Annex 1 Methodological Detail

The following modelling strategy is mainly designed to test the hypothesis that unspecified changes that may have occurred on the financial and money market have had an effect on individual demand behaviour. The principal limitation that we face in practice is the absence of data that would allow us to test the hypothesis directly. Hence our approach is indirect. The intuition is to estimate a set of conditional demand system for each cross section of a set of repeated surveys which span a period of significant financial policy changes. Changes in the characteristics of the demand system that can be correlated with macroeconomic changes allows us then to measure the effect (if any) of the policy on individual welfare (Nichele and Robin,1995).

To begin assume that individual behaviour is represented by a utility function over both goods that will be consumed within the survey frequency, say q_1, and goods that have more durable nature, say q_2. $U\left(q_1, q_2\right)$ stands for the direct utility over both the goods in q_1 and q_2. In particular from the partial description of the preference over q_1 given q_2 we assume that we can derive a full demand system for q_1 given the prices for each of its components.

Therefore we assume that at each point in time (state of nature) individuals solve the following problem:

$$\begin{aligned}
&\max U_t\left(q_1; \bar{q}_{2t}\right) \\
&\text{s.t.} \quad p_{1t} q_1 \le y_t - p_{2t}\bar{q}_{2t} \\
&\qquad\;\; p_{2t}\bar{q}_{2t} < y_t
\end{aligned}$$

where p_{1t} and p_{2t} represent the price vectors that are relevant in period (or state of the world) *t*, while $\bar{q}_{2t}$ is the vector of quantities of each durables that are allocated to an individual in period *t*. y_t is the budget available for spending (or saving) in period *t*. We assume further that $\bar{q}_{2t}$ the allocation of durable goods, whichever it is arrived at, must satisfy the budget constraint[1]. The conditional demand functions for q_1 in period *t* are therefore such that

$$q_{1t}^{*} \equiv q_{1t}\left(p_{1t}, y_t - p_{2t}\bar{q}_{2t}, \bar{q}_{2t}\right),$$

where, given $\bar{q}_{2t}$, we expect homogeneity, additivity and Slutzky's restrictions to apply (Browning and Meghir, 1991). Note further, that the budget constraint implies that $y_t - p_{2t}\bar{q}_{2t} = p_{1t}q_{1t}$, i.e the expenditure on non-durable goods.

The effect of the constraints that the financial market bears on the allocation of durables goods to individuals arises through the effects of the individual changes in $\bar{q}_{2t}$ and their correlation with the other determinants of non durable demand (i.e. p_{1t} and $y_t - p_{2t}\bar{q}_{2t}$). Loosely speaking changes in policy which lead to changes in the financial system and as a consequence changes in the observed allocation of durable goods to individual (through for example a lower interest rate, or reduced credit limits and controls) can be observed through changes in the characteristics of conditional demands between and across policy regimes.

Figure 1 somewhere here…(impossibility of borrowing on the one hand , vs limited amount of borrowing…)

Over time, if financial policies have affected individual behaviour, we expect the conditional demand elasticities with respect to any element of $\bar{q}_{2t}$, i.e $\dfrac{\partial \ln q_{1t}\left(p_{1t}, p_{1t}q_{1t}; \bar{q}_{2t}\right)}{\partial \ln \bar{q}_{2t}}$, to be correlated with macroeconomic policy characteristics, and therefore to exhibit explicable variations.

[1] It is possible to understand savings as part of durables consumption. In that sense expenditure on savings has no effect on current utility (conditional or not), although a fully developed intertemporal model will allow savings to have an effect on future welfare.

A Structural Model adapted to the Data :

The data we use in this work is extracted from the NSO expenditure survey collected in rounds 43,45,46,47,48,49,50,51,52,53,54 covering the period from (July) 1987 until (June) 1999.

The data is sampled in a consistent way over the period and a coherent set of information is recorded over the sample period[2]. In particular each survey is stratified. This stratification reflects mainly spatial differences. We are able to identify the basic cluster of households from which the information is collected. While the size of these clusters vary from one survey to the next (maximum size varies between 10 and 52), they provide us with some ability to control for information at a very local level. Indeed, we make the assumption that all household within the same cluster face identical prices.

Furthermore, the survey records both expenditure and quantities for each good consumed by each household surveyed. Recently, building on earlier work by Deaton (1988), Crawford, Laisney and Preston (2003), CLP thereafter, show how such an information structure in the context of a stratified sample by cluster can be combined to estimate a theoretically consistent demand system, and in particular recover the effect of prices although prices are not directly observed. Here, we follow the methodology proposed by CLP.

The issue resolved is the theoretically consistent modelling of the determination of units values and budget shares. Goods are divided into m broad groups, such as cereals, other food, intoxicants, clothing, durables,…etc. Consumption within a group G is a vector of quantities q_G with unobserved prices p_G. X is the consumer's total budget. From survey information we observe for any commodity group a quantity index Q_G which is defined as

$$Q_G = e_G' q_G ,$$

where e_G is a vector of ones conformable with q_G. Furthermore for each commodity group we observe the expenditure on the group

$$x_G = p_G' q_G .$$

[2] While there are changes in the products nomenclature, these changes do not lead to any loss of information.

The two quantities above lead to the natural idea of a unit value, i.e. the ratio of expenditure over quantity,

$$V_G = \frac{x_G}{Q_G}.$$

Within each geographically identified cluster we assume that prices are constant. Furthermore we assume that within each commodity group, and whatever the cluster, relative prices are constant. Hence the price vector p_G can be written

$$p_G = p_G p_G^0,$$

where p_G^0 is a vector representing the relative price structure within the group, and p_G is a cluster specific price index for the commodity group, which we assume varies between groups. Hence each group G is behaves like a Hicks aggregate, and as a consequence the demand for group G commodities can be written as a function of X total spending and the vector of group price indices p.

CLP then proceed to show that under these hypotheses and assuming the weak separability of preferences in the partition corresponding to each group, the unit values, V_G, the group price index, p_G, and the quantity index, Q_G, are implicitly related, such that

$$V_G = p_G h_G \left(V_G Q_G / p_G\right),$$

for some function $h_G(\cdot)$ (which summarises the information contained in the Engel curve for the particular group). This implicit equation imposes cross equations restrictions between the quantity and unit values equations, in particular CLP find

$$\frac{\partial \ln V_G}{\partial \ln p_H} - \mathbf{1}_{[G=H]} = e_G^h \left(\frac{\partial \ln V_G}{\partial \ln p_H} + \frac{\partial \ln Q_G}{\partial \ln p_H} - \mathbf{1}_{[G=H]} \right),$$

$$\frac{\partial \ln V_G}{\partial \ln X} = e_G^h \left(\frac{\partial \ln V_G}{\partial \ln X} + \frac{\partial \ln Q_G}{\partial \ln X} \right),$$

where e_G^h is the elasticity of $h_G(\cdot)$ with respect to its argument. These two equations together imply:

$$\frac{\dfrac{\partial \ln V_G}{\partial \ln p_H} - \mathbf{1}_{[G=H]}}{\dfrac{\partial \ln V_G}{\partial \ln X}} = \frac{\dfrac{\partial \ln Q_G}{\partial \ln p_H}}{\dfrac{\partial \ln Q_G}{\partial \ln X}}$$

which clarifies the required relationship that must hold between the unit value elasticities and the quantities elasticities. Previous work by Deaton (1987, 1988, 1990 and 1997) in particular failed to recognise the importance of these restrictions in the estimation stage.

The estimation methodology demands that we consider the following system of equations for all commodity groups:

$$w_G = f\left(X, p\right), \qquad \text{(budget share for group G)}$$

$$\ln V_G = \ln p_G + \ln h_G\left(\frac{X}{p_G} f_G\left(X, p\right)\right), \qquad \text{(unit value for group G)}$$

where $w_G = \dfrac{x_G}{X}$ is the share of group G in total expenditure, and $f_G\left(.,.\right)$ is a specification for the budget share.

CLP suggest the use of an approximate AID model for the budget shares, with a log linear approximation of the log price index, together with a simple (and theory consistent) log linear relationship between any group unit value and the group's quantity index and the group price. For some individual *i* in cluster *c* with observed characteristics z_i, and unobserved component $u_{i,G}$ we have

$$w_{i,G} = \alpha_{0G} + z_i \alpha_G + \sum_H \gamma_{GH} \ln p_H + \beta_G \left\{\ln X_i - \ln P_i\right\} + u_{i,G},$$

where $\ln P_i$, the approximate log price index, is such that,

$$\ln P_i = \sum_H \lambda_H \ln\left(p_{i,H}\right).$$

It is an approximate log price index insofar as the weights λ_H are given and not estimated (in our case, following CLP, these are fixed at the shares sample means). Furthermore, since all individuals within a given cluster share the same prices p, we will write

$$\ln P_i = \sum_H \lambda_H \ln\left(p_{c,H}\right) = \ln P_j ,$$

whenever individuals *i* and *j* belongs to the same cluster *c*. Some obvious simplifications lead to

$$w_{i,G} = \alpha_{0G} + z_i \alpha_G + \sum_H \delta_{GH} \ln p_H + \beta_G \ln X_i + u_{i,G} ,$$

where $\delta_{GH} = \gamma_{GH} - \beta_G \lambda_H$.

CLP assume further that the unit value equations are of the form

$$\ln V_{i,G} = \alpha_{oG} + z_i \alpha_G + \ln p_{c,G} + \beta_G \ln Q_{i,G} + v_{i,G} .$$

Finally CLP assume that the only cluster effects allowed in the model are captured through the cluster specific prices. Individual observations are assumed to be independent given the individual characteristics and the commodity, cluster specific, price indices. Hence the vector of unobservables $\left(u_i', v_i'\right)'$ is identically and independently distributed across individuals, furthermore we assume that its variance covariance is constant.

Note that because of the presence of the term β_G in the unit value equation, and despite our assumption above concerning the conditional independence of the unobservables given individual characteristics and cluster price indices, the unit value can not be used as noisy observations of prices. Indeed the implicit relationship between unit values and quantities (and therefore the shares) makes both the unit values and the quantities dependent on the unobservables. Therefore, although the system of equations above is apparently linear in the unobservables, this is misleading and naïve approaches can not be trusted in general.

The estimation proceeds in two stages which rely heavily on the existence of sampling clusters where prices can be assumed constant.

In a first stage, all price independent effects are recovered within clusters. Indeed deviations from cluster means are independent of the unobserved prices (given our choice of functional form above). We have

$$w_{i,G} - \bar{w}_{c,G} = (z_i - \bar{z}_c)a_G + b_G\left(\ln X_i - \overline{\ln X}_c\right) + u_{i,G} - \bar{u}_{c,G} ,$$

$$\ln V_{i,G} - \overline{\ln V}_{c,G} = (z_i - \bar{z}_c)a_G + b_G\left(\ln Q_{i,G} - \overline{\ln Q}_{c,G}\right) + v_{i,G} - \bar{v}_{c,G} ,$$

which does not depend on functions of the $p_{c,H}$ s. Hence the within cluster information essentially recovers the nature of the Engel curves. To cope with the endogenous variables on the right hand side of the equations above, CLP suggest using the other observations in the cluster as instruments. The assumptions of independence between observations make this a valid and natural instrument choice.

The second stage is devoted to the recovery of the price parameters, g_{GH} . This is only possible under the functional form and conditional independence assumptions above. Consider the deviation from sample means determined by the first stage estimated parameters

$$\begin{aligned} h_{c,G} &= \bar{w}_{c,G} - \bar{z}_c\hat{a}_G - \hat{b}_G\overline{\ln X}_c \\ &= a_{0G} + \sum_H (g_{GH} - b_G l_H)\ln p_{c,H} + \bar{u}_{c,G} \equiv h^*_{c,G} + \bar{u}_{c,G}, \end{aligned}$$

and

$$\begin{aligned} z_{c,G} &= \overline{\ln V}_{c,G} - \bar{z}_c\hat{a}_G - \hat{b}_G\overline{\ln X}_c \\ &= a_{0G} + \ln p_{c,G} + \bar{v}_{c,G} \equiv z^*_{c,G} + \bar{v}_{c,G}, \end{aligned}$$

By construction of the quantities $h^*_{c,G}$ and $z^*_{c,G}$, we have the relationship

$$h^*_{c,G} = r_G + \sum_H (g_{GH} - b_G l_H)z^*_{c,G} ,$$

where well defined r_G is a constant. In fact since we are interested in recovering the parameters g_{GH} it is easier to consider the following

$$\eta^{*}_{c,G} + \sum_{H} \beta_G \lambda_H z^{*}_{c,G} = \rho_G + \sum_{H} \gamma_{GH} z^{*}_{c,G} ,$$

which suggests that we consider the apparently linear model based on the observed/calculated values :

$$\hat{\eta}_{c,G} + \sum_{H} \hat{\beta}_G \hat{\lambda}_H \hat{z}_{c,G} = \rho_G + \sum_{H} \gamma_{GH} \hat{z}_{c,G} + \xi_{c,G} ,$$

where the “hat” quantities are either estimates from the first stage or calculated from the observations and the first stage estimates. Furthermore is a $\xi_{c,G}$ is an error term, which is by construction correlated with the quantities $\hat{z}_{c,G}$. The estimation of the parameters γ_{GH} is therefore made difficult in this instance of a measurement error problem. CLP show how this difficulty can be dealt with using (once more) the within-cluster information, this time to estimate variance-covariance terms that correct for the well known form of endogeneity we face here.

Given these estimates, we can straightforwardly proceed to a third stage involving minimum distance estimation in order to impose the symmetry restrictions on the demand system parameters.

Results

The estimation results are presented in a series of tables (Annex 2).

For each round of data, the first two tables present the estimation results for the parameters that are identified by within cluster variations over all the commodity groups of interest. The first table corresponds to the estimation of the Engel curves from the expenditure shares, while the second table corresponds to the estimation of the unit value equation (the standard errors for each coefficient is reported below the estimate).

Each table reports the number of observations in the sample (N), the number of clusters (N_g), the minimum and maximum number of observations per cluster (g_min and g_max), the number of estimated parameters (including cluster means, df_m), an estimate of the correlation between the cluster means and the estimated index xb (rho), as well as the F-statistic for the test of the null hypothesis of non-significance of all regressors.

In both cases we test for the null hypothesis of separability (as described in CLP) between expenditure on durables and expenditure on non-durables. The null hypothesis of separability is never accepted. We then report the mean, median and the standard deviation of the income elasticity, as well as the elasticity of the quantity demanded with respect to the selected set of variables which control for durable expenditure. Each column corresponds to a different product group and each row corresponds to a different conditioning variable.

We then report the result of the estimation of the price effects (the second stage estimates as described in the methodology section). The first set of results are obtained without imposing the theoretically consistent symmetry. We then impose symmetry by minimum distance. Furthermore, we report the test statistics for the null of symmetry. This null hypothesis is consistently rejected. Finally we present the means, medians and standard deviations, of the demand price elasticities (imposing symmetry).

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