Intra-Household Distribution of Resources and Alcohol Consumption: the “Passive Drinking Effect” in Italy

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Abstract

This paper shows that a high consumption of alcoholic beverages can affect intra-household distribution of resources between household members. We term this effect the “passive drinking effect” to underline that it is a negative consequence caused by drinking and that it is suffered by other household members. For the investigation of this issue we rely on the collective framework, and estimate a collective quadratic almost ideal demand system. Our results show that for Italian households a high level of alcohol consumption actually influences the distribution of resources. In general the change is in favour of the husband, with a larger effect for poor households. If we consider who drinks, the shift is in favour of the member that consumes more alcohol and is stronger for males than for females. This suggests that a possible overbearing effect caused by alcohol is more likely to belong to the husband. This evidence underline that alcohol consumption is not only an individual problem and that public costs that are transferred to the other household members should be taken into account when designing social policies.

Preliminary Draft

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1 Introduction

Within the vast literature of applied studies on addictive goods, and in particular on alcohol consumption, we address the issue of whether a high level of individual alcohol consumption leads to negative economic consequences to the other members of the household. In particular, we concentrate our attention to the distribution of economic resources within the household. We refer to the passive drinking effect as the shift from the average intra-household distribution of resources caused by alcohol consumption. We argue that since the intra-household distribution of resources is relevant for the evaluation of households welfare,\textsuperscript{2} then there could be space for policy intervention. That would be the case if we observe that a high level of alcohol consumption brings a shift towards a less egalitarian distribution.\textsuperscript{3} It is worth clarifying that in this study we do not treat explicitly any form of violence, discrimination, lack of communication, and other physical and psychological negative effects that abuse of alcohol is well known to bring. The main reason is that our study can be applied with slight modifications to almost any existing expenditure microeconomic dataset. Other analyses would require specific surveys which collect the relevant information for that analysis, and would be scarcely reproducible.

In general, analyses of addictive goods are difficult to conduct at the individual level. In fact, the process of habit formation, which may bring to addiction, is strictly personal and depends on the quantities consumed by the person itself, and not by the household. However, to our knowledge, microeconomic datasets have little information about individual expenditures,\textsuperscript{4} and if we want to conduct a demand system analysis, within the classic consumption theory is not possible to gather individual preferences.

The reference unit in the classic consumption framework is the household which is seen as a black-box within which the decision process is unknown. To overcome this issue, we refer to the collective models, firstly introduced by Apps and Rees (1988) and Chiappori, Rational Household Labor Supply (1988a). This framework allows to spot some light into the household decision process. Keeping the assumption of Pareto efficient choices, this approach focusses on the distribution of resources within the household, which is governed by a function of exogenous factors. We will refer to this function as the sharing rule.

In this work, we test whether a high level of alcohol consumption induces a modification of the sharing rule respect to household in which alcohol is not consumed. On the other

\textsuperscript{1}http://dse.univr.it/addiction

\textsuperscript{2}This is just one among many negative drawbacks of strong alcohol consumption at household level, such as episodes of violence, misunderstandings, lack of attention towards the other members and a possible bad example given to the children. There could also be negative individual effects, such as health problems or lack of concentration at work, along with social negative effects, such as the increased probability of car crashes, an increment on social costs due to higher public health costs and in general the costs related to intervention in case of troubles caused by drunk people.

\textsuperscript{3}As shown in Peluso and Trannoy (2006), the question of intra-household distribution of resources is relevant also at the aggregate level of welfare analysis. Since it may be the case that a rather large part of the population suffers from an unequal intra-household distribution, even when income distribution among households can be considered egalitarian, we might conclude that such a society is affected by inequality. Further, poorer households are more likely to suffer more this kind of situations: being the total amount of resources small, the welfare drop caused by an unfair intra-household distribution may be dramatic.

\textsuperscript{4}In our case, the Italian household expenditure survey provides individual expenditure information for some goods, such as clothing. We could also gain information about individual alcohol consumption by matching this dataset with the Italian standard of living survey.
side, it might be the case that this shift leads the decision process away from the Pareto efficiency frontier. This could be the case of households with a despotic heavy drinker taking decisions regardless of other members' needs. In similar situations, public intervention can help to guide the household toward the efficiency frontier, but even if the efficient frontier is reached the distribution of resources may still be unsatisfactory. This would happen if a habit to consume alcohol is present and part of household resources are devoted to the daily measure of alcohol, and hence negated to other members. Here policy intervention should be regarded as a attempt to favour a more egalitarian intra-household distribution of resources by reducing consumption of a vicious good.

To analyze in depth these questions we focus on non-elderly Italian couples without children, and match the Italian household expenditure survey with a living standard survey\(^5\) which provides individual information on alcohol consumption.

To our knowledge, in the literature there are no other empirical studies on the link between alcohol consumption and the intra-household distribution of resources. Even if we cannot compare our results with previous works, our findings are rather clear. We find that alcohol consumption affects the intra-household distribution of resources in favor of the husband, especially for low income households. This evidence is probably correlated with the addictive nature of alcohol,\(^6\) but is somewhat surprising since alcohol budget share is not higher for poor households.\(^7\) The effect seems to come just from behavioral consequences of alcohol consumption.

Taking into account individual alcohol consumption, we find that the sharing rule shifts toward the main drinker in the household, and that this shift is stronger for men than for women.\(^8\) This can be explained by the fact that men drink more than women (on average men drink 65% of the household alcohol expenditure), and hence the effect may be statistically more relevant. On the other hand, on average men tend to have an overbearing behavior much more frequently than women, and this tendency may be strengthened by alcohol consumption.\(^9\)

In our analysis, we do not explicitly take into account for the possibility of inefficient resources allocation. However, the collective model would be a suitable instrument to answer these questions since it allows to estimate individual income effects. These income effects could be employed to test Pareto efficiency following the intuition of Browning, Bourguignon, Chiappori and Lechene, Incomes and Outcomes: A Structural Model of Intrahousehold Allocation (1994a) and Udry (1996).

The work is organized as follows. Section 2 introduces the theoretical framework of Collective Choice Models and the demand system specification. Section 3 deals with the econometric method which will be applied and describes the data used. Section 4 shows the results and Section 5 concludes.

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\(^5\)The surveys we refer to are both from the Italian National Statistics Accounts (ISTAT), and titled "Consumi delle Famiglie Italiane" and "Indagine Musliscopo su Stili di Vita e Condizioni di Salute."

\(^6\)The fact is an addictive good is also confirmed by the small value of its compensated own price elasticity. Table 6 evidences that among the group of goods considered for the analysis alcohol have the smallest own price elasticity.

\(^7\)In figure 1, the engel curve for alcohol evidences a reversed U shape relationship between alcohol budget share and total expenditure. Moreover, looking at the magnitudes, the shape is rather flat, indicating that the share of alcohol consumption is stable across household income, with a slight increase for mid income households.

\(^8\)Actually for poor household the sharing rule shifts toward the husband even when the main drinker is the wife. One possible interpretation of the result is given in Section 4.

\(^9\)Cases of physical and psychological violence are clearly frequent in households where the husband is an alcoholic.
2 The Model of Collective Choice

In the collective framework intra-household distribution of resources is represented by the sharing rule, which determines the proportion of household resources devoted to each household member. In the literature, there is much attention to the issue of identifying the sharing rule within a collective model. Consider the case of a household composed by the husband and the wife. Since data are collected at the household level, in general it is impossible to empirically distinguish preferences of the single household member and the sharing rule is not identified. However, in the collective framework, it is possible to overcome this issue using available data.

There are mainly three empirical approaches for the identification of the sharing rule.

1. The first approach is proposed by Chiappori (Chiappori, Collective Labor Supply and Welfare, 1992b) and several successive works, and consists in assuming that time is an exclusive good which a member of the household devotes to work, leisure and household activities. Observing how each member devotes his/her time it is possible to identify the sharing rule by means of a labour supply model.

2. The second approach proposed by Browning, Chiappori and Lewbel, Estimating Consumption Economies of Scale, Adult Equivalence Scales, and Household Bargaining Power (2006b), assumes that there is no change in preferences when passing from single to married. Using available information on singles one can estimate individual preferences, and, applying these preferences to couples, it is possible to recover the sharing rule.

3. The third approach for the identification of the sharing rule consists in using available information on exclusive or assignable goods. If the survey records expenditures in goods which can be assigned to just one member of the household, then it is possible to identify the sharing rule. This method shares its theoretical foundation with the first approach, but uses a different source of identification.

The choice of the proper approach depends on the available data. If the available dataset have no information on any exclusive or assignable good and no information on the time use of individuals, the best that one can do is to use the second approach, since information on singles will always be available. On the other hand, if one have information on the time use, but not on exclusive or assignable goods, the first approach should be the choice. Finally, if one observes consumption of exclusive or assignable goods should use the third approach.

We are exactly in this last situation. The expenditure dataset used in this work provides information on two exclusive goods, male clothing and female clothing. Then, matching information with the living standard dataset, which contains information on individual alcohol consumption, we can also assign the expenditure on alcoholic beverages, which not only improve available information to determine the sharing rule, but also allows for a relevant policy analysis. With this data available, for the identification of the sharing rule our choice falls on the third approach.

This choice allows us to estimate the sharing rule, which in turn allows us to investigate the hypothesis that consumption of addictive substances, in our case alcoholic beverages, leads to a modification of the sharing rule between husband and wife. We expect high levels of alcohol consumption bring to a modification of the sharing rule, and that this change sharing rule will be in favour of the main drinker.

Let us define the theoretical framework in more details.

10 And in the field of labor supply by Barmby and Smith (2001) and Bargain et al. (2006).
2.1 Theoretical Framework

To clarify the exposition, before going through the theoretical model, it is useful to give a definition of what an ordinary, an assignable and an exclusive good are.

**Definition 1** (ordinary good). A good is ordinary when private consumption of this good is not observed or deducible.

This is the common case in household expenditure surveys. It will be consumed by each member of the household, but it is impossible to know in which proportion. Examples are numerous, such as food.

**Definition 2** (assignable good). A good is assignable when it is consumed in observable proportions by each member of the household.

For example, if we have information on how far is working place of each member, we could assign travelling costs proportionally.

**Definition 3** (exclusive good). A good is exclusive when a strictly private good is consumed by one identifiable member of the household only.

This is the case of toys, for instance, which will be consumed only by the children.

We consider couples without children. Spouses vector of private consumption\(^{11}\) is denoted by \(x\). This vector is composed of ordinary goods \(o\) and exclusive goods \(e_k\), for \(k = \{m, f\}\),\(^{12}\) and is additively separable in \(x = x_m + x_f\). Individual consumption \(x_m\) and \(x_f\) is not observed, while prices of the exclusive goods \(p_m\) and \(p_f\) are observed and exogenous. For simplicity but without loss of generality, we consider the vector \(x\) to be composed by one ordinary good \(o\), with price normalized to 1, and two exclusive goods \(e_m\) and \(e_f\), with prices \(p_m\) and \(p_f\) respectively.

We assume that the household is not engaged in production and that labor supply is fixed. As a consequence, household income is exogenous and assumed to be approximated by total expenditure of the household, denoted by \(y\) and equal to \(p^0 x\), with \(p = \{1, p_m, p_f\}\) and \(x = \{o, e_m, e_f\}\). The information set available in our framework is

\[
\{e_m, e_f, o; p_m, p_f; y\}
\]

and the individual decision problem is

\[
\begin{align*}
\max_U U_k(e^k, o) \\
\text{s.t. } & p^k e^k + o \leq \phi^k(p_m, p_f, y) \\
e^k \geq 0, o \geq 0, & k = m, f;
\end{align*}
\]

where \(\phi^k\) is the sharing rule governing the intra-household allocation of resources, represented as the amount of resources devoted to member \(k\).

In this framework, the sharing rule can be viewed as a sort of contracting tool through which household members decide how to distribute resources between them and represent the link between the household and individual level of the decision process. Thanks to this link, and provided that we are able to estimate the sharing rule, we can recover individual preferences.

For the identification of the sharing rule from the structural specification, we use a technique borrowed from Pollak and Wales (1981) and Lewbel, A Unified Approach to

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\(^{11}\)If not differently specified, when we talk about consumption goods or vectors we always refer to quantities. In general, superscripts indicate the household member, subscripts indicate a specific good.

\(^{12}\)\(m\) and \(f\) refer respectively to the husband (male) and the wife (female).
Incorporating Demographic or Other Effects Into Demand Systems (1985a), commonly used to incorporate demographic variables or exogenous factors into the demand functions, and from Bollino et al. (2000), used to estimate household technologies.

In general, demographic functions interact with exogenous prices or income and can be identified provided that there is sufficient information and variability in the data. The analogy stems from the fact that in order to identify the sharing rule from a structural specification, we use an interaction term with income a la Barten (Barten, 1964; Perali, 2003). The estimation problem is similar to that of estimating a regression containing unobservable independent variables (Goldberger, 1972).

The estimation of an individual demand function, as implied by a collective representation of the household decision process, requires the estimation of the sharing rule. The minimal information required for the identification of the sharing rule is the observability of at least one assignable good, or, equivalently, two exclusive goods (Bourguignon, 1999). If a good is exclusive, and there are no externalities, for a given observed demand \( g(p, y) \) satisfying the Collective Slutsky property (Chiappori, Rational Household Labor Supply, 1988a; Chiappori, Collective Labor Supply and Welfare, 1992b; Chiappori and Ekeland, The Micro Economics of Group Behavior: Identification, 2002a; Chiappori and Ekeland, The Micro Economics of Group Behavior: General Characterization, 2006b), and such that the Jacobian \( D_p g(p, y) \) is invertible, then the sharing rule is identified. It is then possible to derive each member’s demand for private goods, and the associated utility functions.

We can now define the demand system specification which will be used for the estimation.

### 2.2 The Collective Quadratic Almost Ideal Demand System

In this section we specify the identifiable model associated with the collective preferences described in Section 2.1.

The chosen demand system is an extension to the Almost Ideal Demand System originally proposed by Deaton and Muellbauer (1980). The model is extended introducing a quadratic income term, following Banks et al. (1997). For the sake of generality, demographic characteristics interact multiplicatively both with prices and income in a theoretically plausible way (Lewbel, A Unified Approach to Incorporating Demographic or Other Effects Into Demand Systems, 1985a). The interaction with prices captures Barten-like substitution effects (Barten, 1964), while interaction with income captures Gorman-like fixed costs (Gorman, 1976). The model is called “collective” because it incorporates the sharing rule.

Budget shares for a Quadratic Almost Ideal Demand System (QAIDS) are specified as

\[
    w_i(y, p) = \alpha_i + \sum_j \gamma_{ij} \ln p_j + \beta_i \ln (y - \ln a(p)) + \frac{\lambda_i}{b(p)} (\ln y - \ln a(p))^2,
\]

(2)

where \( \alpha_i, \gamma_{ij}, \beta_i \) and \( \lambda_i \) are parameters, \( p_j \) is price of good \( j \) and \( y \) is total expenditure. \( a(p) \) and \( b(p) \) are two price indexes, defined as

\[
    \ln a(p) = \alpha_0 + \sum_i \alpha_i \ln p_i + \frac{1}{2} \sum_i \sum_j \gamma_{ij} \ln p_i \ln p_j
\]

\[
    \ln b(p) = \sum_i \beta_i \ln p_i, \quad \text{or, in antilog} \quad b(p) = \prod_i p_i^{\beta_i}.
\]

When demographic modifications a la Barten-Gorman are introduced, budget shares are modified as follows

\[
    w_i(y, p, d) = w_i(t_i(y, d), s_i(p, d), d),
\]

\[13\]The choice is motivated in the following sections, which provide some evidences for a rank 3 demand system.
where $t(d)$ is a translating function, $s(d)$ is a scaling function and $d$ is a vector of demographic variables or household characteristics.

Similarly to the Slutsky decomposition of income and substitution effects, the Barten-Gorman specification translates the budget line through the fixed cost element (translating) and rotates the budget constraint by modifying the effective prices with the related substitution effects via demographic characteristics (scaling).

Applying this transformation to equation (2), we obtain the following demographically modified budget share equation

$$w_i(y,p,d) = \alpha_i + t_i(d) + \sum_j \gamma_{ji} \ln p_j^* + \beta_i (\ln y^* - \ln a(p^*)) + \frac{\lambda_i}{b(p^*)} (\ln y^* - \ln a(p^*))^2,$$

where

$$t_i(d) = \sum_r \tau_{ir} \ln d_r, \quad \ln p_i^* = \ln p_i + \ln s_i(d), \quad \ln y^* = \ln y - \sum_i t_i(d) \ln p_i^*,$$

$$\ln a(p^*) = \alpha_0 + \sum_i \alpha_i \ln p_i^* + \frac{1}{2} \sum_i \sum_j \gamma_{ij} \ln p_i^* \ln p_j^*, \quad \ln b(p^*) = \sum_i \beta_i \ln p_i^*, \quad \sum_r \delta_{ir} \ln d_r,$$

or, in antilog $s_i(d) = \prod_r d_r^{\delta_{ir}}, \quad \ln a(p^*) = \sum_i \alpha_i \ln p_i^* + \frac{1}{2} \sum_i \sum_j \gamma_{ij} \ln p_i^* \ln p_j^*,$

In order to comply with general consumption theory results, the Barten-Gorman specification of the budget shares demand system is subject to a number of restrictions on the parameters. In particular, to satisfy linear homogeneity in $p$ and Slutsky symmetry the following restrictions must hold

$$\sum_i \alpha_i = 1; \quad \sum_i \beta_i = 0; \quad \sum_i \lambda_i = 0; \quad \sum_i \gamma_{ij} = 0; \quad \sum_j \gamma_{ij} = 0; \quad \gamma_{ij} = \gamma_{ji},$$

while, as proven in Perali (2003), to ensure that the Barten-Gorman modified cost function maintains the homogeneity property, demographic parameters must satisfy

$$\sum_i \tau_{ir} = 0; \quad \sum_i \delta_{ir} = 0.$$

The next step to obtain a collective QAIDS is to introduce the sharing rule. The maximization problem in (1) clearly states that the sharing rule determines the natural logarithm of the amount of resources each household member receives. Being the decision process individual rather than centralized, each member decides how to allocate his share of total expenditure, and the observed household budget share will be equal to

$$w_i = \alpha_i + t_i(d) + \sum_j \gamma_{ji} \ln p_j^* + \beta_i (\ln y^{m*} - \ln a(p^*)) + \frac{\lambda_i}{b^m(p^*)} (\ln y^{m*} - \ln a(p^*))^2 (3)$$

$$+ \beta_i (\ln y^{f*} - \ln a(p^*)) + \frac{\lambda_i}{b^f(p^*)} (\ln y^{f*} - \ln a(p^*))^2.$$
Note that in general the resources allocation decision process may be dependent on households or individual characteristics. In fact, households with comparable levels of income and prices may have different sharing rules, which may depend on several factors, as the social background, education of each member, individual labor income, and so on. To introduce this heterogeneity, we define the sharing rule as a function of individual income \( y^m \), price of the exclusive goods \( p^m \) and \( p^f \), and a vector of other exogenous characteristics \( s \), managed in analogy with Barten's scaling, as a demographically scaled income, i.e.

\[
\phi^m(p^m, p^f; y; s) = y^m \cdot m^m(p^m, p^f; s),
\]

which in natural logarithms is

\[
\ln \phi^m(p^m, p^f; y; s) = \ln y^m + \ln m^m(p^m, p^f; s).
\]  

(5)

In equation (5), \( m(p^m, p^f; s) \) is the scaling function, defined over prices and a set of exogenous variables \( s \), which in the literature are often called “distribution factors”, since they affect the distribution of resources within the household.

The identifying assumption in the model is that the portion of income of each member, \( y^m \), can be recovered from observed expenditures on exclusive or assignable goods. In other words personal income is determined on the basis of the ratio of the expenditure in exclusive goods

\[
\text{price of the exclusive goods}
\]

\[
\text{expenditure in ordinary goods}
\]

\[
\text{exclusive or assignable goods}
\]

\[
\text{half of expenditure in ordinary goods}
\]

To save on notation, we can set

\[
\ln y^k = w^k \ln y,
\]

with \( w \) defined as

\[
w^k = \frac{1}{y} \left( p^m e^m + \frac{1}{2} \phi \right).
\]

It follows that we can then write the sharing rules as

\[
ln \phi^m(p^m, p^f; y; s) = w^m \ln y + \ln m^m(p^m, p^f; s)
\]

\[
ln \phi^f(p^m, p^f; y; s) = w^f \ln y + \ln m^f(p^m, p^f; s).
\]

(6)

Since \( \ln \phi^m(p^m, p^f; y; s) + \ln \phi^f(p^m, p^f; y; s) = \ln y \), and, by construction, \( w^m \ln y + w^f \ln y = \ln y \), also the following constraint must hold

\[
\ln m^m(p^m, p^f; s) = - \ln m^f(p^m, p^f; s).
\]

(7)

To save on notation, we can set \( \ln m^m(p^m, p^f; s) = \ln m(\cdot) \) and \( \ln m^f(p^m, p^f; s) = -\ln m(\cdot) \). Substituting (6) into (4) we obtain

\[
\ln y^{m*} = w^m \ln y + \ln m(\cdot) - \sum_i t_i(d) \ln p_i^k
\]

\[
\ln y^{f*} = w^f \ln y - \ln m(\cdot) - \sum_i t_i(d) \ln p_i^k.
\]

In analogy to function \( t_i(d) \), function \( m(\cdot) = m(p^m, p^f; s) \) is identified provided that there is enough variation in distribution factors \( s \), and as long as the distribution factors differ from the demographic variables \( d \). The proof is very similar to proving that function \( t_i(d) \) is identified, for which we suggest to refer to Gorman (1976), Lewbel, A Unified Approach to Incorporating Demographic or Other Effects Into Demand Systems (1985a) or Perali (2003).
In our empirical exercise, we specify the \( m(\cdot) \) function as a Cobb-Douglas function, so that the logarithmic specification is linear, which is

\[
\ln m(p^m, p^f; s) = \phi_0 \ln p + \phi_1 \ln s_1 + \phi_2 \ln s_2 + ... 
\]

It is worth noting that we do not apply the price scaling function \( s_i(d) \) to the demand system, because the scarce variability in the data causes difficulties in the estimation process.

In the following section we report the econometric tools employed in the estimation of the collective demand system.

3 Empirical Strategy

3.1 Data Description

The data used in this work are drawn from the Italian household expenditure survey (ISTAT 2004). We selected households composed by married couples without dependent children with an observed positive consumption for male and female clothing.\(^{14}\) To ensure a demographically homogeneous sample, we excluded households in which at least one member is a pensioner. In this way we restrict to working couples with a similar lifestyle. The sample includes 742 observations. The dataset information have been matched with individual alcohol consumption from ISTAT 2002 survey on standard of living.\(^{15}\)

In the latter dataset, information is collected on the individual basis and individual information is available also for some goods, as alcohol, tobacco and drugs. This feature, together with the choice of keeping only couples, allows us to assign alcohol consumption respectively to the husband or to the wife. Clothing can be exclusively assigned to the husband and the wife since male and female clothing is separately recorded in the expenditure survey and we keep only couples.

We consider only expenditure on non durable goods. The aggregated expenditure categories considered are Food, Alcohol, Clothing, Education&recreation, and Other goods. Household-specific prices are assigned following the procedure described below.

Table 1 and Table 2 report the descriptive statistics of the sample. The set of demographic variables includes macro regions (North-East, North-West and Center), a dummy variable to capture seasonalities (in particular for Christmas time), a dummy variable indicating if household head have a university or higher degree, a dummy variable to indicate that the household do not live in urban areas (rural), a dummy variable indicating that husband is an employee, a variable signaling if at least one in the couple smokes. The exogenous variable chosen for the sharing rule are quite limited by the information disposable in the dataset, and are defined as follows. The price ratio (price-r) is the price of male clothing divided by the sum of male clothing and female clothing prices, the age ratio (age-r) is defined as husband age divided by the sum of both members ages, and the education ratio (edu-r) is defined as husband years of schooling divided by the sum of both members years of schooling.

\(^{14}\)We restrict to positive clothing expenditures because this is the source of identification for the sharing rule. Adding also observations with no clothing expenditure would not add useful information for the identification of the sharing rule.

\(^{15}\)The matching of the two datasets was conducted via the Stata command "Hotdeck" (for details see the references for this command at http://ideas.repec.org/c/boc/bocode/s366901.html). We have two datasets: the first sample, which does not have information on individual alcohol consumption, and the second sample. Both samples have a number of common variables which describe household characteristics. The strategy is as follows. We devide both samples in cells determined by some household characteristics. To impute values to a household in a cell belonging to the first sample, we randomly pick up a value from the corresponding cell in the second sample. This is done for each household belonging to each cell of the first sample. Doing this way we have two particular advantages: zero observed expenditures are preserved, and the overall distribution of the variable remains unchanged after imputation.
We shift now to the empirical evidence which guided us toward the choice of a quadratic demand system.

3.2 Nonparametric Engel Curves and Rank Test

Engel curves are a widely used tool to assess the relationship between consumption and income. Engel curves have been studied for long time, but still there is no agreement on which functional is best suited to describe this relationship. According to the early work of Working (1943) and Leser (1963) Engel curves could be considered linear in the log of income, but later studies, among which Atkinson et al. (1990), Bierens and Pott-Buter (1987), Blundell et al. (1993), Hausman et al. (1995), Härdele and Jerison (1988), Hildebrand (1994), and Lewbel, The Rank of Demand Systems: Theory and Nonparametric Estimation (1991c), have shown that this specification is rather poor in describing Engel curves for some goods. The general evidence on micro-data is in favour of a quadratic relationship between budget shares and log of total expenditure, i.e. a rank 3 demand system.

Even if there is some general agreement on the use of quadratic Engel curves, we use nonparametric technique to verify the rank of the demand system. We use single equation non-parametric Engel curve estimation, and model the budget share of each good to be a non-linear function of the natural logarithm of total expenditure. Following Banks et al. (1997) and Perali (2003), we plot in Figure 1 non-parametric estimates of the Engel curves (orange line) and its 95% confidence interval (blue dashed lines). We also plot a quadratic polynomial regression (purple line) to verify whether a quadratic relationship can fit within this confidence interval. Along with the Engel curves, we present nonparametric kernel bivariate density estimates and contour plots.

From the graphical analysis appears evident the relation between food and total expenditure can be represented by a linear functional form, while all other goods except clothing exhibit a shape rather close to a quadratic function. However, considering the confidence interval, a quadratic form cannot be excluded for clothing either.

To deepen the analysis we perform a non-parametric rank test for the demand system (Gill and Lewbel, 1992). This test does not need the specification of a functional form for the demand system, and hence permits to avoid specification errors. The results of the rank test, summarized in Table 3, show that the system can be considered of rank 3 with a p-value of 0.989, which indicates that the choice of a quadratic demand system is likely to be correct.

In the next section we specify the econometric strategy used to perform our estimates.

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16Total expenditure is often used in cross section analysis when no reliable information on income is available. This is also our case, since ISTAT does not record income information.

17Following Lewbel, Rank, Separability, and Conditional Demand (2002d), we define the rank of a demand system as the maximum dimension of the function space spanned by the Engel curves.

18We use a local polynomial regression of first degree. The bandwidth value is the same for all the goods and is rather larger than the Silverman and Silverman (1986) Rule-of-thumb. Since we do not need much punctual information and we have a quite small sample, the choice of a large bandwidth allows to reduce noise without compromising the information we are looking for. The analysis is conducted using the Nonparametr ix package for Mathematica provided by Bernard Gress, which refer to the technique described in Pagan and Ullah (1999).

19The test is based on the estimated pivots of a matrix associating shares to functions of total expenditure. The data matrix is decomposed using the Lower-Diagonal-Upper (LDU) Gaussian elimination with complete pivoting (Golub and VanLoan (1983)). The rank of each matrix equals the number of non-zero elements of the diagonal matrix of pivots. The null hypothesis is tested against the alternative that the rank is greater than r, and that the rank test is conducted sequentially, starting with r = 1. The test consists in evaluating the hypothesis that only pivot $d_1$ is significantly different from 0, and consequently all remaining $p - r$ pivots are zero.
Figure 1: Engel curves, unconditional joint p.d.f. and contour maps
3.3 Econometric Model

Econometricians working with household micro-data often are faced to the zero expenditures problem, especially when working with disaggregate goods, which is the case, for example, of alcohol consumption, tobacco and clothing.

Since coefficient estimates are inconsistent when only observed positive purchase data are used, the proper correction technique has to be used.

Zero’s correction methods differ for the different assumptions related to the source of zero expenditures. For example the tobit model (Amemiya, Advanced Econometrics, 1985c; Maddala, 1983) simply captures the corner solutions for the utility maximization problem, which imply that the observation is zero just because household decided to consume zero on the basis of disposable income, prices and preferences. This could be the case for some goods, but for some other not, as for semi-durable goods (for example cloths) which may not be purchased in the reference period simply because they give utility for more than one period and a household may need to buy them only once in, say, 3 months. This situation is called infrequency of purchases, and cannot be captured by a tobit model.

The double-hurdle model (Yen, 1993), on the other side, assumes that zero expenditures are explained by a decision process that arise from not observed latent variables which drive consumer choice. The model allows for separate parameter estimation for participation and expenditure choices. This is the case of alcohol, which may be not consumed because of moral conviction or health problems, which are not observable in the survey. Again this model is not useful when we consider semi-durable goods, as cloths.

An alternative to the double-hurdle model is the Heckman two-step estimator, which assumes that zero expenditures are due to sample selection bias (Heckman, 1979) and are treated as a mispecification error. This approach allows to obtain different estimates for participation and expenditure parameters, but the participation choice is dependent from other observable variable which does not enter the “main” regression.

In the original model, the first stage determines the participation probability using a probit regression, and then, in the second stage, Heckman propose a specification for the omitted variable which can be used to correct, if present, the sample selection bias. The omitted variable is the inverse Mill’s ratio, which is the ratio between density and cumulative probability function of the standard normal distribution.

In this paper we use a two-stage generalization of the Heckman two-step model which overcomes the issues which emerge with Amemiya, On a Two-Step Estimationof a Multivariate Logit Model (1978a); Amemiya, The Estimation of a Simultaneous Equation Tobit Model (1979b) and Heien and Wessells (1990). In particular, we refer to the work of Shonkwiler and Yen (1999), which shows the inconsistency of the generalized Heckman estimator and proposes a consistent, though still simple, two-step estimator for a censored system of equations.

In choosing the proper estimator, we had to keep in mind that we had zero expenditures for two goods: alcohol and education&recreation. The double-hurdle model is particularly well suited for alcohol consumption, which is what we are focusing on, but is not general enough to consider other kind of source of zero expenditures. Hence, we decided to use the Shonkwiler-Yen estimator which is well suited for a rather large source of zero expenditures, and is still consistent with a two-stages decision process (similar to that of the double-hurdle).

Following Shonkwiler and Yen (1999), consider the following general limited dependent
variables system of equations

\[ y_{it}^* = f(x_{it}, \theta_i) + \epsilon_{it}, \quad d_{it}^* = z_{it}^*\tau_i + \nu_{it}, \]

\[ d_{it} = \begin{cases} 
1 & \text{if } d_{it}^* > 0 \\
0 & \text{if } d_{it}^* \leq 0
\end{cases} \]

\[ y_{it} = d_{it} y_{it}^*, \quad (i = 1, 2, ..., m; t = 1, 2, ..., T), \]

where \( i \) represents the \( i \)th equation and \( t \) the \( t \)th observation, \( y_{it} \) and \( d_{it} \) are the observed dependent variables, \( y_{it}^* \) and \( d_{it}^* \) are the latent variables, \( x_{it} \) and \( z_{it} \) are vectors of exogenous variables, \( \theta_i \) and \( \tau_i \) are parameters, and, \( \epsilon_{it} \) and \( \nu_{it} \) are random errors. Without entering into details of derivation (refer to the authors for details), system (8) can be written as

\[ y_{it} = \Psi(z_{it}^*\tau_i)f(x_{it}, \theta_i) + \eta_i \psi(z_{it}^*\tau_i) + \xi_{it}, \]

where \( \Psi(\cdot) \) and \( \psi(\cdot) \) are univariate standard normal cumulative distribution function and probability density function respectively. The system can be estimated by means of a two-step procedure, where \( \tau_i \) are estimated using a Maximum Likelihood probit estimator, and used to calculate \( \Psi(z_{it}^*\tau_i) \) and \( \psi(z_{it}^*\tau_i) \). Successively estimates of \( \theta_i \) and \( \eta_i \) in the system

\[ y_{it} = \Psi(z_{it}^*\hat{\tau}_i)f(x_{it}, \hat{\theta}_i) + \eta_i \psi(z_{it}^*\hat{\tau}_i) + \xi_{it} \]

are obtained by Full Information Maximum Likelihood.

Besides that of zero expenditures, another problem arises: we lack information on prices and/or unit values. Since the ISTAT survey records only expenditure information, the lack of information about quantities purchased precludes the possibility to derive household specific unit values. On the other hand, ISTAT’s price indexes have an aggregation level similar to that of the survey but are not sufficient to provide plausible elasticities. For this reason, we use a procedure, originally proposed by Lewbel, Identification and Estimation of Equivalence Scales under Weak Separability (1989b) and applied by Atella et al. (2003), to construct “pseudo” unit values.

In the next section we present the results and some comments.

4 Results

This section describes the results coming from estimates of the sharing rule between husband and wife.

The estimates of the parameters are obtained by Full Information Maximum Likelihood estimation of a collective Quadratic Almost Ideal Demand System, as described in Section 2. Zero observed expenditures are corrected applying a generalized Heckman correction technique proposed by Shonkwiler and Yen (1999).

Symmetry and homogeneity are ensured by construction, with the Slutsky matrix having two individual income terms which sum up to the household income effect, because of the symmetry of the individual transfers shown in equation (7).

Table 6 shows (double-sided numerical) income and compensated price elasticities. Signs are consistent with consumption theory, with negative own price elasticities. According to their size, education & recreation is the most elastic good to price and income changes, while alcohol is one of the less elastic. Alcohol compensated own price elasticity is the smallest of the group of goods, suggesting that a price policy of an increased direct taxation on alcoholic beverages may not be much effective in reducing consumption, since individual can substitute other goods for alcohol.20 This small price elasticity can be interpreted as the result of habits or addiction generated by alcohol consumption.

20 It can be argued, however, that the increased taxation serves to compensate for the negative social effects produced by alcohol abuse.
In Table 4 we present the estimates of the cQAIDS demand system. In general income and price parameters are significant, with some exceptions, as alcohol income parameters which are all non significant. Also the \( \eta_i \) parameters are significant, indicating that the observed zero expenditure do not come from Kuhn-Tucker corner solutions, but rather from other sources of error, like sample selection or infrequent purchases. Among demographic variables, the general trend is towards small parameters values, even if many are still significantly different from 0.

An exception stands on the alcohol demand equation, which is insensible to most demographic variables. A positive effect is observed if the household lives in the north of Italy, with north-east having a stronger effect. This was expected and cited in some ISTAT reports on alcohol. The tendency is to relate this different behavior to climate differences. A warmer temperature in the south discourages consumption of alcoholic beverages in summer, while during winter rigid northern temperatures tend to increase consumption of spirits. A positive effect is also observed for the seasonality control variable. This was also expected, since during winter holidays there is a strong increase in champagne wine demand.

More interestingly, education parameter is fund to be non significant. This implies that for Italy an increase in education does not mean a decrease in alcohol consumption. However, Italian wine culture is rather rich, and a moderate consumption of good quality wine is an encouraged behavior. We also expected a positive parameter for the smoke variable, but we found it non significant. However, we should take into account that we treated separately participation and consumption. In the participation equation (see Table 5) the parameter is in effect positive and significant, indicating that a gateway effect between alcohol and tobacco exists. The non significant parameter in the demand equation simply states that there is not a positive relation between the two levels of consumption. In other words a smoker have a higher probability of being also a drinker, but there is no relation with how much he drinks.

Parameters of the sharing function tell us that the sharing rule, and specifically husband’s share of total expenditure, is negatively influenced by the price of male clothing.\(^{21}\) If the husband is more educated than his wife, the effect will be of an increase in its share of household resources, while if husband is older there will be a decrease.

To detail further our analysis, we have depicted figures 2 through 5, which represent the relative sharing rule, expressed as the ratio between husband share of expenditure and total household expenditure \( (\phi^h(\cdot)/y) \). These pictures are drawn by means of nonparametric regressions of the sharing rule by total expenditure, selecting each time a group of household with some characteristics of interest.

\(^{21}\) As defined in Section 3.1.
In Figure 2, we select a group of abstemious households and a group of “heavy”\(^{22}\) alcohol consumers. The sharing rule differs between these groups, with husbands being favoured in the distribution of resources when alcohol consumption is large, especially for lower income households. This shift cannot be explained with budget related consideration. The alcohol engel curve in Figure 1 shows that alcohol budget share have a reversed U shape relationship with the log of total expenditure, meaning that, on average, poor households do not spend more of their budget on alcohol respect to other households. Moreover, if we look at the magnitudes the curvature of the engel curve is rather flat and income parameters of alcohol equation are all non significant. According to this analysis, alcohol seems to cause an household income distribution problem, which could motivate a policy intervention.

We further investigate the problem through Figure 3, which shows how selecting households by its main drinker\(^{23}\) the sharing rule shifts towards the main drinker itself, except for poorer households where even if the main drinker is the wife, the sharing rule is still shifted towards the husband. When the main drinker is the man the effect is evident and could be explained by a combination of several factors. Among other causes there could be a behavioral explanation. In fact, men tend to have a overbearing behavior much more frequently than women, and this tendency may be strengthened by alcohol, which makes them more self confident and violent. This could also explain why when the main drinker is the wife the distribution of resources still favours the husband when the household is poor. In these households there could be a despotic husband which tends to keep control on household resources and to impose his decisions. In such a situation, It may happen that the wife falls into depression and/or uses alcohol as a means to “escape from that reality”. If this were true, alcohol consumption would be a consequence of a degraded environment, and not the cause of household income distribution inequalities.

It is interesting to note that the change in the sharing rule depicted in Figure 2 can be explained in terms of Figure 3. In fact, most part of the effect observed for poor households in Figure 2 is due to the change in the sharing rule of the wife when she is the main drinker. For high income household the shift of the sharing rule toward the husband is lowered by the wife’s shift, while for low income households the shift is strenghtened. The result is a sharing rule which is strongly modified for poor households in the case of high alcohol consumption, while being substantially unchanged for rich households.

The situation depicted by Figure 2 and 3 justifies a policy intervention. However, as stated above, a strategy based on direct taxation is likely to have a small impact. Moreover, the problem is more serious for low income households and a price increase may even worsen their situation. We are in favour of gender specific policies with the aim of balancing the

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\(^{22}\)Here heavy is not really heavy. Because of numerosity probems, we consider heavy consumers households which have an alcohol budget share above 0.035.

\(^{23}\)The household member is the “main” consumer if he/she consumes at least 75% of household alcohol consumption.
decisional power within the household. Just as an example, subsidies for poor household should be given to woman. In this way the wife gains bargaining power and there is less probability that the money is spent into alcohol. This policy, which have been used also for the micro-credit policies in developing countries, have no costs and could bring a noticeable welfare improvement to those households, especially if we consider that in these situations pareto efficiency is more likely be unattended.

Figure 4 plots the sharing rule by household head’s education. The picture shows that households with less educated household head tend to distribute more resources to the husband for mean and low income households, while for higher level of income the situation is reverted. This can be explained in terms of agreement, in the sense that for rich households, if the husband is educated, the wife may agree that her husband should manage household resources. This is confirmed by the positiveness of the sharing rule parameter which indicate the difference in education. If the husband is more educated, he will obtain a greater share of household resources.

Figure 5 shows that the sharing rule is scarcely influenced by macro-regional divisions. There is a slight difference from North to South, where the distribution of resources favours the husband. In the center low income households tend to allocate more resources to the wife, while for high income households the husband is favoured. Looking at parameters in Table 4 we see that macro regions have generally significant parameters, which means that consumption levels are different across macro regions, and that this difference not always reflects to the sharing rule.

The following section concludes and proposes future developments to this work.

5 Conclusions

In this work we present some evidence that for Italian households an excessive alcohol consumption can affect the distribution of resources within the household and the bargaining power of its members. Results, are relatively strong, even for a country like Italy, which is supposed to have an advanced social background.

In general, we find a systematic shift of the sharing rule towards the husband, when a significative amount of alcohol is consumed. This shift is greater in poor households, implying that the effects of alcohol consumption on the intra-household income distribution are heavier for low income households. This provides the rationale for a policy intervention aimed to contrast this phenomenon. However, since the compensated price elasticity of alcohol is the lowest across goods, we suggest that the proper policy should not be that of increasing direct taxation on alcoholic beverages,\(^{24}\) since the price increase would probably be shifted to other goods.

Taking into account for individual alcohol consumption, we find that the sharing rule shifts toward the main drinker in the household, but with a substantial difference between the husband and the wife. In fact, when the main drinker is the husband the shift is evident and constant in the whole range of household incomes.\(^{25}\) When the main drinker is the wife the effect is less evident and not trivial. In poor households, even when the main drinker is the wife the distribution of resources changes in favour of the husband. In this case it is likely that alcohol consumption is not the cause of a different resource distribution, but rather a reaction against a despotic behavior of the husband.

The generalized shift of the sharing rule toward the husband is clearly the sum of these two situations, and much of the effect for poor households is due to the situation we have

\(^{24}\)This is true only if we consider an aggregate alcohol good. If we are willing to differentiate taxation by content of each beverage, the response would probably increase other alcoholic drinks. However, due to our data we cannot make this interesting analysis.

\(^{25}\)Actually, there is a slight increase of the shift for very poor households.
just depicted. This means that the proper policy for the reduction of the modification of the
distribution of resources observed in case of alcohol consumption should be gender specific.
For example, if subsidies to low income households are planned, these subsidies should be
given to the wife. In this way, she gains bargaining power and there is a lower probability
that these money are spent into alcohol.

However these issues needs further investigations and we are planning some future de-
velopments to extend the analysis in several ways. The first extension regards the quality
of data available. We are building a new dataset to incorporate much more information on
single household components lifestyle, health, income and labour supply. This will be done
by matching three sources of data available in separate datasets by ISTAT and Bank of
Italy. In this regard, the experiment of matching data on individual alcohol consumption
exploited in this paper has given good results and incentives to proceed in this direction.

Also the estimation technique needs some improvements. Even if advantages of a
quadratic demand system might seem evident, numerical complications deriving from the
applications of such a model may sometimes overwhelm its advantages. We are investigating
whether it could be more convenient to estimate the system as a whole, with restrictions
on parameters which come from the theory, or if it would be easier to estimate it equa-
tion by equation, and successively recover parameters restrictions, by means of a Minimum
Distance Estimator. This technique would be useful when maximum likelihood estimation
is much time consuming (a question of hours is what usually happens on a modern pc) or
whenever numeric techniques run into difficulty because of the complexities of calculations
and limited precision of algorithms.

Such a single equation specification would also be useful in treating the observed zero
expenditures. To this extent, we could apply the proper zero correction technique to each
good, allowing the use of specific correction techniques like Double-Hurdle, Infrequent Pur-
chases, etc.

On the theoretical side, in the present work, we focus our attention to the distribution
of resources between husband and wife alone. We are working to prove that a “three-sided”
sharing rule would be identified, provided that three exclusive goods or one assignable
good (or some combination of exclusive and assignable goods) are observed, so that the
sharing rule between three members of the household (husband, wife and children) could
be estimated simultaneously. The usefulness of such a specification is evident in evaluating
the effects of alcohol abuse, in which the looser may be the children, the wife or both.

Finally, a particularly interesting development regards the endogeneity of the sharing
rule. As pointed out by Basu (2006), it is likely that the sharing rule is in part determined
by demand, and the demand be in part determined by the sharing rule. This seems to
be exactly the case for alcohol consumption, where, as we have shown, the sharing rule is
influenced by alcohol consumption, but remains true for virtually any good in a demand
system.
References


## Appendix 1: Tables

### Table 1: Descriptive Statistics (742 obs.) - Goods

<table>
<thead>
<tr>
<th>Shares</th>
<th>Trunc. %</th>
<th>Mean</th>
<th>Std. Dev</th>
<th>Min</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Food</td>
<td>0</td>
<td>0.307</td>
<td>0.128</td>
<td>0.026</td>
<td>0.711</td>
</tr>
<tr>
<td>Alcohol</td>
<td>39.08</td>
<td>0.012</td>
<td>0.019</td>
<td>0</td>
<td>0.162</td>
</tr>
<tr>
<td>Clothing</td>
<td>0</td>
<td>0.195</td>
<td>0.120</td>
<td>0.008</td>
<td>0.742</td>
</tr>
<tr>
<td>Education and Recreation</td>
<td>10.24</td>
<td>0.094</td>
<td>0.131</td>
<td>0</td>
<td>0.777</td>
</tr>
<tr>
<td>Other consumption</td>
<td>0</td>
<td>0.392</td>
<td>0.147</td>
<td>0.055</td>
<td>0.895</td>
</tr>
</tbody>
</table>

**Other relevant shares**

| Clothing for men        | 0        | 0.080 | 0.061    | 0.003| 0.436|
| Clothing for women      | 0        | 0.095 | 0.075    | 0.004| 0.472|

**Total expenditure and Prices\(^1\)**

| Total expenditure       | 7.447    | 0.518 | 5.728    | 9.027|
| Food                   | 1.539    | 0.229 | 0.466    | 2.170|
| Alcohol                | -1.214   | 0.162 | -1.683   | -0.848|
| Clothing               | 0.714    | 0.132 | 0.028    | 0.902|
| Clothing for men       | -0.353   | 0.173 | -0.629   | -0.018|
| Clothing for women     | 0.410    | 0.186 | 0.048    | 0.753|
| Education and Recreation| 0.459   | 0.182 | 0.067    | 0.747|
| Other consumption      | 2.501    | 0.252 | 1.341    | 3.046|

*Note: 1. Values are expressed as natural logarithms.*

### Table 2: Demographic Variables (742 obs.)

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>Std. Dev</th>
<th>Min</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>North-east</td>
<td>0.302</td>
<td>0.459</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>North-west</td>
<td>0.252</td>
<td>0.435</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Center</td>
<td>0.173</td>
<td>0.378</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>December</td>
<td>0.098</td>
<td>0.298</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Rural</td>
<td>0.170</td>
<td>0.376</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Employee</td>
<td>0.690</td>
<td>0.494</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Smoke</td>
<td>0.373</td>
<td>0.484</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>University</td>
<td>0.155</td>
<td>0.362</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Price ratio</td>
<td>0.320</td>
<td>0.048</td>
<td>0.207</td>
<td>0.462</td>
</tr>
<tr>
<td>Edu. ratio</td>
<td>0.493</td>
<td>0.087</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Age ratio</td>
<td>0.517</td>
<td>0.032</td>
<td>0.277</td>
<td>0.667</td>
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### Table 3: Rank Test

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<th>Rank</th>
<th>r=1</th>
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<tr>
<td>test</td>
<td>18.00</td>
<td>1.55</td>
<td>0.021</td>
<td>0.000</td>
</tr>
<tr>
<td>p-value</td>
<td>0.001</td>
<td>0.670</td>
<td>0.989</td>
<td>1.000</td>
</tr>
</tbody>
</table>
Table 4: Parameters of the demand system (742 obs.)

<table>
<thead>
<tr>
<th>param.</th>
<th>food</th>
<th>alcohol</th>
<th>clothing</th>
<th>edu.-rec.</th>
<th>others</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\alpha_i$</td>
<td>0.639 (0.077)</td>
<td>-0.002* (0.039)</td>
<td>0.185 (0.101)</td>
<td>-0.486 (0.106)</td>
<td>0.664 (0.134)</td>
</tr>
<tr>
<td>$\gamma_{ij}$</td>
<td>-0.192 (0.021)</td>
<td>0.004* (0.006)</td>
<td>-0.035 (0.019)</td>
<td>0.108 (0.021)</td>
<td>0.045 (0.019)</td>
</tr>
<tr>
<td>$\beta^m_i$</td>
<td>-0.055 (0.021)</td>
<td>0.011* (0.012)</td>
<td>-0.115 (0.072)</td>
<td>0.137 (0.024)</td>
<td>0.022* (0.053)</td>
</tr>
<tr>
<td>$\beta^f_i$</td>
<td>-0.022* (0.055)</td>
<td>-0.006* (0.022)</td>
<td>-0.154 (0.057)</td>
<td>0.074* (0.092)</td>
<td>0.107 (0.079)</td>
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<tr>
<td>$\lambda^m_i$</td>
<td>-0.011* (0.013)</td>
<td>-0.007* (0.004)</td>
<td>0.072 (0.016)</td>
<td>-0.008* (0.014)</td>
<td>-0.046 (0.019)</td>
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<tr>
<td>$\lambda^f_i$</td>
<td>-0.015 (0.012)</td>
<td>0.001* (0.004)</td>
<td>0.045 (0.013)</td>
<td>0.004* (0.013)</td>
<td>-0.035 (0.019)</td>
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<tr>
<td>$\eta_i$</td>
<td>-</td>
<td>-0.013 (0.012)</td>
<td>-</td>
<td>-0.184 (0.118)</td>
<td>-</td>
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</table>

Demo. vars.

<table>
<thead>
<tr>
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</tr>
</thead>
<tbody>
<tr>
<td>north-east</td>
<td>-0.033 (0.013)</td>
</tr>
<tr>
<td>north-west</td>
<td>0.012 (0.004)</td>
</tr>
<tr>
<td>center</td>
<td>-0.032 (0.014)</td>
</tr>
<tr>
<td>december</td>
<td>0.005* (0.014)</td>
</tr>
<tr>
<td>university</td>
<td>-0.022* (0.012)</td>
</tr>
<tr>
<td>dep. worker</td>
<td>0.007* (0.010)</td>
</tr>
<tr>
<td>rural</td>
<td>0.004* (0.011)</td>
</tr>
<tr>
<td>smoke</td>
<td>-0.001* (0.009)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>sharing rule</th>
<th>price-r</th>
<th>edu-r</th>
<th>age-r</th>
</tr>
</thead>
<tbody>
<tr>
<td>-2.349 (0.835)</td>
<td>0.883 (0.415)</td>
<td>-1.261 (0.943)</td>
<td></td>
</tr>
</tbody>
</table>

* Denotes non significant parameters at the 5% significance level.

Table 5: Parameters of the participation equation (742 obs.)

<table>
<thead>
<tr>
<th></th>
<th>alcohol</th>
<th>education&amp;recreation</th>
</tr>
</thead>
<tbody>
<tr>
<td>constant</td>
<td>0.156* (0.224)</td>
<td>0.904 (0.247)</td>
</tr>
<tr>
<td>december</td>
<td>0.085* (0.163)</td>
<td>0.095* (0.220)</td>
</tr>
<tr>
<td>north-east</td>
<td>-0.392 (0.179)</td>
<td>0.995 (0.214)</td>
</tr>
<tr>
<td>north-west</td>
<td>-0.455 (0.183)</td>
<td>0.784 (0.216)</td>
</tr>
<tr>
<td>center</td>
<td>-0.119* (0.197)</td>
<td>0.662 (0.222)</td>
</tr>
<tr>
<td>south (no isles)</td>
<td>-0.151* (0.195)</td>
<td>0.169* (0.204)</td>
</tr>
<tr>
<td>rural</td>
<td>-0.039* (0.130)</td>
<td>-0.212* (0.157)</td>
</tr>
<tr>
<td>age</td>
<td>0.066 (0.021)</td>
<td>-0.039* (0.027)</td>
</tr>
<tr>
<td>smoke</td>
<td>0.309 (0.099)</td>
<td>0.233 (0.136)</td>
</tr>
<tr>
<td>husband dep. worker</td>
<td>-0.003* (0.112)</td>
<td>0.011* (0.116)</td>
</tr>
<tr>
<td>wife dep. worker</td>
<td>-0.069* (0.107)</td>
<td>-0.081* (0.138)</td>
</tr>
</tbody>
</table>

* Denotes non significant parameters at the 5% significance level.
Table 6: Income and Price Elasticities for m & f

<table>
<thead>
<tr>
<th></th>
<th>food</th>
<th>alcohol</th>
<th>clothing</th>
<th>edu.-rec.</th>
<th>other</th>
</tr>
</thead>
<tbody>
<tr>
<td>income elasticities</td>
<td>0.747</td>
<td>1.051</td>
<td>1.064</td>
<td>2.068</td>
<td>0.882</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>food</th>
<th>alcohol</th>
<th>clothing</th>
<th>edu.-rec.</th>
<th>other</th>
</tr>
</thead>
<tbody>
<tr>
<td>compensated price elasticities</td>
<td>-1.126</td>
<td>0.039</td>
<td>0.373</td>
<td>0.351</td>
<td>0.571</td>
</tr>
<tr>
<td>alcohol</td>
<td>0.472</td>
<td>-1.099</td>
<td>-0.521</td>
<td>0.177</td>
<td>0.855</td>
</tr>
<tr>
<td>clothing</td>
<td>0.521</td>
<td>-0.073</td>
<td>-1.377</td>
<td>0.168</td>
<td>0.635</td>
</tr>
<tr>
<td>edu.-rec.</td>
<td>0.642</td>
<td>-0.028</td>
<td>-0.067</td>
<td>-2.946</td>
<td>1.202</td>
</tr>
<tr>
<td>other</td>
<td>0.511</td>
<td>0.051</td>
<td>0.368</td>
<td>0.412</td>
<td>-1.278</td>
</tr>
</tbody>
</table>