Income, Consumption and Permanent Income in Relation to Household Well-Being and Poverty

Ramses H. Abul Naga* and Enrico Bolzani†

July 1, 2005

Abstract

The life-cycle consumption model is used to obtain an empirical framework for the joint dependence of household income and consumption on permanent income. Predictors of the latter variable are obtained using welfare indicators, determinants of long-run income and socio-demographic variables.

Keywords: Poverty, household income and consumption expenditures, permanent income, Switzerland.

1. Introduction

The catalogue of definitions of poverty appears to be very large and there is little consensus about the appropriate indicator of resources to be adopted (Atkinson, 1989). Clearly the choice of definition is the starting point of any poverty related study, and should not be left as a side issue. Furthermore, the definition of resources greatly influences the set of families identified as being in poverty and there is little overlap between the sets of the poor obtained from alternative definitions (Anand and Harris, 1990; Glewwe and Van der Gaag, 1990, Chaudhuri and Ravallion, 1994).

The rationale underlying a permanent income definition of resources is to identify the chronic poor. As such, current income and consumption contain relevant

*Institute for Health Economics and Management (Université de Lausanne).

†Département Fédéral des Affaires Etrangères, Bern, Switzerland

information about a household's long run status. Nonetheless, household income contains a transitory variance component, making it an imperfect indicator of permanent income. Likewise, because of various institutional constraints, households do not smooth their consumption to the extent predicted by intertemporal allocation theories, thus disrupting the equality between consumption and permanent income.

In this paper, we take the view that various indicators of well being contain potentially useful information about the economic situation of families, and as such, a particular welfare indicator cannot exhaust all the potentially available information. Thus, we propose to obtain an empirical framework for the joint dependence of household income and consumption on permanent income from the life-cycle consumption model. We obtain predictors of permanent income using welfare indicators, determinants of long-run income and socio-demographic variables.

Section 2 of the paper presents the quantitative approach underlying the permanent income methodology. Section 3 contains a brief review of previous work on the subject. Section 4 presents the database used in the applications of section 5 to Swiss household data. Section 6 discusses some policy implications related to the permanent income methodology and section 7 concludes.

2. The Quantitative Approach: Intertemporal Choice and the Permanent Income Hypothesis

Suppose a household is to allocate its consumption over two time periods: today's c_1 and the future c_2. Work hours are assumed to be fixed, so that period $t's$ earnings e_t are outside the household's control. The household also possesses initial assets A_1 that it uses along with earnings to plan its consumption. It is assumed that the household borrows and lends at an identical interest rate r. The two-period intertemporal problem is written:

$$\max E_1 u\left[(c_1, c_2)\right] \tag{1}$$

$$s.t\ c_1 + \frac{c_2}{1+r} = A_1 + e_1 + \frac{E_1(e_2)}{1+r} \tag{2}$$

The interest rate r is assumed to be fixed and the only source of uncertainty considered here pertains to future earnings e_2. In the right-hand side of (2) E_1 denotes the expectations operator given period 1 information, so that the quantity

$$M_1 \mathrel{\hat{=}} A + e_1 + \frac{E_1(e_2)}{1+r} \tag{3}$$

may be taken to denote life-time wealth. First order conditions for the above problem entail

$$E_1\left(\frac{\partial u}{\partial c_1}\right) = (1+r)E_1\left(\frac{\partial u}{\partial c_2}\right) \tag{4}$$

Optimal consumption choices are given by functions

$$c_t = g_t\left(A_1, e_1, e_2, r\right) \qquad t = 1, 2 \tag{5}$$

where g_t is a time dependent function. Though very general, the intertemporal framework yields several conclusions which distinguish it from a static (one-period) consumption model.

Firstly it is to be noted that in a static model only current resources determine consumption, so that e_2 does not intervene in the right-hand side of (2): i.e. consumption is a function of disposable income as opposed to life-time wealth. Secondly, a cross-section of the two-period world will comprise households whose consumption is governed by $g_1(.)$ and older ones who are currently in their second period of economic life, consuming according to the rule $g_2(.)$. Hence, in empirical work one must estimate separate consumption functions for households belonging to different birth cohorts.

In the sub-section below we refine the structure of the general life-cycle problem in order to generate a preference for equal consumption between time periods. This is followed by a sub-section where we present an empirical counterpart to the theoretical model. Then we discuss various methods used to predict household permanent income (sections 2.3 and 2.4).

2.1. The permanent income hypothesis

Time separability of the utility function is almost always assumed in intertemporal allocation models (Browning, 1991 is a rare exception). Such is the case under the permanent income hypothesis $[PIH]$ where $u(c_1, c_2)$ is taken to be additively separable

$$u(c_1, c_2) = \upsilon(c_1) + \frac{\upsilon(c_2)}{1+\kappa} \tag{6}$$

and κ is a discount rate measuring the degree of impatience; that κ is larger the higher the preference for present consumption over the future. Also, it is assumed that preferences exhibit a certainty equivalence property:

$$\upsilon(c_t) = c_t - c_t^2/2 \tag{7}$$

The marginal utility of consumption being linear under (6) and (7), the household's consumption profile is insensitive to perceived changes in future earnings risk (see below). Under such assumptions, the first order condition (4) now specializes to

$$c_1 = E_1\left(\frac{1+r}{1+\kappa}c_2\right) \tag{8}$$

also referred to in the literature as the Euler equation of consumption. A final assumption, $\kappa = r$, provides the rationale for the result underlying the PIH that the household exhibits a preference for equal consumption over the life-cycle (the martingale property):

$$c_1 = E_1(c_2) \tag{9}$$

If we take expectations in the budget constraint (2) using (9), we obtain

$$c_1\left(1 + \frac{1}{1+r}\right) = M_1 \tag{10}$$

i.e.

$$c_1 = \eta \tag{11}$$

where

$$\eta \mathrel{\hat{=}} M_1 / \left(1 + \frac{1}{1+r}\right)$$

is a quantity denoting household permanent income. Saving is the difference between period one cash in hand $A_1 + e_1$ and period 1 consumption:

$$s_1 \doteq A_1 + e_1 - c_1 = \frac{A_1 + e_1 - E(e_2)}{1 + (1+r)} \tag{12}$$

The PIH therefore predicts that households are borrowers when $A_1 + e_1 < E(e_2)$, while households save when they expect a drop in future earning. However, because of the assumption of certainty equivalence (7) a precautionary saving motive is absent from such a theory. In other words, under the PIH, household saving is insensitive to perceived changes in future earnings risk.

In empirical work, taste shifters are introduced to modify the marginal utility of consumption over the life-cycle. If θ_t denotes a taste shifter at period t, then the first order condition (9) is modified to:

$$c_1 - \theta = E_1(c_2 - \theta_2) \tag{13}$$

By making θ_t a function of household structure, one can account for the presence of demographic variables in the consumption process.

2.2. An empirical model

Empirical cross-section models of consumption for the PIH formulation are built of three components: an income process, a consumption function (an empirical version of 11) and an equation for what may be taken to be determinants of household permanent income (eg. Musgrove, 1979, Bhalla,1979, Muellbauer, 1983). The need for the latter equation is prompted by the fact, that we cannot observe permanent income in a cross-section survey.

Let us define m_i as household $i's$ disposable income; c_i denotes consumption expenditure, D_{im} and D_{ic} are respectively demographic controls and Z_i contains determinants of the household's unobserved permanent income η_i. Then, we may write the system:

$$m_i = \eta_i + \delta_m' D_{im} + u_{im} \tag{14}$$

$$c_i = \beta_c \eta_i + \delta_c' D_{ic} + u_{ic} \tag{15}$$

$$\eta_i = \gamma' Z_i + \varepsilon_i \tag{16}$$

In the statistical literature [14-16] is said to be a $MIMIC$ model (Jöreskog and Goldberger, 1975): η_i is a latent variable, m_i and c_i are multiple indicators and Z_i multiple causes pertaining to this unobservable.

Demographic controls typically include a polynomial in the age of the household head, information about the number of children under a given age, the number of adult workers etc. Z variables (determinants of permanent income) are typically chosen to reflect the economic environment under consideration. In rural developing country settings Z variables include measures of cultivable land, ownership dummies for productive durables such as tractors and other productive assets (eg. Singh et al.,1986). In the developed country context, human capital variables such as the educational attainment of working adults typically feature as determinants of permanent income in (16).

The remaining variables u_{im}, u_{ic} and ε_i are disturbances, while δ_m, δ_c and γ are vectors of structural parameters to be estimated. The quantity β_c denotes the marginal propensity to consume out of permanent income. Though in theory $\beta_c = 1$ under the PIH (cf. 11), in practice most estimates of β_c fall short of unity. Two major explanations may be put forward to explain this finding. Firstly, Musgrove (1979) notes that if households have a bequest motive, and such a good may be taken to be a luxury, then this will result typically in a case where $\beta_c < 1$. The existence of a precautionary saving motive may also result in $\beta_c < 1$. Under buffer stock saving behaviour (cf. Browning and Lusardi, 1996) households wish to maintain a target permanent income to wealth ratio. The reaction to an unanticipated rise in permanent income under such circumstances is to save (rather than to increase consumption) in order to re-establish the target level of the permanent income to wealth ratio.

The empirical model is completed by specifying the orthogonality requirements between explanatory variables and disturbances. These take the form $E(u_{im} \mid \eta_i, D_{im}) = E(u_{ic} \mid \eta_i, D_{ic}) = 0$ and $E(u_{ic} \mid Z_i) = E(u_{im} \mid Z_i) = E(\varepsilon_i \mid Z_i) = 0$. The reduced form for the empirical model $[14 - 16]$ is obtained by substituting (16) for η in $[14 - 15]$:

$$
\begin{aligned}
m_i &= \gamma' Z_i + \delta_m' D_{im} + \varepsilon_i + u_{im} && (17) \\
c_i &= \beta_c \gamma' Z_i + \delta_c' D_{ic} + \beta_c \varepsilon_i + u_{ic} && (18)
\end{aligned}
$$

The vectors γ and δ_m are identified from a regression of m_i on Z_i and D_{im}. A simple estimation procedure for the parameters β_c and δ_c is as follows: let $\hat{m}_i$ denote the projection of m_i on Z_i and D_{im}. Then β_c and δ_c can be identified via a regression of c_i on $\hat{m}_i$ and D_{ic}. For a discussion of various estimation procedures for models exhibiting a $MIMIC$ structure such as [14-16], see Jöreskog and Goldberger (1975) as well as Chamberlain (1977).

2.3. Predicting permanent income using multiple indicators and multiple causes

Abul Naga and Burgess (1997) have proposed three predictors of permanent income for the empirical model [14-16]. In what follows we suppress the family subscript i.

We begin first with a definition of unbiasedness in the context of prediction. We shall say that a predictor η^+ of the unobservable η is unbiased if the condition $E[\eta^+ \mid Z] = E[\eta \mid Z]$ is satisfied. That is, the predictor η^+ is unbiased if its mean conditional on Z is equal to the corresponding mean of the unobserved variable η. Let $MSE(\eta^+)$ denote the mean-square error of the predictor η^+. Define Y as the 2×1 vector with the family's income and consumption: $Y \mathrel{\hat{=}} [m\ c]'$; also let $W = \begin{bmatrix} Y \\ Z \end{bmatrix}$ and $U \mathrel{\hat{=}} [u_m\ u_c]'$, $\beta \mathrel{\hat{=}} [1\ \beta_c]'$, and $\delta' \mathrel{\hat{=}} \begin{bmatrix} \delta_m' & 0 \\ 0 & \delta_c' \end{bmatrix}$. Also define the covariance matrices $\Sigma_Y \mathrel{\hat{=}} E(YY')$ and $\Sigma_U \mathrel{\hat{=}} E(UU')$ and the scalar $\tau^o = \sigma_{\varepsilon\varepsilon}\beta' \left(\beta\beta'\sigma_{\varepsilon\varepsilon} + \Sigma_U\right)^{-1} \beta$. The following three predictors are mean-square error optimal in the class of unbiased predictors (cf. the appendix to Abul Naga and Burgess, 1997):

$$\begin{aligned} \eta_Z^* &= \gamma' Z && (19) \\ \eta_Y^* &= (\beta' \Sigma_Y^{-1} \beta)^{-1} \beta' \Sigma^{-1} (Y - \delta' D) && (20) \\ \eta_W^* &= \tau^o \eta_Y^* + (1 - \tau^o) \eta_Z^* && (21) \end{aligned}$$

2.4. Factor analysis

There is an alternative route to predicting permanent income via a factor analysis of various indicators of η. We now let y_j denote some indicator of permanent income (for instance y_1 may denote household income and y_2 may denote consumption expenditure) , and u_j denotes the transitory component associated with y_j. Assume that, all in all, the researcher has data on $j = 1, ..., p$ indicators of permanent income:

$$\begin{aligned} y_1 &= \eta + u_1 && (22) \\ y_2 &= \beta_2 \eta + u_2 \\ &\vdots \\ y_p &= \beta_p \eta + u_p \end{aligned}$$

Define $Y = [y_1, y_2, ..., y]'$, $\beta = \left[1, \beta_2, ..., \beta_p\right]'$ and $U' = [u_1, u_2, ..., u_p]'$. The vector notation for the system of p equations takes the form

$$Y = \beta\eta + U \qquad (23)$$

where η is an unobserved random variable, β is a $p \times 1$ vector of unknown structural parameters and Y and U are p-dimensional random vectors. It is assumed throughout that $E[U|\eta] = 0$.

One natural question to ask is how many indicators of permanent income one must observe in order to be able to predict η. Let Σ_U denote the covariance matrix of U and let $\sigma_{\eta\eta}$ denote the variance of η. There is a total of $p(p+1)/2$ unknown parameters in Σ_U, $p-1$ unknowns in β and assuming η has a zero mean[1], a further unknown parameter being the variance of η. In its general form then, (23) necessitates the estimation of $p+p(p+1)/2$ parameters, on the basis of $p(p+1)/2$ sample moments available from the p indicators on η. In general therefore, model (23) cannot be identified without imposing some restrictions on the vector β or the matrix Σ_U. The assumption underlying the model of factor analysis is that Σ_U is a diagonal matrix. Letting Σ_F denote the covariance matrix of Y, we have

$$\Sigma_F = \sigma_{\eta\eta}\beta\beta' + \Sigma_U \tag{24}$$

Σ_F is the sum of a unit rank matrix $\sigma_{\eta\eta}\beta\beta'$ arising from the common dependence of the p indicators on η, and a full rank diagonal matrix Σ_U pertaining to the transitory, specific, variance components of Y. Under the factor analytic covariance structure Σ_U possesses p non-zero elements, so that the total number of unknowns sums to $2p$ structural parameters. A necessary condition that must be met for identification is that the total number of unknowns does not exceed the number of sample moments. In the present context this condition takes the form $2p \leq p(p+1)/2$. The bottom line then is that a minimum of $p = 3$ indicators is required in order to identify (24).

Most statistical packages will provide a routine for estimation of models of factor analysis via a choice of several procedures (cf. Bartholomew, 1987 for a survey). Unbiased prediction of η in the factor analysis set-up is achieved via the constructing the following statistic:

$$\widetilde{\eta_Y} = \sigma_{\eta\eta}(\beta'\Sigma_F^{-1}\beta)^{-1}\beta'\Sigma_F^{-1}Y \tag{25}$$

As pointed out by Deaton and Muellbauer (1980, pp.103-105), there are different versions of the PIH. Permanent income may take a different meaning than life-time resources (or their expectation) and β_2 also takes a variety of interpretations. Mercader-Prats (1998) considers a case where β_2, the proportion

[1] This amounts to measuring $y_{i1}, ..., y_{ip}$ in deviation from their respective sample means $\overline{y_1}, ..., \overline{y_p}$.

of permanent income allocated to family consumption, is individual specific (depending on demographics such as family size and composition). Re-introduce the subscript i to highlight that the marginal propensity to consume is family specific, and assume the only available indicators on η_i are household income and consumption expenditure:

$$y_{i1} = \eta_i + u_{i1} \tag{26}$$
$$y_{i2} = \beta_{i2}\eta_i + u_{i2} \tag{27}$$

Mercader-Prats works with the assumption that household equivalence scales can be used to approximate β_{i2}, and that these may be constructed from the data. Under such circumstances β_{i2} is no longer an unknown structural parameter, and the remaining unknowns are the variances of the transitory income and consumption components, ω_{11} and ω_{22}, together with $\sigma_{\eta\eta}$. Income and consumption expenditure provide 3 sample moments: two variance terms and a covariance. On such basis, the system [26-27] may be identified provided β_{i2} is approximated by an equivalence scale.

3. Review of Previous Work

The methodology presented above builds a joint model of household income and consumption around the permanent income hypothesis. What sets it aside from a large body of literature is its use in identifying the poor, when most work has been centered around the effort of testing predictions about the evolution of consumption over time, and how saving reacts to income change (cf. for instance Hall and Mishkin, 1982, Deaton, 1992 and Blundell and Preston, 1998).

The empirical framework [14-16] is based on Bhalla (1979), Musgrove (1979) and Muellbauer (1983). The related predictors of permanent income [18-20] have been proposed by Abul Naga and Burgess (1997). These authors apply their methodology to household data from two Chinese rural provinces and contrast the set of families identified as being in poverty using income, consumption and permanent income. Abul Naga and Bolzani (2000) apply the permanent income methodology to Swiss household data. Abul Naga (2005) extends the empirical framework in the context of household precautionary saving behaviour.

Another route to constructing multiple indicator permanent income measures is via the model of factor analysis. Abul Naga (1994), Mercader-Prats (1998) and

Mitrakos and Tsakloglou (2000) provide related models for predicting permanent income from a factor analysis of welfare indicators.

4. The Database

For our empirical investigation we employ data from two household surveys carried out by the Swiss Federal Statistical Office. The first one is a household consumption survey carried out in 1990 (Enquête sur la Consommation des Ménages: hereafter EC90). The second one is a follow-up survey carried out in 1998 (Enquête sur le Revenu et la Consommation des Ménages: hereafter ERC98). Both surveys sample the population living in Switzerland on a permanent basis[2]. Thus, people on a temporary stay for visiting or employment purposes are not included in the sample. Unfortunately, this survey was not conducted between 1990 and 1998. However, these two years may provide a good example for our applied welfare analysis: in 1990 the country was approaching the end of a growth cycle, while in 1998 it was barely emerging from the recession. EC90 sampled about 2000 households, whereas ERC98 sampled approximately 9000 households.

The household head is defined as the prime income earner. Family level data concerning demographic composition, household income and consumption expenditure are available. Information on a number of characteristics, such as his/her citizenship, education, marital and employment status, was also obtained. However, lifetime variables such as permanent income are typically unobserved in cross-sectional surveys and this is the case in the context of our Swiss household data.

In our discussion, we made some allowance for uncertainty with respect to labour income while we assumed a constant interest rate. However, it must be conceded that, in practice, the interest rate is not constant. In fact, even if it were to fluctuate in a non-random, fully anticipated fashion, it would still be the case that, in a life-cycle perspective, the several birth cohorts sampled in a cross-section survey would face different sequences of interest rates. Consequently, as noted in Section 2, the structural parameters of the consumption function would be cohort specific, since they are linked to the interest rates.

For this reason, in our empirical application, we restrict our analysis to families belonging to a common cohort. In what follows, we choose to compare the situations of households headed by a person born between 1946 and 1955 (i.e.

[2] For a full and detailed description, see Office Fédéral de la Statistique (1992, 1999).

between 35 and 44 years of age in 1990 and between 43 and 52 years of age in 1998). Moreover, as emphasized by Deaton and Paxson (1994), inequality changes in a cross-sectional distribution often reflect variations in the age structure of the population. Therefore, sampling from a single cohort is also a way to partially overcome this problem. We were thus left with 561 observations from EC90 and 1578 families taken from ERC98.

Table I about here

Table I reports the main statistics pertaining to the household income and consumption data of our 1946-1955 birth cohort. In these calculations, the 1998 income and consumption data have been deflated using the national Consumer Price Index to 1990 Swiss francs. We may observe that, while mean income grew between 1990 and 1998 by 18,8%, average consumption expenditure grew much more moderately, by 7,1%. Income inequality, measured by the coefficient of variation (standard deviation divided by the mean), rose also much more than consumption inequality. These distributional changes are partly driven by the dispersion of family size as household heads enter middle age. As a consequence of the permanent income hypothesis, consumption inequality increases as a cohort ages. On the other hand, this increase of inequality may be attenuated in presence of a precautionary saving motive, thus making expenditure inequality increase less than income inequality (see Deaton and Paxson, 1994; and Blundell and Preston, 1998).

5. Presentation of the Empirical Results

In this section we implement the permanent income methodology presented in Section 2 on our Swiss household data. It is important to note that, since household permanent income is unobserved, we have constructed predictors of this variable to be used as measure of resources in quantifying the extent of permanent income poverty.

5.1. Estimation and prediction results

First we turn to the estimation of our consumption and income model. Since the income and consumption processes may vary according to the characteristics of the household, we have used some demographic control (D) including the number of adult workers, the number of children under the age of 10 and a dummy for marital status. The set of Z variables related to the household head include the educational level attained and three dummies: one related to his/her sex, one to his/her citizenship and one to living in the more opulent economic areas of Switzerland ($AGGLO$)[3]. A number of studies conducted at the Swiss level demonstrated an important pay differential between men and women and Swiss and non-Swiss citizens (see, for instance, Leu and Burri, 1998). This is the reason why we introduce these dummies. Educational attainment of the family head measures human capital, which we expect to be positively correlated to the level of living of a family.

Table II about here

Table II presents parameter estimates for the permanent income model (14-16). We may observe that for both our 1990 and 1998 data parameter estimates for the marginal propensity to consume and the slope coefficients for education are strongly significant. However, the parameter estimates for the three dummies are not statistically significant at the 5% level. It is important to note that, in accordance with the PIH, a 95% confidence interval for β_c contains the value $\beta_c = 1$ for our 1990 data. This is not the case, however, in the context of the 1998 data. It would appear therefore that credit market constraints and precautionary saving behaviour are less likely to be observed during growth cycles than recession episodes in an opulent economy such as Switzerland.

The Sargan test is used to test for the exogeneity of Z variables. The test takes a value of 1.79 for the 1990 data and 1.11 in 1998. Given the critical value of 7.82 at the 5% level, we may conclude that these variables are plausible instruments.

Table III about here

Next we turn to the prediction of household permanent income η. Table III presents results for the three predictors discussed in Section 2. $YPRED$ is the predictor η^*_Y, $ZPRED$ is the predictor η^*_Z and $WPRED$ is the predictor η^*_W

[3] These areas include Zurich, Mittelland, Central and North Western Switzerland.

(cf. equations 19-21). For $YPRED$, the weights on income and consumption are respectively 0.55 and 0.47 for the 1990 data and 0.63 and 0.58 for the 1998 data. The coefficients on $ZPRED$ are the corresponding parameter estimates pertaining to Z variables in Table II. The last predictor is a function $\eta_W^* = 0.72\eta_Y^* + 0.28\eta_Z^*$ for the 1990 data and $\eta_W^* = 0.57\eta_Y^* + 0.43\eta_Z^*$ for the 1998 data.

5.2. Implementation to the identification of the poor

Next, we classify our households according to our three welfare indicators, namely consumption expenditure, income, and permanent income. We use the predictor $YPRED$ (equation 19) as our permanent income measure. In order to make poverty comparisons between families of different demographic composition, the three welfare measures have been normalized by the square root of family size.

We begin by defining poverty lines for each welfare standard. Conférence Suisse des Institutions d'Action Sociale (2000) sets the level of annual expenditure per adult required to meet subsistence needs at 23'700 CHF. We took this amount as the poverty threshold for our consumption expenditure distribution in 1998. For 1990, we set the consumption poverty line at CHF 20'014 (i.e. the corresponding 1998 poverty line deflated by the Consumer Price Index). According to this definition, 69 families lie under the consumption poverty line in 1990, which amounts to 12.3% of the cohort. Then we have chosen the level of the income and permanent income poverty lines such that an identical number (or proportion) of households are poor using all three definitions. This amounts to setting the income poverty line at CHF 19'140 and the permanent income poverty line at CHF 22'268.

Figure I about here

We use Venn diagrams to depict the extent of overlap between the three definitions of poverty. Figure I shows the extent of agreement between the three definitions of poverty in 1990. Recall that each indicator identifies 12.3% of families as falling under the poverty line. This means that each circle contains in total 12.3% of all observations. Consider first consumption poor families (upper right circle): there is a 3.4% of households in poverty only according to the consumption definition. Income and consumption jointly classify 7.3% of families as being in poverty (1.8% + 5.5%). Likewise, 7.1% of families (1,6%+5,5%) are classified as poor using the consumption and permanent income definitions. As shown in the diagram, only 5.5% of households are jointly identified as being poor by the 3 indicators. On the other hand, 79.3% of the sample do not fall under the poverty line according to either definition.

Figure II about here

A similar methodology is used to set poverty lines for the 1998 data. Using the consumption poverty line of CHF 23'700 entails a poverty head count of 5.5% (86 families). We choose the level of the income and permanent income poverty lines such that an identical proportion of families is considered poor using the three definitions. The income poverty line is then set at CHF 24'079, while the permanent income poverty line is established at CHF 25'054. In Figure II we depict a Venn diagram for the 1998 data. There are 2.4% of families which are identified as being poor only using the consumption indicator. The corresponding figure is 2.0% for the income threshold and 1.4% for the permanent income definition. Together, the permanent income predictor commonly identifies with consumption 2.6% of families, and with income 3.0% of households. On the other hand, 2.0% of families are classified as poor according to the income and consumption definitions. Only a 1.5% are simultaneously poor using the three definitions. There are 89.7% of families which are classified as non poor according to all three definitions.

The policy implications that may be derived from our analysis are examined in the next Section.

6. Policy Implications

If the state is to allocate resources to relieve poverty, there is a sense from which one may first want to channel efforts to reaching the chronic poor. It has been increasingly recognized that poverty is a multi-dimensional phenomenon. The methodology discussed here has a primary purpose of identifying the chronic poor using standard welfare indicators available in household surveys.

As comes out clearly from our Venn diagrams, the identification of the poor depends on the choice of welfare indicator. As such, this methodology and related results suggest that defining eligibility to poverty relief programmes on the basis of a single welfare indicator may exclude a substantial proportion of families in need when need is measured using alternative welfare standards.

There is thus some potential interest in reappraising the efficient targeting methodology in relation to poverty relief programmes (cf. van de Walle and Nead, 1995) when one accepts the multi-dimensional nature of deprivation. By hoping to exclude coverage of government assistance programmes to say the income *non-poor*, one may be excluding some consumption poor families from state relief. Clearly, by defining assistance on the basis of a permanent income index there are also potential targeting errors. However, a framework which is explicitly multi-dimensional allows the researcher to quantify the potential extent of classification error which the adoption of a unique indicator of welfare may entail.

7. Conclusions

The methodology discussed in this paper has two building blocks: an economic life-cycle consumption model and a derivation of predictors of permanent income chosen to minimize criteria related to mean-square error performance. The life-cycle framework is used to obtain an empirical model for the joint dependence of household income and consumption on permanent income. Predictors of the latter variable are obtained using welfare indicators, determinants of long-run income and socio-demographic variables.

The methodology yields interesting insights about the sensitivity of resource definitions when it comes to the identification of the poor population. Our empirical application in relation to Swiss household data illustrates this pattern: there is a substantial share of the poor population which household income, consumption and permanent income jointly identify as being poor. However, it is also the case that each separate indicator identifies groups of households as being in poverty when these same families cross the poverty line in other dimensions of well-being. This is the case for the two mostly commonly used indicators of well-being, namely income and consumption. But it is also true for the permanent income indices discussed here. As such there is some potentially new information about the incidence of poverty to be obtained from permanent income indices.

8. References

Abul Naga, R. (1994): "Identifying the Poor: A Multiple Indicator Approach", Distributional Analysis Research Program Discussion paper No. 9, LSE.

Abul Naga R. (2005): Social Welfare Orderings: A Life-Cycle Perspective, *Economica* (forthcoming).

Abul Naga, R. and E. Bolzani (2000): "Poverty and Permanent Income: A Methodology for Cross-Section Data", Discussion Paper, DEEP, University of Lausanne.

Abul Naga, R. and R. Burgess (1997): "Prediction and Determination of Household Permanent Income", Distributional Analysis Research Program Discussion paper No. 32, LSE.

Anand, S. and C. Harris (1990): "Food and Standard of Living: An Analysis based on Sri Lankan Data", in Drèze, J. and Sen, A. (eds.): *The Political Economy of Hunger*, Vol.1, Oxford University Press, Oxford.

Atkinson, A. (1989): *Poverty and Social Security*, Hemel Hempstead, Harvester Wheatsheaf.

Bartholomew, D. (1987): *Latent Variable Models and Factor Analysis*, New York, Oxford University Press.

Bhalla, S. (1979): "Measurement Errors and The Permanent Income Hypothesis: Evidence from Rural India", *American Economic Review* 69, 295-307

Blundell, R. and I. Preston (1998): "Consumption Inequality and Income Uncertainty", *Quarterly Journal of Economics* 113, 603-640.

Browing, M. (1991): "A Simple Non Additive Preference Structure for Models of Household Behaviour Over Time", *Journal of Political Economy* 99, 607-637.

Browning M. and A. Lusardi (1996): "Household Saving: Micro Theories and Micro Facts", *Journal of Economic Literature* 34, 1797–1855.

Chamberlain, G. (1977): "An Instrumental Variables Interpretation of Identification in Variance-Components and MIMIC models", in P. Taubman ed.: *Kinometrics*, Amsterdam, North Holland.

Chaudhuri, S. and M. Ravaillon (1994): "How Well Do Static Indicators Identify the Chronically Poor?", *Journal of Public Economics*, 53, pp.367-394.

Conférence Suisse des Institutions d'Action Sociale (2000): *Aide Sociale, Concepts et Normes de Calcul*, Bern, Paul Hampt AG.

Deaton A. (1992): *Understanding Consumption*, Oxford, Oxford University Press.

Deaton A. and C. Paxson (1994): "Intertemporal Choice and Inequality", *Journal of Political Economy* 102, 437-467.

Deaton, A. and Muellbauer, J. (1980): *Economics and Consumer Behavior*, Cambridge, Cambridge University Press.

Glewwe, P. and J. Van der Gaag (1990): Identifying the Poor in Developing Countries: Do Different Definitions Matter?", *Word Development*, 18, 803-814.

Hall, R. and Mishkin, F. (1982): "The Sensitivity of Consumption to Transitory Income: Estimates from Panel Data on Households", *Econometrica*, 50, 461-481.

Jöreskog, K. and A. Goldberger (1975): "Estimation of a Model with Multiple Indicators and Multiple Causes of a Single Latent Variable", *Journal of the American Statistical Association*, 70, 631.639.

Leu, R.E. and S. Burri (1998), "Poverty in Switzerland", *Revue Suisse d'Economie Politique et de Statistique*, Vol. 134 (3), 303-328.

Mercader-Prats, M. (1998): "Identifying Low Standards of Living: Evidence from Spain", *Research on Income Inequality*, 8, 155-173.

Mitrakos, T. and P. Tsakloglou (2000): "Income, Consumption or Something Else? Selecting a Welfare Indicator for Distributional Studies", Athens University of Economics and Business.

Muellbauer, J. (1983): "The Measurement of Long-Run Living Standards with a Permanent Income Model", mimeo Nuffield College, Oxford.

Musgrove P. (1979): "Permanent Income and Consumption in Urban South America", *American Economic Review* 69, 355-368.

Office Fédéral de la Statistique (1992): *Enquête sur la Consommation 1990: les Dépenses et les Revenus des Ménages Privés*, Bern, Publications de l'Office Fédéral de la Statistique.

Office Fédéral de la Statistique (1999): *Enquête sur les Revenus et la Consommation 1998: Nomenclature des Dépenses et des Revenus*, Neuchâtel, Publications de l'Office Fédéral de la Statistique.

Singh I., L. Squire and J. Strauss (1986): *Agricultural Household Models*, Baltimore, Johns Hopkins University Press.

van de Walle, D. and K. Nead (1995): *Public Spendings and the Poor*, Baltimore, Johns Hopkins University Press.

TABLES AND FIGURES

TABLE I: Summary Statistics

	CONS 90	*CONS 98*	*INC 90*	*INC 98*
Mean	63’260	67’740	63’700	75’660
Standard Deviation	27’940	35’850	29’100	44’730
Coefficient of Variation	0.44	0.53	0.46	0.59

Note: n=561 for the 1990 survey; n=1578 for the 1998 survey. *CONS* denotes household annual consumption expenditure and *INC* is household income. Resources are measured in 1990 Swiss Francs.

TABLE II: Parameters Estimation

	1990 (n = 561)	*1998 (n = 1578)*
INC	1.00	1.00
CONS	0.94 (0.085)	0.64 (0.070)
EDU	3.46 (0.344)	4.41 (0.407)
SWISS	-1.05 (1.871)	3.12 (2,072)
AGGLO	-0.08 (1.337)	-1.52 (1.327)
SEX	3.91 (2.380)	1.36 (1.944)
Sargan Test	1,79 [0.774]	1.11 [0.893]

Notes: 1) Standard errors appears inside parentheses. Test P-values are reported inside square brackets. 2) Sargan Test is the Sargan Test for endogeneity of Z variables.

TABLE III: Prediction of Permanent Income

	1990			1998		
	YPRED	***ZPRED***	***WPRED***	***YPRED***	***ZPRED***	***WPRED***
INC	0.55		0.40	0.63		0.36
CONS	0.47		0.34	0.58		0.33
EDU		3.46	0.97		4.41	1,90
SWISS		-1.05	-0.29		3.12	1.34
AGGLO		-0.08	-0.02		-1.52	-0.65
SEX		3.91	1.09		1.36	0.58
τ			0.72			0.57

Figure I – Identifying the Poor using Income, Consumption and the Multiple Indicator Index. A Venn Diagram for 1990 Data

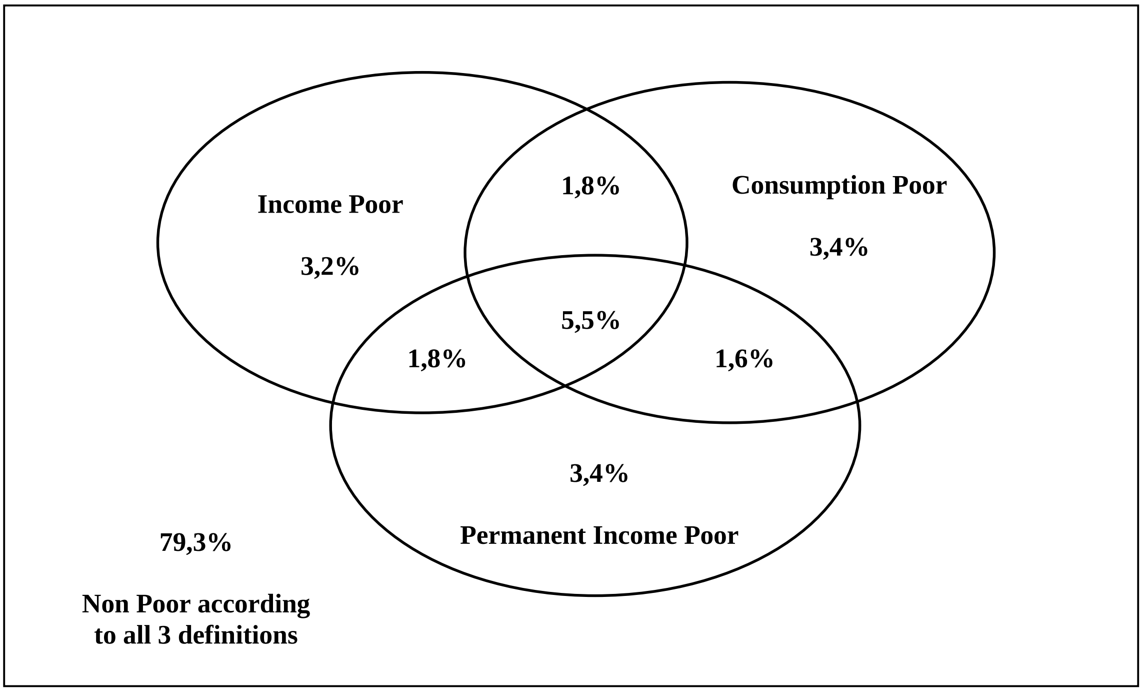

Figure II – Identifying the Poor using Income, Consumption and the Multiple Indicator Index. A Venn Diagram for 1998 Data