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# Households Consumption Patterns and Equivalence Scales in Italy: 1997-2004


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**Abstract -** We use a sample of 43,700 observations on Italian households' current expenditures to investigate consumption patterns from 1997 to 2004, a time period which encompasses the introduction of the Euro. Compensated and uncompensated price elasticities and expenditure elasticities for ten goods and heterogeneous households are obtained from the estimated parameters of a complete Censored non linear Almost Ideal Demand System (CAIDS) with demographic shifters. To tackle the problem of corner solutions for some goods we adopt the Two Step estimator proposed by Shonkweiler and Yen (1999). Parametric equivalence scales for the investigation period 1997-2004 are also computed for households with different demographic composition and different geographical location.

**JEL Classification**: D11, D12.
**Keywords**: Equivalence Scales, Demand Analysis, Censoring.

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# 1 Introduction

This paper analyzes the consumption pattern of Italian households with different demographic profiles over the years 1997-2004, an investigation period which encompasses the introduction of the Euro. The consumption pattern of households is explained calculating own and cross price Marshallian and Hicksian elasticities of demand as well as expenditure elasticities for all households types. To this aim we estimate a Censored non linear Almost Ideal Demand System using a sample of 43,701 observations on households expenditures, which have been grouped in four different demographic household profiles and in four different macro-areas of Italy.

During the last two decades the use of household survey data has become dominant in demand analysis. Cross-sectional data offer obvious advantages for better deriving elasticity estimates due to the availability of detailed demographic information, which allow treatment of heterogenous preferences; large samples provide the degrees of freedom necessary to estimate large demand systems. However the use of household level data is often complicated by zero values in the dependent variables, a problem which particularly affects highly disaggregated demand systems.

There is a growing literature on the estimation of censored demand systems which has been developed since the works of Shonkweiler and Yen (1999), Perali and Chavas (2000) and Golan, Perloff and Yen (2001). In this work we use the two step procedure suggested by Shokweiler and Yen (1999) to tackle censored data in some classes of expenditures. This is an easily manageable estimator which has been applied several times[1] to estimate demand systems. We contribute to this strand of literature by estimating a complete demand system where the total consumption bundle is divided into ten goods.[2]

A further objective is to carry out a welfare analysis through the calculation of consumption equivalence scales. These indices measures the relative levels of spending required by different households' types to attain given levels of utility. Moreover, they may be used to deflate expenditure in order to better explain consumption inequality among households and to draw some consideration on the efficiency of different households' types in reaching given levels of welfare.

The empirical results may be useful tools to further investigate the pattern of income inequality registered in Italy over the last ten years (Baldini and Toso, 2004).

The remaining of the paper is structured as follows: section two outlines the censored demand system, the adopted econometric strategy and discusses the results of the demand

[1] See Tauchmann (2005) for a review.

[2] Alternatives to the AID system include the QAIDS (Banks, Blundell and Lewbel, 1997) and the more recent Translated QAIDS (Lewbel, 2003) which allows for a more flexible specification of the Engel curves. This is an important property in applications where a high number of consumption goods is considered.

system's estimation; in section three equivalence scales are calculated; section four draws some concluding remarks.

# 2 Specification and Demand System Estimation

## 2.1 Data

The sources of data used are cross-sections of households' current expenditures collected by ISTAT through the annual survey of households' consumption from 1997 to 2004. This survey, completely renewed since 1997, collects monthly consumption expenditure of Italian households in about two hundred and eighty consumption categories, with the exact number changing from year to year due to minor adjustments in the item's list. Some of the items, whose allocation is assumed to occur under the hypothesis of strong separability, such as durables, are not considered in the demand system. Households are interviewed at different times during the year, on a monthly basis. The questionnaire includes, besides questions on monthly income and expenditure, detailed questions on the household structure, so that relevant information on demographic characteristics is available such as: location on a regional basis, number of households members, sex, age, education and employment condition of each household member. All annual samples are independently drawn according to a two-stage design.[3]

A sub-sample of 43,701 observations (which thereafter will be referred to as the sample) has been selected according to the following selection criteria[4]. We consider households: i) whose members are aged less than sixty-five; ii) with a couple of adults, of which at least one employed, aged more than twenty-four; iii) with no additional members or with a number of children, aged less than fifteen, between one and three. We estimate a ten goods demand system[5]: (1) Food and beverages; (2) Tobacco and Alcoholic beverages; (3) Clothing; (4) Housing excluding rent; (5) Household operation (including child care); (6) Health care; (7) Transports; (8) Communications; (9) Recreation; (10) Other goods and services. These aggregate goods are chosen according to availability of monthly regional price indices also supplied by ISTAT, which are included in the data

[3]Details on the sampling procedure used to collect these data can be found in ISTAT, *Indagine sui Consumi delle Famiglie. File standard. Manuale d'uso. Anni 1997-2004*.

[4]All the information described above, besides information on prices, has been handled within a single database used for the sample selection.

[5]See Perali (1999), Betti (2000) and Donaldson and Pendakur (2006) for demand systems chosen for similar purposes.

set[6].

Other exogenous variables also includede in the model are: four dummy variables that classify household types: Two Adults (N1), Two Adults and a Child aged less than fourteen (N2), Two Adults and Two Children (N3), Two Adults and Three Children (N4); dummy variables distinguishing the location of the household : North West (NO), North East (NE); Centre (CE), South and the Islands (SI); a dummy variable to account for the presence of a second employed member (DUO) and two additional variables accounting for the level of education of the first and second adult member of the household (SCOLA1, SCOLA2). These are discrete variables indexed from 1, which denotes the highest level of education (PhD degree), to 8, denoting no education at all. Finally a logarithmic annual time trend is also included. Summary statistics of the data are given in Table 1.

[6] ISTAT provides, in fact, price indices for eleven goods. The first nine coincide with that of our list. The residual class in our list, Other goods and services, includes also Education, Hotels and Restaurants for which ISTAT supplies separate values.

**Table 1: The Data**

| **No. of households: 43,701** | mean | std dev | min | max |
|---|---|---|---|---|
| ***Current Expenditures (Euro/month)*** | | | | |
| Total Expenditure | 1,613.289 | 945.750 | 250.527 | 8,972.019 |
| Food From Stores | 425.660 | 227.771 | 0.000 | 2,946.880 |
| Alcohol and Tobacco | 40.063 | 49.977 | 0.000 | 624.009 |
| Clothing | 200.367 | 267.714 | 0.000 | 4,824.001 |
| Household Operation | 133.166 | 100.736 | 0.000 | 1,173.626 |
| Household Furnishing and Equipment | 75.452 | 118.351 | 0.000 | 3,268.560 |
| Health | 92.968 | 243.203 | 0.000 | 6,615.609 |
| Transports | 209.922 | 233.349 | 0.000 | 5,508.500 |
| Communication | 44.362 | 36.753 | 0.000 | 623.900 |
| Recreation | 118.095 | 137.878 | 0.000 | 2,520.430 |
| Other Goods and Services | 273.234 | 396.778 | 0.000 | 5,603.389 |
| ***Price indices (1995=1)*** | | | | |
| Food from Stores | 1.109 | 0.066 | 0.978 | 1.338 |
| Alcohol and Tobacco | 1.241 | 0.105 | 1.059 | 1.561 |
| Clothing | 1.158 | 0.073 | 1.024 | 1.398 |
| Household Operation | 1.195 | 0.085 | 1.015 | 1.387 |
| Household Furnishing and Equipment | 1.117 | 0.052 | 1.015 | 1.277 |
| Health | 1.150 | 0.067 | 1.011 | 1.310 |
| Transports | 1.148 | 0.072 | 1.009 | 1.361 |
| Communication | 0.974 | 0.059 | 0.750 | 1.071 |
| Recreation | 1.102 | 0.054 | 0.984 | 1.262 |
| Other Goods and Services | 1.151 | 0.083 | 1.009 | 1.349 |
| ***Other exogenous variables*** | | | | |
| Childless Adult Couple (N1) | 0.324 | 0.467 | 0.000 | 1.000 |
| Two Adults and one Child (N2) | 0.315 | 0.464 | 0.000 | 1.000 |
| Two Adults and two Children (N3) | 0.316 | 0.465 | 0.000 | 1.000 |
| Two Adults and three Children (N4) | 0.045 | 0.207 | 0.000 | 1.000 |
| NO | 0.247 | 0.431 | 0.000 | 1.000 |
| NE | 0.223 | 0.416 | 0.000 | 1.000 |
| CE | 0.174 | 0.379 | 0.000 | 1.000 |
| SI | 0.356 | 0.479 | 0.000 | 1.000 |
| DUO | 0.524 | 0.499 | 0.000 | 1.000 |
| SCOLA1 | 4.876 | 1.463 | 1.000 | 8.000 |
| SCOLA2 | 4.779 | 1.425 | 1.000 | 8.000 |
| Annual time trend | 4.607 | 2.273 | 1.000 | 8.000 |

## 2.2 Estimation of a Censored Almost Ideal Demand System (CAIDS)

The functional form chosen to specify the model is the Almost Ideal Demand System (AIDS, Deaton and Muellbauer, 1980). To obtain the deterministic shares equations we use a logarithmic cost function, for household $h$, which implies PIGLOG preferences, a dual representation of a consumer's utility function, from which the demand system is derived (Pollack and Wales, 1992):

$$ln\ C(u, \mathbf{p}, d^h) = ln\ a(\mathbf{p}, d^h) + u\ b(\mathbf{p}) \tag{1}$$

Where $a(\mathbf{p}, d^h)$ and $b(\mathbf{p})$ are functions of prices, $ln$ indicates the natural logarithm and $d^h$ are demographic variables. $a(\mathbf{p}, d^h)$ is increasing and homogenous of degree one in $\mathbf{p}$ and $b(\mathbf{p})$ is increasing and homogenous of degree zero in $\mathbf{p}$. The corresponding system of Marshallian demand functions, for household $h$, as shares is given by:

$$w_i^h = \alpha_i + \sum_k \alpha_{ik} d_k^h + \sum_j c_{ij}\ ln\ p_j + b_i\ ln\left[\frac{y^h}{P^h}\right] \tag{2}$$

where $y^h$ is total expenditure of household $h$, the parameters $c_{ij}$ are defined as: $c_{ij} = \frac{1}{2}(c^*_{ij} + c^*_{ji}) = c_{ji}$ and $\alpha_{ik}$ are the coefficients of the translating intercepts $d^h = d_1^h...d_k^h$, which, in this model include households' types, households' location and the annual time trend. Finally,

$$P^h = \alpha_0 + \sum_i (\alpha_i + \alpha_{ik} d_k^h)\ ln\ p_i + \frac{1}{2}\sum_i \sum_j c^*_{ij}\ ln\ p_i\ ln\ p_j \tag{3}$$

These demand functions satisfy integrability, i.e. are consistent with utility maximization, when the following parametric restrictions hold: $\sum_i \alpha_i = 1, \sum_i b_i = \sum_j c^*_{ij} = 0$, $\sum_i \alpha_{ik} = 0\ \forall k$ (Adding-up); $\sum_j c_{ij} = 0$ (Homogeneity); $c_{ij} = c_{ji}$ for all $i, j$ (Symmetry).

Starting from the early work of Heien and Wessels (1990) estimation procedures for censored consumer demand systems have been developed and include the efficient Generalized Maximum Entropy procedure (Golan, Perloff and Shen, 2001) and consistent but less efficient approaches such as Perali and Chavas (2000) multi-step procedure and Shonkweiler and Yen (1999) Two-Step (TS) estimator which involves probit estimation in the first step and a selectivity-augmented equation system in the second step[7]. To deal

[7] Shonkweiler and Yen (1999); Yen, Lin and Smallwood (2003) and Yen and Lin (2006) provide useful literature review on estimation procedures for censored demand systems.

with corner solutions we have used the TS procedure proposed by Shonkwiler and Yen (1999).

Following Yen *et al.* (2002) we denote the deterministic expenditure share for commodity $i$ as $w_i(p, y; \theta)$, where $\theta$ is a vector containing all parameters ($\alpha_i$, $\alpha_{ik}$, $b_i$ and $c_{ij}$) in the demand system (2). Censoring of each commodity $i$ is governed by a separate stochastic process $z_i^{'}\tau_i + \nu_i$ such that

$$s_i = \begin{cases} w_i(p, y; \theta) + \varepsilon_i & \text{if } z_i^{'}\tau_i + \upsilon_i > 0 \\ \\ 0 & otherwise \end{cases} \tag{4}$$

where $s_i$ is the observed expenditure share, $z_i$ is a vector of exogenous variables, $\tau_i$ is a parameter vector, and $\varepsilon_i$ and $\nu_i$ are random errors. Using equation (4) and bivariate normality of the matrix $[\varepsilon_i, \nu_i]^{'}$, the mean of $s_i$ conditional on a positive observation is

$$E(s_i|\nu_i > -z_i^{'}\tau_i) = w_i(p, y; \theta) + \varepsilon_i + \delta_i\phi(z_i^{'}\tau_i)/\Phi(z_i^{'}\tau_i) \tag{5}$$

where $\phi(\cdot)$ and $\Phi(\cdot)$ are the standard normal probability density and distribution functions, respectively. Since $Pr(\nu_i > -z_i^{'}\tau_i) = \Phi(z_i^{'}\tau_i)$ and $E(s_i|\nu_i < -z_i^{'}\tau_i) = 0$, the unconditional mean of $s_i$ is:

$$E(s_i) = \Phi(z_i^{'}\tau_i)w_i(p, y; \theta) + \delta_i\phi(z_i^{'}\tau_i) \tag{6}$$

and the system of share equations can be written as

$$s_i = \Phi(z_i^{'}\tau_i)w_i(p, y; \theta) + \delta_i\phi(z_i^{'}\tau_i) + \xi_i \tag{7}$$

where $\xi_i = s_i - E(s_i)$.

The system of equations (7) is estimated using a two-step procedure: (i) obtain ML probit estimates $\hat{\tau}_i$ of $\tau_i$ using the binary outcome $s_i = 0$ and $s_i > 0$; (ii) calculate $\Phi(z_i^{'}, \hat{\tau}_i)$, $\phi(z_i^{'}\hat{\tau}_i)$ for all $i$ and estimate $\theta, \delta_1, \delta_2, ..., \delta_n$ in the augmented system (7) by ML. Such two-step estimator is consistent, but the error terms in equation (7) are heteroscedastic, thus the estimated elements of the second-step conventional covariance matrix are inefficient. Yen *et al.* (2002) suggest that the correct covariance matrix can be calculated using Murphy and Topel's procedure (1985). However, for simplicity, in this paper we empirically calculate the standard errors of the elasticities and equivalence scales using bootstrapping and running 500 replications. This ensures that the standard errors of these derived parameters are correct.

Exogenous variables used in the first-step probit estimates are: total expenditure, dummies indicating household type, level of education of the first and second member of the household, presence of a second employed member, geographical location and the annual time trend in logarithms. The dependent variable in the first-step probit estimates is the quantity consumed of each of the ten goods.

One issue that arises in estimating a system of censored equations is that, though the adding up restriction holds for the latent expenditure shares, it does not hold for observed expenditure shares. To address this problem we adopt a simple approach suggested by Pudney (1989, p. 155) and used, among others, by Yen *et al.* (2003), Dong *et al.*(2004), Yen and Lin (2006). This consists of estimating $n-1$ equations using the TS procedure together with an identity

$$s_n = 1 - \Sigma_{i=1}^{n-1} s_i, \tag{8}$$

defining the residual expenditure category as the difference between total expenditure and spending on the first $n-1$ categories and treating the $n$th good as a residual category with no specific demand of its own. Demand elasticities for the residual good, if necessary, can be calculated using the adding up identity (8). For censored goods, elasticities are calculated from the unconditional means of the expenditure shares. Differentiation of equation (7) gives demand elasticities for the first $n-1$ goods and elasticities for the $n$th good are obtained exploiting the Cournot and Engel restrictions (Deaton and Muellbauer, 1980, p. 16): denoting the Marshallian, Hicksian and expenditure elasticities for good $i$ as $e_{ij}^{h}$ , $e_{ij}^{*h}$ and $e_{i}^{h}$, respectively, then $e_{nj}^{h}$ , $e_{nj}^{*h}$ and $e_{n}^{h}$ can be calculated using the Cournot restriction $\sum_{i=1}^{n} w_i^h e_{ij}^h + w_j^h = 0$ and the Engel restriction $\sum_{j=1}^{n} e_{ij}^h + e_i^h = 0$.

## 2.3 Results

Table 2 reports first-step probit estimates for the first nine goods along with their asymptotic standard errors. Most of the variables included are significant at the 5% level in each of the goods considered. Income plays a positive role in determining the consumption of all goods except for food. Demographic and regional variation is also evident in the likelihood of consuming most goods. The presence of one or more children in the household decreases the probability of consuming Alcohol and Tobacco and the presence of a second employed member significantly increases the likelihood of spending on Households operation and on Transports. Finally, an increase in the level of education of one of the adult members of the household increases the likelihood of consuming Alcohol and Tobacco, but decreases the likelihood of spending on Recreation (although the coefficient is very low). All the explanatory variables play significant roles in the probability of consumption of one or more of the commodities.

In Table 3 we show second-step estimates of the CAID system and second-step estimates of the symmetry restricted parameters $c_{ij}$ using parameter estimates $\hat{\tau}_i$ from the first step probit estimation. Standard errors have been computed from a heteroscedastic-consistent matrix using the White correction.

Economic theory also requires the matrix of the substitution effects to be negative semi-definite. Such a requirement is satisfied by the data without adopting any reparametrization procedure of the price coefficients.

Hicksian (compensated) elasticities, based on parameters of the second-step are computed at the sample mean as:

$$e^{*h}_{ij} = e^h_{ij} + e^h_i w^h_j \tag{9}$$

where $e^h_{ij}$ is the uncompensated price elasticity of good $i$ with respect to price $j$ and $e^h_i$ is the expenditure elasticity of good $i$. These elasticities are shown in Table 4 along with expenditure elasticities for all goods, the estimated budget shares and the rate of change in autonomous consumption, calculated as the logarithmic derivative of the share equations with respect to the annual time trend.

Expenditure elasticities for all goods are significantly different from zero. Food, Household operation and Communication present elasticities which differ significantly from one, classifying Clothing, Health and Other goods and services as luxuries; Food, Households operation and Communication as necessities. A surprise is perhaps the rather high budget elasticity of Transports whereas Alcohol and Tobacco have a unit elasticity. The low income elasticity of demand for Household operation, which includes expenditures on electricity, water services, heating, housing and transport fuels, suggests these goods being necessities, a result which is in line with the literature.

As to the budget shares, Food, Transports and Clothing are the consumption categories on which the largest part of the monthly expenditure is allocated.

All own compensated elasticities have the correct sign and are statistically significant. Compensated cross price elasticities provide precise information on net complementarities and net substitutions among goods. An interesting result is the high value of the cross price elasticity of the demand for Communication and Recreation with respect to the price of Clothing suggesting a high level of net substitution between Recreation and Clothing and between Communication and Clothing. A possible explanation is that an excessive Clothing expenditure is actually a recreation activity in competition with similar ones. Another interesting result is the high level of net substitution between Household furniture and Household operation with the cross price elasticity of Household furniture with respect to a rise in the price of Household operation services being almost 1.479. As to net complementarities, there appear to be a high level of complementarity between Household furniture and Food and Communication and Food. These cross price elasticities are respectively $-1.200$ and $-1.005$. The decrease in Communication expenditure following an increase in Food prices can be explained by the diffusion and over-utilization of mobile telephones in Italy since the Communication category, in this work, includes telephone calls.

Marshallian (uncompensated) elasticities are computed as logarithmic derivatives of the second step share equations using DIFFER in TSP 5.0 and calculated at the sample means of variables (Table 5). As mentioned above, we empirically calculate the standard errors of elasticities using bootstrapping (with 500 replications).

All uncompensated own price elasticities are statistically significant and those for Household operation, Household furniture and Health are greater than unity which is rather surprising. Another unexpected result is the rather low own price elasticity for Clothing and Recreation, whereas the low elasticity of Food and Alcohol and Tobacco is in line with what is expected.

Most complementarities and substitutions detected by Hicksian cross price elasticities are also confirmed by the uncompensated ones. An interesting exception is given by ”vices” (i.e. Alcohol and Tobacco) which are net complements, but gross substitutes of Household furniture. They same type of relation characterizes Household operation and Household furniture.

The elasticities with respect to the time trend $e_{jT}$ suggest a slight decrease in expenditures for Food, Alcohol and Tobacco and a large decrease in Health expenditures (almost 19%) over the eight years under consideration. Another interesting result is the increase in Clothing expenditures (14%) whereas the expenditure on Transports has remained almost stable.

As the sample period of our data encompasses the date of the introduction of the Euro, a further application is to try to give a contribution to the debate that has recently emerged in Europe, and particularly in Italy, on the inflationary effects of the introduction of the Euro from January 2002. The debated question is whether the change of currency was accompanied by an unexpected increase in the price levels, not accurately measured by official statistics. Following Moschini and Rizzi (2007), we test whether our model supports a structural break occurring in January 2002, when the Euro replaced the Lira, i.e. we test whether the parameters of the demand system have significantly changed after the introduction of the Euro, implying that consumers have changed the way they make their consumption choices. The test we carry out, proposed by Anderson and Blundell (1984) is based on the Likelihood Ratio test statistic:

$$\Lambda = 2\left[\frac{T}{T_1}L_1^* + 0.5log\frac{T}{T_1}L^*\right] \tag{10}$$

where $T = 43,701$ and $T_1 = 25,998$ are the sizes of the full sample and of the sub-sample up to the hypothesized structural break (i.e. January 1997 to December 2001), $L^*$ is the maximized value of the log-likelihood function over the entire sample, and $L_1^*$ is the maximized value of the Log-likelihood function over the sub-sample of $T_1$. The computed value of this statistic is $\Lambda = 7,781$. Under the null hypothesis of parameters stability, the statistic $\Lambda$ is distributed as a $\chi^2$ with $(T - T_1)N$ degrees of freedom, where $N = 9$ is the number of estimating equations. In line with previous results by Moschini and Rizzi (2007) we find no structural break, as the hypothesis of constancy of the parameters after the introduction of the Euro is not rejected at the 5% significance level.

# 3 Equivalence Scales

Just as we are interested in modeling the effects on demand of differences in prices and budget levels, so it is useful to model the effects on demand of households characteristics (Deaton and Muellbauer, 1980, p. 191). To compare welfare or real income across households with different sizes and composition we may use index numbers known as equivalence scales.

While true-indices-of-the-cost-of-living compare the welfare levels of households facing different price vectors, equivalence scales compare the welfare levels of households with different demographic profiles. If, for instance, the demographic profile of two families varies only in relation to the number of children, the equivalence scale will measure the cost of children. In other words, equivalence scales allow to measure the cost of demographic characteristics such as household size, the presence of children, of old parents, of unemployed women. They are also used for the measurement of poverty. Given a poverty threshold for a reference household, we can multiply that threshold by equivalence scales to obtain the corresponding poverty threshold for households of other sizes and compositions.

Engel (1895) proposed to use a household's share of food expenditure as a measure of a household's welfare or standard of living. The resulting Engel equivalence scale is defined as the ratio of incomes of two different sized households that have the same Food budget share (Lewbel and Pendakur, 2008, p. 2). This is the method used by the United States Census Bureau to measure poverty and it is also used by ISTAT to measure poverty in Italy (Carbonaro, 1985 and 2004). Roughly, ISTAT first defines the poverty threshold for a typical household as 50% of the per capita consumption expenditure and then uses Food shares (Engel scales) to derive comparable poverty thresholds for households of different sizes and compositions. Modern equivalence scales measure well being in terms of utility, using cost functions estimated from consumer demand data via revealed preference theory.

Although empirical evidence suggests that equivalent expenditure may have an increasing relationship with household expenditure (Koulovatianos, Schroeder and Schmidt, 2005), only absolute and relative equivalence scales that are independent of expenditure have been used until a few years ago, due to identification problems (Blundell and Lewbel, 1991, and Lewbel and Pendakur, 2008). The property of independence of the base level of expenditure (IB) or exact equivalence scales (ESE) solves this identification problem and ensures that equivalence scales are uniquely determined[8].

We estimate IB equivalence scales following Engel's approach and then imposing a parametric restriction suggested by Pashardes (1991), which allows for more general equivalence scales, interpreting the components $\alpha_{ik}$ as deviations with respect to the general equivalence scale.

If $C(\mathbf{p}, u, \mathbf{d})$ is the minimum expenditure required for a household $h$ with characteristics $\mathbf{d}$ to attain utility level $u$ when facing prices $\mathbf{p}$, the equivalence scale is defined as

$$ES(\mathbf{p}, u, \mathbf{d}) = \frac{C(\mathbf{p}, u, \mathbf{d})}{C(\mathbf{p}, u, \bar{\mathbf{d}})} \tag{11}$$

[8]Recent advances on the identification of equivalence scales (Donaldson and Pendakur, 2006) have proposed a more general class of equivalent expenditure functions which satisfy a condition known as Generalized Absolute Equivalent Scale Exactness (GAESE). If the equivalent expenditure function falls in this class, then identification from demand behavior of equivalence scales that are dependent on expenditure is possible. In this case we may also have equivalence scales which decline with expenditure. The possibility of estimating equivalence scales which depend on household's expenditure changes substantially the way we can measure poverty and inequality. Donaldson and Pendakur (2006) show, using Canadian data, that, taking a single adult as the reference household, the equivalence scale for a family of dual parents with one child is 2.11 for poor households, but only 1.98 for rich households. This result reveals that households consumption economies of scale increase not only in the number of households (a well known result in the literature) but also as the standard of living goes up, i.e. with increasing expenditure.

where $\bar{\mathbf{d}}$ is the vector of characteristics of the reference household. Perali (2001) shows that the AIDS model, underlying PIGLOG preferences, is suitable for estimation of equivalence scales because utility transformations of PIGLOG preferences are independent of household characteristics, a restriction necessary to maintain the IB property. The logarithm of the equivalence scale *ES* derived from the AIDS model has the following form (Perali, 2001):

$$ln\ ES_{IB} = ln\ C(\mathbf{p}, u, \mathbf{d}) - ln\ C(\mathbf{p}, u, \bar{\mathbf{d}}) = ln\ D(\mathbf{d}) - ln\ D(\bar{\mathbf{d}}) \tag{12}$$

where $ln\ D(\mathbf{d})$ is the logarithm of the demographic function, assumed to be separable from the original cost function and derived from the demographic modification of the original cost function.

Following Patrizii and Rossi (1991, chapter four), the logarithm of the Engel scales, can be obtained imposing a zero restriction on the specific component $\alpha_{ik}$ for Food which, in our model, gives:

$$\alpha_k = -\frac{\alpha_{ik}}{b_i} \tag{13}$$

where $i$ denotes the Food category.

Pashardes (1991) suggests that, given the estimate of $b_i$, equation (13) can be considered as a regression equation with $\alpha_{ik}$ interpreted as mean zero residuals and $\alpha_k$ as the slope of the same regression equation so that the logarithm of the equivalence scale becomes:

$$\alpha_k = -\frac{\sum_{i=1}^{n} b_i \alpha_{ik}}{\sum_{i=1}^{n} b_i^2} \tag{14}$$

Both types (13) and (14) equivalence scales are calculated at the sample mean for the sixteen types of families considered, i.e. households differing by location (NO, NE, CE, SI) and number of members (N1-N4) with the reference household being a Childless Adults' Couple (N1) living in central Italy (CE) with only one employed member. A second set of equivalence scales is calculated taking the same reference household and comparing it with households with two employed members and the same demographic and geographic profiles as before. This second set of equivalence scales should reveal how, having two employed members of the households, changes the cost of reaching a given level of welfare in comparison with households having a single member employed. Table 6 and Table 7 report Engel's equivalence scales and equivalence scales calculated imposing Pashardes' restriction, respectively.

Table 6 can be read both horizontally and vertically. If read horizontally, it conveys the usual information about variations in costs of reaching the same welfare level of households with different demographic dimension, whereas the vertical dimension suggests the variation in costs due to location of the household. The lower part of the table shows scales calculated for households with two employed members. For a given composition of the household, the North East area of Italy produces utility more efficiently than the other three areas of Italy. Specifically, reaching a mean level of welfare costs, to a childless adults' couple, about 22% less in the North East than in the Centre and such cost represents 78% of the cost of an adult equivalent. Reaching the same level of welfare in the South increases the cost by about 18%. This result is consistent with findings from previous studies, such as Patrizii and Rossi (1991, p. 143). Such finding is also consistent across all household dimensions suggesting a marked difference in costs of living in different areas of Italy. Given the location of the reference household, having a child increases the cost by about 18% in the Centre and in the North West, by 13% in the North East and by 21% in the South. Having two children raises the cost of the reference household by 27% in the Centre and by 43% in the South whereas having three children increases it by about 70% in the Centre and by 81% in the South. Adding a child to an adult's couple is more expensive than adding a second child, but adding a third child produces a higher marginal cost in all areas of Italy, so the usual assumption of economies of scales in the dimension of the household does not hold here, as the cost of households is not a concave function of the number of children. Perali (2005) suggests this is not surprising, because the most reasonable source of households economies of scale is the presence of public goods to be shared within the household.

The lower part of Table 6 shows equivalence scales in which the same reference household as before is compared with households with two employed members. As expected, the presence of a second employed member markedly decreases the cost of reaching the same level of welfare of the reference household. Adding a second employed member to the reference household reduces the cost by about 17%. Costs decreases are largest for households living in the South.

Table 7 shows equivalence scales calculated imposing the Pashardes parametric restriction where all categories of expenditures are accounted for in the calculation of the scale and not just the Food share as in the Engel approach. As expected, the introduction of such components reduces the variation in the scales and it also reduces the difference in costs of reaching the same level of welfare between the reference household and the

South. With the Engel scales such difference is about 18%, whereas the Pashardes approach reduces it to 5%. A household with three children living in the South spends 30% more than a similar household living in the Centre according to the Engel scale, but this difference reduces to 7% when looking at the Pashardes scale. These marked variations suggest that policy makers should be careful in drawing policy implications from Engel scales, as it happens in Italy, as they may overstate differences in costs of reaching the same level of welfare by different household types.

# 4 Concluding remarks

We have estimated a Censored AI demand system using Italian micro data to analyze the pattern of consumption of households with different demographic profiles. The problem of censoring in expenditure data has been tackled using the Two Step procedure developed by Shonkweiler and Yen (1999) and the total household expenditure has been split into ten goods to better capture complementarities and substitutions among them. To our knowledge, this is the first attempt at analyzing Italian consumption patterns using a very large sample of micro data over the investigation period 1997-2004, which encompasses the introduction of the Euro. A Likelihood Ratio test carried out to detect a structural break occurring during January 2002 does not reject the hypothesis of constancy in the systems parameters, thus denying the occurrence of the break.

Equivalence scales imposing Engel and Pashardes restrictions have also been calculated for households of different dimension and geographical location. The Engel approach appears to overstate the value of equivalence scales in comparison with Pashardes'. This is important, because it implies that relying on Engel scales to measure poverty, as the Italian Statistical Office does in Italy, may lead to an overestimation of the number of households below the poverty lines.

The North Eastern area of Italy seems to produce utility more efficiently than the other three areas of Italy. As the reference household is a childless couple living in the Centre, the scales suggest that there are significant household economies of scales going from one to two children, but adding a third child produces a higher marginal cost in all areas of Italy, so the usual assumption of costs of households being a concave function of the number of children does not hold here. Families with two employed members show considerably lower equivalence scales in comparison with families with only one member employed suggesting a marked saving in costs of reaching the same welfare level when there is a second occupied person in the household. Finally, it would also obviously be interesting to estimate equivalence scales which depend on household's expenditure, because this may change substantially the way we measure poverty and inequality, as the recent work by Donaldson and Pendakur (2006) seem to suggest.

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**Table 2: First-step probit estimates**

| | Goods | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | $i = 1$ Food | $i = 2$ Alc./Tob. | $i = 3$ Clothing | $i = 4$ Household op. | $i = 5$ Household furn. | $i = 6$ Health | $i = 7$ Transport | $i = 8$ Communication | $i = 9$ Recreation |
| *Constant* | **3.375** | **0.158** | **0.189** | **3.146** | **0.659** | **-0.267** | **0.660** | **1.238** | **0.492** |
| | *0.106* | *0.014* | *0.018* | *0.104* | *0.019* | *0.014* | *0.024* | *0.028* | *0.024* |
| *Income* | -0.101 | **0.442** | **0.940** | 0.031 | **0.645** | **0.592** | **1.089** | **0.644** | **1.170** |
| | *0.069* | *0.013* | *0.020* | *0.088* | *0.020* | *0.013* | *0.029* | *0.031* | *0.029* |
| $N2$ | **0.270** | **-0.055** | **0.287** | -0.085 | **0.085** | **0.055** | 0.028 | **-0.054** | **0.071** |
| | *0.118* | *0.016* | *0.019* | *0.116* | *0.020* | *0.016* | *0.025* | *0.028* | *0.024* |
| $N3$ | **0.386** | **-0.114** | **0.277** | -0.018 | **0.098** | **0.064** | **-0.065** | **0.074** | **0.084** |
| | *0.142* | *0.017* | *0.019* | *0.121* | *0.021* | *0.016* | *0.025* | *0.030* | *0.024* |
| $N4$ | 0.045 | **-0.214** | **0.265** | 0.003 | **0.096** | 0.038 | -0.074 | 0.003 | 0.060 |
| | *0.230* | *0.033* | *0.040* | *0.233* | *0.045* | *0.032* | *0.053* | *0.056* | *0.049* |
| $NE$ | 0.078 | **-0.244** | 0.037 | -0.293 | **-0.214** | **0.111** | **-0.223** | 0.080 | **0.068** |
| | *0.137* | *0.021* | *0.025* | *0.189* | *0.025* | *0.020* | *0.031* | *0.043* | *0.031* |
| $NO$ | -0.019 | **-0.153** | -0.028 | -0.296 | **-0.148** | **-0.057** | **-0.120** | 0.023 | **0.133** |
| | *0.126* | *0.020* | *0.024* | *0.187* | *0.025* | *0.018* | *0.031* | *0.041* | *0.032* |
| $SI$ | **0.479** | **0.141** | -0.035 | -0.268 | **0.228** | **-0.081** | **0.281** | **-0.427** | **-0.140** |
| | *0.186* | *0.020* | *0.023* | *0.179* | *0.026* | *0.014* | *0.031* | *0.036* | *0.028* |
| $DUO$ | -0.093 | -0.015 | **-0.053** | **0.233** | **-0.081** | **0.032** | **0.057** | 0.037 | **-0.053** |
| | *0.108* | *0.014* | *0.017* | *0.106* | *0.018* | *0.005* | *0.022* | *0.026* | *0.021* |
| $SCOLA1$ | 0.013 | **0.055** | 0.011 | **-0.098** | 0.002 | **0.324** | 0.002 | **-0.061** | **-0.049** |
| | *0.040* | *0.005* | *0.006* | *0.044* | *0.007* | *0.005* | *0.008* | *0.010* | *0.008* |
| $SCOLA2$ | -0.003 | **0.060** | -0.010 | 0.019 | 0.004 | **0.016** | 0.006 | **-0.052** | **-0.045** |
| | *0.042* | *0.006* | *0.007* | *0.042* | *0.007* | *0.005* | *0.009* | *0.010* | *0.008* |
| $LTrend$ | 0.072 | **-0.108** | **-0.032** | 0.047 | **-0.096** | **-0.221** | **0.043** | **-0.239** | **-0.128** |
| | *0.073* | *0.010* | *0.012* | *0.068* | *0.013* | *0.009* | *0.015* | *0.019* | *0.015* |
| *mean of dep. var.* | 0.999 | 0.723 | 0.841 | 0.999 | 0.891 | 0.632 | 0.935 | 0.958 | 0.922 |
| *LR* (*zero slopes*) | 31.414 | 1984.59 | 3653.19 | 19.872 | 1825.38 | 2994.37 | 2270.16 | 1584.11 | 3036.53 |
| | (.001) | (.000) | (.000) | (.047) | (.000) | (.000) | (.000) | (.000) | (.000) |
| *n. obs.* | 43,701 | 43,701 | 43,701 | 43,701 | 43,701 | 43,701 | 43,701 | 43,701 | 43,701 |

Note: Standard Errors in Italics below coefficients. Bold entries correspond to rejection of $H_0 : e = 0$ at the 5% significance level for a two tailed test.

**Table 3: Second-step AIDS estimates (1997-2004)**

| Coefficients | Goods | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | $i$ = 1 Food | $i$ = 2 Alc./Tob. | $i$ = 3 Clothing | $i$ = 4 Household op. | $i$ = 5 Household furn. | $i$ = 6 Health | $i$ = 7 Transport | $i$ = 8 Communication | $i$ = 9 Recreation |
| $\alpha_i$ | **0.282** | **0.010** | **0.100** | **0.087** | **0.049** | **0.042** | **0.138** | **0.031** | **0.093** |
| | *0.001* | *0.002* | *0.006* | *0.001* | *0.002* | *0.009* | *0.002* | *0.005* | *0.002* |
| $\beta_i$ | **-0.102** | -0.000 | **-0.061** | **-0.048** | **0.006** | **0.035** | **-0.007** | **-0.018** | **-0.016** |
| | *0.001* | *0.002* | *0.006* | *0.006* | *0.002* | *0.005* | *0.003* | *0.005* | *0.002* |
| $\delta_i$ | -0.769 | **0.059** | **0.158** | 0.494 | 0.004 | **0.062** | 0.005 | 0.000 | **-0.138** |
| | *0.455* | *0.006* | *0.023* | *0.421* | *0.013* | *0.016* | *0.020* | *0.005* | *0.009* |
| $\alpha_{i,N2}$ | **0.016** | **-0.005** | **0.015** | **-0.003** | **0.004** | **-0.018** | **-0.008** | **-0.012** | **-0.002** |
| | *0.002* | *0.001* | *0.003* | *0.001* | *0.004* | *0.002* | *0.001* | *0.000* | *0.001* |
| $\alpha_{i,N3}$ | **0.032** | **-0.008** | **0.014** | 0.007 | **0.002** | **-0.007** | **-0.017** | **-0.003** | -0.001 |
| | *0.002* | *0.007* | *0.003* | *0.008* | *0.008* | *0.002* | *0.001* | *0.000* | *0.001* |
| $\alpha_{i,N4}$ | **0.054** | **-0.011** | 0.005 | 0.001 | **0.005** | **-0.010** | **-0.023** | **-0.003** | -0.001 |
| | *0.003* | *0.001* | *0.004* | *0.001* | *0.001* | *0.004* | *0.002* | *0.005* | *0.002* |
| $\alpha_{i,NO}$ | **-0.007** | **-0.003** | **-0.010** | **0.014** | 0.000 | **0.008** | **-0.004** | **-0.002** | -0.001 |
| | *0.002* | *0.008* | *0.002* | *0.001* | *0.001* | *0.002* | *0.002* | *0.000* | *0.001* |
| $\alpha_{i,NE}$ | **-0.025** | **-0.008** | -0.003 | **0.008** | 0.001 | **0.016** | **-0.002** | **-0.001** | 0.002 |
| | *0.002* | *0.001* | *0.002* | *0.001* | *0.001* | *0.002* | *0.002* | *0.000* | *0.001* |
| $\alpha_{i,SI}$ | **0.017** | **0.006** | 0.019 | **-0.020** | **0.011** | **-0.012** | **-0.005** | -0.001 | 0.001 |
| | *0.002* | *0.001* | *0.003* | *0.001* | *0.001* | *0.002* | *0.002* | *0.001* | *0.001* |
| $\alpha_{i,DU}$ | **-0.019** | -0.000 | **0.012** | -0.002 | **0.004** | **-0.005** | **0.005** | **-0.001** | 0.001 |
| | *0.001* | *0.001* | *0.001* | *0.001* | *0.001* | *0.002* | *0.001* | *0.000* | *0.001* |
| $\alpha_{i,SC1}$ | **0.005** | **0.003** | **-0.002** | **-0.002** | **-0.001** | **0.003** | 0.001 | **-0.001** | -0.000 |
| | *0.000* | *0.002* | *0.001* | *0.000* | *0.000* | *0.001* | *0.000* | *0.000* | *0.001* |
| $\alpha_{i,SC2}$ | **0.007** | **0.003** | **-0.003** | **-0.001** | **-0.001** | 0.001 | 0.000 | **-0.001** | **-0.000** |
| | *0.000* | *0.000* | *0.001* | *0.000* | *0.000* | *0.001* | *0.000* | *0.000* | *0.000* |
| $\alpha_{i,LT}$ | **-0.015** | **-0.003** | **0.019** | **0.004** | **-0.003** | **-0.015** | **0.001** | **0.004** | |
| | *0.001* | *0.001* | *0.001* | *0.001* | *0.001* | *0.002* | *0.001* | *0.000* | *0.001* |

**Table 3 (continued): Symmetric restricted estimates of $c_{ij}$**

| Coefficients | Goods | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | $j = 1$ Food | $j = 2$ Alc./Tob. | $j = 3$ Clothing | $j = 4$ Household op. | $j = 5$ Household furn. | $j = 6$ Health | $j = 7$ Transport | $j = 8$ Communication | $j = 9$ Recreation |
| $c_{1j}$ | **0.091** | | | | | | | | |
| | *0.023* | | | | | | | | |
| $c_{2j}$ | **-0.034** | 0.012 | | | | | | | |
| | *0.002* | *0.007* | | | | | | | |
| $c_{3j}$ | -0.034 | -0.004 | **0.062** | | | | | | |
| | *0.019* | *0.009* | *0.028* | | | | | | |
| $c_{4j}$ | **0.031** | 0.003 | -0.014 | **-0.066** | | | | | |
| | *0.011* | *0.006* | *0.012* | *0.011* | | | | | |
| $c_{5j}$ | **-0.074** | **-0.029** | **0.031** | **0.068** | **-0.067** | | | | |
| | *0.011* | *0.006* | *0.011* | *0.008* | *0.011* | | | | |
| $c_{6j}$ | 0.013 | -0.006 | -0.000 | 0.010 | 0.011 | -0.020 | | | |
| | *0.014* | *0.006* | *0.017* | *0.008* | *0.008* | *0.020* | | | |
| $c_{7j}$ | **0.056** | **0.018** | **-0.068** | **-0.057** | 0.006 | **0.050** | 0.004 | | |
| | *0.014* | *0.007* | *0.016* | *0.010* | *0.009* | *0.012* | *0.017* | | |
| $c_{8j}$ | **-0.043** | **0.008** | **0.035** | 0.006 | -0.007 | **-0.025** | 0.004 | **0.005** | |
| | *0.005* | *0.003* | *0.005* | *0.003* | *0.004* | *0.004* | *0.004* | *0.002* | |
| $c_{9j}$ | **-0.054** | -0.011 | **0.078** | **0.030** | **0.018** | **-0.019** | **-0.061** | **0.010** | **0.043** |
| | *0.012* | *0.007* | *0.013* | *0.009* | *0.009* | *0.009* | *0.010* | *0.004* | *0.014* |
| *LogLikelihood* | 553,001 | | | | | | | | |
| $R^2$ | 0.300 | 0.044 | 0.062 | 0.160 | 0.023 | 0.038 | 0.011 | 0.117 | 0.048 |
| *n. obs.* | 43,701 | | | | | | | | |

Note: Standard Errors in Italics below coefficients. Bold entries correspond to rejection of $H_0 : e = 0$ at the 5% significance level for a two tailed test.

**Table 4: Mean household Budget Shares, $w_j$, expenditure elasticities, $e_j$, Hicksian elasticities $e^*_{ij}$ and rate of change in autonomous consumption, $e_{jT}$**

| | Goods | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | $j$ = 1 Food | $j$ = 2 Alc./Tob. | $j$ = 3 Clothing | $j$ = 4 Household op. | $j$ = 5 Household furn. | $j$ = 6 Health | $j$ = 7 Transport | $j$ = 8 Communication | $j$ = 9 Recreation | $j$ = 10 Other Goods |
| $w_j$ | 0.297 | 0.027 | 0.113 | 0.095 | 0.044 | 0.050 | 0.130 | 0.032 | 0.069 | 0.144 |
| $e_j$ | **0.657** | **0.997** | **1.454** | **0.496** | **1.131** | **1.442** | **0.949** | **0.454** | **0.791** | **1.761** |
| | *0.003* | *0.035* | *0.043* | *0.005* | *0.037* | *0.058* | *0.022* | *0.012* | *0.019* | *0.040* |
| $e^*1j$ | **-0.402** | **-0.057** | -0.008 | **0.198** | **-0.203** | **0.093** | **0.321** | **-0.113** | **-0.105** | **0.277** |
| | *0.069* | *0.024* | *0.058* | *0.031* | *0.031* | *0.037* | *0.040* | *0.016* | *0.035* | *0.053* |
| $e^*2j$ | -0.323 | **-0.659** | -0.004 | 0.188 | **-0.722** | -0.096 | **0.606** | **0.241** | -0.213 | **0.984** |
| | *0.192* | *0.142* | *0.199* | *0.135* | *0.138* | *0.134* | *0.151* | *0.070* | *0.144* | *0.175* |
| $e^*3j$ | 0.048 | 0.002 | **-0.421** | -0.006 | **0.273** | 0.051 | **-0.381** | **0.291** | **0.643** | **-0.498** |
| | *0.131* | *0.056* | *0.174* | *0.073* | *0.074* | *0.098* | *0.095* | *0.035* | *0.077* | *0.125* |
| $e^*4j$ | **0.620** | 0.055 | -0.044 | **-1.600** | **-0.762** | **-0.155** | **-0.467** | **-0.095** | **0.394** | 0.031 |
| | *0.105* | *0.053* | *0.103* | *0.097* | *0.068* | *0.068* | *0.079* | *0.032* | *0.074* | *0.091* |
| $e^*5j$ | **-1.200** | **-0.555** | **0.744** | **1.479** | **-2.313** | **0.271** | 0.260 | -0.112 | ***0.424*** | **1.001** |
| | *0.191* | *0.102* | *0.183* | *0.128* | *0.169* | *0.119* | *0.134* | *0.071* | *0.138* | *0.159* |
| $e^*6j$ | **0.471** | -0.036 | 0.119 | **0.226** | **0.180** | **-1.202** | **0.765** | **-0.285** | -0.183 | -0.058 |
| | *0.144* | *0.062* | *0.162* | *0.082* | *0.076* | *0.178* | *0.107* | *0.036* | *0.089* | *0.152* |
| $e^*7j$ | **0.700** | **0.155** | **-0.380** | **-0.318** | 0.091 | **0.413** | **-0.841** | **0.061** | **-0.374** | **0.492** |
| | *0.086* | *0.039* | *0.092* | *0.055* | *0.046* | *0.065* | *0.099* | *0.024* | *0.057* | *0.081* |
| $e^*8j$ | **-1.005** | **-0.256** | **1.154** | **0.273** | **-0.168** | **-0.707** | **0.259** | **-0.821** | **0.370** | **0.390** |
| | *0.147* | *0.081* | *0.149* | *0.093* | *0.105* | *0.095* | *0.096* | *0.071* | *0.103* | *0.117* |
| $e^*9j$ | **-0.429** | -0.118 | **1.156** | **0.491** | **0.281** | ***-0.206*** | **-0.690** | **0.159** | **-0.348** | **-0.295** |
| | *0.143* | *0.067* | *0.144* | *0.094* | *0.086* | *0.093* | *0.102* | *0.042* | *0.148* | *0.125* |
| $e^*10j$ | **0.444** | **0.246** | **-0.361** | 0.080 | **0.301** | -0.100 | **0.521** | **0.079** | **-0.150** | **-1.061** |
| | *0.099* | *0.041* | *0.099* | *0.055* | *0.049* | *0.072* | *0.074* | *0.026* | *0.061* | *0.126* |
| $e_{jT}$ | **-0.050** | **-0.085** | **0.139** | **0.044** | **-0.070** | **-0.187** | **0.017** | **0.033** | **0.056** | **0.017** |
| | *0.004* | *0.016* | *0.010* | *0.008* | *0.016* | *0.026* | *0.008* | *0.013* | *0.011* | *0.012* |

Note: Standard Errors in Italics below coefficients. Bold entries correspond to rejection of $H_0 : e = 0$ at the 5% significance level for a two tailed test.

**Table 5: Marshallian elasticities $e_{ij}$**

| | Goods | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | $j = 1$ Food | $j = 2$ Alc./Tob. | $j = 3$ Clothing | $j = 4$ Household op. | $j = 5$ Household furn. | $j = 6$ Health | $j = 7$ Transport | $j = 8$ Communication | $j = 9$ Recreation | $j = 10$ Other Goods |
| $e1j$ | **-0.597** | **-0.075** | -0.082 | **0.135** | **-0.232** | 0.061 | **0.236** | **-0.134** | **-0.151** | **0.182** |
| | *0.069* | *0.027* | *0.056* | *0.033* | *0.031* | *0.038* | *0.040* | *0.016* | *0.034* | *0.055* |
| $e2j$ | **-0.618** | **-0.686** | -0.117 | 0.093 | **0.766** | -0.147 | **0.476** | **0.210** | -0282. | **0.841** |
| | *0.198* | *0.140* | *0.210* | *0.129* | *0.136* | *0.137* | *0.144* | *0.075* | *0.134* | *0.172* |
| $e3j$ | **-0.384** | 0.038 | **-0.585** | -0.145 | **0.209** | -0.021 | **-0.570** | **0.245** | **0.542** | **-0.707** |
| | *0.124* | *0.060* | *0.165* | *0.072* | *0.072* | *0.098* | *0.091* | *0.035* | *0.083* | *0.117* |
| $e4j$ | **0.473** | 0.042 | -0.100 | **-1.647** | **0.741** | **0.130** | **-0.532** | **0.079** | **0.359** | -0.041 |
| | *0.103* | *0.055* | *0.103* | *0.090* | *0.063* | *0.068* | *0.075* | *0.032* | *0.073* | *0.091* |
| $e5j$ | **-1.535** | **-0.585** | **0.616** | **1.371** | **-2.363** | 0.215 | 0.114 | -0.148 | **0.346** | **0.839** |
| | *0.193* | *0.102* | *0.194* | *0.125* | *0.167* | *0.120* | *0.133* | *0.069* | *0.139* | *0.162* |
| $e6j$ | 0.043 | -0.075 | -0.044 | 0.091 | **0.116** | **-1.273** | **0.578** | **-0.330** | -0.283 | -0.265 |
| | *0.146* | *0.063* | *0.168* | *0.080* | *0.073* | *0.182* | *0.112* | *0.037* | *0.088* | *0.159* |
| $e7j$ | **0.419** | **0.129** | **-0.487** | **-0.408** | 0.049 | **0.366** | **-0.964** | 0.031 | **-0.439** | **0.355** |
| | *0.084* | *0.041* | *0.093* | *0.053* | *0.049* | *0.066* | *0.097* | *0.023* | *0.058* | *0.079* |
| $e8j$ | **-1.140** | **0.243** | **1.102** | **0.229** | -0.188 | **-0.730** | 0.199 | **-0.835** | **0.338** | **0.325** |
| | *0.139* | *0.082* | *0.140* | *0.092* | *0.102* | *0.089* | *0.104* | *0.071* | *0.097* | *0.113* |
| $e9j$ | **-0.664** | -0.139 | **1.067** | **0.415** | **0.246** | **-0.246** | **-0.793** | **0.134** | **-0.403** | **-0.408** |
| | *0.144* | *0.072* | *0.140* | *0.086* | *0.093* | *0.090* | *0.110* | *0.044* | *0.139* | *0.125* |
| $e10j$ | -0.078 | **0.198** | **-0.559** | -0.087 | **0.224** | **-0.188** | **0.293** | **0.023** | **0.272** | **-1.314** |
| | *0.096* | *0.044* | *0.102* | *0.058* | *0.053* | *0.071* | *0.072* | *0.028* | *0.065* | *0.126* |

Note: Standard Errors in Italics below coefficients. Bold entries correspond to rejection of $H_0 : e = 0$ at the 5% significance level for a two tailed test.

**Table 6: Engel Equivalence Scales**

| | Household Type | | | |
|---|---|---|---|---|
| Household Location | $N1$ | $N2$ | $N3$ | $N4$ |
| $NO$ | **0.914** | **1.095** | **1.278** | **1.575** |
| | *0.015* | *0.026* | *0.031* | *0.048* |
| $NE$ | **0.778** | **0.915** | **1.068** | **1.317** |
| | *0.014* | *0.025* | *0.030* | *0.042* |
| $CE$ | **1.000** | **1.176** | **1.272** | **1.691** |
| | | *0.021* | *0.026* | *0.043* |
| $SI$ | **1.179** | **1.386** | **1.617** | **1.994** |
| | *0.026* | *0.047* | *0.056* | *0.068* |
| $NO2$ | **0.776** | **0.913** | **1.065** | **1.313** |
| | *0.016* | *0.022* | *0.027* | *0.043* |
| $NE2$ | **0.649** | **0.763** | **0.890** | **1.097** |
| | *0.014* | *0.022* | *0.026* | *0.037* |
| $CE2$ | **0.833** | **0.980** | **1.143** | **1.409** |
| | *0.010* | *0.019* | *0.024* | *0.039* |
| $SI2$ | **0.982** | **1.155** | **1.346** | **1.661** |
| | *0.025* | *0.039* | *0.047* | *0.060* |

Note: Standard Errors in Italics below coefficients. Bold entries correspond to rejection of $H_0 : e = 0$ at the 5% significance level for a two tailed test.

**Table 7: Equivalence Scales with Pashardes identifying restriction**

| | Household Type | | | |
|---|---|---|---|---|
| Household Location | $N1$ | $N2$ | $N3$ | $N4$ |
| $NO$ | **0.987** | **1.031** | **1.126** | **1.277** |
| | *0.013* | *0.020* | *0.022* | *0.029* |
| $NE$ | **0.870** | **0.908** | **0.992** | **1.126** |
| | *0.013* | *0.019* | *0.021* | *0.026* |
| $CE$ | **1.000** | **1.044** | **1.141** | **1.294** |
| | | *0.014* | *0.016* | *0.024* |
| $SI$ | **1.052** | **1.099** | **1.201** | **1.362** |
| | *0.020* | *0.030* | *0.032* | *0.037* |
| $NO2$ | **0.883** | **0.922** | **1.007** | **1.143** |
| | *0.013* | *0.016* | *0.018* | *0.027* |
| $NE2$ | **0.778** | **0.813** | **0.888** | **1.007** |
| | *0.014* | *0.017* | *0.018* | *0.023* |
| $CE2$ | **0.895** | **0.934** | **1.021** | **1.158** |
| | *0.009* | *0.013* | *0.015* | *0.024* |
| $SI2$ | **0.942** | **0.983** | **1.074** | **1.218** |
| | *0.018* | *0.026* | *0.029* | *0.033* |

Note: Standard Errors in Italics below coefficients. Bold entries correspond to rejection of $H_0 : e = 0$ at the 5% significance level for a two tailed test.