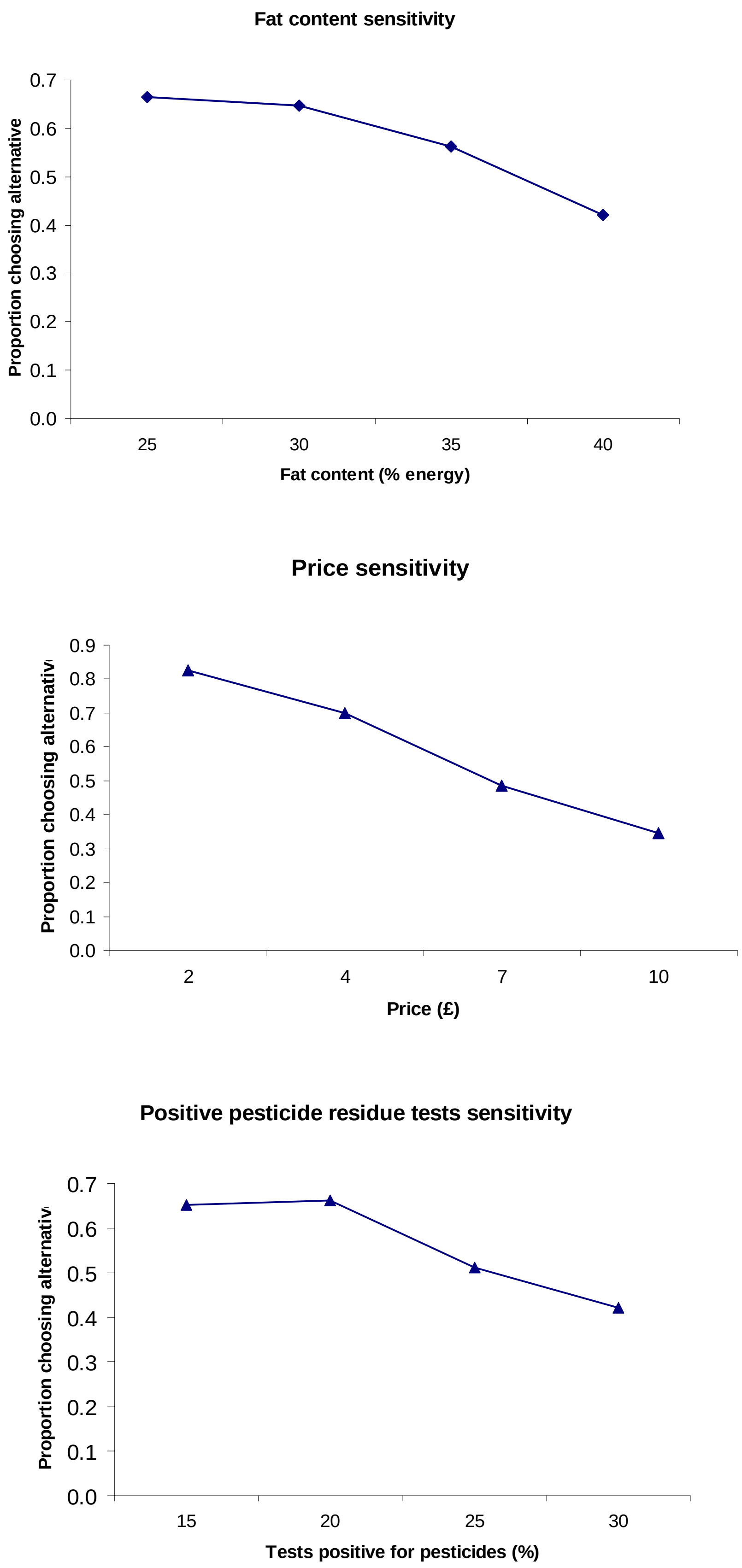


Figure 3 Sensitivity to the attributes (whole sample).

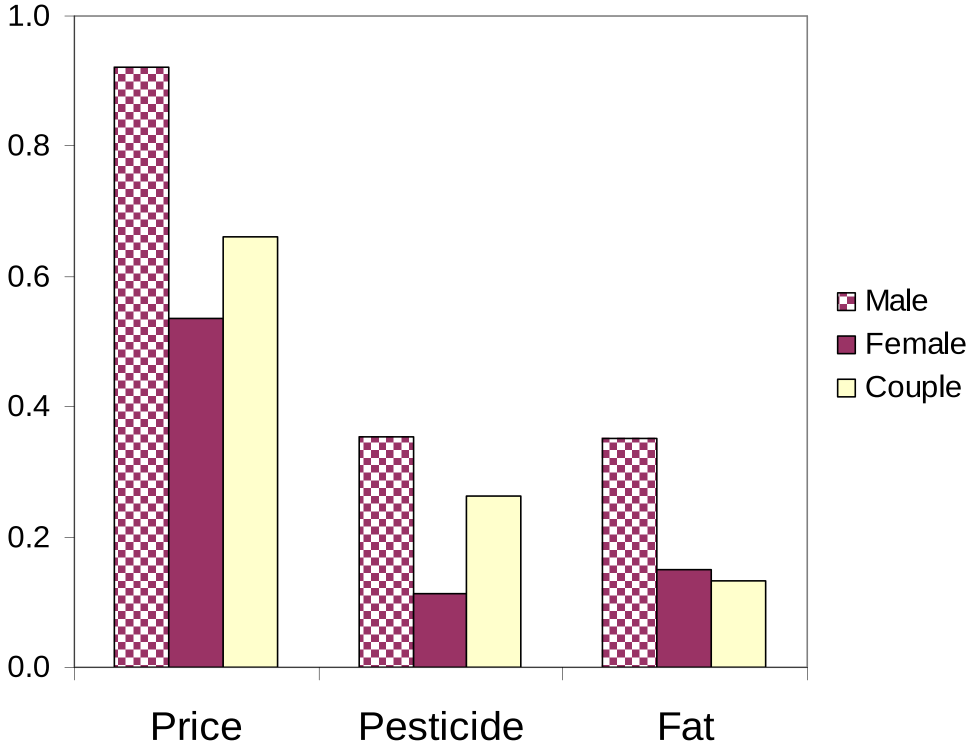


Figure 4. Absolute Marginal values

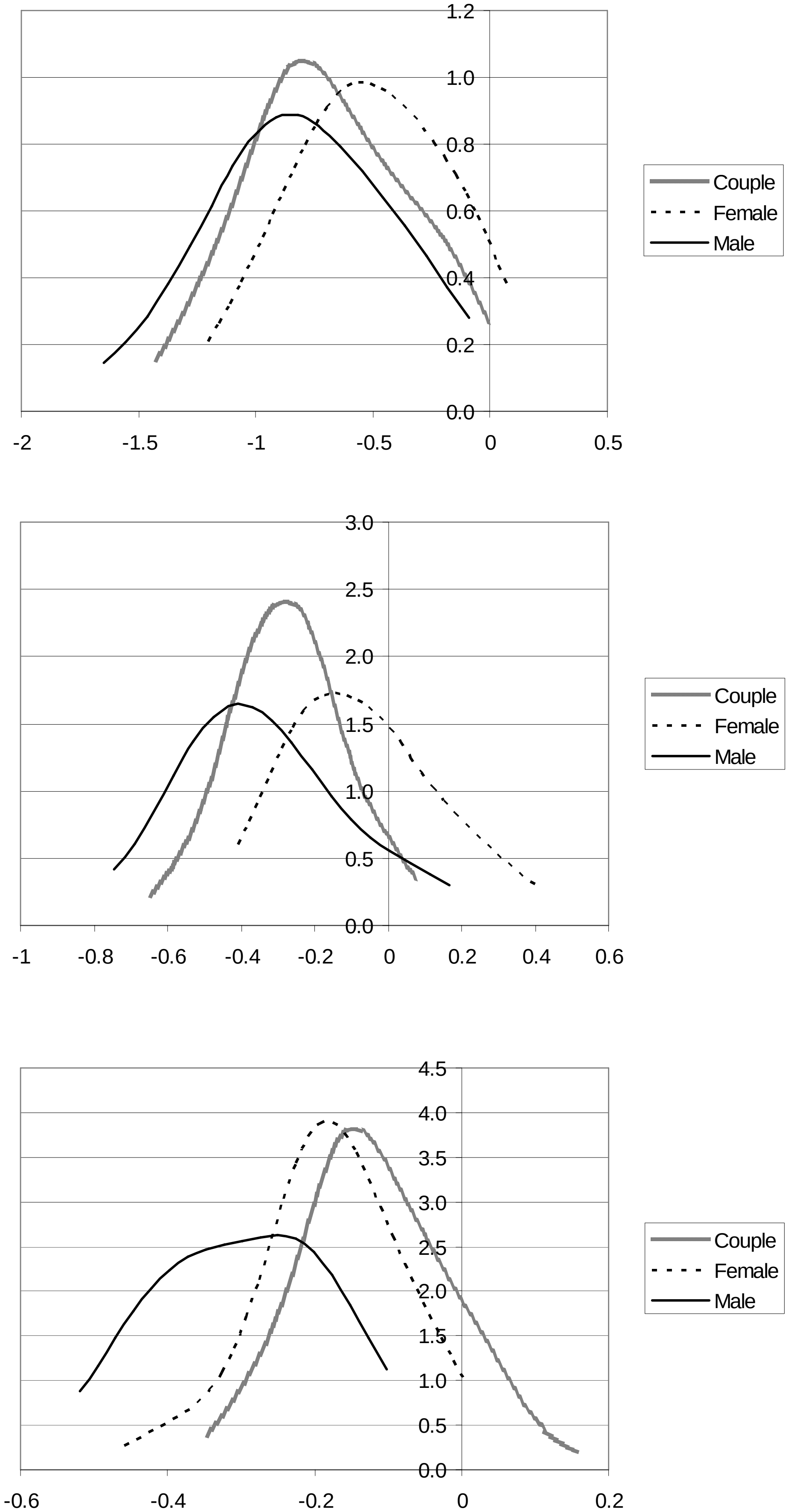


Figure 5. Fitted Conditional Distributions of Marginal values (Price, Pesticide and Fat)

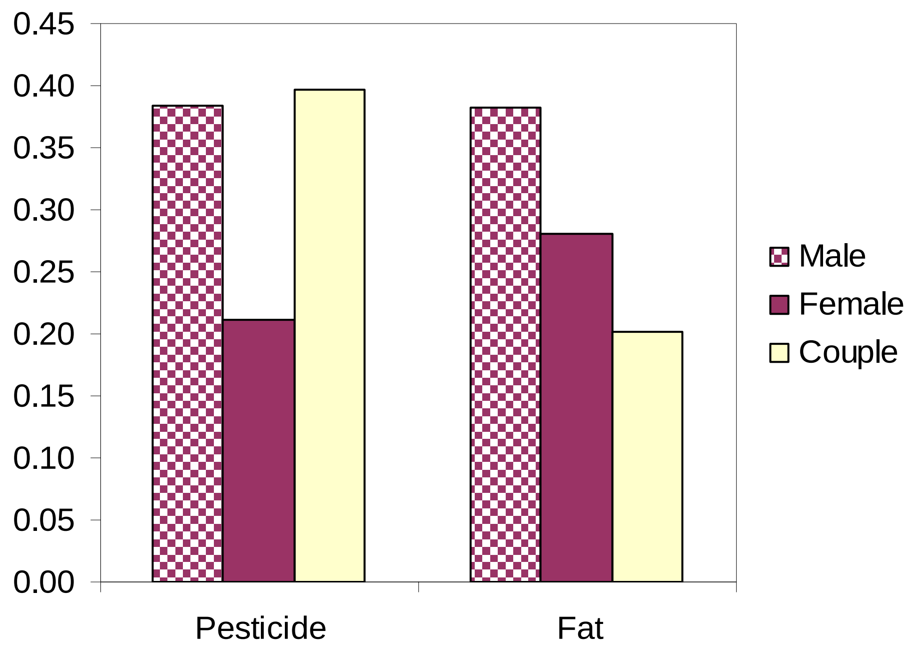


Figure 6. Marginal willingness to pay (£ per week per percentage point).