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Valuation of health inputs and convenience in new products

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Abstract

The prevalence of illnesses related to the modern diet and a more sedentary lifestyle has increased markedly over the last few decades. There is therefore a need for effective strategies to promote health and to reduce the prevalence of diet-related diseases. In this paper**,** we study the willingness to pay for a new concept, *healthy canteen takeaways*. In the analysis, we depart from a household production model. To control for the endogeneity of the health state, we use a control function approach. The result suggests that health inputs, such as low-fat meat and a larger amount of vegetables, increase respondents' utility. Respondents' valuations of the convenience attribute are very heterogenous, with both positive and negative values. From a policy perspective, the IV estimation turns out to be of importance, with a sign change in the valuation of low-fat meals for individuals with a poor health state (high MBI).

Key words: endogen, discrete choice, health, household production, instrumental variable

JEL code: C25, D12, D13, I10

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1. Introduction

Poor nutrition is an important contributor to several serious diseases, such as hypertension, dyslipidemia, type 2 diabetes, cardiovascular disease, osteoporosis, dental disease, many common cancers and obesity (Palacios *et al*. 2009, WHO 2003, Mann 2002). In most Western countries, as well as in many transition economies, the prevalence of illnesses related to the modern diet and a more sedentary lifestyle has increased markedly over the last few decades.

The demand for ready-to-eat and fast food has also increased over recent years.[1] A major factor in the increased demand for ready-to-eat meals is increased labour supply, especially for women, which has decreased the household's time for home production, including the preparation of food. Mancino and Newman (2007) find for example that household time resources significantly affect how much time is allocated to preparing food. According to their results, working full-time and being a single parent appear to have a larger impact on time allocated to food preparation than an individual's earnings or household income. Grot et al. (2009) also find that lack of time and old habits are major barriers to healthy eating.

Although the Danes' food habits have improved over the last 15 years (Kjøller *et al*. 2007), the average intake of fat (especially from meat and dairy products) is still above the recommended level, while the intake of fruit and vegetables is below the recommendation. It is estimated that if the Danish population consumed the recommended daily amount of 500 g fruits and vegetables and reduced the intake of fats to the recommended 30E%, mortality due to cardiovascular diseases would decrease by 17 and 9 percent respectively. In addition, 30 percent of all new occurrences of cancer in Denmark are estimated to be diet-related (Kjøller et al., 2007). There is therefore a need for effective strategies to promote health and to reduce the prevalence of diet-related diseases.

One setting in which it is possible to implement new health-promotion interventions is in the workplace. The workplace is a unique setting, since it reaches a large proportion of the adult

[1] Fast food and convenience food tend on average to be more calorie dense and nutritionally poorer (containing less vegetables and more fat and salt) than foods prepared at home. For Denmark, Hansen et al. (2006) and Fagt (2006) estimate that fast foods and convenience food contain 800-1400 kJ/100g, while home-cooked food contains about 600 kJ/100g.

population including those unlikely to engage in preventive health behaviour programmes (European Commission 2005, University of Crete School of Medicine 2001, Wanjek 2005, and Terborg 1986). One suggested strategy to meet the challenge of lifestyle-related health problems is the concept of *healthy canteen takeaways* (CTA). The idea is to make the preparation of healthy meals at home easier and less time-consuming by making available fresh, ready-to-eat-meals produced in canteens for employees to take home.

Intervening at this level of the workplace environment not only has the potential to improve the health and well-being of employees themselves but also their families. This is an additional advantage compared to interventions that solely aim to improve the dietary habits of employees, for example by interventions in the workplace canteen at lunch.[2] The idea behind the healthy CTA is that it should contain more vegetables and less fat than the dishes consumed by the average Dane for dinner.[3]

In this paper, we will examine the willingness to pay for healthy canteen takeaways. Since the product and concept are new, we will use stated preference data from a large-scale choice experiment to carry out the analysis.[4] Although there is a need to improve the dietary intake of Danes in general, it is also of interest to study whether this product attracts different groups of individuals, especially those groups that have previously been found to have a particularly poor nutritional intake or have a poor diet-related health state.

Since the *diet-related* health state is endogenous, one has to control for this in the estimation of the econometric model. Previous studies that have included the individual's health state in discrete choice models (see e.g. Chen 2011, de Jong et al. 2007, van der Horst and Siegrist

[2] Although a large number of studies have evaluated worksite health-promotion programmes, most have focused on interventions that mainly affect the individual worker, see e.g. Aldana et al. (2005), Bertera (1990), Downey and Sharp (2007), Gil and Wijk (2004), Lassen et al. (2004), Lee et al. (2006), Mills et al. (2007), Oberlinner et al. (2007), Schultz et al. (2002) and Stein et al. (1999, 2000).

[3] Surveys of the dietary habits of the Danish population (Fagt et al., 1998) indicate that in 1995 the average intake by adults of vegetables during the evening meal was approximately 50-60 g/day and the average intake of sauce 20-25 g/day. The intake of vegetables during the evening meal has increased since that time and is now about 75 g/day.

[4] A small number of companies have recently introduced canteen takeaways for their employees in Denmark. However, since the concept is new and the present market small, it is not possible to carry out an analysis of the demand for healthy CTA on revealed preference data.

2011) have not accounted for endogeneity, which may have affected their results and policy conclusions. In this paper, we use a control function approach to control for endogeneity in a discrete choice model. To the best of our knowledge, this is the first application in the health economic literature.[5] Petrin and Train (2010) use the approach to study households' choices among television options, and Guevara and Ben-Akiva (2006) use it to analyse residential location; in both applications the price variable is endogenous.

As pointed out by Train (2009), a central issue in the control function approach is the specification of the control function. Departing from a simple utility maximizing model, we show that the reduced form demand function for health can be seen as a good specification of the control function in health-economic applications. The empirical results of this study reveal that treating the health state as exogenous can have major effects on policy recommendations.

The paper is organised as follows. In the next section we present the economic model. In Section 3 we describe the choice experiment, followed by presentation of the data in Section 4. Section 5 presents the econometric model and Section 6 the results. The paper ends with concluding remarks in Section 7.

[5] Terza et al. (2008) show that two-stage residual inclusion gives consistent parameter estimates in non-linear econometric models. They present simulation results for two commonly used models within the health economic literature, the durations model and the ordered logit model.

2. The economic model

In the analysis of the demand and willingness to pay for healthy canteen takeaways, we will depart from a household production model, in which we consider the choice of meal as a short-term decision conditioned on longer-run labour supply by the male and female in the household. One reason for conditioning on labour supply instead of treating leisure as a choice variable is that most people in our sample would not change their labour supply if they were offered a more convenient and timesaving dinner alternative, see Section 6.3.[6]

Thus, conditional on labour supply, the household is assumed to get utility from health, H, *n* X-goods that affect health, and a composite good Y which does not contribute to bodily health. The utility function, which has the usual properties, can thus be written as

$$U = U\big(H, X_i, Y; L_m, L_f\big), \qquad i = 1, \dots, n, \tag{1}$$

where labour supply by the male, L_m, and female, L_f, is measured as numbers of hours worked per week. The health function can be described by the production function

$$H = H\big[F_j(X_i, N_{ik}), \dots, F_m(X_i, N_{ik}), E; D\big], \qquad \begin{matrix} i = 1, \dots, n \\ k = 1, \dots, l \end{matrix} \tag{2}$$

where $F_j(X_i, N_{ik})$ represents the risk of developing chronic disease *j* from the consumption of good X_i. The health risk is a function of the level of consumption and the nutritional content of the product, N_{ik}, measured as the density of nutrient *k* in product *i*, e.g. grams of fat per 100g of X_i. For a nutrient like saturated fat, the risk of developing a chronic disease increases with consumption and the amount of fat per weight unit of the product. Increasing the intake of fibre (vegetables) will, on the other hand, be health improving and reduce the risk of develop a chronic disease.

We assume that the person values the X-goods via the health function because they have characteristics, nutrients, necessary for the production of health, but also that the X-goods

[6] An additional advantage of this approach is that labour supply (measured as the number of hours worked per week) is more accurately measured than the rate of pay for individuals.

have some additional characteristics, C, such as taste, texture and convenience that affect utility directly via equation (1). *E* is exercise time, which is assumed not to argument utility other than through the effect on *H*.[7] D is a vector of exogenous observable personal characteristics (e.g., age, gender, education) that may affect the allocative efficiency across heath inputs. From equation (2), we see that the health state is endogenous.

The individual maximizes utility subject to (2) and the budget constraint

$$I = \sum_i X_i P_i + P_E E + Y, \qquad i = 1, \dots, n, \tag{3}$$

where *I* is exogenous money income and P_i are exogenous prices, with the price for the composite good Y normalized to one. The household production model, as depicted, is characterized by joint production (Pollak and Wachter, 1975), in the sense that the X-goods both affect health and contribute to utility directly.

First order conditions from the maximization of (1) subject to (2) and (3) state that the marginal utility of a health-related X-good depends on the direct marginal utility of the consumption, such as the marginal utility of taste, plus the product of the marginal utility of health and the marginal effect of the consumption on health. A new product with a high fat content is likely to have a negative effect on health, but whether the effect on the marginal utility is positive or negative is an empirical question. In addition to the negative health effect, it depends on the individual's valuation of poorer health and his/her valuation of e.g. the product's taste. Studies (e.g. Drewnowski, 1997a,b) show for example that the most palatable food is high in fat and energy, which suggest that the marginal utility could be positive.

The household's reduced form demand functions for the goods (including the health inputs X_i and *E*) derived from the constrained maximization have the general form

$$G^* = G^*\big(P_1, \dots, P_k, I; L_f, L_m, D\big), \tag{4}$$

[7] The health production function could also be augmented with additional health inputs, such as medical care or medication. In general, food intake and exercise are not the only market goods in a health production function. The health production function can be seen as a static version of Grossman's (1972a, 1972b) health investment function.

where $G^* = [X_i^*, \dots, X_n^*, E^*, Y^*]$ is the set of utility-maximizing demands for food, exercise and the composite non-health good. Substitution of the optimal choices of food and exercise from expression (4) into the health equation (2) yields the reduced form demand function for health

$$H^* = H^*\big(P_1, \dots, P_k, I; L_f, L_m, D\big). \tag{5}$$

From equation (5) we see that the individual, conditional on the household's labour supply, chooses his/her health state, conditional on prices, income and exogenous tastes.

Since we will use a choice experiment to elicit the valuation of the health inputs and convenience, we need an expression of the indirect utility function. Substitution of the optimal choice of health status and the optimal choices of the X-goods and the composite non-health good into the utility function gives us the conditional indirect utility function

$$V = V\big(\mathbf{P}, I, \mathbf{N}, \mathrm{C}; L_f, L_m, \mathbf{D}\big), \tag{6}$$

where **P** is the price vector for the goods, and **N** and C are the attribute vectors for the X-goods**,** representing nutrients and convenience respectively.

The marginal willingness to pay (MWTP) for a change in nutrient *k* in good x_1 is given by totally differentiating the indirect utility function with respect to N_{1k}. Solving for the compensating change in income, and using the expressions from the totally differentiated health function and substituting in the first-order conditions shows that the marginal willingness to pay (MWTP) for a change in nutrient *k* in good X_1 is given by

$$\begin{aligned} MWTP_{N_{1k}} = &\left[\frac{\partial U/\partial H}{\lambda}\right]\frac{dH}{dN_{1k}} + \left[\frac{\partial U/\partial X_1}{\lambda}\right]\frac{\partial X_1^*}{\partial N_{1k}} + \left[\frac{\partial U/\partial X_2}{\lambda}\right]\frac{\partial X_2^*}{\partial N_{1k}} \\ &-P_1\frac{\partial X_1^*}{\partial N_{1k}} - P_2\frac{\partial X_2^*}{\partial N_{1k}} - P_E\frac{\partial E^*}{\partial N_{1k}} \end{aligned} \tag{7}$$

where λ is the marginal utility of income. To simplify the representation we have set *n* = 2, i.e. we consider a case with two X-goods. Expression (7) shows that the MWTP can be described as the sum of observed changes in expenditures on all goods, including physical

exercise, plus the monetary equivalent of the disutility of illness (the first term in the equation) and of the marginal utilities of the X-goods.

The MWTP for a change in N_{1k} thus depends on how the individual adjusts his/her demand, not only on X_1 but on all goods, and on the good prices. However, the expression also shows that it is not sufficient to observe the change in the expenditures on all goods to estimate a correct value of the MWTP, since this neglects both the utility value of the induced change in health $((\partial U/\partial H)/\lambda) \times (dH/(dN_{1k})$ and the direct utility values of the changes in the X-goods $((\partial U/(\partial X_i))/\lambda) \times (dX_i^*/(dN_{1k}))$.

There are therefore at least two reasons for undertaking a choice experiment where we use information about the individual's indirect utility function: it gives a theoretically correct estimate of the willingness to pay, and it allows us to estimate the value of a new product.

3. The Choice Experiment

To elicit the willingness to pay for different attributes of a meal, we carried out a choice experiment. The attributes were chosen to be as neutral as possible, to avoid the possibility that some people might dislike a particular type of dish. The attributes that we consider in this study are fat content (represented by different types of meat and sauce), amount of vegetables, CTA/home cooking, and price.

Before designing the choice experiment, we surveyed the prevailing price level for CTA. The survey showed a price span for CTA from DKK 25 to DKK 95 (€3.35 to €12.70) per portion. Meals at the lower end of the price span consisted of 'leftovers' from the dish served at lunch, while alternatives with a special menu were found from DKK 40 (€5.36) and above. As the cost for the provisions used for home cooking are expected to be lower than that for CTA, which also include labour, we use a design with asymmetric prices for home cooking and CTA. As the information loss of excluding price observations at the upper tail of the distribution is minute, Alberini (1995), the highest price for CTA in the choice experiment is set at DKK 75 (€10.05), see Table 1. For home cooking, we apply prices in the range DKK 20 (€2.68) to DKK 50 (€6.70).

In the choice experiment, the amount of vegetables is either 75 grams or 200 grams. Seventy-five grams per portion corresponds to the average amount of vegetables consumed by Danish households, while the recommendations are 200 grams of vegetables per portion. The attribute *meat and sauce* also has two levels: low-fat meat and sauce with 5 percent fat or meat and sauce with 15 percent fat. With reference to nutrients – see equation (2) – vegetables can be regarded as an attribute that contains healthy nutrients (such as vitamins and fibre), while meat and sauce varies in fat content – a nutrient that is generally considered unhealthy when overconsumed. The design of the choice experiment thus allows respondents to show their WTP for an increase in the intake of healthy nutrients and a decrease in the intake of unhealthy nutrients.

Table 1 about here

The choice set also contains a third alternative, an opt-out (Haaijer et al. 2001, Kontoleon and Yabe 2003). An example of a choice set is presented in Figure 1. Each choice set was also provided with examples of possible low-fat meat and meat, and the amount of vegetables corresponding to 75 grams, see Figure 1.

Figure 1 about here

In the CE, we used a fractional-factorial design, with 32 choice sets divided into eight blocks. Each respondent thereby received four choice sets. The 32 choice sets were generated in SAS (Kuhfeld 2005). To increase the amount of statistical information collected and increase the efficiency of the design, we then used a foldover design or swapping (see e.g. Johnson et al. 2006, Huber and Zwerina 1996) for the two-level attributes. That is, when the same level of a two-level attribute appeared for both meal A and B in a choice set, the alternative quantity was applied to one of the meals, keeping the asymmetry of the prices. This strategy guarantees that the resulting choice sets will have no overlap for the two-level attributes. In the final design, there were no dominant alternatives and each block contained the four prices for home cooking. In the survey the four choice sets in each block were randomly assigned to each individual.

In addition to the choice experiment, respondents were asked a number of questions about food intake, exercise habits, labour supply and household characteristics by questionnaire. The questionnaire was conducted as an internet survey in February 2008. It was sent to 9,918 Nielsen's web panel members aged 18 to 65 years[8]; 4,550 respondents answered after two reminders, giving a response rate of 45.9 percent.

[8] Since we are interested in the workforce's willingness to pay for healthy CTA, we have restricted the age of the respondents. In Denmark, the retirement age is usually 65 years.

4. Data and Descriptive Statistics

The data used in this study are based on the subsample of respondents who say that they have an interest in buying CTA. A relatively large proportion, 31 percent, state that they are not interested in buying CTA. According to the survey results, the main reason for this is that they do not think that the quality is good enough and they prefer food for which they know the nutritional content.[9] Generally, these individuals state that they have a good diet (with good nutritional content). This group is thus not the main target for CTA, if the aim is to improve the dietary quality of the household.

Since we are mainly interested in the WTP for employees with access to a canteen, we also excluded students, pensioners, farmers and the self-employed from the sample. To reduce the impact of outlying observations, 24 respondents with a body mass index (BMI) of over 35 were removed from the final sample, which consisted of 2,509 respondents.

Descriptive statistics for the sample are presented in Table 2.

Table 2 about here

About 7 percent of respondents state that they purchase convenience (takeaway) food more than once a week, while 13 percent purchase it once a week. Approximately 18 and 22 percent respectively state that they purchase convenience food once or twice per month. The cumulative percentage that purchases this type of food at least twice per month is thus around 40 percent. Twenty-eight percent state that they purchase convenience food less than once a month and 13 percent that they never purchase prepared food. These results are in line with Groth et al. (2009), who found that about 17 percent of Danes eat convenience (takeaway) food at least once per week.

[9] The arguments given by these respondents highlight an important problem for suppliers of high quality takeaway food – the problem of asymmetric information, see e.g. Akerlof (1970). Although they can be shown to be of high dietary quality, consumers generally believe that takeaway food and fast food have a lower dietary quality, which will also be reflected in their demand and WTP for these products.

5. The Econometric Model

In the analysis of the discrete choice data, we apply a mixed logit model which allows for taste differences between respondents. We start the analysis by considering a main effects model, whereupon we extend the model to allow for interaction effects. As described in the choice experiment, the sampled individual (h = 1,…,H) can choose between three alternatives in each of four choice situations. The individual is assumed to consider the full set of alternatives and choose the one with the highest indirect utility. The utility associated with each alternative i as evaluated by individual h in each choice situation can be represented by the indirect utility expression

$$U_{hi} = V(\mathbf{A}_{hi}, p_{hi}, \boldsymbol{\lambda}_h) + \varepsilon_{hi}, \tag{8}$$

where $\mathbf{A}_{hi}$ is a vector of the attributes $\mathbf{N}_{hi}$ and $\mathbf{C}_{hi}$, p_{hi} is the price, $\boldsymbol{\lambda}_h$ is a parameter vector representing the respondent's tastes which are allowed to vary across individuals, and ε_{hi} is a random term that is i.i.d. extreme value distributed. More specifically**,** we specify the indirect utility function as

$$U_{hi} = \alpha_i + \boldsymbol{\beta}_h' \boldsymbol{A}_{hi} + \gamma p_{hi} + \delta \nu_h c_{hi} + \varepsilon_{hi}, \tag{9}$$

where α_i is an alternative specific constant, $\beta_h = b + \xi_h$, where b is the population mean, and ξ_h is the stochastic deviation that represents the household's tastes relative to the average tastes in the population, and γ is the price parameter that is assumed to be fixed. In the estimation, the beta parameters are assumed to be normally distributed. To simplify the notation we omit the time index in the presentation of the models.

To allow for correlation in unobserved utility between the first two alternatives, we add an error component, $\nu_h c_{hi}$, in the model. c_{hi} is a dummy variable that equals 1 for alternatives one and two, and zero for the opt-out alternative; ν_h is an i.i.d. standard normal deviate. The standard deviation of the error component, which reflects the degree of correlation between the two first alternatives, is estimated via the δ coefficient. This specification is similar to a nested logit model with alternatives 1 and 2 within the same branch and the opt-out

alternative in another branch.[10] In the estimation we normalize α_i for the opt-out alternative to zero.

5.1 Model with interaction terms

The model with interaction terms can be written as

$$U_{hi} = V\left(\mathbf{A}_{hi}, p_{hi}, I_h, \mathbf{D}_h, H_h, L_m, L_f, \boldsymbol{\lambda}_h\right) + \varepsilon_{hi}. \quad (10)$$

In the interaction model the $\mathbf{D}_h$ vector and the scalars I_h , H_h, L_m and L_f are interacted with all or some of the attributes in the vector $\mathbf{A}_{hi}$. $\mathbf{D}_h$ contains household characteristics that are considered to be exogenous, such as age, gender and education. Equation (10) is similar to eq. (6), which is derived from the individual's utility maximization problem, with the exception that eq. (10) includes the individual's health state instead of the price for health. We have chosen to include the individuals' health state instead of the price for health since the latter consists of a large set of prices (e.g. the cost of exercise, price of medicine and foodstuffs). The individual's health state also constitutes an important variable from a policy perspective. However, according to the economic model**,** the health state is endogenous. This implies that the random term ε_{hi} is not independent of H_h, which is required for standard estimation.

One solution is to use an instrumental variable estimator to estimate the parameters. The idea of the control function approach (see e.g. Blundell and Powell 2004, Imbens and Newey 2009, and Pertin and Train 2010) that we apply in this study is to decompose the endogenous variable, H_h, into two parts**,** one that is independent of ε_{hi} and another that is correlated with ε_{hi}. This can be symbolized by the function

$$H_{hi} = Q(\mathbf{Z}_{hi}, \boldsymbol{\delta}) + \eta_{hi}, \quad (11)$$

[10] In an initial estimation, the error terms for all equations were allowed to be correlated. The results revealed, however, that the estimated variance coefficients between the opt-out alternative and the other alternatives were insignificant.

where Q is a function of variables $\mathbf{Z}_{hi}$ that are independent of ε_{hi} and η_{hi}. The correlation between H_{hi} and ε_{hi} is then captured by the correlation between η_{hi} and ε_{hi}; by accounting for this correlation, consistent parameters can be estimated.

Following Blundell and Powell (2004) and Train (2009), we decompose ε_{hi} into its mean conditional on η_{hi} and its deviations around this mean, $\varepsilon_{hi} = E[\varepsilon_{hi}|\eta_{hi}] + \epsilon_{hi}$. Since $\epsilon_{hi} = \varepsilon_{hi} - E[\varepsilon_{hi}|\eta_{hi}]$ is not correlated with η_{hi}, the deviations are also uncorrelated with H_{hi}, and the endogeneity of H_h is captured by $E[\varepsilon_{hi}|\eta_{hi}]$. In other words, conditional on η_{hi}, H_{hi} and ε_{hi} are independent, and H_{hi} is exogenous. If the endogenous variable is continuous and eq. (11), $H_{hi} = h(Z, \eta_{hi})$, is strictly monotone in η, $\boldsymbol{\lambda}_h$can be estimated consistently by augmenting eq. (10) with the expectation of ε_{hi} with respect to η_{hi}, Blundell and Powell (2004) and Imbens and Newey (2009).

In our case, η_h is an estimated residual from a regression of H_h on $\mathbf{Z}_h$, and the conditional expectation (and control function) is $E[\varepsilon_{hi}|\eta_{hi}] = \varphi\eta_{hi}$, i.e., the control function is η_{hi} times a coefficient to be estimated. Thus, given a consistent estimate of η_h, $\boldsymbol{\lambda}_h$ can be consistently estimated by substituting the conditional mean and deviations into the indirect utility equation, i.e., $U_{hi} = V(\cdot) + \varphi\eta_{hi} + \epsilon_{hi}$.

For estimation purposes, we also have to consider the distribution of η_{hi} and ϵ_{hi}. Since ε_{hi} is extreme value distributed, we follow Pertin and Train (2010) and decompose the error term in (10) into two components, $\varepsilon_{hi} = \varepsilon_{hi}^{I} + \varepsilon_{hi}^{II}$, where ε_{hi}^{I} is normally distributed and correlated with H_{hi}, ε_{hi}^{II} is i.i.d. extreme value distributed, and η_{hi} and ε_{hi}^{I} are jointly normally distributed.

The conditional distribution of ε_{hi}^{I} is then normal with mean $\varphi\eta_{hi}$, $\epsilon_{hi}^{I} = \varepsilon_{hi}^{I} - E[\varepsilon_{hi}^{I}|\eta_{hi}]$ is normal with zero mean, while the conditional distribution of ε_{hi}^{II} is extreme value since ε_{hi}^{II} and η_{hi} are independent. Expressing $\epsilon_{hi}^{I} = \sigma\mu_{hi}$, where μ_{hi} is i.i.d. standard normal, the indirect utility function can then be written as

$$U_{hi} = V\left(\mathbf{A}_{hi}, p_{hi}, I_h, \mathbf{D}_h, H_h, L_m, L_f, \boldsymbol{\lambda}_h\right) + \varphi\eta_{hi} + \sigma\mu_{hi} + \varepsilon_{hi}^{II}. \qquad (12)$$

The choice probability is a mixture of logit model, with the mixing over the error components μ_{hi} and the random elements of $\boldsymbol{\lambda}_h$.

Empirical specification

In an initial specification of the interaction model, $\mathbf{D}_h$ contained a continuous variable representing the respondent's age, and dummy variables representing the respondent's gender, educational level (low, medium or high, or other form of training**),** type of employment (blue/white collar), household with children, and single adult household. These variables, plus the household income, I_h, were then interacted with all attributes of the $\mathbf{A}_{hi}$ vector *i* = 1, 2 (type of meat and sauce [i.e. fat content], amount of vegetables and CTA/home cooking). The health variable, H_h, was interacted with the meat/sauce and vegetable attributes, since these attributes enter the health production function; labour supply, L_f and L_m, was interacted with the attribute CTA/home cooking, i.e., reduced time spent buying food and cooking. For each attribute, the estimated parameters for the interaction variables were specified as mean shifters for the *b* coefficient. If we just consider the variables in the $\mathbf{D}_h$ vector, this implies that the beta coefficient in the interaction model can be written as $\beta_h^D = b + \boldsymbol{\psi}'\boldsymbol{D_h} + \xi_h$.

To reduce the number of parameters in the final model specification, groups of interaction variables that had low explanatory power (where the *p*-value for the most significant interaction variable in the group (e.g. age) was above 0.15) were removed. Variables that had low explanatory power when interacted with the attributes of **A** were age, type of employment, education and income. In addition, the results show that the point estimate for the interaction variable health×amount of vegetables was strongly insignificant with a *p*-value of 0.95. These variables were therefore removed from the final model specification. The final specification for the indirect utility function, to which we also add the error component in the main effects model, can therefore be written as

$$U_{hi} = \alpha_i + \gamma p_{hi} + \boldsymbol{\beta}_h^D \boldsymbol{A}_{hi} + (\psi^m L_m + \psi^f L_f)\mathrm{CTA}_{hi} + (\psi^H H_h + \varphi\eta_h)\mathrm{meat}_{hi} + \sigma\mu_{hi} + \delta\nu_h c_{hi} + \varepsilon_{hi}^{II}. \quad i = 1, 2. \tag{13}$$

In this application, it natural to apply the reduced form demand function for health (5), as the instrumental equation for the individuals' health state, i.e. equation (11), is specified as

$$H_h = H^*(\mathbf{P}, I_h, \mathbf{D}_h) + \eta_h. \quad (14)$$

Equation (13) and (14) then represents the triangular system that we estimate. The reduced form demand function for health is estimated in a first step, whereupon the residuals are substituted into the utility expressions for the discrete choice model.

5.3 The instrumental equation: the reduced form demand function for health

In the estimation of the instrumental equation, i.e. the reduced form demand function for health, $H_h = H^*(\mathbf{P}, I_h, \mathbf{D}_h) + \eta_h$, we use the respondent's body mass index (BMI) as a proxy variable for the individual's health state. As instrumental variables**,** we use the individual's age, gender and education in addition to household income**,** which is considered to be exogenous in the economic model. These variables are generally also considered to be important determinants for individuals' dietary intake and health state. Furthermore, we include consumer prices for foodstuffs that are considered less healthy and that Danes generally overconsume (Pedersen et al. 2010), e.g. soft drinks and butter; we also include consumer prices of foodstuffs that are considered healthy, such as fruit and vegetables. A priori, these types of energy-dense and healthy products are assumed to have a greater impact on individuals' BMI than other foodstuffs.

To minimise the problem of quality differences, we collected prices for specific products/brands with large market shares, such as the price for a 250g pack of *Kærgården* butter or 500g of broccoli. These prices were collected at local (municipal)[11] level from sales statistics in stores that are part of Coop Denmark (i.e., *Kvickly*, *SuperBrugsen*, *DagligBrugsen*, *Fakta*, *Irma* and *Irma City*). They were then converted to price indexes. The price indexes for specific products at municipal level were then matched with the data from the choice experiment, which contain information on which municipality the respondent lives in. The price indices, which are based on data for 2008, were supplied by *FDB analyse.*

[11] In Denmark there are 98 municipalities.

The results in Table 3 indicate that the parameter estimates for both gender and age are strongly significant, with a significantly higher BMI for males than females. The significantly negative sign of the income parameter also suggests that people with higher incomes have lower BMI. In addition, the results reveal that people with lower education have a higher BMI, which may suggest that education affects the allocative efficiency across health inputs. Compared to the group with the highest education (five or more years of education after high school), we find a significantly higher BMI for all groups with a shorter education. However, one should note that there is a small difference in the parameter estimates for the groups with 'low' and 'medium' education. These results are in line with findings from other studies, see e.g. Kjøller et al. (2007) and references therein, which suggest that respondents' self-reported BMI seems to be reliable.

Table 3 about here

From Table 3, we can see that most of the price indices that we have included in the regression are significant at a five percent significance level. The results suggest that higher prices for soft drinks and organic butter will result in lower BMI. The results for butter indicate conversely that a higher price would increase BMI. For the healthy food products, the results are mixed. A higher price for broccoli would result in a lower BMI, whereas an increase in the price of apples would increase BMI, though this effect is insignificant. Although most of the parameter estimates are significant, one should interpret the price coefficient with caution since we do not observe changes in BMI and prices over time.

6. Results

6.1 Main effects model

Table 4 presents the results from the estimation of the main effects model. In an initial specification, the β coefficients for all attributes except price were allowed to vary across individuals. Since the estimated standard deviations for the β coefficients for *amount of vegetables* and *type of meat and sauce* were insignificant, these coefficients are treated as fixed in the final specification. The results reveal that all parameters in the main effects

model are strongly significant. A larger amount of vegetables and low-fat meat both result in a higher utility for individuals.

On the other hand, the attribute *canteen takeaway*, compared with home cooking, results in a reduced utility for the average individual in the sample. The estimated standard deviation for the canteen takeaway parameter is large, however, implying that there is a large heterogeneity among individuals in their valuation of canteen takeaways. Forty-four percent of the individuals are estimated to value the attribute positively. One explanation for the large standard deviation is that CTA may represent several characteristics for respondents, such as convenience and quality. Groth et al. (2009) find for example that a lack of time is an important barrier to healthy eating among Danes, but also that Danes have strong preferences for home-cooked meals with fresh ingredients.

Table 4 about here

The estimated willingness to pay is presented in Table 5. Since the utility function equations (9) and (13) are linear in money, the marginal willingness to pay (MWTP) for the attribute is the ratio between the parameter of the attribute and the cost parameter, such that

$$MWTP = -\frac{\text{Attribute parameter}}{\beta_{Cost}}.$$

For the mixed logit model**,** the expected WTP is given by (see e.g. Hanemann 1999, Small and Rosen 1981)

$$E(WTP_i) = \frac{1}{\beta_{Cost}}\left(ln\left(\sum_{j=1}^{J^1} e^{V_{ij}^1}\right) - ln\left(\sum_{J=1}^{J^0} e^{V_{ij}^0}\right)\right)$$

In a market in which a single before and after option is to be evaluated ($J^1 = J^0 = 1$), the expected WTP is equal to the marginal WTP. In the case of multiple options, where more than one combination of attributes is present in the market and individuals can choose between

options, the marginal and expected WTP will generally differ. Intuitively, the expected value takes account of the change in utility, weighted by the probability of choosing that option.[12]

We estimate the expected WTP for five scenarios, see Table 5. In the initial state, the individual can choose between four options ($J^0 = 4$), which all involve home cooking with different quantities of vegetables and types of meat. In the different scenarios, we change one or several of the attributes for one of the options. The options in the initial state and the different scenarios are presented in the appendix.

Table 5 about here

Table 5 reveals that the marginal WTP is about four times higher than the expected WTP. The marginal WTP for 200g vs 75g of vegetables is for example DKK 11.12 (€1.49), while the expected WTP is DKK 2.55 (€0.34). For an improvement in the health inputs in a meal, from 75g of vegetables and meat with 15% fat to a meal with 200g of vegetables and meat with 5% fat, respondents have a marginal and expected WTP of DKK 34.70 (€4.66) and DKK8.43 (€1.13) respectively. For the 44 percent of respondents with a positive valuation of CTA, these amounts can also be seen as a lower bound of their valuation of healthy CTA. Individuals with a negative valuation of CTA are less likely to buy healthy CTA. However, even if the average respondent has a negative valuation of CTA, scenario 5 reveals that the *healthy* CTA concept increases the utility for the average respondent.

6.2 Model with interaction variables

Table 6 presents the estimation results from the IV estimation and a reduced/uncorrected model that does not account for endogeneity. From the IV estimation, we see that the point estimate for the control function is strongly significant, supporting the hypothesis that the health state/BMI is endogenous. As in the main effects model, the coefficients for the attributes *price, type of meat and sauce, amount of vegetables* and *canteen takeaways* are all statistically significant at a five percentage significance level for the IV-estimated model.

[12] Expected WTP is the value of having a healthier alternative in the choice set, whether consumers purchase it or not.

The negative point estimate for the interaction variable canteen takeaways/children indicates that, in practice, the CTA concept may have to be adjusted so that it fits the needs for both households with and without children, for example making to possible to order CTA in different package sizes. However, it may also indicate that a 'quality' characteristic (preparation of food) of canteen takeaways can be more important for families with children. Compared with households consisting only of adults, households with children will obtain a higher utility from meals that contain low-fat meat and a smaller amount of vegetables. However, for households with children, it is only the interaction variable with the amount of vegetables that is significant at a five percentage significance level.

Compared with the other interaction variables, the interaction variables between CTA and labour supply are more likely to identify the 'convenience' characteristic of CTA. And for both men and women, an increased labour supply is associated with a higher utility from CTA, although it is only the interaction variable with female labour supply that is statistically significant. One explanation is that women generally have a greater responsibility for preparing and cooking dinner (see e.g. Groth et al. 2009).

The results also suggest a more negative effect on utility from *low-fat meat* the higher the individual's BMI, indicating that individuals with a high BMI have a stronger preference for fat. Sensory studies also support this result. Bartoshuk *et al*. (2006) and Drewnowski (2002) found for example that the liking for fat varies with body mass index, and that obese individuals have a stronger preference for fat than those that are not obese.

Although households with one adult will gain a higher utility from all interacted attributes compared with households with two or more adults, the effects are not statistically significant. Nor is there any statistically significant difference in utility from the interacted attributes between men and women, at a five percent significance level.

Table 6 about here

The reduced model that does not control for endogeneity gives similar results to the IV estimates, except for the endogenous variable *BMI* and *low-fat meat*. When we do not control for endogeneity, the point estimate for the interaction variable *low-fat meat/BMI* changes sign, becoming significantly positive. From a policy perspective, this result is of great importance

since it suggests that introducing healthy CTA would attract groups of individuals with high BMI (individuals that likely need to improve their dietary intake), whereas the IV estimates suggest the opposite. Compared with the IV estimates, there is also a sign change in the point estimate for the attribute *low-fat meat* in the reduced model. The point estimate also becomes insignificant.

The significantly negative point estimate of 0.055 for the interaction variable vegetable and households with children implies that the MWTP for an increase in the amount of vegetables from 75g to 200g is DKK 8.44 (€1.13) lower for households with children compared with households with no children.

An increase in female labour supply of 10 percent, say from the average labour supply for women of 33.8 hours per week to 37.2 hours per week, which corresponds to full-time work in Denmark, results in an increased MWTP for canteen takeaways of DKK 2.40 (€0.32). An increase in male labour supply of 10 percent (corresponding to 3.8 hours per week for the average man) results in a somewhat lower increase in the MWTP of DKK 1.96 (€0.26). According to the IV-estimates, an increase in an individual's BMI of 1.0 will lower the marginal WTP for *low-fat meat* by DKK 9.83 (€1.32).

6.3 Alternative food intake and time use

To find out the alternative food intake to healthy canteen takeaways, we asked respondents to state what kind of food healthy CTA would replace. We also asked respondents to state their alternative time use if they purchased canteen takeaways. Although the introduction of healthy CTA can be said to be welfare improving for individuals, it is of interest to find out for example whether this would result in more time for exercise, which is one of the variables in the health production function, or in an increased labour supply, which would be seen as a positive component in a cost-benefit analysis. For both questions, respondents were allowed to state two alternatives.

The results suggest that healthy CTA would most likely replace other types of fast food, followed by prepared food from supermarkets and takeaway meals from other suppliers. About 20 percent of respondents stated that healthy CTA would most likely replace fast food.

The corresponding figures for prepared food from supermarkets and takeaway meals from other suppliers were 19 and 17 percent respectively. However, the difference in the percentage shares for the five first alternatives was relatively small, and it is also quite likely that healthy CTA would replace a home-cooked meal or a cold dish that did not require cooking, as 17 and 16 percent respectively of respondents marked these alternatives.[13]

Considering alternative time use, the results of the survey indicate that, if respondents purchased a canteen takeaway, they would most likely increase the time they spent with their friends and family (29 percent citing this alternative), followed by more time on spare-time activities and hobbies (20 percent). Approximately 15 percent of respondents would exercise more (the third most likely choice), while about 13 percent stated that they would increase their labour supply. However, since healthy CTA would mainly replace other types of fast or prepared food, the time saved by not buying food and cooking dinner might be relatively small.

7. Conclusion

The prevalence of illnesses related to the modern diet and a more sedentary lifestyle has increased markedly over the last few decades. The workplace is one environment where it is possible to implement new health-promotion interventions. One suggested strategy to meet the challenge of lifestyle-related health problems is healthy canteen takeaways. The idea is to make the preparation of healthy meals at home easier and less time-consuming by making available fresh, ready-to-eat meals in canteens for employees to take home: a low-fat meal with a large amount of vegetables prepared at the workplace canteen that only requires reheating. The idea behind the healthy CTA is that it should contain more vegetables and less fat than the dishes consumed by the average Dane for dinner. To the extent that healthy canteen takeaways replace meals that are nutritionally poorer, there may be positive health effects, not only for the individual employee but for the whole household.

[13] The respondent was allowed to mark two alternatives. The figures represent the real percent, i.e. the percentage shares have been normalised to sum to 100 percent.

In this paper, we used a household production model as an analytical framework in the analysis of the demand and willingness to pay for healthy canteen takeaways. To elicit the valuation of different attributes in a canteen takeaway meal, we carried out a large-scale choice experiment. The results suggest that respondents have a positive valuation of meat and sauce with a lower fat content, and also a positive valuation of meals with a higher content of vegetables. The valuation of the 'convenience' attribute, canteen takeaways, is very heterogenous among respondents, with both positive and negative values. About 44 percent of respondents are estimated to have a positive valuation of the canteen takeaways attribute.

A general explanation for the negative valuation of healthy canteen takeaways may be a problem with asymmetric information, which makes it more difficult for high quality producers of takeaway food to sell their products. That is, even if many individuals have a positive valuation of convenience, they may question the quality of the product as a result of missing (asymmetric) information and a subjective belief that fast food is generally low quality. In the case of Denmark, Groth et al. (2009) find that a lack of time is seen as a constraint for healthy eating, but also that home-cooked food is highly appreciated, which supports our findings. An additional explanation for the negative valuation of canteen takeaways is that, for some respondents, a takeaway meal may not be considered a 'proper dinner' (Murcott 1982).

The model with interaction variables reveals that an increased female labour supply has a significantly positive impact on the WTP for canteen takeaways, while the impact of male labour supply is insignificant. A likely explanation is that women usually have the greater responsibility for buying and cooking food. The marginal effects on the WTP from an increased labour supply are fairly small, however.

The empirical results also support the theoretical model that suggests that the health state is endogenous. From a policy perspective, this is important since the estimated model that does not account for endogeneity suggests that individuals with a high BMI (a poorer health sate) are willing to pay more for low-fat meat and sauce, while the model that controls for endogeneity suggests the opposite.

Other target groups with poor nutritional intake, such as those with low education or lower incomes, do not show any significant differences in their valuation of healthy CTA meals

compared with groups with either high education or income. The introduction of healthy CTA may thus create greater health benefits for groups with low education/income compared with those with high education/income, since healthy CTAs are likely to replace meals that are nutritionally poorer for the former group.

Families with children gain a significantly lower utility from meals with more vegetables compared to families without children. In addition, the results suggest that families with children have a lower valuation of canteen takeaways, although this is not statistically significant. However, it may suggest that the healthy canteen takeaway concept, in practice, has to be adjusted so that it fits the needs of both families with and without children. For example, making it possible to order healthy canteen takeaways in different sizes.

According to the survey, healthy CTA will mainly replace other types of fast and prepared food, which is nutritionally poorer on average. The health effect from introducing healthy CTA is therefore expected to be positive. Since healthy CTA will mainly replace other types of convenience or fast food, the time saving is likely to be small. Nevertheless, the time saved from not having to cook will mainly be devoted to increased time with family/friends and on spare-time activities.

Although introducing healthy CTA will be welfare improving for a minority of Danes, the results also show that Danes highly appreciate home-cooked meals. It is thus likely that healthy canteen takeaways can improve the dietary intake of households that frequently consume takeaway food, but that it will have a minor effect on households that prefer home cooking. Since a lack of time is seen as a major barrier to healthy eating, and home cooked meals are highly appreciated, development of new healthy, prepared food products (purchased in supermarkets, at the grocer’s etc) that make it easier to cook healthy meals at home could therefore be a good complement to improve the dietary intake of the Danish population.

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Appendix A: Overview of the different scenarios in the initial state and the new states for the meal alternatives

	Alternative 1	**Alternative 2**	**Alternative 3**	**Alternative 4**
Initial State	Meat 75 g vegetables Home cooking	Low-fat meat 75 g vegetables Home cooking	Meat 200 g vegetables Home cooking	Low-fat meat 200 g vegetables Home cooking
New State				
Scenario 1	Low-fat meat 75 g vegetables Home cooking	No Change	No Change	No Change
Scenario 2	Meat 200 g vegetables Home cooking	No Change	No Change	No Change
Scenario 3	Meat 75 g vegetables Canteen takeaway	No Change	No Change	No Change
Scenario 4	Low-fat meat 200 g vegetables Home cooking	No Change	No Change	No Change
Scenario 5	Low-fat meat 200 g vegetables Canteen takeaway	No Change	No Change	No Change

Table 1. The attributes and their levels in the choice experiment

Attributes	***Levels***
Meat	Meat, low-fat meat
Vegetables	75 grams, 200 grams
Price, home cooking [a]	20, 30, 40, 50
Price, canteen takeaway [b]	25, 30, 40, 50, 55, 65, 75

Note: Prices are in DKK (DKK 10 ~ EUR 1.34). [a] Each price appears eight times in the 32 choice occasions. [b] Each price appears four times in the 32 choice occasions, except DKK 50 which appears eight times.

Figure 1. Example choice set

The meat can be lean (e.g. ground beef[14] with 5 percent fat or boneless chicken) or regular (e.g. ground beef with 15 percent fat or chicken with skin in breadcrumbs). A medium-sized carrot and a medium-sized tomato weigh about 75 grams each.

Meal A	**Meal B**	**Meal C**
Low-fat meat and sauce with rice	Meat and sauce with rice	
Vegetables 75 grams	Vegetables 200 grams	Neither of these
Home cooking Preparation: purchase and cooking	Canteen Take Away Preparation: requires only reheating	
Price (DKK) 30	Price (DKK) 40	

[14] For the Danish context, we used *hakkebøffer* to exemplify the type of meat. The ingredients for *hakkebøffer* are lean ground beef, butter, salt and pepper.

Table 2. Summary of socioeconomic data

Variable	Mean	Std. Dev.
Gender (male)	0.50	0.50
Single	0.23	0.44
Age	44.74	10.75
Number of children 0-18 years	0.67	0.95
Household income [a]	537.2	214.6
Education after high school		
Other education[b]	0.11	0.31
Low (2 years)[c]	0.31	0.46
Medium (less than 3 years)	0.14	0.35
High (3-4 years)	0.28	0.45
High (5 years or more)	0.15	0.35
Number of hours worked per week[d]		
Male	38.32	9.67
Female	33.84	10.52
BMI	24.96	3.35

Note: [a] In DKK thousands. [b] No or other education. [c] Vocational training. [d]Generally, a full-time job in Denmark corresponds to a working week of 37 hours.

Table 3: Estimation results from the reduced form demand function for health

Variable	Coefficient	s.e.	*p*-value
Constant	8.077	6.442	0.210
Gender (male)	0.813	0.125	0.000
Age[e]	4.052	0.582	0.000
Age squared[e]	-13.546	4.986	0.006
Price			
Soft drinks [d]	-0.015	0.005	0.004
Butter (*Kærgården* 250g)	0.310	0.091	0.001
Organic butter (*Kærgården* 250g)	-0.133	0.070	0.055
Broccoli (500g)	-0.023	0.011	0.044
Apples	0.010	0.023	0.670
Education after high school [c]			
Other education [a]	0.994	0.248	0.001
Low (2 years)[b]	0.761	0.200	0.001
Medium (<3 years)	0.721	0.226	0.015
High (3-4 years)	0.448	0.191	0.019
Income	-0.123	0.052	0.019
Income missing	0.723	0.473	0.127

Note: *F*-test = 15.18 *p*-value 0.00. [a] No or other education. [b] Vocational education. [c] The reference level is the highest education level (five years or more). [d] Soft drinks includes all types of soft drinks with a volume of 50 cl or less. [e]Age has been divided by 100 in the estimation.

Table 4. Results for the main effects model

Variable	Coefficient	s.e.	*p*-value
Price	-0.006	0.001	0.000
200 g vegetables	0.072	0.026	0.005
Low-fat meat	0.152	0.031	0.000
Canteen takeaway	-0.096	0.035	0.006
Price opt-out alternative	-0.014	0.005	0.006
Constant Alt 1	3.277	0.227	0.000
Constant Alt 2	3.477	0.227	0.000
Standard dev β CTA	0.627	0.050	0.000
σ Alt1,Alt2	2.808	0.148	0.000

Note: The model is estimated with simulated maximum likelihood using 200 Halton draws

Table 5: Marginal and expected willingness to pay in DKK (and EUR) based on the main effects model

Scenario (Attribute)	Marginal WTP	Expected WTP
Scenario 1 (Low-fat meat)	23.58 [€3.16]	5.57 [€0.75]
Scenario 2 (200 grams of vegetables)	11.12 [€1.49]	2.55 [€0.34]
Scenario 3 (Canteen takeaway)	-14.86 [€-1.99]	-3.19 [€-0.43]
Scenario 4 (Home cooking + low-fat meat + 200g of vegetables)	34.70 [€4.66]	8.43 [€1.13]
Scenario 5 (CTA + low-fat meat + 200g of vegetables)	19.84 [€2.66]	4.64 [€ 0.62]

Note: Reference meal (option) in calculations of marginal WTP: home-cooked meal, 75g of vegetables, and meat and sauce with 15% fat. Low-fat meat and sauce have 5% fat.

Table 6. Estimation results from the discrete choice model with interaction variables

	IV estimation			Reduced model		
Variable	Coefficient	*s.e.*	*p*-value	Coefficient	s.e.	*p*-value
Price	-0.007	0.002	0.000	-0.007	0.002	0.00
Low-fat meat	1.671	0.849	0.049	-0.334	0.209	0.11
200 g of vegetables	0.137	0.046	0.027	0.135	0.046	0.00
Canteen takeaways	-0.310	0.139	0.026	-0.309	0.138	0.02
CTA/Children	-0.051	0.032	0.111	-0.048	0.031	0.12
Meat/Children	0.040	0.028	0.149	0.048	0.027	0.08
Vegetable/Children	-0.055	0.028	0.048	-0.055	0.028	0.05
CTA/male labour supply	0.003	0.002	0.164	0.003	0.002	0.18
CTA/female labour supply	0.005	0.002	0.049	0.005	0.002	0.05
Low-fat meat/BMI	-0.065	0.034	0.060	0.017	0.008	0.04
Control function	0.086	0.035	0.016	-	-	-
CTA/Single	0.140	0.094	0.137	0.137	0.094	0.14
Low-fat meat/Single	0.067	0.064	0.298	0.077	0.063	0.21
Vegetables/Single	0.020	0.060	0.738	0.021	0.060	0.72
CTA/Male	-0.061	0.067	0.359	-0.058	0.066	0.38
Low-fat meat/Male	0.109	0.061	0.074	0.041	0.052	0.43
Vegetables/Male	-0.063	0.052	0.224	-0.059	0.051	0.25
Constant Alt 1	3.940	0.541	0.000	3.954	0.531	0.00
Constant Alt 2	4.141	0.541	0.000	4.154	0.531	0.00
Price opt-out alternative	-0.012	0.005	0.022	-0.012	0.005	0.02
Number of children opt-out alternative	-0.232	0.115	0.044	-0.234	0.115	0.04
Gender (male) opt-out alternative	-0.488	0.197	0.013	-0.523	0.197	0.01
Single opt-out alternative	0.513	0.218	0.019	0.470	0.220	0.03
Age opt-out alternative	0.019	0.009	0.041	0.021	0.009	0.03
Standard dev β canteen takeaways	0.637	0.051	0.000	0.629	0.050	0.00
η	0.162	0.144	0.260	-	-	-
σ Alt1,Alt2	2.777	0.148	0.000	2.754	0.149	0.00

Note: The model is estimated with simulated maximum likelihood using 200 Halton draws