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## SOCIAL AND ECONOMIC DIMENSIONS OF AN AGING POPULATION

### **Asking Consumption Questions in General Purpose Surveys**

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**SEDAP Research Paper No. 77**

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June 2002

The Program for Research on Social and Economic Dimensions of an Aging Population (SEDAP) is an interdisciplinary research program centred at McMaster University with participants at the University of British Columbia, Queen's University, Université de Montréal, and the University of Toronto. It has support from the Social Sciences and Humanities Research Council of Canada under the Major Collaborative Research Initiatives Program, and further support from Statistics Canada, the Canadian Institute for Health Information, and participating universities. The SEDAP Research Paper series provides a vehicle for distributing the results of studies undertaken by those associated with the program. Authors take full responsibility for all expressions of opinion.

# ASKING CONSUMPTION QUESTIONS IN GENERAL PURPOSE SURVEYS\*

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April 2002

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\* The authors have benefited considerably from discussions with Erich Battistin and from the comments of seminar participants at the Institute for Social Research, York University. The usual caveat applies. The data used in this study were made available by Human Resources Development Canada (HRDC) and by ISTAT and Bank of Italy. Neither organization bears any responsibility for the interpretation of the data given here. Browning thanks the Danish National Research Foundation for financial support; Crossley gratefully acknowledges the support of the Social Sciences and Humanities Research Council (SSHRC) of Canada; Weber is grateful for financial support from CNR and MIUR (Italy). Corresponding author: Thomas Crossley, Department of Economics, McMaster University, 1280 Main St. W., Hamilton, Ontario, Canada, L8S 4M4. [crossle@mcmail.cis.mcmaster.ca](mailto:crossle@mcmail.cis.mcmaster.ca).

# ASKING CONSUMPTION QUESTIONS IN GENERAL PURPOSE SURVEYS

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In many research areas it is desirable to have information on household total expenditure ('consumption'). We draw evidence from several sources on the usefulness of recall consumption questions. We conclude that valid information can be collected by adding specific recall questions to general purpose surveys, and provide recommendations on how to do so.

*Key Words:* Consumption, Expenditures, Surveys

*JEL Classification:* C81, D12

# 1. Introduction.

In many research areas it is desirable to have information on household total expenditure ('consumption'). A partial list<sup>1</sup> of the uses for such data includes:

- A) *Tracking changes in the distribution of material living standards over time.* There is a great deal of interest in how the distribution of material well-being evolves over time (for example, is poverty increasing or decreasing?). Consumption (the purchase of non-durables and flow of services from the stock of durables) is probably the best direct measure of material well-being and is the focus of a number of recent studies (see Cutler and Katz (1992) and Slesnick (1993) for the U.S, Blundell and Preston (1996, 1998) for the U.K., Pendakur (1998, 2001) for Canada, Barrett, Crossley and Worswick (2000) for Australia and Zaidi and de Vos (2001) for Europe).
- B) *The impact of environmental shocks or policy changes on the material well-being of different households.* Examples include the impact of retirement on material well-being (the so-called 'consumption retirement puzzle': see Hammermesh (1984), Banks, Blundell and Tanner (1998), Bernheim, Skinner and Weinberg (2001) and Miniaci, Monfardini and Weber (2002) for discussion); the role of Unemployment Insurance benefits in job search and maintaining short run living standards (see Gruber (1997) and Browning and Crossley (2001)); the adequacy of Social Assistance (see Gruber (2000), Edin (1991) and Edin and Lien (1996)); the long run cost of job loss (Stephens (2001) and Browning and Crossley (2001)) and tests of full insurance (Cochrane (1991) and Attanasio and Davis (1996)).

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<sup>1</sup> The focus throughout this paper will be on empirical research on high income countries. Closely related measurement issues arise in middle income and low income countries, but there are also significant differences (for example, the importance of small farms and small businesses, the lack of income data etc.); see Deaton and Grosh (1999) for a discussion.

- C) *Consumption and saving research.* There are still far more unanswered questions in consumption and saving research than there are settled issues. Examples include: the importance of the precautionary motive (see Carroll and Samwick (1998), Hubbard, Skinner, and Zeldes, (1994) and Lusardi (1998)); the reaction of household expenditure to temporary and permanent tax changes (see Shapiro and Slemrod (1995), Souleles (1999) and Parker (1999)); the efficacy of tax shelter inducements in raising saving (see Hubbard and Skinner (1996), Poterba, Venti and Wise (1996) and Engen, Gale and Scholz (1996)); the importance of the retirement motive in saving (see Jappelli and Modigliani 1998); and the role of durables in smoothing mechanisms (Browning and Crossley (1999) and Fernandez-Villaverde and Kreuger (2001)).
- D) *The use of consumption as a conditioning variable in life cycle models.* Under some circumstances current consumption can be taken as a ‘sufficient statistic’ for expectations and unobservable wealth in models of life cycle decisions such as labour supply (Blundell and Walker (1982)); human capital formation; and fertility. This is potentially very useful not only at a cross-section level but also over time: changes in consumption may signal (unobservable) changes in current circumstances or expectations.

Given these different research needs, there are a number of options. These are:

- A. *Use aggregate time series data.* Given the ATS we currently have (means of levels of expenditures on different categories of goods), this is only useful under very restrictive circumstances (see, for example, Altug and Miller (1990), Browning (1993), Attanasio and Weber (1993) and Blundell, Pashardes and Weber (1993)). Our own feeling is that there are severe limits on what we can learn from studies based solely on ATS.
- B. *Use a proxy for consumption.* Income is the most widely suggested. For example, for inequality measures researchers often use income. This is problematic if income exhibits transitory fluctuations which most (but not all!) households can smooth; see Blundell and Preston (1996) for a discussion and references to the earlier literature. Alternatively, questions can be asked regarding the ease with which households can “*make ends meet*” (as

is done in the ECHP and HILDA – see Appendix 1) or the ability, for example, to keep the home adequately warm. These have had some success but their use is obviously very limited. In particular, they only pick up variations in living standards at the bottom of the distribution. Finally, many researchers use measures of expenditures on food as proxies for total consumption. Attanasio and Weber (1995) discuss drawbacks involved in using this procedure to estimate the elasticity of intertemporal substitution. We shall return to the use of food expenditure information at length below.

C. *Run a diary based survey.* This is costly and can usually be justified only by the need for central statistical offices to calculate weights for consumer price indices. Additionally, recording such data is onerous and time consuming, which makes it difficult to gather much other information on the households taking part. Time series of family expenditure surveys can provide valuable information. For example, using such data it is possible to map out the evolution of the distribution of consumption over time, as in the literature on consumption-measured poverty and inequality cited above. However, (1) many countries conduct budget studies to re-weight their consumer price series only on an irregular basis, (2) the lack, in such surveys, of information on items other than expenditures can mean that while the evolution of the distribution of expenditure can be tracked, it is more difficult to isolate the sources of change, and (3) the interpretation of the distribution of expenditure levels depends on assumptions about the nature of intertemporal allocation, about preferences, and about credit and insurance markets, which are difficult or impossible to test with cross-section data. Time series of family expenditure surveys can also be used to construct quasi-panels ('cohort mean' data) (see Browning, Deaton and Irish (1985)) that have been extensively used in the consumption research literature. There are, however, significant limitations to what can be done with a quasi-panel. For example, it is not possible to link households to analyse the persistence of low consumption spells. More generally, it is not possible to analyse convincingly many dynamic situations with quasi-panel data.

Furthermore, responses to environmental shocks or policy changes can only be measured at the level of a cohort average. For example, using a time-series of cross sections from the British Family Expenditure Survey (FES), Banks, Blundell and Tanner (1998) report an average adjusted fall in consumption at retirement of 1%. However, for many policy questions we would very much like to know the distribution of consumption changes at retirement, and not just the mean. What fraction of households experience a disastrous fall in expenditures around retirement? The obvious way to overcome many of these problems is to collect a diary based panel. It is generally felt that this is not possible for long periods (more than four quarters) because of the respondent burden. The experience in Spain with the EBFS suggests that the pessimism here may be exaggerated. The EBFS is a nationally representative expenditure survey. It collected diary based consumption information for a large group of households for 24 periods in the 1970's and collected a rolling panel in which households participated for eight periods in the 1980's and 1990's.

- D. *Use panel data on wealth and income to impute total expenditure.* In principal, the inter-temporal budget constraint (income minus consumption equals the change in wealth) implies that consumption can be imputed from panel data on income and wealth. Ziliak (1998) attempts such a scheme with the PSID. In practice, wealth holdings are usually very noisy – and first differencing makes it very difficult to extract the expenditure ‘signal’ in the data. This approach might be more successful with administrative data in countries in which wealth is recorded by the government.
- E. *Ask retrospective questions on consumption and expenditures.* This is the focus of the present paper. The practice is actually more widespread than is usually thought. It is well known that the PSID collects non-diary information on expenditures on ‘food at home’ and ‘food outside the home’ as well as some other expenditure items. Less well known is that some national expenditure surveys are partially or wholly based on retrospective questions. For example, the US CEX rolling quarterly panel is based on interview recall questions and



the Canadian FAMEX collects household information on annual calendar year expenditures in the following March. More commonly, expenditure information on durables and clothing and less frequently purchased items is based on retrospective questions coupled with diaries for day-to-day expenditures.

The plethora of possible uses of consumption questions immediately raises one of the issues that we shall emphasise below. It is unlikely that we will ever be able to design a set of questions that is succinct enough to be included in most surveys and also comprehensive enough to meet most research needs. Nonetheless, as we show below, the inclusion of some consumption questions in general purpose surveys (be they cross-section or longitudinal) is potentially very valuable. We also, however, need to have an eye to designing consumption questions for more tightly focussed surveys which are partly designed to answer research questions in the consumption and saving area. As we shall see, the design criteria differ between the two contexts. It is also important to be aware of the psychology of survey response; see, for example, Ornstein (1998) for discussion and references.

The outline of the remainder of this paper is as follows. In the next section we discuss the feasibility of asking a single broad 'total expenditure' question. This has obvious attractions if we are interested in total expenditure but, as we shall show, there are significant problems. The other two methods that can be used to recover total expenditures are based on asking questions concerning expenditures on sub-items of the total, such as food at home, clothing, utilities etc.. In the first method respondents are asked about an exhaustive range of items and in the second about a selected subset of the total list of sub-items. Since 'food at home' questions are used in both methods and are also widely used, in section 3 we provide a detailed analysis of the experience of asking about food at home. In section 4 we analyse the experience of asking questions concerning expenditures on an exhaustive list of consumption items. That is, asking for expenditures on all of the components of total expenditures and taking the sum of these to be total expenditure. The issues here are which items to choose and the appropriate level of disaggregation. In section 5 we discuss

asking questions on selected items (including ‘food at home’) and then using this partial information to impute the total. In the final section we present some recommendations based on the foregoing analysis.

## 2. Total expenditure questions.

If we are interested in the total expenditure of a household in a given period then one superficially attractive procedure is to simply ask respondents how much this is. As most readers will readily believe, this is fraught with hazard (how much did *you* spend last month on everything?). Few surveys contain broad consumption questions; here we concentrate on the experience of the Canadian Out of Employment Panel (COEP) and the Italian Survey on Household Income and Wealth (SHIW). We also discuss pilot studies conducted in the U.S. on the Asset and Health Dynamics among the Oldest Old (AHEAD) sample (Hurd et al.1998) and in the Netherlands on the VSB sample (Winter, 2001).

The Canadian Out of Employment Panel (COEP) sampled about 20,000 Canadian workers who separated from a job in either 1993 or 1995.<sup>2</sup> In this survey a number of questions were asked concerning expenditures in the past week or month on a range of goods including housing; food at home; food outside the home; clothing and total expenditure. Browning and Crossley (2002) (hereafter BC) provide a detailed assessment of the quality of these expenditure data. The tables and information given below are drawn from that source, and further details of the COEP are given there. The total expenditure question in the COEP followed the questions concerning individual items. The exact form of the question was:

*About how much did you and your household spend on EVERYTHING in the PAST MONTH? Please think about all bills such as rent, mortgage, loan payments, utility and other bills, as well as all expenses such as food, clothing, transportation, entertainment and any other expenses you and your household may have.*

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<sup>2</sup> Consequently the COEP sample is *not* representative of the Canadian population.

This was a first attempt at asking a total expenditure question (in fact, the first author of this paper wrote the question in 1991). The Hurd *et al* and Winter pilots use essentially the same question. Experience suggests a number of problems with the question in this form. First, the time period should have been specified more precisely. We now feel that it better to ask about expenditures in the last calendar month. More importantly, there are also significant problems with the cues (the list of expenditure items that respondents are asked to think about). First, the cues include 'loan repayments' which is clearly a saving item and not a consumption item! It would also be useful to explicitly exclude insurance payments. Second, the cues do not mention durables and this seems to have caused problems (see Hurd *et al* (1999) for an analysis of responses to this exact question by elderly people in the US). In retrospect it would have been better to have explicitly excluded purchases of durables and to have asked about this separately. We also feel that it would best to exclude housing expenditures and to ask about these separately. Another problem with the set of cues given above is that they were designed for one specific population (unemployed Canadian workers) and may not be appropriate in other contexts. For example, if one were sampling old people in the U.S. then one would want to include out-of-pocket medical expenses in the cues. Conversely, a cohort study of young people (such as the NLSY) might explicitly mention items such as schooling or child care expenses. In general, it is better to tailor the list of cues to the target population.

The Bank of Italy Survey on Household Income and Wealth (SHIW) is a representative sample of the Italian population (even though response rates in recent waves are in the 40-70% range), with about 6-8000 participating households in every wave; see Brandolini and Cannari (1994) for a thorough description.<sup>3</sup> SHIW asks respondents a very broad range of questions including one on their average monthly expenditure on all items except for a few listed durable goods and another on monthly expenditure on food alone. The quality of the expenditure data in the 1995 wave has been

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<sup>3</sup> Up-to-date details are available on the Bank of Italy web site: <http://www.bancaditalia.it/>.

assessed by Battistin, Miniaci and Weber (2001) (hereafter BMW) by comparing it to the corresponding diary based survey (SFB) run by the official statistical office (ISTAT).

One issue that is often raised in this context is the item response rate for such questions. Hurd *et al* (1999) find fairly low response rates for their total expenditure question and go on to an unfolding brackets procedure to increase the response rate. Our findings are somewhat different. Tables 1 and 2 examine item non-response for the total expenditure and other questions in the COEP. Table 1 presents basic rates of item non-response and Table 2 reports logit estimates of very simple models of non-response, based on who in the household was asked the question. We draw two lessons from these numbers. First, recall expenditure questions need not suffer from excessive item non-response. As Table 1 illustrates, recall total expenditure question may suffer from considerably less item non-response than a similar question about total household net income, and item non-response that is comparable to a question about past earnings. There seems to be a pervasive view that recall expenditure questions are more difficult to answer than the recall income and earnings questions which are commonly asked in general surveys. The experience with the COEP calls this view into question. Moreover, the item non-response observed in the COEP is not anomalous; Winter (2001) reports very similar item non-response (of about 10%) to the total expenditure question in his pilot.

The second point is that the difficulty that respondents have in answering such questions varies in important ways with characteristics of the respondent and her or his household. Table 2 illustrates that there is less item non-response to the total expenditure question when the respondent is the head (primary earner) in the household and much more non-response when the respondent lives in a 'composite household' (that is households which comprise individuals other than either a single person, a couple or a couple and their children). This fact will obviously be important for survey designers to consider. Are you surveying households or individuals? Are there many composite households in your populations (as there are for example in Italy and Japan) or rather fewer?

A second issue to consider with respect to recall total expenditure questions is that they display considerable heaping and rounding. Since this is a familiar problem and there are well established ways of dealing with it (see BMW and Heitjan and Rubin, (1990)), for most analysis this presents relatively minor problems.

Finally, we consider the accuracy of the data collected. Table 3 presents some statistics on the two surveys discussed above, along with statistics on data from comparable expenditure surveys that are believed to be of high quality (the Canadian Family Expenditure Survey or FAMEX, and the Italian Survey on Family Budgets, or SFB). In these calculations allowance has been made for composition differences across the pairs of surveys.<sup>4</sup> As can be seen, in each case the mean and median are quite different between the general purpose survey and the dedicated expenditure surveys. In particular, there is considerable under-reporting in the COEP and SHIW. The dispersion is much lower for the SHIW (relative to the SFB) and higher for the COEP (relative to the FAMEX). In both cases the assessment of dispersion is problematic: the FAMEX refers to annual expenditures and the COEP to monthly,<sup>5</sup> whereas SFB collects previous monthly expenditure and SHIW refers to average monthly spending.

Thus we see that total expenditure as measured by a single recall question seems to be underreported relative to total expenditure. On the other hand, it seems that the bias is consistent across the two countries, which suggests that we may be able to devise methods to take account of the bias.

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<sup>4</sup> Sampling differences can be dealt with by applying a propensity score method (see Rosenbaum and Rubin, 1983). Given two samples, this procedure requires estimating the probability that a given observation belongs to one sample as a function of a set of variables that are observed in both samples. The predicted probabilities are then used to weight the observations of either sample.

<sup>5</sup> Any purchase infrequency or mean reversion in the expenditure process would lead to different dispersion at different time horizons.

As an alternative check of validity, we consider how the recall total expenditure question correlates with other household attributes. In Table 4 we presents regression results for the correlation of the total measure with household demographics for the recall survey and the expenditure survey. By and large the two sets of coefficient estimates are similar across the two surveys in the same country, with the obvious exception of the intercept (which picks up the bias seen in Table 3) and the age effects for Canada. Whilst formal tests unambiguously reject that the two sets of slope parameters are equal, the correspondence in signs and the fairly close agreement in value suggest strongly that the recall total expenditure measure is not just noise. Indeed, we would argue that these results are evidence that there is a good deal of ‘valid covariance’ in the recall total question and that it is potentially quite informative about many issues.

### 3. Food at home questions.

A number of surveys contain a question on expenditure on ‘food at home’, most notably the PSID. As we shall see below, this is potentially very useful information for imputing total expenditure. In this section we present a detailed discussion of the findings for food at home questions. One source of information on the reliability of survey questions on food at home is the U.S. Consumer Expenditure Survey (CEX). This survey has both an interview and a diary component. Specifically, the CEX consists of two separate samples: one is a rotating panel (following households for four quarters) and the other is a cross section. The panel sample households are asked in each interview recall questions on their consumption of a large number of items over the previous month and quarter. The cross section sample households instead fill in a detailed diary on expenditure on a number of non-durable goods and services. The two samples are independent draws from the same population and the sample design is common. A thorough comparison of the two data sources is given in Battistin (2001).

In the CEX interview sample (1980-1998) a food at home question has always been asked, but the exact wording of the question has changed twice. In 1980-81 there were three questions that can

be used to infer food expenditures. First the respondent was asked about expenditures on usual weekly expenses at the grocery store or supermarket. Then they are asked about how much of this is *not* for food. Finally, the respondent is asked about food purchased in other places (such as bakers). This information is then used to construct the ‘food at home’ measure. In 1982-87 the question was changed to how often and how much was spent in food over the previous month. In 1988 the 1980-81 question was resumed. Average spending on food appears to be heavily affected by the structure of the questions, as shown in Figure 1<sup>6</sup>. This is of obvious importance for anyone designing recall expenditure questions. Based on his analysis of the CEX information since 1988, Battistin (2001) suggests that there is over-reporting of ‘food at home’ in recall questions, relative to the diary measures. Note, however, that the way information on food is elicited in the recall question (groceries minus non-food items) may be responsible for this finding.

We can also use the Canadian and Italian surveys discussed in the last section to look at these issues. Turning first to the Italian surveys, BMW show that food expenditure data are of comparable quality and informational content across the two surveys, once heaping, rounding and time averaging are properly accounted for. A graphical illustration is quite revealing in this case. In Figure 2a we see the histogram for food consumption in the raw SHIW (recall) data. It is clear that the recall data are heavily affected by heaping and rounding, particularly around values such as £1,000,000 (= €516) and multiples of £500,000. Figure 2b presents the histogram for the (weighted) SFB (diary) data; clearly this does not suffer from heaping and rounding. To facilitate the comparison of the two distributions, BMW jointly estimate the conditional density function of food consumption and the heaping process, where the latter depends on both the true unobserved value of food consumption and on survey quality information. These estimates can be used to impute food consumption for each household in the SHIW sample. Figure 2c displays the histogram of imputed SHIW food consumption data, which bears a striking resemblance to the one for SFB data in Figure 2b. It is worth noting that a similar correction for total non-durable expenditure fails

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<sup>6</sup> We are grateful to Erich Battistin for making this graph available to us.

to reduce the large discrepancies across the two surveys, as one might expect in view of the evidence shown in Table 3.

Turning to the Canadian data, in Figure 3, we plot the empirical cumulative distributions for food at home for the (recall) COEP and the FAMEX.<sup>7</sup> As can be seen, the two are very similar, even without correction for the rounding in the recall data. This demonstrates that the recall food responses also look very good in the COEP. Table 5 presents summary statistics for the COEP and FAMEX, and the SHIW and SFB. Once again we see that the recall and expenditure survey questions are close in central measure and not too different in dispersion.

The general conclusion from this analysis is that respondents seem to do a remarkably good job of reporting their household's expenditures on 'food at home'. This is in contrast to the experience with the 'total' expenditure questions.

#### 4. An exhaustive list of sub-items.

One procedure that is sometimes used to recover total expenditure in a survey is to ask a series of questions on all of the sub-items of the total. For example, we could ask for total non-durables, durables and housing but usually we think of the exhaustive list being more detailed than this. Thus the *Japanese Panel Survey on Consumers (JPSC)* asks about 15 distinct expenditure items that cover all expenditures and the Winter pilot study on the Dutch VSB asked about 35 different non-durable items. More importantly, as we have seen, both the U.S. and Canadian expenditure surveys (the panel CEX and the FAMEX, respectively) are based on recall questions, albeit with a very high level of disaggregation.

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<sup>7</sup> In this Figure we present two CDFs for the FAMEX: one is re-weighted to make it comparable to the COEP, and one is un-weighted. As the graph illustrates, such re-weighting makes little difference.



There are two closely related aspects to asking an exhaustive list. The first is, what is the correct level of disaggregation? The second question is, how accurately are the sub-items reported? Pradhan (2001) presents evidence on the first issue based on the Indonesian national socio-economic survey (Susenas).<sup>8</sup> This consists of a core questionnaire and a module questionnaire. The core questionnaire is administered to the whole sample (over 200,000 households), the module questionnaire to a large subsample (about a third of the total). The module questionnaire contains expenditure and self-consumption records on 218 items; the core questionnaire has records on 15 broad commodities. The module consumption items can be directly aggregated into these 15 commodities, but the same household is never asked to provide both detailed and aggregate measures for them. Comparing the two samples, Pradhan finds that the (aggregated) core questionnaire underestimates total consumption relative to the (disaggregated) module by between 11.7% and 19.6%. In line with the results of the previous section, food expenditures are less severely underestimated in the core questionnaire; conversely, non-food consumption is on average at least 23.8% lower than in module data. Looking at the 15 broad categories, Pradhan reports that there is negative underestimation for most goods with the worst being durable goods (-46%), housing and utilities (-31%) and miscellaneous goods and services (-53%) . He also reports overestimation for some goods: education (+28%), alcohol (+83%, but note that the amounts here are very small) and tobacco (+9%). The evidence does not change much if we consider a yearly rather than monthly recall period. Pradhan (2001) also finds that the reporting differences are correlated with the level of total expenditure. He summarises his results as follows: “using a high level of aggregation yields a lower consumption measure and the fraction of underestimation increases as consumption rises”.

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<sup>8</sup> As discussed above we generally only consider evidence from high-income countries, but the results discussed here may have general validity.

Battistin (2001) presents results on the accuracy of recall questions for particular items and also summarises the evidence from other studies. On the basis of this he suggests that the diary measure is superior for ‘food and non-alcoholic beverages at home’, ‘food and non-alcoholic beverages away from home’, ‘alcoholic beverages (at home and away)’, ‘personal care’, ‘entertainment’ and ‘other services’. He instead takes the interview measure to be preferable for ‘clothing and footwear’, ‘tobacco’, ‘transport services (including gasoline)’, ‘heating fuel, light and power’ and ‘housing’.

It seems that although the ‘exhaustive list’ method is widely used, it is quite demanding in terms of interview time. The evidence given above suggests that we need to ask about a quite detailed list of items and some of these may be reported with substantial error. Given this, we might reasonably ask if it would not be better to drop the noisy questions altogether and to concentrate on using information on a non-exhaustive list of items which are thought to be better measured. It is to this that we now turn.

## 5. Non-exhaustive list of sub-items.

In this section we address the following questions: if one can only (or is only willing to) ask questions about some sub-components of total expenditure, which components should one choose? And how should the responses be used to construct a measure of “total” expenditure? These issues are important because the second section above indicated that recall total questions, while containing valid variance and being suitable for some uses, are nonetheless subject to flaws (such as underreporting) that make them unsuitable for others uses (for example, constructing savings measures). We have also noted that recall questions about certain specific subcomponents work quite well; for example both the BMW and BC studies found good responses for food at home. In using this partial information, we shall suppose that we have available an associated expenditure survey which gives reliable information on all goods.

We shall be interested in how we could use information on a non-exhaustive list of expenditure items in imputing total non-durable expenditure.<sup>9</sup> Our imputation method derives from Hammermesh (1984) and Skinner (1987); see Weil (QJE 94), Lage (1991) and Ziliak (1998) for further extensions and uses of the Skinner imputation. We begin with a linear Engel curve specification for expenditure on good  $i$ ,  $x_i$ , in terms of total expenditure,  $x$ :

$$x_i = \alpha_i + \beta_i x + u_i \quad (0.1)$$

If the slope coefficient  $\beta_i$  is non-zero then we can invert this to give:

$$x = -\frac{\alpha_i}{\beta_i} + \frac{1}{\beta_i} x_i - \frac{u_i}{\beta_i} \quad (0.2)$$

Now take an arbitrary subset of the goods,  $i=1,2,\dots,k$  where  $k < n$  and arbitrary weights  $(\omega_1, \omega_2, \dots, \omega_k)$  which sum to unity and define:

$$x = \sum_{j=1}^k \omega_j x = \left( -\sum_{j=1}^k \alpha_j \frac{\omega_j}{\beta_j} \right) + \frac{\omega_1}{\beta_1} x_1 + \frac{\omega_2}{\beta_2} x_2 + \dots + \frac{\omega_k}{\beta_k} x_k - \sum_{j=1}^k \frac{\omega_j}{\beta_j} u_j \quad (0.3)$$

This provides a basis for imputing total expenditure from observations of a non-exhaustive list of expenditure items  $(x_1, x_2, \dots, x_k)$  since we can estimate the  $\alpha_i$ 's and the  $\beta_i$ 's from cross-section data.

This raises a number of issues:

- Empirical Engel are not linear so that we should typically take a non-linear specification. In this respect, it is worth noting that Hammermesh (1984) and Skinner (1987) impose homotheticity ( $\alpha_i = 0$  for all  $i$ ), so that they also suppress the constant in equation (0.3).
- Which subset of goods to choose for the analysis?

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<sup>9</sup> Its worth emphasizing here that we are considering only nondurable expenditures; Browning and Crossley (1999) suggest that nondurable expenditures such as food may be differentially smoothed in response to shocks, and show that much more action appears in small durables.

- How should we choose the weights?
- How can we allow for the fact that the individual expenditure items are measured with considerable noise?

Although we do not rule out the possibility of making these choices optimally, for the moment we go with a much simpler scheme that follows the line developed by Skinner (1987). In this scheme we first choose a subset of goods  $1, 2, \dots, k$  and then we run the regression:

$$x = \pi_0 + \pi_1 x_1 + \pi_2 x_2 + \dots + \pi_k x_k + \varepsilon \quad (0.4)$$

on expenditure survey data. Denote the OLS estimates by  $\hat{\pi}_j$ . This gives us weights to use in predicting on the non-expenditure survey that we are interested in:

$$\hat{x} = \hat{\pi}_0 + \hat{\pi}_1 x_1 + \hat{\pi}_2 x_2 + \dots + \hat{\pi}_k x_k \quad (0.5)$$

The expenditure items we recommend for this procedure are those that are believed to be well measured by recall questions (see the previous section). For the purposes of this paper we only consider ‘food at home’, ‘food outside the home’ and expenditures that are regularly billed. For the latter we take ‘phones’ and ‘utilities’ (a composite of water, fuel and electricity). This choice is the result of some prior analysis of the data (not reported here) but we do not rule out that a more systematic analysis would give an improvement on these items. Note that we do *not* use income as a predictor even though it is surely a good one. There are two reasons for this. First, in many expenditure surveys income is not well measured; see, for example, Lusardi (1996) on the CEX. Second, the use of income to impute expenditure introduces spurious relationships between income and the imputed measure which invalidate some uses of the imputed measure (for example, testing for excess sensitivity).

We explore this issue in Canadian data (using the 1996 FAMEX), in Italian data (using the *SFB*) and in the Spanish ECPF which has a panel aspect that allows us to take annual differences. Table 6 lists the subcomponents of consumption that we consider as predictors for total consumption, and their respective budget shares (as a proportion of non-durable expenditures). In

Table 7, we report the results of five experiments. For each we report coefficient estimates, the  $R^2$  for the regression, and also the  $R^2$  for the fit of the estimated model on a sub-sample of 25% of households that were randomly held back from the estimation. The latter provides a test for ‘over-fitting’ in the original regression.

In the first column of table 7, we report the results of regressing total non-durable expenditure on ‘food at home’ and ‘food outside the home’. These two ‘predictors’ ‘explain’ 56% and 67% of the variance of non-durable expenditure in the Italian and Canadian data respectively. Thus the food categories ‘explain’ a good deal of the variance of total non-durables. One important aspect of this is that we include a constant; Skinner finds a lower  $R^2$  for total food on the US CEX (only 26%), but this is without including a constant. When we add the two utilities categories the  $R^2$ 's rise to 63% and 74% respectively. As discussed above, the possibility of nonlinear Engel curves suggests a nonlinear specification. In the third column in Table 7 we augment the levels of expenditures on the four goods with their squares and cross products. In both data sets this leads to a relatively minor increase in explanatory power. The final two columns indicate that adding demographics leads to a small increase in explanatory power.

These results suggest that imputing the total from the sub-items we can ‘explain’ a substantial proportion of the total variability. As a further check, in figures 4 and 5, we present some evidence on how well the imputed paths match with the true paths as we follow agents through their life-cycle. In the left-hand-side panels we consider the imputations from column 2 of table 7, which does not directly use demographic information. As can be seen, the imputations reproduce the basic patterns seen in the true measure, albeit with some systematic divergences over the life-cycle. When basic demographics – including age and age squared - are used in the regression (column 4 of table 7) the age profiles match almost perfectly. This is as expected, and is illustrated in the right-hand-side panels.

The evidence presented here concerns cross-section variability. As Skinner (1987) emphasises, often our interest is in changes over time. To investigate this, we finish up with an

analysis of data drawn from the Spanish ECPF. These data provide information on household expenditures over eight quarters and have the advantage over the four quarter US CEX panel that we can take annual first differences (thereby washing out any idiosyncratic seasonal variations). In Table 8, we present the results of a cross-section analysis similar to that of Table 7 and also the first differenced results. As can be seen, the  $R^2$  achieved using the two food measures is 73% for the levels and 53% for first differences. The fact that we are less successful in explaining changes in perhaps unsurprising, and may reflect a number of things (including the possibility that first differencing removes signal and exacerbates measurement error.) Our view is that the fact that we can explain more than half of the variation in the changes with such a simple scheme suggests that it may well be possible to study intertemporal allocation issues using imputed consumption based on a non-exhaustive list of sub-items.

## 6. Conclusions and recommendations.

We have reviewed various methods that can be used to recover a measure of total household expenditure in general purpose surveys. As we have seen, there is rather more information about asking expenditure questions than is sometimes thought and the various surveys that do it provide some guidance as to future possibilities. Based on the analysis of such surveys, we feel that we are in a position to offer some advice on asking consumption questions in general purpose surveys.

Some of our recommendations are common to any survey question. For example, it is no use asking a question about something that the respondent does not know much about. This suggests that it may be worth asking specific questions on how well informed the respondent is about household matters such as household expenditures, household income and family links. Equally obviously, the specific form of the question can make a big difference to responses: extensive pre-testing is always recommended for non-standard questions.

In general, we believe that the most accurate recall based measure of total expenditure will be derived from asking about an exhaustive list of highly disaggregated expenditure items. This is,

however, a counsel of perfection that few general purpose surveys could afford. Given that this is not feasible, we suggest the following. First, always ask a ‘food at home’ question. It seems that respondents can report this accurately and that being a large budget item, it is very useful in imputation (as well as sometimes being of independent interest). Second, always ask a ‘food outside the home’ question. Although there is no convincing evidence on the accuracy of a recall question on this, it is a useful complement to the ‘food at home’ question. This is because the two items are obvious substitutes and there is a great deal of heterogeneity in the two food budget shares for households that have the same level of total expenditure. Thus the two measures together give a better predictor for the total. The analysis presented in the last section also suggests that it is worth collecting information on utilities and telephones. One warning note here is that the utilities expenditure information used in our imputation analysis is typically validated by the interviewer seeing bills and noting the specific amounts and time periods. It is not clear that a simple question such as “how much did you spend on water, fuel and electricity in the last calendar month” will elicit accurate information.

The analysis in section 5 suggests that asking for just three or four sub-items of expenditures recovers a reasonable amount of the information needed to impute nondurable consumption accurately. However, one concern with this strategy used alone is that there is a great deal of heterogeneity in expenditure patterns and some budget items can sometimes be idiosyncratically large. For example, it may be that a particular household is very keen on horse riding and spends half of total expenditure on that. Clearly the list above would lead us to dramatically underestimate total expenditure for such a household. Consequently, we suggest supplementing the sub-item list above with a ‘total non-durable’ expenditure question. At present it is not clear how to optimally combine these two sets of information and the supplementary evidence presented above on bias. Nevertheless, the analysis described in Section 2 demonstrates that recall questions about total expenditure can generate reasonable response rates, and that the responses contain substantial valid

variance. It is likely that the total expenditure question does give some genuine extra and valuable information over and above the responses on the sub-items.

In the introduction we outlined the advantages of having total expenditure information in general purpose surveys. Many researchers are pessimistic about the possibility of recovering such information without expensive diaries or long lists of recall expenditure questions. As will be clear from the foregoing, we do not share this pessimism. It is possible to elicit a great deal of useful information on expenditures and as time goes on we shall discover better ways of using this information.



## Appendix 1: Consumption Questions In General Surveys

### *Canadian Out of Employment Panel (COEP) –*

The COEP asks questions about food at home, food in restaurants, clothing, transportation and total expenditure:

The next questions deal with the expenses of your HOUSEHOLD. About how much did you and your household spend on food that you use at home in the PAST MONTH?

Excluding any meals at work or at school, about how much did you and your household spend eating out in the PAST MONTH?

About how much did you and your household spend on clothing in the PAST MONTH?

About how much did you and your household spend on transportation in the PAST MONTH? Include expenditures on public transportation, taxi services, and if your household owns a car, include expenditures on gas, repairs and parking.

About how much did you and your household spend on EVERYTHING in the PAST MONTH? Please think about all bills such as rent, mortgage, loan payments, utility and other bills, as well as all expenses such as food, clothing, transportation, entertainment and any other expenses you and your household may have.

The Transportation question was not asked in 1993 and in 1993 the reference period for food in restaurants was past week. Uniquely, the COEP also collected information about changes in expenditures. This made sense in a survey constructed around a specific event (a job loss).

Has the amount you spend on everything gone down since the month before your job ended on [fill ROE]?

By about what amount monthly?

Has the amount you spend on everything gone up since the month before [fill ROE]?

By about what amount monthly?

In 1995, a question about the purchase of “any major home appliances or electronics in the past 3 months” was also asked.

Questions about personal and household income, and changes in household income were also asked. The survey was designed so that the expenditure questions preceded the income questions.

### *AHEAD -*

The AHEAD experimented with one question, based on the COEP:

About how much did you and your household spend on everything in the PAST MONTH? Please think about all bills such as rent, mortgage loan payments, utility and other bills, as well as all expenses such as food, clothing, transportation, entertainment and any other expenses you and your household may have.

### *Italian Survey on Household Income and Wealth (SHIW) –*

The SHIW asked a food question and a total expenditure question:

What was your family's average monthly expenditure in 1995 for all consumption items?  
*Consider all expenses, including food, but excluding those for: housing maintenance; mortgage instalments; purchases of valuables, automobiles, home durables and furniture; housing rent; insurance premiums.*

What was your family's average monthly expenditure for food alone?  
*Consider expenses on all food items in grocery stores or similar food stores and expenses on meals normally consumed out.*

These were followed by detailed questions on housing maintenance, purchases of jewels and valuables, automobiles and other vehicles, furniture and home durables; housing rent and insurance premiums.

*VSB-CentER (Winter's pilot) -*

Two groups of households. All answered first a question on spending on durable goods. Then one group (836 households) answered a total expenditure question:

Think about how much you and your household spent on everything in the PAST MONTH? Please think about all bills such as rent, mortgage loan payments, utility, insurance and other bills, as well as all expenses such as food, clothing, transportation, entertainment and any other expenses you and your household may have. Roughly, how much would that amount to?

The other group (116 households) answered questions on 35 non-durable items (mortgage, house insurance, property tax, rent, utilities, housekeeping supplies, gardening supplies, home repair, domestic services, food and beverages, eating and drinking out, clothing, personal care products, personal care services, vehicle finance charges, gasoline, vehicle maintenance, vehicle insurance, drugs, health care services, medical supplies, health insurance, trips and vacations, tickets, club membership, video and audio entertainment, hobbies, computer equipment, reading, pet food etc., tobacco, contributions, gifts, life and liability insurance).

*British Household Panel (BHPS) –*

The BHPS records expenditures on durable items (household appliances plus electronics only) and then asks a single food question:

Please look at this card and tell me approximately how much your household spend each week on food and groceries" (includes take-aways but excludes meals out)

*US Panel Study on Income Dynamics (PSID) -*

Until 1997 the PSID asked a few questions (food in, food out, rent and sometimes utilities). Since 1999, transport and education expenses, health (out of pocket and insurance premium), and child care expenses have been added to the previous list. Reference periods vary according to questions: food at home and meals out refer to average week, education expenses refer to the previous calendar year, car insurance is per year, other transportation expenses are the previous month and health premiums and out of pocket health costs refer to the two previous years.

*European Community Household Panel (ECHP) -*

The ECHP asks no direct consumption questions. It does ask a series of qualitative questions, regarding whether the household can ‘make ends meet’, whether it can ‘afford’ various expenditures (heating, holidays, replacing worn out furniture, new rather than second-hand clothes, meat every second day, family or friends for drink/dinner) and whether the household has money left for saving. It also asks about events, such as the non-payment of various kinds of bills.

*Japanese Panel Survey on Consumers (JPSC) -*

The JPSC asks a detailed question:

Please enter the amount you spent this September for each of the following items.  
(Include expense directly charged to your bank/post office account as well as expenses paid by cash.)  
(Enter “0” for items you spent nothing on.)

Food  
Residence (rent/house repair) (Do not include house loan)  
Water supply/gas/electricity  
Furniture/housework goods  
Clothing  
Medication  
Transportation  
Correspondence  
Education  
Culture/entertainment (Include lessons other than tuition lessons/preparation for entrance exams)  
Social intercourse  
Pocket money for family members  
Other expenses  
Amount handed to your husband’s parents  
Amount handed to your own parents  
Total

*The Household Income and Labour Dynamics in Australia (HILDA) Survey –*

The HILDA asks about groceries, food as a component of groceries and meals outside the home. HILDA uses face-to-face interviewing, and hence can employ visual aids to the questioning.

I am now going to ask you some questions about household spending.

(Show card R27 listing what is included.)

How much does this household spend on groceries in a *normal week*?

Your best guess will do.

(Probe for supermarket shopping, meat, fish, fruit&veg, bread, pet food)

(Show card R28 listing what is included)

And of this, about how much of the weekly grocery bill goes on food and drink (but not alcohol)?

Your best guess will do.

(The gap between this and R27 should be mostly cleaning products and toiletries. If the gap is substantial, or the amounts are the same, probe to check accuracy.)

Approximately how much would this household usually spend per week on meals outside the home; that is, restaurants, take-aways, bought lunches and snacks? Do not include anything spent on alcohol.

(Where applicable prompt) Include your children’s expenditure e.g. lunch money etc.

HILDA also asks a qualitative question about the difficulty or ease of 'making ends meet' given household income.

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## Tables and Figures

Table 1: Item non-response from the first wave of the 1995 COEP

	Wave 1
Usual net ('take home') earnings prior to job separation	10.9
Usual gross earnings prior to job separation	7.5
Usual net ('take home') earnings in current job	9.6
Usual gross earnings in current job	6.9
Food at home (in the past month)	10.4
Food in restaurants (in the past month)	5.7
Total expenditure (in the past month)	11.8
Net personal income (in the past month)	5.9
Net household income (in the past month)	19.3

Notes:

1. Drawn from Table 1 in BC 2002.

Table 2: Determinants of Item Non-Response, 1995 COEP

Logit model of probability of Non-response	Food at home	Total expenditure	Net household income
Item non-response, base group (single female, who is by definition head of her household)	7.4%	6.0%	5.8%
Male	+3.6** (0.64)	+0.3 (0.66)	+2.2** (0.88)
Not Head of Household	+3.7** (0.80)	+7.7** (0.88)	+10.1** (1.04)
Nuclear Family	-3.0** (1.09)	-0.2 (1.22)	+6.6** (1.57)
Composite Family	+7.8** (1.60)	+14.0** (2.30)	+40.1** (3.12)

Notes:

1. Coefficients are marginal effects for a discrete change in the dummy variable from zero to unity. All numbers are multiplied by 100, so should be read as additional percentage points. Thus a single male has a predicted non-response rate for the total expenditure question of 6.3%.
2. Standard error of the marginal effect in parentheses.
3. \* significant at 5% \*\* significant at 10%

Table 3: Descriptive statistics of 'total' expenditure				
	Survey	Median.	Mean	Coefficient of Variation
Italy	SHIW (recall) N= 7502	1700	1869.46	0.500
	SFB (diary) N=31,400	2240.77	2677.74	0.686
	Ratio, SHIW/SFB	0.76	0.70	0.73
Canada	COEP (recall) N=5191	1500	1734	0.575
	FAMEX N=6782	2398	2565	0.467
	Ratio, COEP/FAMEX	0.63	0.68	1.23

## Notes:

1. For Canada and Italy the measures are total expenditures and total non-durables respectively.
2. FAMEX numbers are re-weighted to match the COEP.
3. COEP and FAMEX numbers exclude composite households.
4. See text for further details.

Table 4: Demographic Determinants of Ln(Total Nondurable Expenditures)

	Canada			Italy	
	FAMEX	COEP		SFB	SHIW
Head 30-39	-0.025 (.017)	0.123** (.023)	centre	-0.063 (0.008)**	-0.072 (0.012)**
Head 40-49	0.001 (.017)	0.105** (.024)	south	-0.318 (0.007)**	-0.300 (0.010)**
Head over 50	-0.132 ** (.018)	0.106** (.022)	household size	0.787 (0.023)**	0.686 (0.036)**
Ontario	0.208** (.014)	0.257** (.023)	(hh size) <sup>2</sup> /100	-13.759 (0.684)**	-11.567 (0.988)**
Quebec	0.047** (.015)	0.052* (.023)	(hh size) <sup>3</sup> /1000	8.246 (0.608)**	6.574 (0.831)**
Prairies	0.098** (.014)	0.167** (.027)	head male	0.097 (0.009)**	0.123 (0.014)**
British Columbia	0.236** (.016)	0.318** (.029)	head age	0.037 (0.002)**	0.031 (0.003)**
ln(household size)	0.600** (.029)	0.454** (.041)	head age <sup>2</sup>	-0.040 (0.002)**	-0.029 (0.003)**
(ln(household size)) <sup>2</sup>	-0.124** (.018)	-0.070** (.025)	Constant	5.714 (0.046)**	5.554 (0.072)**
Own home	0.274** (.011)	0.173** (.016)			
Constant	7.095** (.02)	6.635** (.028)			
N	6782	5191	N	31400	7525
R <sup>2</sup>	0.39	0.24	R <sup>2</sup>	0.37	0.40
F-test of common slopes	F( 10,11951) = 14.11 P < 0.0001		F-test of common slopes.	F(8,38896) = 30.34 P < 0.0001	

## Notes:

1. Estimates are not weighted.
2. SFB regression also contained a full set of month dummies.
3. \* significant at 5%; \*\* significant at 1%

Table 5: Descriptive statistics of food expenditure

	Survey	Median.	Mean	Coefficient of Variation
Italy	SHIW (recall) N= 7502	800	869.49	0.500
	SFB (diary) N=31,400	783.40	869.51	0.547
	Ratio, SHIW/SFB	1.02	1.00	0.91
Canada	COEP (recall) N=5022	400	382	0.514
	FAMEX N=6782	347	363	0.530
	Ratio, COEP/FAMEX	1.15	1.05	0.97

## Notes:

1. FAMEX numbers are re-weighted to match the COEP.
2. COEP and FAMEX numbers exclude composite households.
3. See text for further details.

Table 6: mean budget shares of selected sub-components (%)

Commodity	Canada (FAMEX)	Italy (SFB)	Spain (ECPF)
Food at home	22.1	32.1	60.0
Food in restaurants	6.3	5.0	3.4
Total food	28.4	37.1	
Phone	3.9	3.3	-
Utilities	8.2	8.0	8.3
Overall total	40.5	48.5	

## Notes:

1. Based on un-weighted calculations.
2. Utilities is energy in Spain.
3. In Spain, food in restaurants includes holidays.

Table 7: Predicting Total Nondurable Expenditures

	<i>FAMEX – CANADA</i>				
Food at home	2.74** (0.035)	2.19** (0.034)	2.36** (0.085)	1.71** (0.039)	1.50** (0.092)
Food in restaurants	3.69** (0.053)	3.28** (0.048)	3.50** (0.125)	2.89** (0.047)	2.59** (0.122)
Water, fuel, electricity	----	2.72** (0.079)	1.87** (0.190)	1.91** (0.094)	-0.09 (0.219)
Telephone	----	3.03** (0.128)	4.32** (0.310)	2.68** (0.121)	3.17** (0.294)
Squares and Cross Products	N	N	Y	N	Y
Demographics	N	N	N	Y	Y
R <sup>2</sup> (Estimation sample)	67.1%	74.3%	75.9%	78.1%	79.3%
R <sup>2</sup> (Cross validation sample)	66.3%	73.5%	75.1%	77.2%	78.5%
	<i>SFB – ITALY</i>				
Food at home	2.484** (0.018)	2.220 (0.017)**	2.302 (0.039)**	1.993 (0.019)**	1.853 (0.044)**
Food in restaurants	2.559** (0.026)	2.327 (0.024)**	2.642 (0.059)**	2.082 (0.024)**	2.050 (0.061)**
Water, fuel, electricity	----	1.489 (0.027)**	1.845 (0.071)**	1.342 (0.026)**	1.563 (0.070)**
Telephone	----	4.347 (0.102)**	5.922 (0.253)	3.441 (0.102)**	3.895 (0.256)**
Squares and Cross Products	N	N	Y	N	Y
Demographics	N	N	N	Y	Y
R <sup>2</sup> (Estimation sample)	55.7%	63.4%	64.9%	66.0%	66.9%
R <sup>2</sup> (Cross validation sample)	55.0%	63.2%	64.4%	66.1%	66.4%

## Notes:

1. In both countries all expenditures were normalized so that the mean of the dependent variable (total expenditure) was 100.
2. FAMEX (CANADA): 6736 observations in the estimation sample and 2245 in the cross validation sample. SFB (ITALY): 19352 observations in the estimation sample and 6450 in the cross validation sample.
3. Standard errors in parentheses. \* significant at 5%. \*\* significant at 1%.
4. Demographics include: FAMEX: gender and marital status of head, age of head and its square, two dummies for education of head, 4 region dummies, logarithm of household size and its square, ratio of adults to household size, dummies for the presence of younger and older children, dummies for home and car ownership, number of rooms in the home.
5. Total nondurable consumption is defined as: food at home, food out, water, fuel, electricity, household operations, clothing, transportation (excluding car purchases) medical care, personal care, recreation (excluding purchases of recreational vehicles), reading material, educational expenses, alcohol and tobacco.
6. Calculations in both the FAMEX and SFB use neither the original sample weights nor the (propensity score based) weight that match the to the COEP/SHIW.

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 Table 8 : Explaining Levels and Changes in Nondurable Expenditure
 

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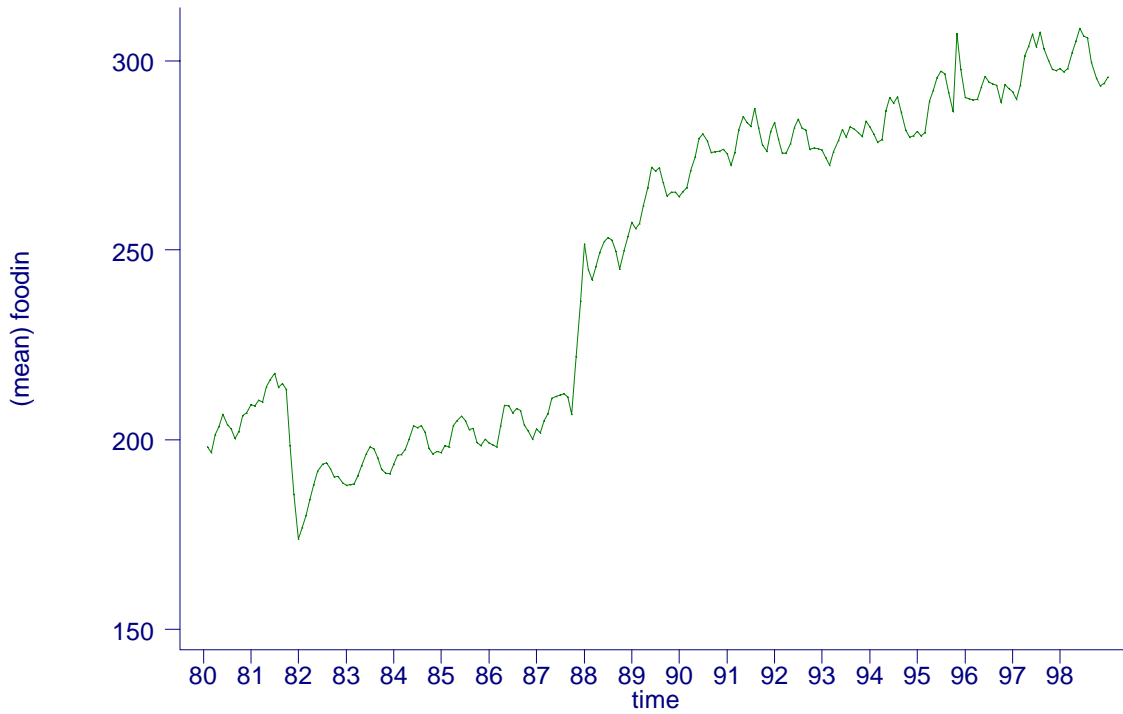
*ECPF - Spain*

	<u>Levels</u>		
Food at home	1.49** (0.047)		1.33** (0.042)
Food at home + Restaurants and holidays		1.45** (0.042)	
Restaurants and holidays			1.26** (0.15)
Energy			1.65 (0.13)
R <sup>2</sup>	58.6%	63.0%	70.0%
		<u>Changes 78:Q1 – 79:Q1</u>	
Δ Food at home	1.21** (0.051)		1.21** (0.047)
Δ (Food at home + Restaurants and holidays)		1.21** (0.047)	
Δ (Restaurants and holidays)			1.28** (0.17)
Δ Energy			0.99** (0.12)
R <sup>2</sup>	44.5%	48.3%	52.8%

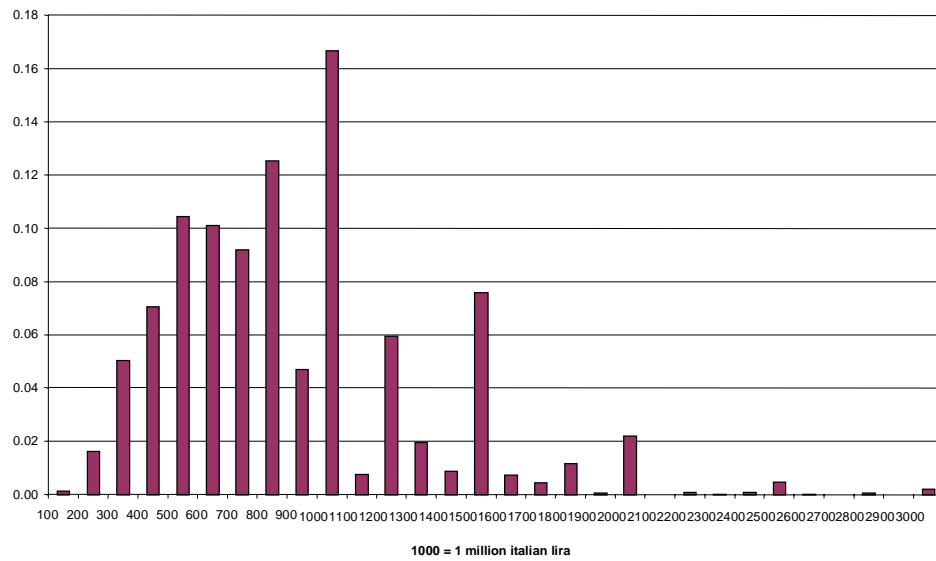
Notes:

1. 705 observations
-

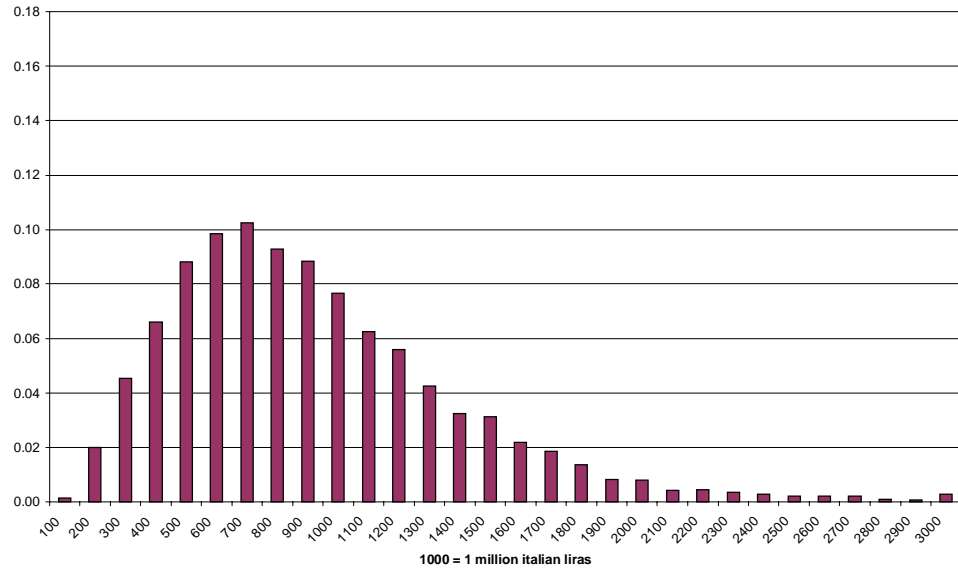




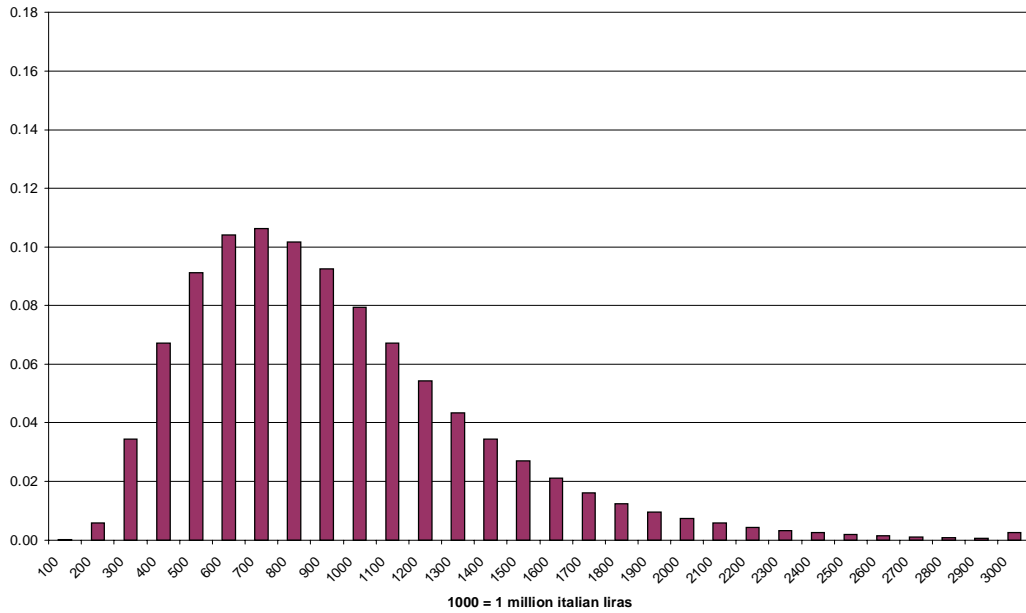
**Figure 1 – US CEX average monthly food expenditure (interview sample)  
(From Battistin, 2002)**



**Figure 2a – Histogram of food consumption in SHIW sample (recall question)  
(From BMW 2002)**



**Figure 2b – Histogram of food consumption in SFB sample (diary records)  
(From BMW 2002)**



**Figure 2c – Histogram of imputed food consumption in SHIW sample  
(From BMW 2002)**

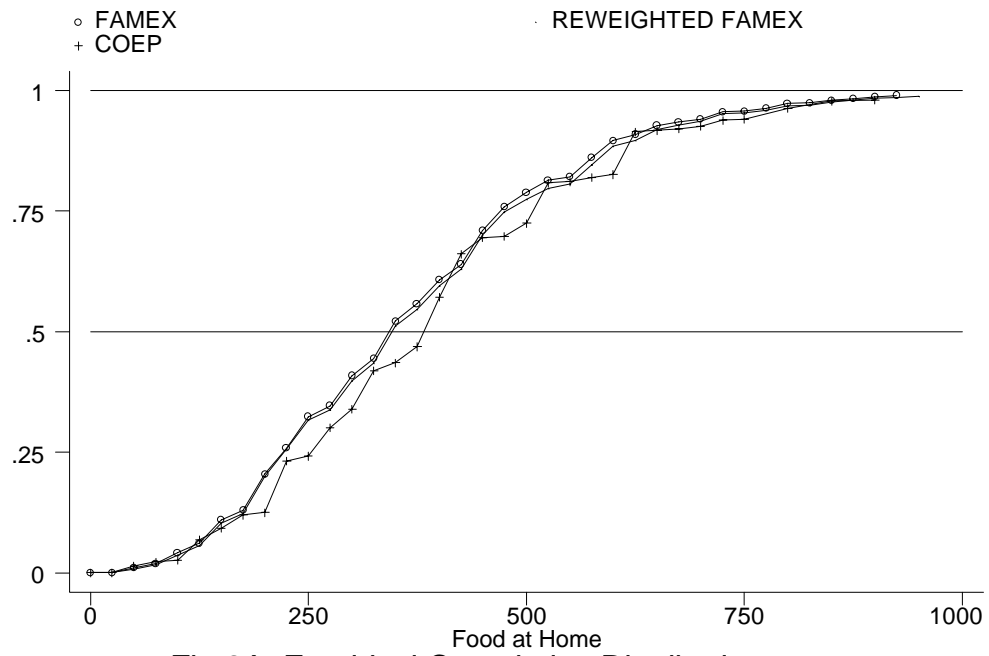
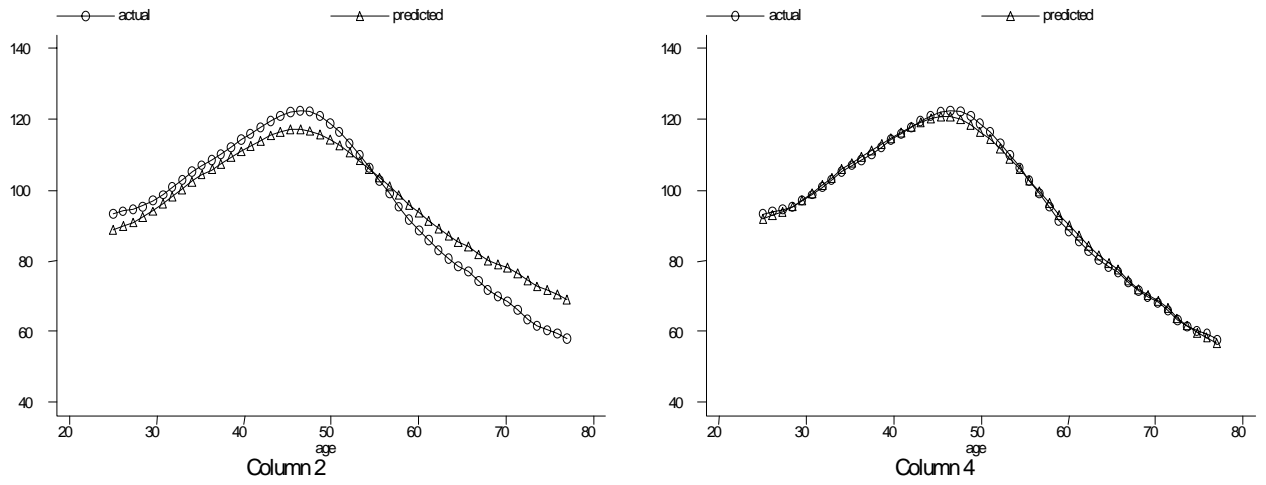
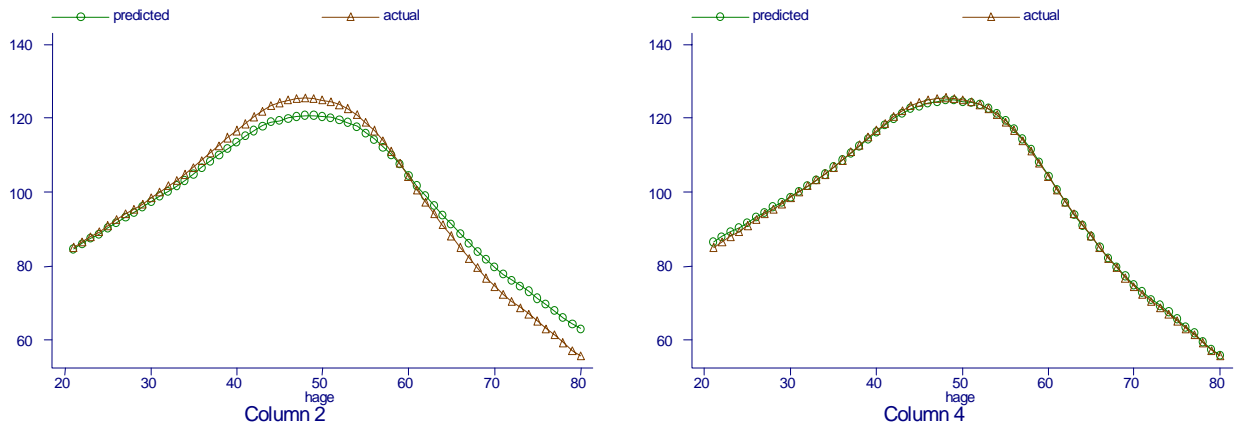


Fig 2A: Empirical Cumulative Distribution

**Figure 3 – Empirical Cumulative Distributions of Monthly Food Expenditure from COEP and FAMEX (from BC 2002)**



**Figure 4: Age profiles of actual and imputed non-durable consumption in the FAMEX**



**Figure 5: Age profiles of actual and imputed non-durable consumption in the SFB**

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