

Income Fluctuations, Poverty and Well-Being Over Time: Theory and Application to Argentina

by

Guillermo Cruces

ECLAC and STICERD

**Discussion Paper
No. DARP 76
July 2005**

**Distributional Analysis Research Programme
The Toyota Centre
Suntory and Toyota International
Centres for Economics and
Related Disciplines
London School of Economics
Houghton Street
London WC2A 2AE**

ABSTRACT

This paper studies poverty as a dynamic phenomenon, motivated by the recurring economic crises that affect developing countries and the incidence of income fluctuations on household welfare. While the increasing availability of household panel data has been exploited in theoretical analysis and empirical applications, the methodological and applied literatures still lack a unified framework. Echoing Atkinson (1987), this paper addresses the question of how poverty should be measured over time – or, in more general terms, how to measure well-being based on repeated observations of household income. The paper develops and illustrates a set of tools for empirical work based on theoretically sound extensions of the existing methodology for static distributional analysis. Moreover, this framework encompasses some of the existing approaches as special cases. These tools are illustrated with longitudinal data for Argentina in the 1995-2002 period, which is well suited for this type of analysis given the large fluctuations in household income due to the repeated economic crises in the country.

Keywords: Risk, Income Fluctuations, Panel Data, Poverty Measurement, Argentina

JEL Codes: D81, I32, D63

ACKNOWLEDGEMENTS

The views expressed here are those of the author and do not represent those of ECLAC or the UN. This paper constitutes the second Chapter of my PhD dissertation at the London School of Economics, supervised by Professor Frank Cowell. It has benefitted from joint work with Quentin Wodon, and from comments from (and discussions with) Frank Cowell, Stefan Dercon, Martin Ravallion, Ramses Abul-Naga and Sebastián Galiani, as well as detailed comments from my Ph.D examiners, Tony Atkinson and Jonathan Wadsworth. The usual disclaimer applies.

© Guillermo Cruces. All rights reserved. Short sections of text, not to exceed two paragraphs, may be quoted without explicit permission provided that full credit, including © notice, is given to the source.

Contact Address: CEPAL-Naciones Unidas, Casilla 179-D, Santiago, Chile. Email: Guillermo.Cruces@cepal.org

Distributional Analysis Research Programme

The Distributional Analysis Research Programme was established in 1993 with funding from the Economic and Social Research Council. It is located within the Suntory and Toyota International Centres for Economics and Related Disciplines (STICERD) at the London School of Economics and Political Science. The programme is directed by Frank Cowell. The Discussion Paper series is available free of charge and most papers are downloadable from the website. To subscribe to the DARP paper series, or for further information on the work of the Programme, please contact our Research Secretary, Sue Coles on:

Telephone: UK+20 7955 6678
Fax: UK+20 7955 6951
Email: s.coles@lse.ac.uk
Website: <http://sticerd.lse.ac.uk/DARP>

Contents

1	Introduction	3
2	Income Fluctuations, Poverty and Well-Being Over Time	4
2.1	Ex-ante and Ex-post Income Variability	4
2.1.1	Distributional analysis and panel data	4
2.1.2	Prospective evaluation of well-being: ex-ante utility and income risk	5
2.1.3	Retrospective evaluation of well-being: ex-post utility and income fluctuations	7
2.2	A Framework for the Evaluation of Income Fluctuations	9
2.2.1	The structure of the evaluation function	9
2.2.2	Evaluation of well-being and variability over time	11
2.2.3	“Fluctuation adjusted” population measures of well-being . .	13
2.2.4	Empirical implementation: alternative evaluation functions .	15
2.3	Comparison with Alternative Approaches	18
2.3.1	Ex-post measures: transient and chronic poverty	18
2.3.2	Ex-ante measures: risk and vulnerability	20
3	Application to Argentina 1995-2002: Poverty and Income Fluctuations in Turbulent Times	22
3.1	Household Data and Measurement of Poverty in Argentina	22
3.1.1	National cross sections and the Greater Buenos Aires rotating panel	22
3.1.2	Income aggregates and poverty measures	23
3.2	Poverty Trends and Short Term Dynamics	27
3.2.1	Poverty in turbulent times: Argentina during the 1990s	27
3.2.2	Income, prices and poverty	28
3.2.3	Poverty transitions and short term dynamics	33
3.3	Application of the Evaluation Framework to Argentina	35
3.3.1	Evolution of variability adjusted income and the variability premium	35
3.3.2	Variability adjusted poverty and sensitivity to discounting . .	37
4	Conclusion	41
	References	43

1 Introduction

This paper studies poverty as a dynamic phenomenon, motivated by the recurring economic crises that affect developing countries and the incidence of income fluctuations on household welfare. While the increasing availability of household panel data has been exploited in theoretical analysis and empirical applications, the methodological and applied literatures still lack a unified framework. Echoing Atkinson (1987), this paper addresses the question of how poverty should be measured *over time* – or, in more general terms, how to measure well-being based on repeated observations of household income. The paper develops and illustrates a set of tools for empirical work based on theoretically sound extensions of the existing methodology for static distributional analysis. The framework developed in the following pages accounts explicitly for the negative effects of income variability. This welfare criteria is based on the intuition, derived from the risk aversion literature, that households will prefer a steady stream of income to a variable one with the same mean. Since the proposed family of measures does not rely on a specific functional form, this paper's evaluation framework encompasses some of the existing approaches as special cases.

These tools are illustrated with longitudinal data for Argentina in the 1995-2002 period, which is well suited for this type of analysis given the large fluctuations in household income due to the repeated economic crises in the country. During the 1990s the country's economy underwent a process of market-oriented structural reforms. The resulting openness of the economy and the hard peg of the local currency to the US dollar contributed to a high degree of vulnerability to the succession of international financial crises of the second half of the decade, which was characterised as a period of "boom and bust." This series of external macroeconomic shocks and the weaknesses of the Argentine economy led to a severe economic and social crisis that started at the end of 2001 and continued well into 2002.

The discussion starts in Section 2 by establishing the foundations for the measurement of well-being based on panel data. Section 2.1 presents a model of distributional analysis and an analogy between with a simple expected utility model to establish the main intuitions behind the methodology. Section 2.2 then presents the proposed framework for the evaluation of past incomes. Section 2.3 compares this method with existing approaches, which are interpreted as special cases of the evaluation framework.

Section 3 presents an application of the evaluation framework developed in Section 2. Section 3.1 introduces the survey data and the income aggregate, and discusses methodological issues on poverty measurement in Argentina. Section 3.2 presents the main trends of GDP, income and poverty during the turbulent 1995-2002 period, and provides a simple analysis of short term poverty dynamics. Finally, Section 3.3 illustrates the uses of the evaluation framework with a rotating

panel from the Greater Buenos Aires region in the 1995-2002 period. Conclusions follow.

2 Income Fluctuations, Poverty and Well-Being Over Time

2.1 Ex-ante and Ex-post Income Variability

2.1.1 Distributional analysis and panel data

A myriad of papers on poverty dynamics investigate the movements into and out of poverty in two consecutive periods. This paper addresses a related but different question: echoing Atkinson (1987), they deal with the problem of how poverty should be measured *over time* – or, in more general terms, how to measure well-being based on repeated observations of household income. The framework developed in the following pages accounts explicitly for the negative effects of income variability. This welfare criteria is based on the intuition, derived from the risk aversion literature, that households will prefer a steady stream of income to a variable one with the same mean, at least in a second-best world with incomplete insurance and capital markets (Cowell, 1989).

The evaluation of well-being with panel data can be thought of as an extension of the standard model of distributional analysis. Cowell (2000) describes the welfare theory of income distribution in terms of \mathcal{F} , “the space of all univariate probability distributions” F of income y_i , and defines a “welfare ordering” $W : \mathcal{F} \rightarrow \mathbb{R}$ as a function that maps income distributions into the real line. The analysis of repeated observations is based on the distribution of N vectors of T observations y_{it} over the period $t = 1$ to T , defined as $\mathbf{y}_i = [y_{i1}, \dots, y_{iT}]$, in a population with N households. Slightly abusing Cowell’s (2000) notation, the evaluation framework developed in the following pages maps from \mathcal{F}^T , the space of distributions F^T of vectors \mathbf{y}_i , into the real line, with a transformation of the form $W^T : \mathcal{F}^T \rightarrow \mathbb{R}$.

The contribution of this paper is to define a transformation W^T in two steps, exploiting analogies with well-established results in economics and distributional analysis theory in each stage. The first step is the definition of an aggregate of the observations of income over time for household i that maps each vector \mathbf{y}_i into the real line. As discussed below, the average \bar{y}_i does not account for the welfare effects of income variability: the insight is to exploit the formal analogy between states of the world in the expected utility model and past incomes in a multi-period setting, in a procedure that echoes the social welfare function approach in distributional analysis (Atkinson, 1970). Building on the concept of the certainty equivalent of income, the first step reduces a distribution F^T of N vectors \mathbf{y}_i to F , a distribution of N scalars \tilde{y}_i . The second stage of the proposed W^T transformation involves an additional analogy: by showing that these scalars are appropriate money metrics of well-being, all the available tools of distributional analysis can be directly applied

to the distribution F . The W^T transformation is done first from each vector \mathbf{y}_i to a scalar \tilde{y}_i , and then from $F(\tilde{y}_i)$ into some distributional index.

This methodology owes a great deal to the standard model of risk (Pratt, 1964; Arrow, 1970) and to its reinterpretation in the social welfare context (Atkinson, 1970), as well as to the literature on lifetime income (Cowell, 1979). In terms of recent work in the poverty literature, the methodology is related to (and draws from) the concept of expected poverty (Ravallion, 1988), the transient-chronic decomposition (Jalan and Ravallion, 1998) and the recent body of work on economic vulnerability (Ligon and Schechter, 2003; Calvo and Dercon, 2003). The approach proposed below is discussed in the light of this literature, and it attempts to unify some of the existing methodologies under a general framework.

2.1.2 Prospective evaluation of well-being: ex-ante utility and income risk

The objective of this paper is to develop tools for the analysis of well-being based on panel data on household income. To reduce this problem to a tractable form, the proposed methodology aggregates these repeated observations into a single indicator for each household by means of an evaluation function. This Section presents a simple model of choice under uncertainty to introduce the intuition and some formal results for deriving such an indicator, and to clarify the difference between ex-ante and ex-post evaluations of well-being.

The standard expected utility framework, due to von Neumann and Morgenstern (1944), specifies a household's utility function $u(y)$, where y is income, consumption or wealth (income for short).¹ In this formulation, utility is defined over a single argument, in the tradition of Friedman and Savage (1948), Pratt (1964) and Arrow (1970).² The function u represents a reduced form that encapsulates the utility level resulting from behavioural responses in savings, labour supply and other choice variables (Cowell, 2005, Chapter 9): the focus is placed on the outcome and not on the process through which it is reached.³

The function u is assumed to be differentiable, strictly increasing and strictly concave. Uncertainty enters this model as a countable set Ω of possible future states of the world. The household evaluates its future prospects in time $t = 0$. These uncertain prospects are defined as state-contingent incomes y_ω that materialise in $t = 1$. Each of these possible states of the world $\omega \in \Omega$ has an associated probability τ_ω .

¹The discussion could be based on income or consumption. As money metrics of welfare, the two are used interchangeably in this paper. See Ravallion (1994) and Deaton (1997) for discussions of the advantages and disadvantages of using either for evaluating well-being.

²A concept lost in this formulation is the function of assets to link consumption in different periods. Kimball (1990), however, demonstrates the formal equivalence of the model of precautionary savings under income risk (Leland, 1968; Sandmo, 1970; Drèze and Modigliani, 1972) and models of choice under uncertainty.

³See Besley (1995) and Browning and Lusardi (1996) for reviews on responses to risk.

The function u is an ex-post utility function, since it evaluates the utility of a determinate income y (Felli, 2003). The household's ex-ante utility is defined as the expectation over the ex-post outcomes: in the words of Mas-Colell et al. (1995, Chapter 6, page 184), u is defined on "sure amounts of money," while ex-ante utility is "defined on lotteries." By means of the expected utility theorem (first due to von Neumann and Morgenstern, 1944), the ex-ante utility can be expressed as:

$$U = E[u(\hat{y})] = \sum_{\omega \in \Omega} \tau_{\omega} u(y_{\omega}) \quad (1)$$

where E is the expectations operator, \hat{y} the uncertain income prospect and y_{ω} the contingent income associated with state of the world ω .⁴

A key result in choice under uncertainty is that expected utility depends not only on $E[\hat{y}]$, the expectation of future outcomes, but also on their distribution. A simple example clarifies this assertion. The random variable \hat{y} is equal to either $y_H = \bar{y} + h$ or $y_L = \bar{y} - h$ with equal probability, and $h > 0$, so that a change in h represents a mean preserving spread in future income.⁵ Then U can be written as $U = \frac{1}{2}u(y_H) + \frac{1}{2}u(y_L)$, which depends on the value of h in the following way:

$$\frac{\partial U}{\partial h} = \frac{1}{2}u'(y_H) - \frac{1}{2}u'(y_L) \quad (2)$$

where u' represents the first derivative of u . Risk aversion follows from the concavity of u , which implies that u' is decreasing, and results in a negative value of $\partial U / \partial h$. The intuition is that greater uncertainty about future income makes a risk averse household worse-off, since by the concavity of u the possibility of a gain is outweighed by the prospect of a loss.

An important implication of risk aversion is that the expected value of income – $E[\hat{y}] = \bar{y}$ in the example above – is not a suitable money metric measure of well-being since it does not reflect the effects of risk on utility (Cowell, 1979). As shown in the example, an increase in h reduces expected utility, yet leaves $E[\hat{y}]$ unchanged. However, the concept of certainty equivalence – a fundamental notion in the theory of choice under uncertainty – provides an intuitively appealing indicator of well-being. The (non-random) certainty equivalent income \tilde{y}_{ce} is implicitly defined by:

$$U = E[u(\hat{y})] = u(\tilde{y}_{ce}) \quad (3)$$

An expected utility maximising household with preferences defined by u would be

⁴Alternatively, the set of outcomes can be continuous. In that case, the expectation is defined over the integral of the distribution of \hat{y} . It is assumed throughout that this distribution is well-behaved, that $\sum_{\omega \in \Omega} p_{\omega} = 1$, and that all functions have the regularity conditions of the standard model of choice under uncertainty (Newbery and Stiglitz, 1981). See Mas-Colell et al. (1995, Chapter 6) for a detailed presentation of the expected utility model and its underlying axioms.

⁵These results hold under the much more general conditions of second order stochastic dominance (Rothschild and Stiglitz, 1969), of which this example is a special case.

indifferent between receiving \tilde{y}_{ce} with certainty in the future or facing the uncertain prospect \hat{y} . For a risk-averse household, Equation 3 implies, by the concavity of u and Jensen's inequality, that $\tilde{y}_{ce} < E[\hat{y}]$. Moreover, since $E[u(\hat{y})]$ is decreasing in the level of risk, it follows from Equation 3 that \tilde{y}_{ce} is also negatively affected by greater uncertainty. The certainty equivalent is thus better suited than $E[\hat{y}]$ as a money metric indicator of well-being, since it captures the disutility arising from uncertainty.

Risk aversion and the certainty equivalent, however, are ex-ante concepts, and this paper's aim is to measure well-being based on (ex-post) panel data: the following pages deal with the distinction between ex-ante prospects and ex-post outcomes.

2.1.3 Retrospective evaluation of well-being: ex-post utility and income fluctuations

The expected utility U in Equation 1 is defined over events that have not occurred, while the underlying utility function u is defined over certain ex-post outcomes, an aspect of the theory that is often overlooked (Hammond, 1981; Milne and Shefrin, 1988; Ravallion, 1988, constitute some exceptions). It is necessary to distinguish between "income risk," an ex-ante concept based on variability in future prospects, and "income fluctuations," defined as experienced variability in the past. Panel data on incomes is inherently linked with both concepts: it reflects income fluctuations and thus it is ex-post by definition, but these fluctuations result from the presence of ex-ante income risk, as discussed below.

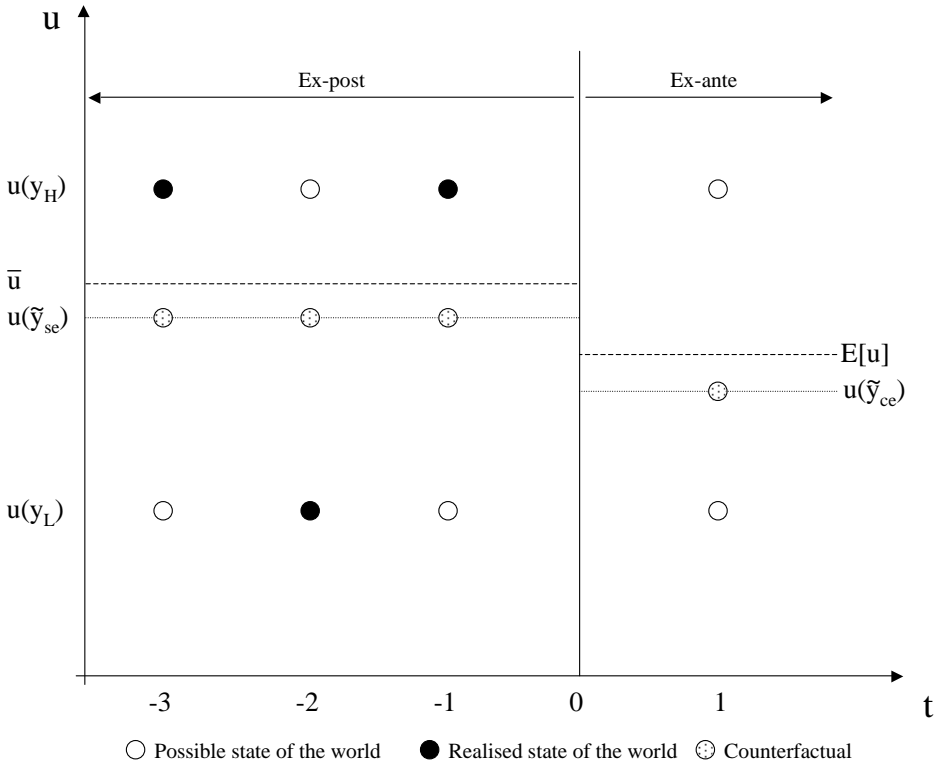
The setting described by Equation 1 corresponds to the case of income risk: once the state of the world ω materialises in $t = 1$, the random variable \hat{y} takes a value and ex-post utility becomes $u(y_\omega)$, either $u(y_H)$ or $u(y_L)$ in the example above. To introduce the idea of income fluctuations, it is necessary to consider multiple past periods. It is assumed that a household at $T + 1$ has faced a series of consecutive independent realisations of states of the world drawn from the set Ω , which result in a past stream of income $\mathbf{y} = [y_1, \dots, y_T]$. While every \hat{y}_t is a random variable before its realisation, from the retrospective point of view of $t + 1$, every y_t is just a determinate quantity given by the materialised state of the world ω_t .

Well-being over time is determined by the experienced income stream \mathbf{y} . The average of experienced utilities, while not accounting for time preferences, provides a simple aggregate of utility over the T periods:

$$\bar{u} = \frac{1}{T} \sum_{t=1}^T u(y_t) \quad (4)$$

Equations 1 and 4 are formally similar, but the two represent the distinct but related concepts of income risk and income fluctuations.

Figure 1: Ex-Ante Risk and Ex-Post Variability: States of the World and Realised Incomes



The example in Figure 1 illustrates this point. The Figure depicts the past outcomes and the future prospects for a household from the point of view of the present ($t = 0$) according to the formulations of Equations 1 and 4. The income variable \hat{y}_t is assumed to have the same distribution in each period $t = \{-3, -2, -1, 1\}$, being either $y_H = \bar{y} + h$ or $y_L = \bar{y} - h$ with equal probability.

While both U and \bar{u} are determinate quantities, Equation 1 reflects the expected utility of the household in $t = 1$ from the point of view of $t = 0$, while Equation 4 is the evaluation of a series of past outcomes at $t = \{-3, -2, -1\}$ from the same point of view. To stress this difference, \bar{u} in Figure 1 is the result of two y_H and one y_L realisations, which differs from the expected utility $U = E[u]$, represented by the average of $u(y_H)$ and $u(y_L)$.

While income risk as summarised in Equation 1 and income fluctuations in Equation 4 are different in their nature, the connection between the two is that (ex-ante) risk is the source of (ex-post) fluctuations: with no risk, the distribution of \hat{y}_t would be a fixed value at every point in time, and the resulting stream of past income would be flat.

Moreover, while a risk averse household would prefer lower variability for a given value of expected future prospects (Equation 2), a similar intuition applies to the simple aggregate of past utilities given by Equation 4: a risk averse house-

hold would trade off a reduction in the average for lower variability in past incomes, at least in a second-best world with incomplete insurance and capital markets (Cowell, 1989).

The following Section develops a framework for the evaluation of past incomes based on this analogue of risk aversion in an ex-post setting and on the formal similarity between the formulations of expected and average experienced utilities.

2.2 A Framework for the Evaluation of Income Fluctuations

2.2.1 The structure of the evaluation function

A general formulation for an aggregate of household income over time, $\mathbf{y} = [y_1, \dots, y_T]$, is given by an evaluation function V that maps a vector of T observations into the real line:

$$V(\mathbf{y}) = V(y_1, \dots, y_T) \quad (5)$$

In terms of the Introduction's terminology, V defines a transformation $W : \mathcal{F} \rightarrow \mathbb{R}$, from the distribution of past incomes for a household into the real line.

The problem remains in defining a functional form for V , which determines the normative criteria associated with the evaluation of \mathbf{y} . The presence of the time dimension introduces a higher degree of complexity with respect to the analysis of an income distribution at one point in time.

The framework proposed here concentrates on a series of intuitive criteria. As a starting point, it is reasonable to assume that V should be non-decreasing in its arguments. Moreover, the aggregate level of welfare over the T periods should depend not only on the level of \mathbf{y} , but also on its variability. The idea, pervasive in economic theory, is that risk averse agents are willing to trade off a reduction in expected income for certainty. In an ex-post setting, the concept of risk aversion translates into a "dislike" of fluctuations, or variability aversion (to be formally defined below).

These two basic normative principles can be incorporated into the evaluation function V based on the results and intuitions of the previous Section. The evaluation framework, however, does not rely on utility functions u : the function V is interpreted within a social welfare context as a judgement on the welfare value of the experienced income stream. This approach, followed by Cruces and Wodon (2003b) and Ligon and Schechter (2003) among others, implies that it is not necessary to impute a utility function and assume homogeneous preferences in the population.

In the evaluation framework, the stream of past income $\mathbf{y} = [y_1, \dots, y_T]$ is assessed retrospectively from the point of view of period $T + 1$. The parallelism of V with the expected utility formulation in Equation 1 means that each past income y_t is evaluated by a sub-function – or instantaneous evaluation – $v(y_t)$, assumed to be

continuous, strictly increasing and twice-differentiable. The result is the following characterisation of V :

Definition 1 Additive, time-separable evaluation function. *The evaluation of the observed stream of past income $\mathbf{y} = [y_1, \dots, y_T]$, $V(\mathbf{y})$, is the discounted average of the instantaneous evaluation function v for each period from $t = 1$ to T :*

$$V(\mathbf{y}) = \sum_{t=1}^T \Delta(t)v(y_t) \quad (6)$$

The weights are given by a discounting function $\Delta(t)$, with $0 < \Delta(t) \leq 1$, and normalised (without loss of generality) so that $\sum_{t=1}^T \Delta(t) = 1$.

The structure imposed by Equation 6 implies the following analogy: the model of choice under uncertainty in a single period (Equation 1) and the evaluation of past incomes based on an additive, time-separable evaluation function as in Equation 6 are formally equivalent. The results from the former can be applied to the latter by: a) replacing the function u by its analogue v , b) replacing state-contingent incomes y_ω by observed incomes y_t , and c) replacing probabilities τ_ω by $\Delta(t)$.

This analogy is established by inspection of Equations 1 and 6: ranking vectors of past incomes \mathbf{y} according to V is formally identical to ranking probability distributions according to the expected utility criterion. From a formal point of view, Equation 6 can be treated as a special case of Equation 1 with $u = v$, $\omega = t$, $y_\omega = y_t$ and $\tau_\omega = \Delta(t)$, that is, “as if” past incomes were drawn from T events with outcomes y_t . The formulation for V in Equation 6 implies that the formal results from risk theory can be applied directly to the evaluation framework, although the interpretation of these results differs: the connection between the theory of risk and the evaluation framework stems from the discussion of income risk and income fluctuations in the previous Section.⁶

The main difference between risk and the formulation of Equation 6 is the presence of the discounting function $\Delta(t)$, which accounts explicitly for the time dimension of the problem of evaluating past incomes. The motivation for the incorporation of $\Delta(t)$ into V is the presence of pure time preferences: in the example of Figure 1, a household would not be indifferent to the ordering of past incomes, giving more weight to events closer in time.⁷ The function $\Delta(t)$ is thus required to increase as t approaches T . Since the discount factors are normalised to sum one, they can be interpreted as “discounting weights.” In the simplest form of aggrega-

⁶The idea of borrowing results from risk theory is at the basis of Atkinson’s (1970) re-interpretation of choice under uncertainty in a social welfare context. However, a social welfare function aggregates the distribution of income in a point in time for a population, while V is a social evaluation of household welfare as defined by Equation 5.

⁷Alternatively, $\Delta(t)$ can also be motivated by the presence of imperfect storage technologies, in which only a limited amount of income can be left for future use.

tion, every period of time is given an equal weight so that $\Delta(t) = 1/T$.⁸

The parallel with the theory of risk is completed by the following Proposition, which is the evaluation framework's analogue of risk aversion, and specifies a key condition for v :

Proposition 2 *Variability aversion. The function v is assumed to be strictly concave, which implies that $V(\mathbf{y})$ is strictly decreasing in the dispersion of $\mathbf{y} = [y_1, \dots, y_T]$ weighted by the discounting function $\Delta(t)$. The dispersion is defined in the sense of Rothschild and Stiglitz's (1969) second order stochastic dominance.*

This result derives from the concavity of v , and it is equivalent to the risk aversion result ($\partial U/\partial h < 0$) in Equation 2. The curvature of v determines the degree of variability aversion, and its magnitude can be quantified by defining measures of absolute and relative aversion by analogy with the canonical model of risk (Pratt, 1964; Arrow, 1970).

Proposition 2 implies that for a given average discounted income over time, $\bar{y}_\Delta = \sum_{t=1}^T \Delta(t)y_t$, a higher variability in the underlying stream reduces welfare as captured by V . The properties of V and v given by Definition 1 and Proposition 2 adapt the concept of risk aversion to the intertemporal setting, incorporating in the evaluation framework the principle that past fluctuations reduce welfare, and should be penalised by an evaluation function. While not all fluctuations might be considered bad, for instance when income grows over time (Cowell, 1989), the variability aversion is based on the discussion of the effects of riskiness on household utility in Section 2.1. Moreover, the presence of the discounting function $\Delta(t)$ in V ensures that the evaluation of past incomes is not invariant with respect to the ordering of the components of \mathbf{y} , except for the special case in which $\Delta(t) = 1/T$. For instance, in a setting with $T = 2$, if $y_2 > y_1$ then $V(y_1, y_2) \geq V(y_2, y_1)$: an increasing income stream results in a higher evaluation than a decreasing stream.

The following pages build on the additive structure of the evaluation function to specify measures of well-being and its variability over time.

2.2.2 Evaluation of well-being and variability over time

The concept of variability aversion and the structure of V given by Definition 1 imply that another important notion from the theory of choice under uncertainty can be adapted to the evaluation of past incomes. The analogue of the certainty equivalent income (Equation 3) is given by:

Definition 3 *The stability equivalent income \tilde{y}_{se} is a real number such that*

$$V(\mathbf{y}) = v(\tilde{y}_{se}) \tag{7}$$

⁸Section 3 discusses specific functional forms for $v(y)$ and $\Delta(t)$.

\tilde{y}_{se} is the level of income that, if received in every past period $t = 1$ to T , as $\tilde{\mathbf{y}} = [\tilde{y}_{se}, \dots, \tilde{y}_{se}]$, would result in the same level $V(\mathbf{y})$ of the evaluation function as the observed stream $\mathbf{y} = [y_1, \dots, y_T]$.

The continuity of v guarantees that \tilde{y}_{se} exists, and its concavity implies that it is decreasing in the dispersion of \mathbf{y} . Both results are formally analogous to those for the certainty-equivalent in risk theory (Pratt, 1964).⁹

The counterfactual stability equivalent \tilde{y}_{se} is a function of the shape of v and the level and distribution of y_t in \mathbf{y} . Under the assumption that the variability of past income reduces well-being, the \tilde{y}_{se} can be interpreted as a “variability adjusted” income. It constitutes a welfare-based counterpart to the statistical measure \bar{y}_Δ , and it is thus superior to the discounted average income as an indicator of well-being, just as the certainty equivalent \tilde{y}_{ce} was deemed superior to $E[\hat{y}]$ in the expected utility model of Section 2.1.¹⁰

Finally, another concept that can be adapted from the theory of choice under uncertainty is the risk premium. Since \tilde{y}_{se} is lower than the average income \bar{y}_Δ because of the concavity of v , the difference between the two provides a money metric of the loss in household welfare attributable to income fluctuations, as described in the following Definition:

Definition 4 *The variability premium π_v and the relative variability premium Π are real numbers such that*

$$\pi_v(\mathbf{y}) = \bar{y}_\Delta - \tilde{y}_{se} \quad (8)$$

$$\Pi(\mathbf{y}) = \frac{\pi_v}{\bar{y}_\Delta} \quad (9)$$

where \bar{y}_Δ is the weighted average income over time given by $\bar{y}_\Delta = \sum_{t=1}^T \Delta(t)y_t$, and \tilde{y}_{se} is the stability equivalent income defined above.

Since \tilde{y}_{se} is decreasing in the dispersion of \mathbf{y} , π_v and Π are increasing in the same parameter. Moreover, the curvature of v also affects these quantities through its effect on \tilde{y}_{se} : for a given \mathbf{y} , the stability equivalent income falls and the premia increase with v 's degree of variability aversion. The premium π_v can be considered a welfare-based measure of the variability of past incomes, while the relative premium Π shares the same property and has the advantage of being unit-free.¹¹

⁹This stability equivalent income is formally equivalent to Atkinson's (1970) “equally distributed equivalent level of income,” and it is closely related to Ravallion's (1988) notion of “stabilised income.”

¹⁰This argument is derived from Cowell's (1979) discussion of a “lifetime welfare-equivalent current income” for an income stream (Definition 2, page 12).

¹¹Some manipulation shows that $\Pi(\mathbf{y}) = 1 - \tilde{y}_{se}/\bar{y}_\Delta$, which is formally equivalent to Atkinson's (1970) simple inequality index.

2.2.3 “Fluctuation adjusted” population measures of well-being

In terms of the Introduction’s terminology, both V and \tilde{y}_{se} define transformations $W : \mathcal{F} \rightarrow \mathbb{R}$ that result in scalar measures of well-being based on a household’s past incomes. While $V(\mathbf{y})$ and \tilde{y}_{se} provide equivalent measures, the unit of $V(\mathbf{y})$ is given by the specific functional form of v . This implies that simple transformations of v will lead to different values of $V(\mathbf{y})$. Moreover, the resulting measures from two functions, $V(\mathbf{y})$ and $V'(\mathbf{y})$, are not directly comparable since they are not necessarily in the same scale.

The importance of the stability equivalent income \tilde{y}_{se} resides in the fact that it provides a money metric of household welfare as captured by the evaluation function V . The following Proposition establishes this result:

Proposition 5 *The stability equivalent income \tilde{y}_{se} , given by Definition 3, is a sufficient money metric statistic of household welfare defined by the evaluation functions v and V .*

The proof of this Proposition relies on the uniqueness of the certainty equivalent in risk theory (Pratt, 1964). With a well-behaved, standard function v , Equation 7 implicitly defines V and \tilde{y}_{se} as monotonic transformations of each other, because v is strictly increasing and continuous. Since v takes income as its argument, the scalar measure of well-being, \tilde{y}_{se} , is money metric.

This implies that the stability equivalents \tilde{y}_{se} and \tilde{y}'_{se} , corresponding to two functions $V(\mathbf{y})$ and $V'(\mathbf{y})$, are directly comparable because they are both measured in money terms. Besides this property, Proposition 5 and the nature of the stability equivalent imply that \tilde{y}_{se} satisfies Cowell’s (1995, Chapter 1) requirements for a measure of income, which must be “measurable [...] and comparable among different persons.”¹³ For this reason, Proposition 5 ensures that all the tools of univariate distributional analysis can be applied to the distribution of \tilde{y}_{se} .

This procedure constitutes a second $W : \mathcal{F} \rightarrow \mathbb{R}$ transformation. The problem of studying the distribution of vectors \mathbf{y} in the population is reduced, by means of the evaluation function V , to the study of $F(\tilde{y}_{se})$, the univariate distribution of the stability equivalent income. This means that any poverty measure P , inequality measure I , and social welfare function W defined over the distribution of incomes y at one point in time can also be applied to the distribution of \tilde{y}_{se} (Atkinson and Bourguignon, 2000). Moreover, since \tilde{y}_{se} is money metric, its distribution can be compared to that of the average over time for each household, \bar{y} . This exercise is akin to the comparison of distributions before and after tax or transfers, for which there exists an extensive literature and a standard set of tools (Cowell, 1995).

The two-step methodology described in this Section is similar in spirit to the process of equalisation in distributional analysis. Survey data usually contain

¹³Incomes y_t are adjusted for differences in household size and composition by an equivalence scale, and normalised so that they can be compared over time. See Section 3.1 for details of these adjustments.

information about a number of income-earners in a household. The equivalisation process converts a vector of incomes from different members of a household into a single measure, according to some welfare criteria – usually taking into account the gender and age composition of the household (see Section 3.1 for details on the Argentine case). The analysis is then carried out on the distribution of the scalar equivalised aggregate.

The framework as stated in these pages seems limited to stationary periods, or to periods with rises and falls in earnings. However, the ideas presented in this Section can still be applied to contexts where household income grows, for instant by defining the income aggregate as a fraction of average population income, as done by Cruces et al. (2004) with panel data from the United Kingdom during a period of aggregate growth.

2.2.4 Empirical implementation: alternative evaluation functions

This Section deals with the implementation of the evaluation framework. It adds structure to the formulation in the previous Sections by stipulating a series of functional forms for v and studying the characteristics of the resulting stability equivalent incomes \tilde{y}_{se} .

The definition of V in Equation 6 relies on the functions v and Δ . The empirical applications presented below are based on an exponential discounting function, although $\Delta(t)$ can in principle accommodate hyperbolic discounting or other suitable principles (O’Donoghue and Rabin, 1999). In what follows, $\Delta(t)$ is given by:

$$\Delta(t, T, \delta) = \frac{\delta^{T-t}}{\sum_{t=1}^T \delta^{T-t}} \quad (10)$$

with a bounded discount factor, $0 < \delta \leq 1$. The weighted or discounted average of income is then defined as:

$$\bar{y}_\Delta = \sum_{t=1}^T \left[\frac{\delta^{T-t}}{\sum_{t=1}^T \delta^{T-t}} y_t \right] \quad (11)$$

The formulation in Equation 10 and the bounds in the parameter δ ensure that $\sum_{t=1}^T \Delta(t) = 1$ and that the function is increasing in t .¹⁴ The parameter δ is the discount factor, which defines the relative weight given to the recent past with respect to events further in away in time. As δ approaches 0, more weight is placed on the last period, T , and in the limit $\Delta_{\delta \rightarrow 0}(T) = 1$ and $\Delta_{\delta \rightarrow 0}(t \neq T) = 0$. The opposite case is that of no discounting, which corresponds to $\delta = 1$: this implies that the “discount weights” simplify to $\Delta(t) = 1/T$. In this case, the evaluation function V becomes the average of $v(y_t)$, and Equation 11 represents \bar{y} .

¹⁴The motivation for an increasing $\Delta(t)$ derives from pure time preferences, which give more weight to events closer to the present. However, the formulation in Equation 10 allows for a decreasing $\Delta(t)$ if $\delta \geq 1$. In that case, larger values of δ imply more weight for events further in the past. In the limit, $\Delta_{\delta \rightarrow +\infty}(1) = 1$ and $\Delta_{\delta \rightarrow +\infty}(t \neq 1) = 0$.

Regarding the functional form of v , the prominence of choice under uncertainty in the evaluation framework implies that intuitive functional forms for v are derived from the instantaneous utility functions used in the theory of risk.

A first alternative is the analogue of the isoelastic utility function,¹⁵ the Constant Relative Variability Aversion (CRVA). The following Equations describe this function and the implied stability equivalent income:

$$v(y) = \begin{cases} \frac{y^{1-\rho}}{1-\rho} & \text{if } \rho \neq 1 \\ \ln y & \text{if } \rho = 1 \end{cases} \quad (12)$$

which results in

$$\tilde{y}_{se} = \begin{cases} \left[\sum_{t=1}^T \Delta(t) y_t^{1-\rho} \right]^{\frac{1}{1-\rho}} & \text{if } \rho \neq 1 \\ \prod_{t=1}^T y_t^{\Delta(t)} & \text{if } \rho = 1 \end{cases} \quad (13)$$

This functional form allows for a sensitivity parameter ρ , the analogue of the relative risk aversion parameter in the Constant Relative Risk Aversion (CRRA) utility function. Since \tilde{y}_{se} is decreasing in ρ , it quantifies the effect of past variability on well-being: for a fixed dispersion of past incomes, higher values of ρ result in lower stability equivalent incomes.

The CRVA form implies that the degree of aversion to fluctuations is constant relative to the household's income, since the curvature of v is constant. This is compatible with the intuition that "the rich are more tolerant of risks than the poor" (Deaton and Muellbauer, 1980, Chapter 14), and it is reflected in the fact that the relative stability premium Π (Equation 9) based on Equation 13 remains constant when all incomes in y are multiplied by the same positive factor (in the case of no discounting).

An alternative to the CRVA functional form is given by the analogue of the Constant Absolute Risk Aversion (CARA) utility function, which is also widely used in the risk literature. The Constant Absolute Variability Aversion (CAVA) is given by:

$$v(y) = -\frac{1}{\eta} e^{-\eta y} \quad (14)$$

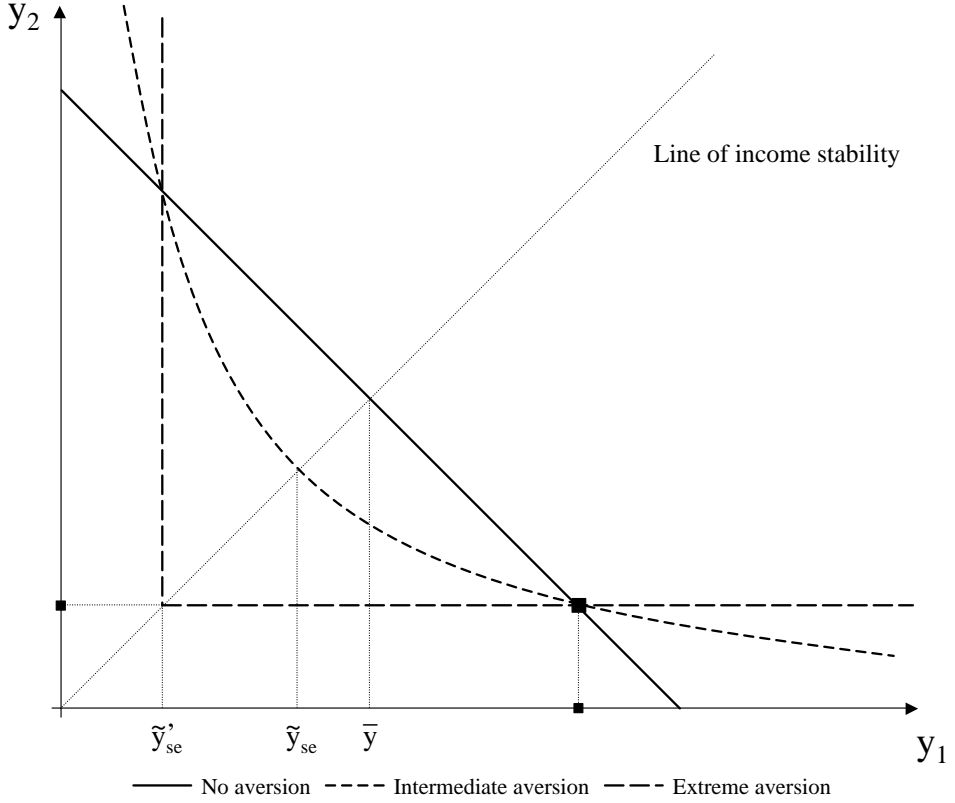
resulting in the stability equivalent:

$$\tilde{y}_{se} = -\frac{1}{\eta} \ln \left[\sum_{t=1}^T \Delta(t) e^{-\eta y_t} \right] \quad (15)$$

Equation 14 also allows for a sensitivity parameter, $\eta \neq 0$, which captures the degree of variability aversion, since larger values of η imply lower stability equivalents \tilde{y}_{se} . Moreover, this formulation is also compatible with the intuition mentioned above: as income grows, households are willing to accept larger fluctua-

¹⁵This formulation is also known as the the Constant Relative Risk Aversion (CRRA) utility function.

Figure 3: Evaluation Function Contours for Different Degrees of Variability Aversion



tions. Compared to the CRVA, the CAVA functional form implies that the relative stability premium Π (Equation 9) falls when all incomes in y are multiplied by the same positive factor (again, in the case of $\delta = 1$).

Finally, two extreme cases are presented for illustration. The first case, in which v is not strictly concave, is given by a linear evaluation function:

$$v(y) = y \quad (16)$$

resulting in

$$\tilde{y}_{se} = \bar{y}_{\Delta} = \sum_{t=1}^T \Delta(t) y_t \quad (17)$$

This formulation can be interpreted as the limit case of the CRRA function with $\rho = 0$: with no variability aversion, the fluctuation adjusted income reduces to the discounted average over time.

The opposite case to Equation 16 is given by extreme variability aversion, corresponding to the limit case of the CRRA function with $\rho \rightarrow +\infty$. In the case of no discounting, this formulation results in:

$$\tilde{y}_{se} = \min(y_t) \quad (18)$$

The implied evaluation function only takes into account the lowest of past incomes, and it is the analogue, in the evaluation context, of a “Rawlsian” social welfare function (Hammond, 1975).

Figure 3 highlights the difference between these different degrees of variability aversion, which are not readily apparent in the evaluation-income space of previous figures. With $T = 2$, the Figure represents the stability equivalent income in the y_1, y_2 space for evaluation function contours with different degrees of variability aversion and no discounting. The CRVA and CAVA cases are represented by the “intermediate aversion” curve in the Figure, while the contour implied by Equation 16 is the “no aversion” solid straight line, which results in $\tilde{y}_{se} = \bar{y}$. Finally, the extreme aversion case is depicted by the kinked contour in Figure 3.

The following Section compares the evaluation framework with the related methodologies in the poverty and distributional literature. The Conclusion discusses some possible extensions to the evaluation framework by incorporating other principles beyond variability aversion.

2.3 Comparison with Alternative Approaches

2.3.1 Ex-post measures: transient and chronic poverty

The evaluation framework has a series of advantages over the existing approaches for the analysis of panel data on incomes. This Section reviews the results from the two main alternatives in the literature.

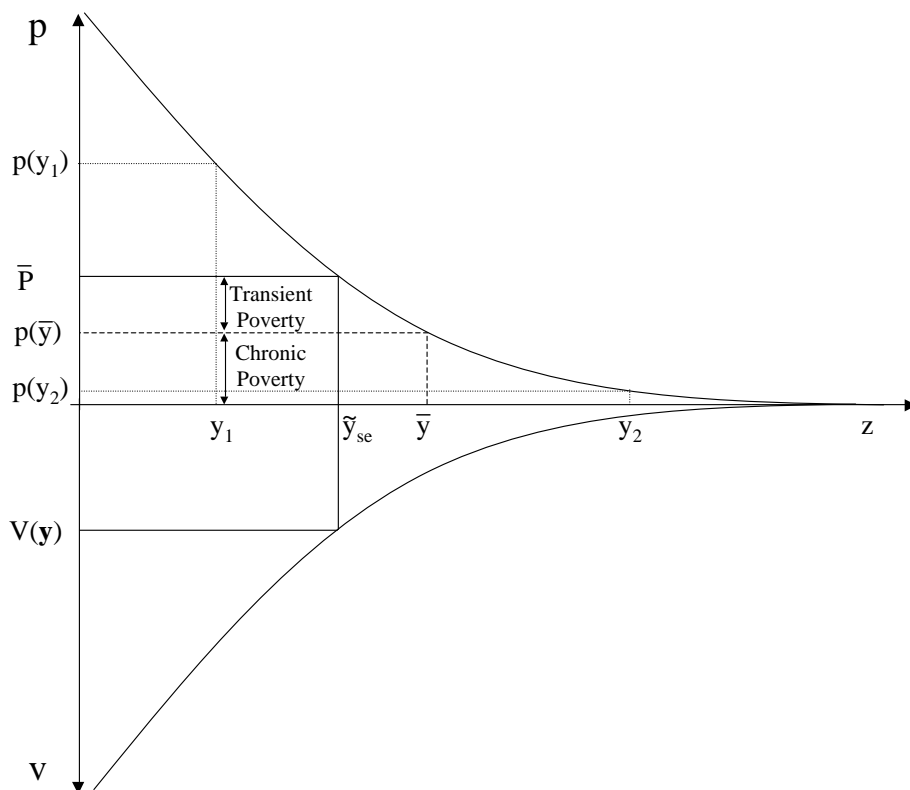
The first approach, widely used in empirical applications, is the transient-chronic poverty decomposition. This methodology originates in Ravallion’s (1988) contribution on poverty and welfare variability, on which Jalan and Ravallion (1998; 2000) base their definitions of transient and chronic poverty – Cruces and Wodon (2003c) build on these categories to study the Argentine case.

The approach applies Atkinson’s (1987) family of additive poverty measures to a multi-period setting. A household’s poverty in time t is given by the evaluation function $p(y_t)$, where p is required to be additive, strictly convex and decreasing up to the poverty line, and taking a value of zero thereafter. Intertemporal poverty P_i , chronic poverty C_i and transient poverty T_i are defined as:

$$\begin{aligned} P_i &= \frac{1}{T} \sum_{t=0}^T p(y_{it}), \\ C_i &= p(\bar{y}_i) \text{ and} \\ T_i &= P_i - C_i \end{aligned} \tag{19}$$

Intertemporal poverty is the average of the poverty evaluations over time for a household, while chronic poverty reflects the poverty evaluation at the average income over time for i , \bar{y}_i . Finally, transient poverty is calculated as the difference

Figure 4: Transient, Chronic and Variability Adjusted Measures of Poverty



between the two. Jalan and Ravallion (1998) compute these measures for every household and then aggregate them into population averages, using the squared poverty gap function for p (Equation 25).

In terms of empirical applications, the main difference with the evaluation framework is that Jalan and Ravallion (1998) work with poverty evaluations, whereas the methodology presented in Section 2.2 first derives variability adjusted measures of income with an evaluation function, and then computes poverty indices based on them (Section 3 below presents an example of this procedure).

Despite this difference, the transient-chronic decomposition represents a special case of the evaluation framework. The poverty evaluation function p can be interpreted as an evaluation function by setting $v = -p$, which reflects an assessment of i 's well-being that gives zero weight to income above the poverty line. This is illustrated in Figure 4, which presents an example for $T = 2$, with no discounting ($\Delta(t) = 1/T$) and with y_1 and y_2 below the poverty line. In the Figure, the poverty evaluation p is mirrored by the evaluation function $v = -p$. This representation highlights the connection between the two methodologies: the money metric indicator \tilde{y}_{se} based on $v = -p$ represents the fixed level of income that would result in the same intertemporal poverty P as the observed stream \mathbf{y} .

A disadvantage of the Jalan and Ravallion (1998) approach is that the aversion

to variability is implicitly built into the poverty evaluation function p , which amalgamates the poverty and time dimensions. This function, however, may not be appropriate for evaluating income over time. For instance, most of the transient-chronic applications are based on the squared poverty gap, which is akin to a quadratic utility function and thus implies the undesirable property of increasing relative risk aversion (Kurosaki, 2003).¹⁶ On the contrary, the two-step procedure proposed here ensures that these two facets are accounted for by a separate set of principles. The stability equivalent is derived from a set of principles specific to the time dimension, summarised by v , and the measure of poverty is then obtained by applying a function p , specific to the income dimension, to this household aggregate.

Finally, the evaluation framework has two additional advantages. On the one hand, it allows to compute variability adjusted measures of income for the whole population, while the transient-chronic decomposition by definition applies only to the poor. On the other hand, the incorporation of a discount factor in Equation 6 accounts for the trajectory of income, whereas the measures in Equation 19 are invariant to changes in the ordering of incomes y_t in \mathbf{y} .

Some of the advantages of the evaluation framework over the transient-chronic decomposition are also present when compared with the vulnerability approach, analysed in the following pages.

2.3.2 Ex-ante measures: risk and vulnerability

The vulnerability approach, as defined by Ligon and Schechter (2003), attempts to capture the ex-ante risk faced by households.¹⁷ They rely on a “welfare function” U_i^{LS} defined over household income y_i . The vulnerability of a household i , V_i^{LS} , is given by the difference between U_i^{LS} evaluated at the poverty line z and the expectation of $U_i^{LS}(y_i)$:

$$V_i^{LS} = U_i^{LS}(z) - E[U_i^{LS}(y_i)] \quad (20)$$

which is decomposed into “poverty” and “risk” components:

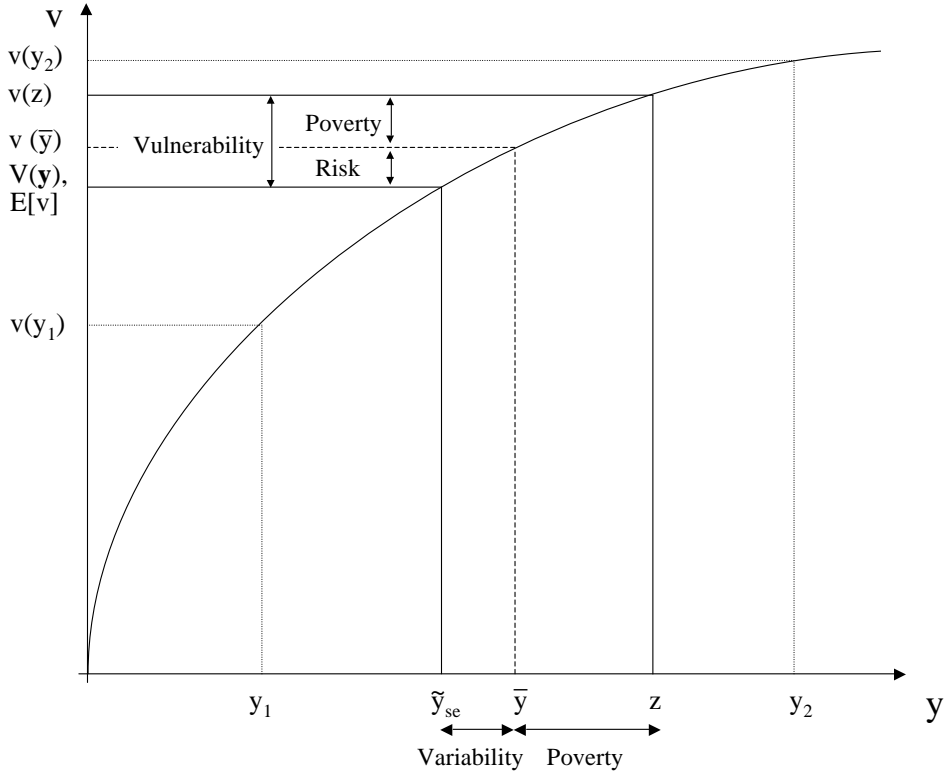
$$V_i^{LS} = \underbrace{\{U_i^{LS}(z) - U_i^{LS}(E[y_i])\}}_{Poverty} + \underbrace{\{U_i^{LS}(E[y_i]) - E[U_i^{LS}(y_i)]\}}_{Risk} \quad (21)$$

The expectation operator in Equations 20 and 21 refers to the distribution of future income: V_i^{LS} is meant to capture ex-ante risk and is thus “inherently forward-looking” (Ligon and Schechter, 2004). This is the main difference between the vul-

¹⁶The properties of the quadratic utility function in terms of risk aversion are analysed by Deaton and Muellbauer (1980, page 400).

¹⁷Thorbecke (2003) and Ligon and Schechter (2004) provide extensive overviews of the literature, including its relationship with Ravallion’s (1988) concept of “expected poverty.”

Figure 5: Poverty, Vulnerability and Income Fluctuations – Cardinal and Money Metric Measures



nerability approach and the evaluation framework: the former attempts to capture ex-ante income risk, while the latter evaluates ex-post fluctuations, as illustrated in Figure 1 and discussed in Section 2.1.

Since observed data is ex-post by definition, this approach requires an identifying assumption to use past realisations “to estimate the probability of possible future outcomes” (Ligon and Schechter, 2003). The assumption made by these authors is stationarity, which imposes the restriction that “the probability distribution of income in one period is identical to the probability distribution of income in any other period” (Ligon and Schechter, 2004). This implies that the last term in Equation 20, $E[U_i^{LS}(y_i)]$, becomes $(1/T) \sum_{t=0}^T U_i^{LS}(y_{it})$.

However, whether trying to capture past variability or future risk, from an applied point of view only realisations of income y are available to the researcher. The vulnerability approach and the evaluation framework methodologies differ conceptually, but the identifying assumption made by the former implies that the two result in similar empirical applications. This means that, as the transient-chronic decomposition, Ligon and Schechter’s (2003) vulnerability measures can be interpreted as a special case of the evaluation framework. This is illustrated in Figure 5 (based on Thorbecke, 2003), which presents an example with $T = 2$ and no discounting ($\Delta(t) = 1/T$). In this setting, the evaluation function in Equation 6 be-

comes $V(\mathbf{y}) = (1/T) \sum_{t=0}^T v(y_{it})$. The connection between the two methodologies emerges from setting the evaluation and welfare functions to coincide: assuming $U_i^{LS} = v$ results in $V(\mathbf{y}) = E[v(y_t)] = E[U_i^{LS}(y_i)]$, the last term in Equation 20. As can be appreciated in Figure 5, Ligon and Schechter's (2003) measure of vulnerability is equivalent, in the evaluation framework, to the difference between the evaluation of the poverty line, $v(z)$, and that of the observed income stream, $V(\mathbf{y})$.

The Figure also illustrates, in its vertical axis, the decomposition of vulnerability given by Equation 21. This example shows that the same exercise can be carried out within the evaluation framework: the Figure presents, along its horizontal axis, a monotone transformation of the "poverty" and "risk" components of Equation 21 in money metric terms, $z - \bar{y}$ and $\bar{y} - \tilde{y}_{se}$ respectively. The latter corresponds to the variability premium defined in Equation 8.¹⁸

A disadvantage of Ligon and Schechter's (2003) vulnerability measure, similar to that of the transient-chronic decomposition, is that the function U_i^{LS} determines not only the value of $U_i^{LS}(E[y_i]) - E[U_i^{LS}(y_i)]$, the "risk" component in Equation 21, but also the functional form of the "poverty" component, $U_i^{LS}(z) - U_i^{LS}(E[y_i])$. In the evaluation framework, however, the stability equivalent \tilde{y}_{se} is derived from a function v , and the poverty measures are then based on \tilde{y}_{se} , which ensures that fluctuations and poverty are disentangled.

Moreover, V_i^{LS} in Equation 20 is derived in units of the cardinal welfare function U_i^{LS} ("utils" in Ligon and Schechter, 2003), which implies that measures of vulnerability based on two functions U_i^{LS} and $U_i^{LS'}$ are not directly comparable. As discussed in Section 2.2, a money metric indicator like \tilde{y}_{se} ensures the comparability of results for different evaluation functions.

Finally, by attempting to capture the ex-ante risk faced by the households, the stationarity assumption means that the measure of vulnerability in Equation 20 does not take into account the dynamic dimension of the observed stream \mathbf{y} : V_i^{LS} is the same for the vectors $\mathbf{y} = [y_1, y_2]$ and $\mathbf{y}' = [y_2, y_1]$ with $y_1 \neq y_2$. While assuming stationarity is plausible in some contexts, the evaluation framework can account for the dynamic nature of \mathbf{y} through the discounting function $\Delta(t)$. This is illustrated in the empirical applications presented in the following Section.

¹⁸Moreover, the representation of V_i^{LS} in terms of income in the horizontal axis of Figure 5 reveals that this measure of vulnerability is a monotone transformation of the poverty gap ($\alpha = 1$ in Equation 25) evaluated at \tilde{y}_{se} .

3 Application to Argentina 1995-2002: Poverty and Income Fluctuations in Turbulent Times

3.1 Household Data and Measurement of Poverty in Argentina

3.1.1 National cross sections and the Greater Buenos Aires rotating panel

The empirical analysis conducted in this paper is based on data from the Argentine Permanent Household Survey (“Encuesta Permanente de Hogares”, EPH).¹⁹ This is a labour market and living conditions survey that has been collected since 1975 in the Greater Buenos Aires region, which covers the country’s capital and adjacent municipalities, and constitutes the country’s largest urban centre. The EPH is one of the longest serving household surveys in Latin America, and is considered to be of relatively high quality (World Bank, 2000). The data is collected by the national statistical agency, the Instituto Nacional de Estadísticas y Censos (INDEC), which is responsible for household, expenditure and manufacturing surveys, the national Census, price indices and the national accounts.

During the 1995-2002 period, the survey was collected every year in two waves, in May and October (denoted waves 1 and 2 for each year), and all estimates are based on the fifteen waves available between May 1995 and May 2002. The EPH is structured as a rotating sample, where 25 percent of households surveyed are replaced in each wave, and the data is treated as a series of repeated cross sections (INDEC, 2002). INDEC provides household weights, which are used in all the estimates presented in this paper.

The rotating structure of the EPH’s sample implies that households stay in the sample for four consecutive waves, a period of about a year and a half. A consistent series of panels, however, can only be constructed for the Greater Buenos Aires region (GBA), since for other urban centres INDEC did not release all the matching codes, and changes were made to the sample rotations. The Greater Buenos Aires region represents around 60 percent of the total population and 70 percent of the urban population of the country.

The fifteen waves between May 1995 and May 2002 contain data for twelve “cohorts” of households observed in the same four consecutive waves. Table 1 illustrates the structure of the panels and clarifies the distinction between waves and cohorts. Only households observed four times and with complete information on income for every member of the household in the four waves are kept in the sample, which results in an average of 453 households observations per cohort – about 60 percent of the theoretical total for the GBA region. Cruces and Wodon (2003c) argue that the attrition from the panel is compensated by the INDEC’s weighting

¹⁹The contents of Section 3.1 are a revised version of Cruces and Wodon (2003a). Some of the material covering the description of the data has also appeared previously in Cruces and Wodon (2003c) and Cruces and Wodon (2003b).

Table 1: Rotating Sample: Cohorts and Waves in the GBA Panel

Wave:	95-1	95-2	96-1	96-2	97-1	97-2	98-1	98-2	99-1	99-2	00-1	00-2	01-1	01-2	02-1
Cohort:															
1 95-1 to 96-2	1	1	1	1											
2 95-2 to 97-1		2	2	2	2										
3 96-1 to 97-2			3	3	3	3									
4 96-2 to 98-1				4	4	4	4								
5 97-1 to 98-2					5	5	5	5							
6 97-2 to 99-1						6	6	6	6						
7 98-1 to 99-2							7	7	7	7					
8 98-2 to 00-1								8	8	8	8				
9 99-1 to 00-2									9	9	9	9			
10 99-2 to 01-1										10	10	10	10		
11 00-1 to 01-2											11	11	11	11	
12 00-2 to 02-1												12	12	12	12

structure, and does not bias income and poverty measures in a significant way. Moreover, given the relatively short span of the panels, the problems identified by Cowell (1982) with respect to changes in family structure do not affect the results. Cruces et al. (2004) discuss alternatives for dealing with these issues in a long panel.

3.1.2 Income aggregates and poverty measures

The EPH collects information on the income and labour market status of every member of a household, as well as some dwelling and individual characteristics. To obtain results which are comparable to official figures and to the literature on poverty and labour economics in Argentina, this paper employs INDEC’s methodology for the computation of household income aggregates, which is critically assessed below.

The aggregation of income at the household level is not a trivial task, as witnessed by the long discussion in the poverty literature (Ravallion, 1994; Deaton, 1997, cover these debates and most of the issues raised in this Section). While some authors base their estimates on per capita income, this is problematic as an indicator of well-being because it does not allow for economies of scale in the household, nor for differences in needs between members of different age and gender. Ignoring these aspects may result in an over-estimation of the negative impact of household size on poverty (Coulter et al., 1992; Lanjouw and Ravallion, 1995).

INDEC’s methodology recognises the differences in needs between household members, and accounts for the differential requirements by age and gender (INDEC, 2002). The assessment is based on the daily caloric intake requirements for various types of individuals in Argentine urban centres, which results in “adult equivalent coefficients” determined by INDEC (Morales, 1988). The reference category is men aged 30 to 59, who need 2,700 kcal per day, and other coefficients are defined with respect to this reference point. For instance, a three year old girl requires 1,500

kcal per day, and thus represents 0.56 of an equivalent adult. INDEC's adjustments for differential needs are within the range of those employed in the distributional literature, and they are robust to adjustments for economies of scale.²⁰

The first step in the equivalisation procedure followed by INDEC and implemented in this paper involves computing the number of equivalent adults for each household i with k_i members as $\sum_{j=1}^{k_i} q_j$, where q_j represents the adult equivalent coefficients and is determined by member j 's age and gender.

Total household income is computed by INDEC for each household i with k_i members as $\sum_{j=1}^{k_i} y_i^j$, where y_i^j represents each individual member's total monthly monetary income. Most individuals have only one source of income which consists of salaries for the active population and pensions for those who are retired. Combining this figure and the number of equivalent adults in the household, the total household equivalent monthly income is defined by the following expression:

$$y_i^e = \frac{\sum_{j=1}^{k_i} y_i^j}{\sum_{j=1}^{k_i} q_j} \quad (22)$$

This aggregate is attributed to every member of the household – which is why the text refers interchangeably to households and individuals – and by adjusting for differences in household composition it represents a better measure of well-being than per capita income (Deaton, 1997).²¹

As an “index” of income, y_i^e satisfies the basic criteria of measurability and comparability among different persons (Cowell, 1995, Chapter 1). However, this paper deals with observations spanning the period 1995 to 2002, and y_i^e as defined in Equation 22 is not comparable across regions or in different periods if prices differ geographically or over time. While it is possible to deflate y_i^e with respect to prices at a given period to express it in constant units (i.e., in terms of real income), the main measure that will be employed in this paper is the adult equivalent income

²⁰While INDEC choses not to adjust household income for economies of scale, this is relatively straightforward to implement by means of a parameter s , $0 \leq s \leq 1$, with each extreme representing full and no economies of scale respectively. The number of adult equivalents is then computed as $[\sum_{j=1}^{k_i} q_j]^s$, where q_j is the coefficient and k is the size of the household. This is not implemented in this paper to maintain compatibility with official statistics and existing academic work. Gasparini (2003) conducts a sensitivity analysis with EPH data and finds that most income and poverty measures are robust to reasonable deviations from INDEC's implicit choice of $s = 1$.

²¹In the context of panel data, some of the variability observed over time of the y_i^e aggregate might be due to changes in the age and gender composition of the household. However, even for a fixed monetary income, the changes in y_i^e reflect fluctuations in the needs of the household. I owe this observation to Tony Atkinson.

normalised by the contemporaneous poverty line z_t . It is defined as:

$$y_{it} = \frac{y_{it}^e}{z_t} = \frac{\left[\frac{\sum_{j=1}^{k_i} y_{it}^j}{\sum_{j=1}^{k_i} q_j} \right]}{z_t} \quad (23)$$

This formulation is known as the “welfare ratio” in the literature and has a series of advantages (Blackorby and Donaldson, 1987; Ravallion, 1998). Besides making equivalised incomes comparable over time and space,²² Equation 23 can be given an interpretation in terms of poverty measurement: $y_{it} < 1$ indicates that a household’s income is below the poverty line, and thus its members can be classified as poor.²³ For these reasons, the choice of the poverty line as the unit of measurement is preferable to deflating incomes with respect to the Consumer Price Index.

Finally, the quality of the income aggregate y_{it} is given by INDEC’s validation process, which checks each of the components of individual income for consistency and discards households for which a complete total income cannot be computed, adjusting the sample weights accordingly. The small fraction of households reporting zero total income are kept in the final sample since they are considered valid by INDEC.

The rest of this Section covers the construction of poverty lines in Argentina, which establish the fundamental partition of the population between the poor and the non-poor (Cowell, 2003). For each wave of the EPH, INDEC reports the cost of an extreme (or “indigent”) poverty line, z_t^I , which is based on a basic food basket (INDEC, 2002). The components of this basket are constructed from a household expenditure survey,²⁴ and its cost is updated with changes in prices between each wave of the EPH.

The poverty line z_t is derived from the basic food basket z_t^I using the inverse of the Engel coefficient to incorporate the cost of basic non-food goods (Ravallion, 1998; INDEC, 2002, discuss this procedure in detail). The idea behind this approach is that the extreme poor cannot afford a minimum food basket, whereas the moderately poor, while able to cover their basic nutritional needs, cannot afford other essential goods and services. While other alternatives for the definition of poverty lines exist, this paper follows the literature on distributional analysis in Argentina and adopts INDEC’s methodology to ensure comparability with previous results. Finally, as argued in the discussion of Equation 23, normalising incomes by the poverty lines facilitates comparisons over time.

²²As discussed in the following pages, poverty lines vary between regions, and Equation 23 should refer to the income of a household living in region r and the regional poverty lines z_{rt} . The notation in the text is preferred for being more compact.

²³The denominator of the right hand side of Equation 23, $\tilde{z}_{it} = z_t \sum_{j=1}^{k_i} q_j$, can be interpreted as a household specific poverty line.

²⁴This survey, the “Encuesta Nacional de Gasto de los Hogares,” is carried out only every ten years by INDEC.

Before discussing the poverty figures for 1995-2002, this Section presents the methodology followed by INDEC to compute its official statistics, which is adopted in this paper to provide comparable results.

According to Cowell (2003), the measurement of poverty requires three components: an income estimate, a poverty line, and a measure or index, which represents a device for aggregating the poverty evaluations obtained at the household level into a population figure. The first two components were covered from the methodological and empirical points of view in the preceding pages. Regarding the third element, a household i 's poverty evaluation is given by a function defined over its equivalised income y_i^e and a poverty line z as (Cowell, 2003):

$$\begin{cases} p(y_i^e, z) & \text{if } y_i^e < z \\ 0 & \text{otherwise} \end{cases} \quad (24)$$

This paper relies on the FGT decomposable poverty measures proposed by Foster et al. (1984), which belong to the general class defined by Atkinson (1987). The FGT measures imply the following functional form for the poverty evaluation:

$$p(y_i^e, z) = \left[\frac{\max(z - y_i^e, 0)}{z} \right]^\alpha \quad (25)$$

where α is a sensitivity parameter ($\alpha \geq 0$).²⁵ The resulting poverty measure is given by the sample average of p , which can be represented as:

$$FGT(y^e, z, \alpha) = \frac{1}{N} \sum_{i=1}^N \left[\frac{\max(z - y_i^e, 0)}{z} \right]^\alpha \quad (26)$$

where N denotes the total number of households or individuals in the population.²⁶ With the parameter set to $\alpha = 0$, Equation 26 represents the poverty headcount. With $\alpha = 1$ and $\alpha = 2$, the resulting measures are the poverty gap and the squared poverty gap, which take into account not only the number of poor (as the headcount does) but also the intensity of poverty.

3.2 Poverty Trends and Short Term Dynamics

3.2.1 Poverty in turbulent times: Argentina during the 1990s

The 1980s represented a "lost decade" for most of Latin America. In the case of Argentina, the decade ended in political instability and a series of hyperinflation

²⁵If the income aggregate y_i^e is normalised by the poverty line as in Equation 23, p simplifies to $p(y_{it}, z) = [\max(1 - y_{it}, 0)]^\alpha$.

²⁶The resulting FGT measure can refer to the number of households or the number of individuals in poverty. The latter is derived from computing Equation 26 with weights reflecting household size. This procedure is equivalent to defining FGT in terms of N_I , the number of individuals in the population, since the poverty status and the income aggregate are defined at the household level and then assigned to every member.

episodes that extended into 1990 and 1991.²⁷ In March 1991, the country adopted the “Convertibility Plan,” a currency board where the Argentine peso was pegged to the US dollar. This plan was accompanied by a series of market oriented structural reforms that included privatisations of public utilities and the opening of the economy to flows of goods and capital . These reforms and the liquidity of international credit markets prompted a steady inflow of capital, which sustained growth between 1991 and 1994 . This is depicted in Figure 6, which presents the evolution of GDP annotated with the main economic events of the 1990-2003 period for Argentina.²⁸

The Convertibility’s currency board, however, made the economy highly vulnerable to external shocks. At the end of 1994, Mexico devalued its currency and triggered an international financial crisis (the “Tequila crisis”) that affected all emerging markets. Argentina rapidly suffered from contagion, with runs against the peso and significant capital flights, but the currency board resisted this large external shock. As shown in Figure 6, a brief recovery followed during 1996 and 1997, but the economy was hit again by the economic crisis in South-East Asia, which started in Thailand in early 1997, and its aftermath. Russia, in turn, entered a severe financial crisis in August 1998, and its sovereign debt default prompted yet another contagion to Argentina, which was – like most emerging markets – badly hit by capital outflows and interest rate rises. In January 1999, Brazil, Argentina’s main trading partner, was forced to devalue its currency, worsening a recession that started around 1998.

After three years of negative growth, the Argentine government was forced to impose restrictions on bank accounts in late 2001. This precipitated events, which converted the recession into an economic meltdown. The decision to freeze bank deposits was followed by social unrest and political instability, and led to the resignation of President De La Rúa. The currency board could not be sustained in this context, and in early 2002 the new government put an end to the parity between the peso and the US dollar and announced a default on the country’s sovereign debt. The subsequent fall in confidence and the disruption of productive activity resulted in a fall in Gross Domestic Product of 10.9 per cent during 2002.

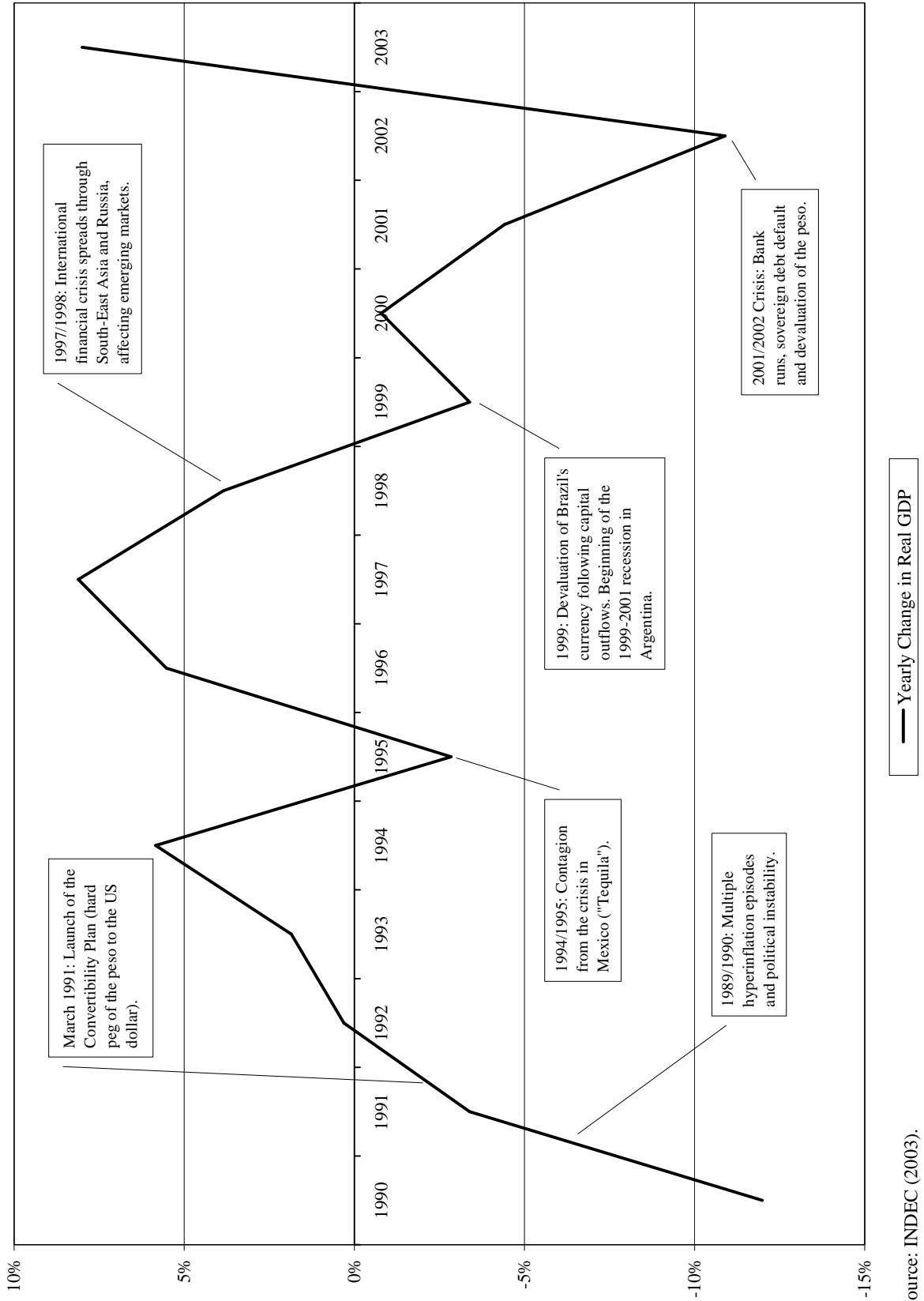
The sources of the crisis can be traced back to, among other factors, the exchange rate parity with the US dollar and the resulting over-valuation of the local currency, the vulnerability of the country to external shocks, and the economy’s own structural weaknesses (Galvani et al., 2003).

The crisis was reflected in the poverty rates, which reached 53 percent of the population in May 2002, 15 percentage points higher than in October 2001. This increase in poverty mirrored a large fall in household income, caused by two fac-

²⁷This summary draws on Lewis (2002), Bonvecchi (2003) and Gerchunoff and Llach (2004), which are recommended for further reference on the economic history and the political economy of Argentina.

²⁸The contents of Section 3.2 are a revised version of Cruces and Wodon (2003a).

Figure 6: Yearly Change in Real GDP and Key Economic Events, Argentina, 1990-2003



Source: INDEC (2003).

tors (World Bank, 2003). On the one hand, labour market conditions deteriorated sharply: in May 2002, the unemployment rate exceeded 21 percent, more than 3 percentage points higher than in October 2001 (see the discussion of Figure 7 below). On the other hand, real incomes fell because of the large increase in consumer prices induced by the devaluation.

3.2.2 Income, prices and poverty

This Section presents the main trends in poverty for the period 1995-2002. It first discusses the evolution of the income aggregate and the poverty lines, and then describes the evolution of regional and national poverty figures. The final subsection deals with the short term dynamics of poverty over this period.

The impact of the series of crises and recoveries described in the Introduction to this paper can be appreciated in the evolution of the unemployment rate, which mirrors the changes in household income and GDP, as depicted in Figure 7. In the aftermath of the Mexican crisis, the unemployment rate reached 18.8 percent in May 1995, and remained high until October 1996. It fell to 12.4 percent in October 1998 during the recovery, but from that wave onwards it increased again, reaching the highest recorded rate of 21.5 percent in May 2002, with the largest increase between waves of over 3 percentage points between October 2001 and May 2002.

Figure 7 also depicts the evolution of the sample average of y_{it}^e , the adult equivalent income defined in Equation 22, in nominal (current pesos) and real terms, for all the large urban areas covered by the EPH. Real values are adjusted by the Consumer Price Index and correspond to September 2001 prices.²⁹

This aggregate fell almost 4 percent from May 1995 until October 1996, as a consequence of the contraction that followed the contagion from the Mexican crisis (Figure 6). Household income recovered briefly until May 1998, but from then on it fell almost continuously in both nominal and real terms, with the exception of a brief recovery between May and October 2000. The sharpest decrease corresponds to the crisis of 2001-2002, as captured by the May 2002 wave of the EPH (the last in the Figure).

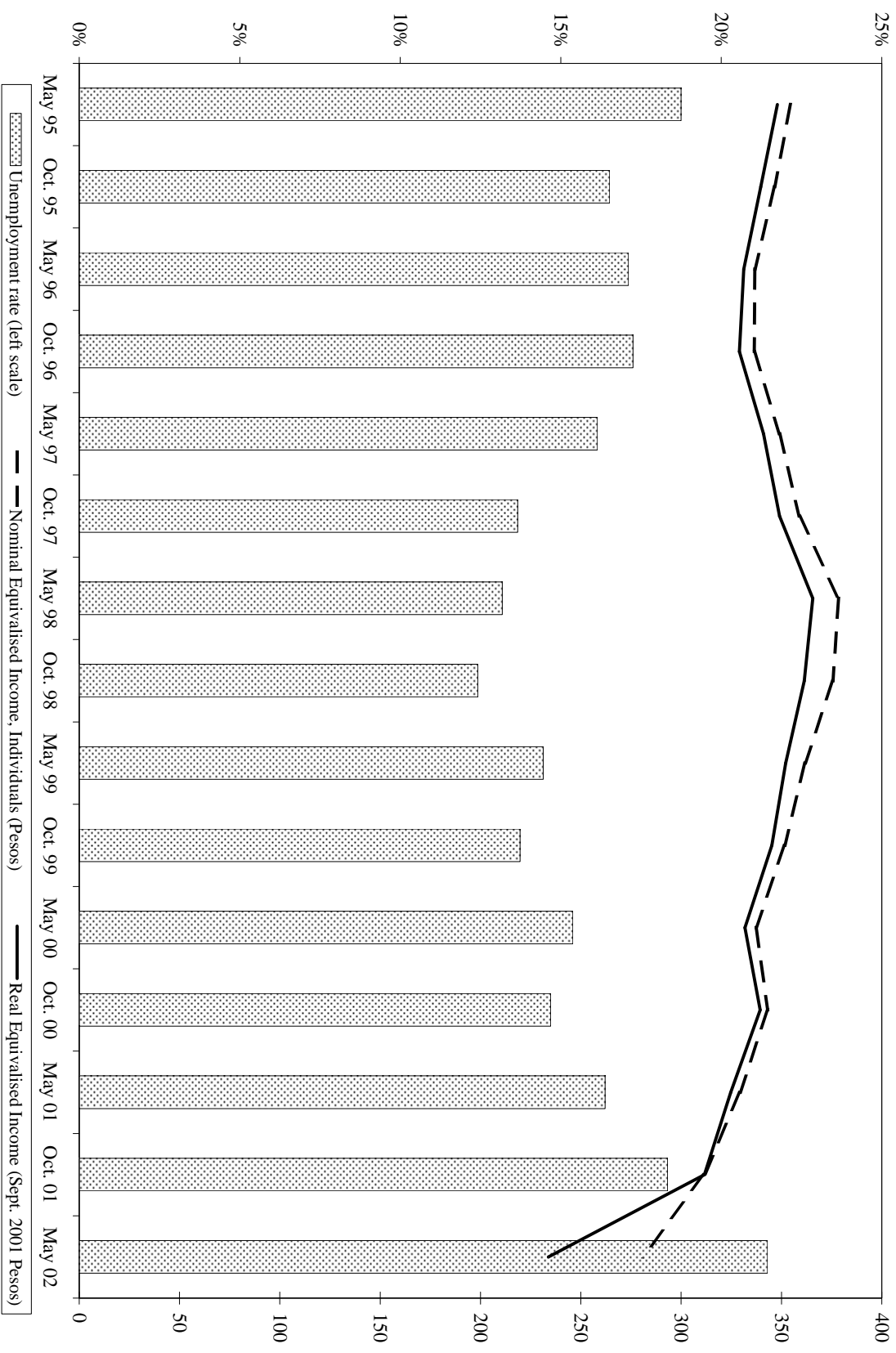
Between October 2001 and May 2002 nominal income fell 10 percent, but it is interesting to note in Figure 7 that the sudden increase in consumer prices caused by the crisis of 2001-2002 was reflected in a much larger fall in real income of 25 percent.

The following Figures were constructed using the equivalent income y_i^e in the FGT measures in Equation 26. Both the poverty lines z_t and extreme poverty lines z_t^I were allowed to vary by region.

Figure 8 presents the headcounts of poverty and extreme poverty (indigence)

²⁹Detailed CPI, poverty lines, equivalent income and poverty estimates are provided in Cruces and Wodon (2003a).

Figure 7: Unemployment Rate, Real and Nominal Equivalised Household Income, Urban Argentina, 1995-2002



Source: Author's estimations based on EPH household survey data (INDEC).

for the urban areas covered by the EPH, corresponding to *FGT* with $\alpha = 0$ (Equation 26). This Section discusses only the evolution of the poverty headcounts. As in the official statistics provided by INDEC, both headcounts are calculated as fractions of the total number of households (share of households in poverty or extreme poverty) and the total number of individuals (share of individuals in poverty or extreme poverty).

As is usually the case, the proportion of individuals under the poverty and extreme poverty lines is always higher than the proportion of households, reflecting the fact that poor households tend to be larger than non-poor households.

Since the income aggregate and the poverty lines were affected by the repeated crises and recoveries of the 1995-2002 period, the measures of poverty based on those numbers were also sensitive to the evolution of the economy. During the contagion from the Mexican crisis, the poverty and extreme poverty headcounts increased significantly from May 1995 to October 1996, then fell slightly from October 1996 until May 1998.³⁰

The May 1998 wave of the EPH represents a turning point in the data: the individual-based poverty headcount increased steadily from 28.6 percent to 38.3 percent in October 2001, with a similar trend for extreme poverty and for household-based measures. This increase in poverty of almost 10 percentage points in a little over three years reflects the worsening of the labour market conditions and economic activity during the recession, depicted in Figures 6 and 7. Over the same period, the proportion of the population in extreme poverty doubled from 6.8 percent to 13.6 percent.

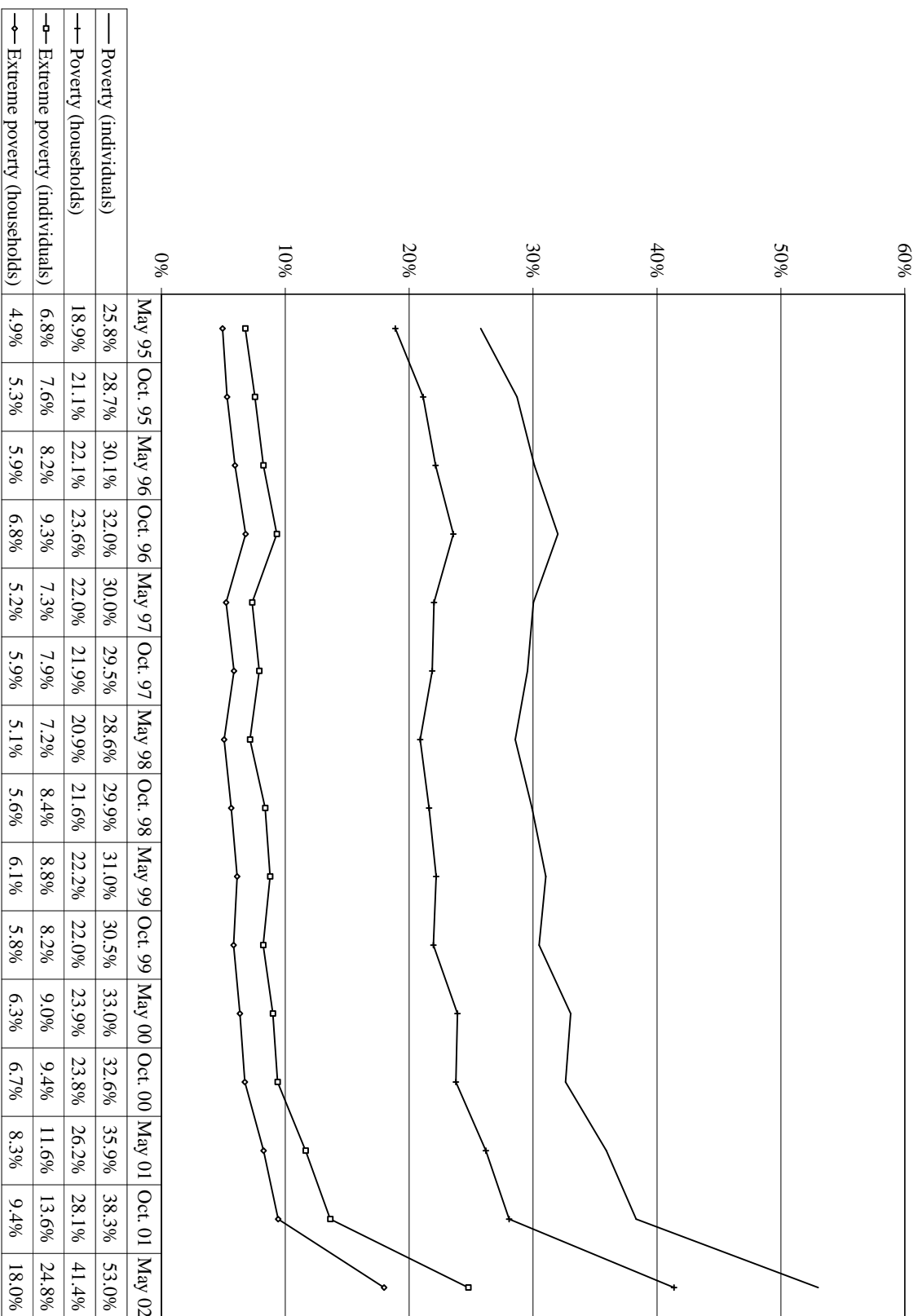
These increases, however, are relatively minor when compared with the changes occurring between the October 2001 and May 2002 waves of the EPH. At the national level, the individual-based poverty headcount jumped from 38.3 percent to 53 percent (13.6 to 24.8 percent for extreme poverty), with household measures following the same upward trend. This jump in poverty rates is the result of the sharp increase in prices and hence poverty lines, coupled with the fall in real and nominal income of the households (Figure 7).

3.2.3 Poverty transitions and short term dynamics

The analysis of cross section data usually results in discussions of changes in poverty rates between two periods, as in Figure 8. The rotating sample structure of the EPH, however, allows for a deeper analysis in terms of the poverty transitions of households between two periods. The evidence for Argentina is depicted in Figure 9, which is based on a special version of the EPH dataset where households were paired in two consecutive waves, resulting in a series of two-period panels. This

³⁰A full poverty profile is beyond the scope of this paper. For detailed poverty profiles, see World Bank (2000), World Bank (2003) and Cruces and Wodon (2003a).

Figure 8: Poverty and Extreme Poverty Headcounts, Individuals and Households, Urban Argentina, 1995-2002



Source: Author's estimations based on EPH household survey data (INDEC).

dataset is representative at the national level, and because of the sample rotation it contains about 70 percent of the total cross-section observations.³¹

Figure 9 presents the basic poverty transition between two waves (a six-month period). Starting from the October 1995, it decomposes the population into four transition categories, according to their current and past poverty status: the non-poor who stayed non-poor, the poor who stayed poor, the poor who escaped poverty, and the non-poor who became poor in the following period. The Figure represents a decomposition of the change in poverty between two waves of the EPH, which is equal to those who entered poverty minus those who escaped poverty – for this reason, the latter appears as negative in the Figure.

This evidence complements the description of the main poverty trends in Figure 8. Excluding the change between the last two waves, which cover the unusual circumstances of the 2001-2002 crisis, the proportion of individuals switching poverty status is fairly stable along the 1995-2001 period. In each wave, an average of 7 percent to 8 percent of the population manages to escape poverty, while an average of 8 percent to 9 percent of the population enters poverty. These fluctuations are relatively large when compared to the changes in the cross-sectional headcounts, which were never higher than 2.4 percentage points for the same period (Figure 8). These large movements in and out of poverty compensate each other and result in relatively low net changes in the static cross-sectional poverty rates.

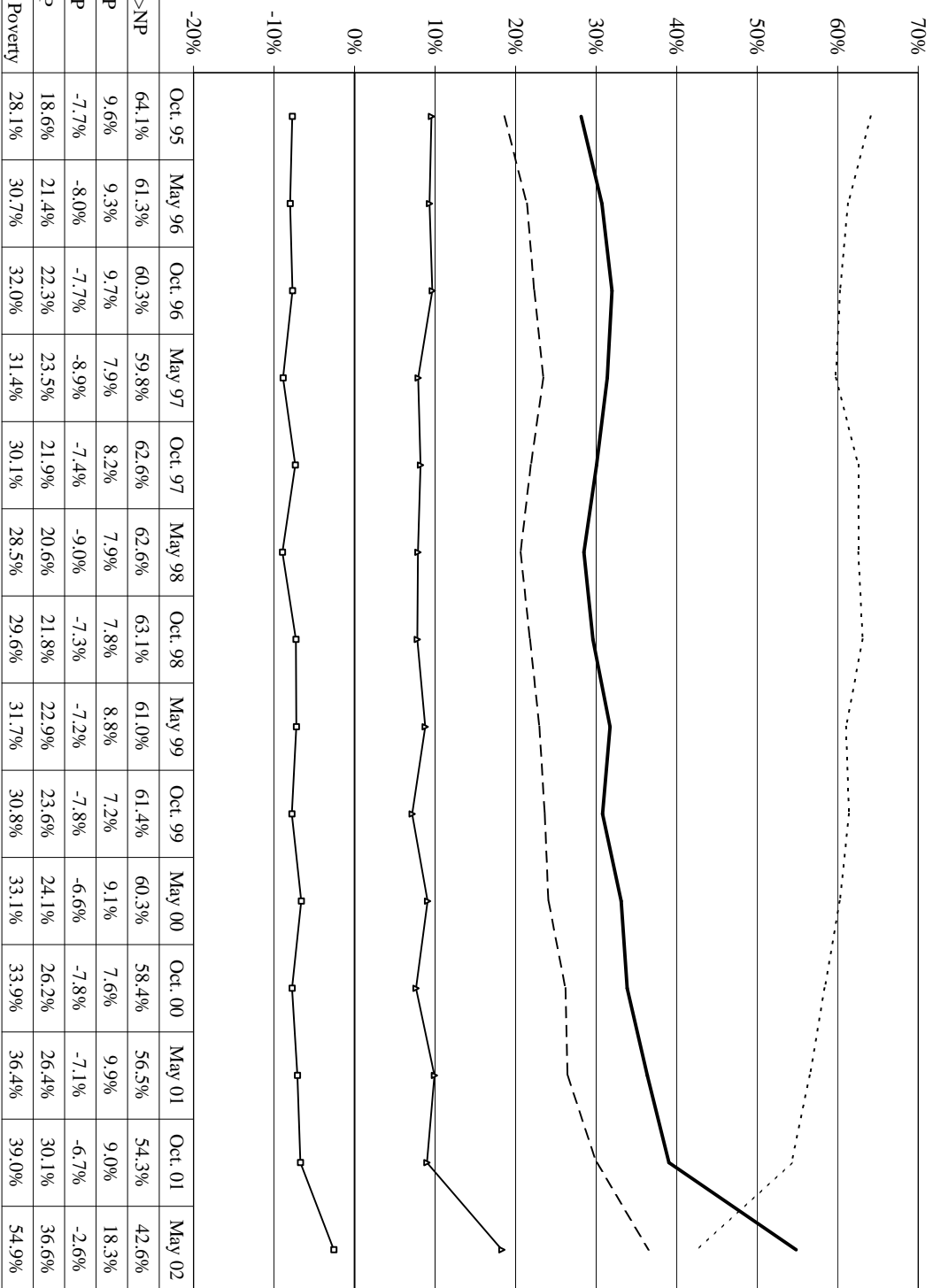
These relatively high and stable levels of switching in poverty status were affected by the worsening of the economic conditions over the 1995-2001 period. This is manifested in the almost continuous increase in the fraction of the population in poverty that stayed in poverty in the following wave of the survey.

Figure 9 also presents interesting results on the effects of the 2001-2002 crisis, which are captured by the changes in poverty status between October 2001 and May 2002. The Figure indicates that the recession and the subsequent crisis affected the persistence of poverty and not only its level. The proportion of individuals who were poor and remained poor increased from 26.4 percent between the waves of October 2000 and May 2001 to 36.6 percent between October 2001 and May 2002. Moreover, 18.3 percent of the population was non-poor in October 2001 but was recorded as poor in May 2002, a major increase when compared to the average of about 8 to 9 percent for the 1995-2001 period. This is also reflected in the proportion of the population that was above the poverty line and remained at that level, which fell from a fairly stable 60 to 65 percent to a low 42.6 percent between the last two waves.

Finally, Cruces and Wodon (2003a) provide evidence on movements within the

³¹This paired dataset was prepared and kindly provided by Juan Martín Moreno, from the Argentine Ministry of Labour. It should be noted that the resulting poverty rates are slightly different from the ones presented in Figure 8. This is due to the nature of the rotating sample: since the dataset consists of observations paired across two waves, only a maximum of 75% of the total observations for each wave is available, as illustrated in Table 1.

Figure 9: Proportion of Individuals as a Function of Previous Poverty Status, Urban Argentina, 1995-2002



Note: P stands for "poor," and NP for "non poor." The legend refers to the transition from the state in t-1 to the state in t. Note also that (5)=(2)+(4)=(100-(1)+(3))

Source: Author's estimations based on EPH household survey data (INDEC).

poor using the same paired dataset. An average of around 3 percent of the population was found to switch between extreme poverty and poverty, and vice versa, in every wave of the EPH in the 1995-2001 period. From May 1998 onward however, there was a continuous increase in the share of individuals who were moderately poor and became indigent.

3.3 Application of the Evaluation Framework to Argentina

3.3.1 Evolution of variability adjusted income and the variability premium

The following pages present alternatives for empirical analysis using the evaluation framework and the functional forms discussed above. The results in Cruces and Wodon (2003b) (on risk adjusted poverty) and Cruces and Wodon (2003c) (on transient and chronic poverty), which can be interpreted in the evaluation context (Section 2.3), provide examples of more elaborate empirical work by developing regression analyses to identify the covariates of risk and poverty variability.

The data corresponds to the Greater Buenos Aires dataset described in Section 3.1, a series of rotating panels over the 1995-2002 period with twelve cohorts of households with four observations each ($T = 4$). The evaluation functions and stability equivalents defined above are applied to the equivalised and normalised income of these households, given by y_{it} in Equation 23.

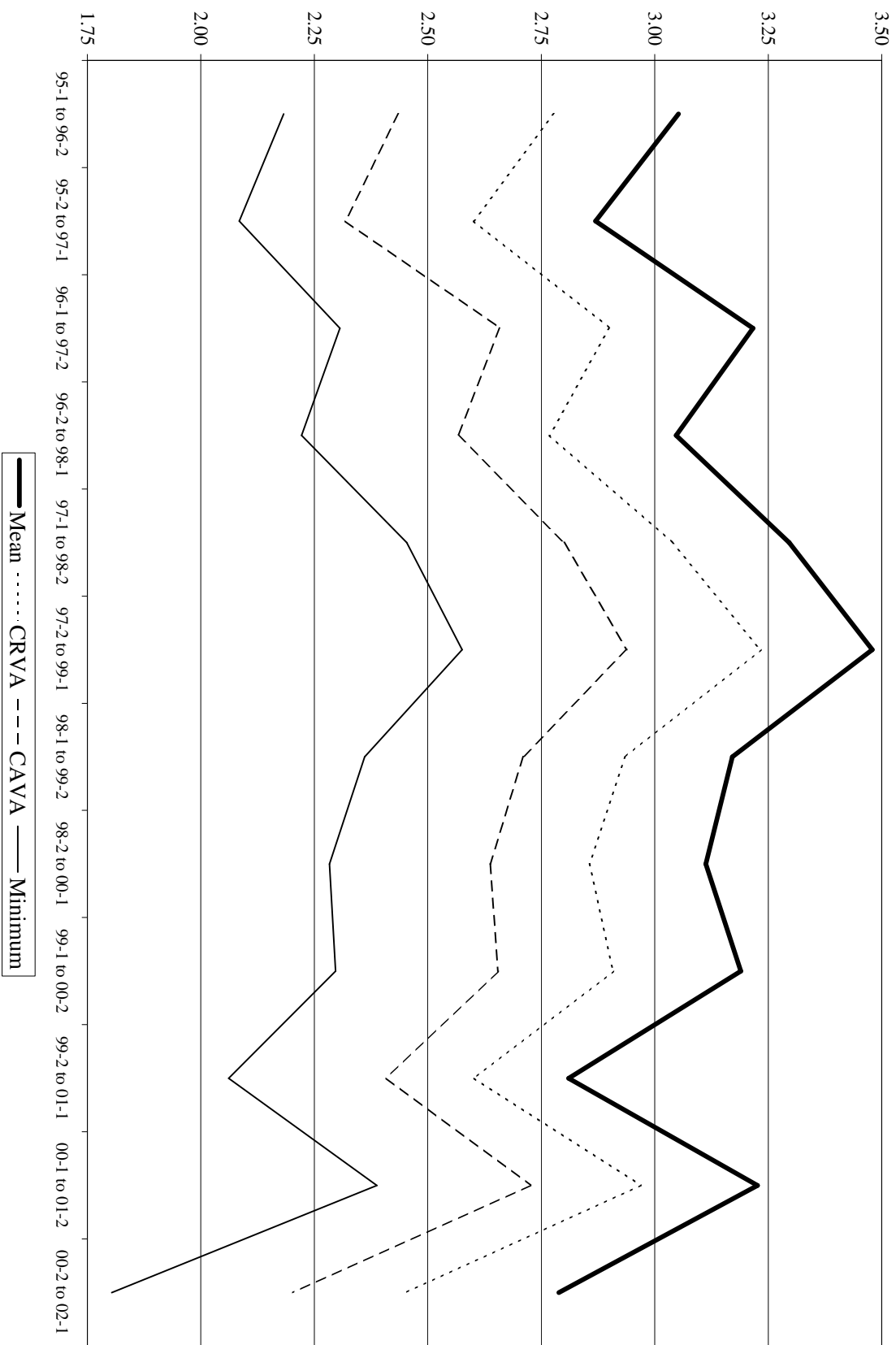
The simplest analysis can be carried out over the population average of \tilde{y}_{se} , depicted in Figure 10 for each of the twelve cohorts. The evaluation functions in this Figure are the CRVA (Equation 12), CAVA (Equation 14) and the extreme aversion (Equation 18), while the average of income over time (Equation 16) is used as the benchmark case. For the CRVA and CAVA formulations, the parameters ρ and η are set to 2, a value adopted for empirical analysis in Cruces and Wodon (2003b) and by Ligon and Schechter (2003), among others.³² This example concentrates on different functional forms, and thus the parameter δ in Equation 10 is set to 1, resulting in $\Delta(t) = 1/T$.

Incomes are normalised by their contemporaneous poverty lines so their unit is the poverty line. The four variability adjusted measures and the average income in Figure 10 follow the basic trends described in Section 3.2, confirming the highly pro-cyclical nature of household income. Notably, the difference between the average of income over the four periods in which households are observed (bold solid line) and its minimum (solid line) is quite sizeable at about three quarters of the poverty line. This indicates the presence of strong within-panel fluctuations in household income.

This “minimum” stability equivalent can be interpreted as resulting from an extreme aversion evaluation function, while the average income represents no aver-

³²Cruces and Wodon (2003b) discuss the range of plausible values and the sensitivity of measures of this type with respect to ρ .

Figure 10: Variability Adjusted Measures of Income for Different Evaluation Functions, Greater Buenos Aires, 1995-2002



Source: Author's estimations based on EPH household survey data (INDEC).

Table 2: Relative Variability Premium by Quintile of Mean Income, Isoelastic Evaluation Function with Aversion Parameter=2, Greater Buenos Aires, 1995-2002

Cohort	Bottom Quintile	Second Quintile	Third Quintile	Fourth Quintile	Top Quintile	Overall
95-1 to 96-2	16.7%	11.3%	9.0%	10.4%	7.8%	11.0%
95-2 to 97-1	25.5%	9.4%	8.2%	11.2%	8.2%	12.4%
96-1 to 97-2	22.9%	14.3%	9.5%	10.0%	7.5%	12.7%
96-2 to 98-1	19.2%	11.9%	9.8%	9.4%	8.8%	11.8%
97-1 to 98-2	24.6%	8.6%	7.6%	6.9%	6.9%	11.0%
97-2 to 99-1	22.1%	10.4%	7.2%	7.4%	5.3%	10.4%
98-1 to 99-2	24.4%	11.0%	8.1%	7.9%	5.2%	11.2%
98-2 to 00-1	21.9%	12.8%	7.2%	5.6%	7.1%	10.9%
99-1 to 00-2	24.3%	10.1%	7.3%	5.2%	7.4%	10.8%
99-2 to 01-1	22.2%	10.0%	10.1%	7.5%	5.1%	10.9%
00-1 to 01-2	20.7%	15.2%	7.6%	5.8%	7.0%	11.2%
00-2 to 02-1	34.9%	19.7%	13.2%	12.2%	9.8%	17.9%
Overall	23.3%	12.1%	8.7%	8.3%	7.2%	11.8%

Source: Author's estimations based on EPH household survey data (INDEC).

sion and the CRVA and CAVA constitute intermediate cases (see the diagram in Figure 3). This implies that in Figure 10 the stability equivalents based on these two formulations fluctuate between the average and the minimum. On average, the difference between the stability equivalent given by the CRVA function with $\rho = 2$ and the average income is around a quarter of the poverty line, while the difference between the latter and \tilde{y}_{se} based on the CAVA with $\eta = 2$ is about half of this unit. These differences represent the population averages of the absolute variability premium defined in Equation 8, and they are relatively large with respect to the average income, which fluctuates between 3 and 3.25 times the poverty line. Finally, while the four measures tend to move similarly, the CRVA is more sensitive to increases and decreases in the average income over time, magnifying its fluctuations.

Another type of empirical analysis based on the evaluation framework is presented in Table 2, which depicts the evolution of the relative variability premium Π (defined in Equation 9) by quintile of average income, based on a CRVA with $\rho = 2$ and no discounting. The advantage of this formulation is that the relative variability premium is constant with respect to proportional changes in the income vector y when $\delta = 1$, so that differences in its value at different points of the income distribution reflect the differential impact of income fluctuations as a proportion of total

Table 3: Variability Adjusted Income for Different Values of the Discount Factor, Isoelastic Evaluation Function with Aversion Parameter=2

Income Profile	Observed Income					Stability Equivalent, CRVA $\alpha=2$			
	t=1	t=2	t=3	t=4	s	d=1	d=0.9	d=0.5	d=0.1
Flat	1	1	1	1	0	1.00	1.00	1.00	1.00
"Early" MPS	1.5	0.5	1	1	0.35	0.86	0.85	0.90	0.99
"Late" MPS	1	1	1.5	0.5	0.35	0.86	0.83	0.69	0.53
Increasing	0.5	0.75	1.25	1.5	0.40	0.83	0.88	1.14	1.46
Decreasing	1.5	1.25	0.75	0.5	0.40	0.83	0.79	0.64	0.52

Note: MPS refers to a mean preserving spread of income over time. The constant relative variability aversion (CRVA) function and the stability equivalent are defined in the text.

income. As can be appreciated from the Table, the poorest quintile bears the highest level of fluctuations in relative terms, with values of around 20 and 25 percent of the average income, with a peak of almost 35 percent in the period corresponding to the 2002 crisis (see Section 3.2 for details). The second quintile also has a relatively higher level of the variability premium at around 12 percent, but for the three richest groups a pattern is not clearly discernible, standing between 7 and 9 percent on average.

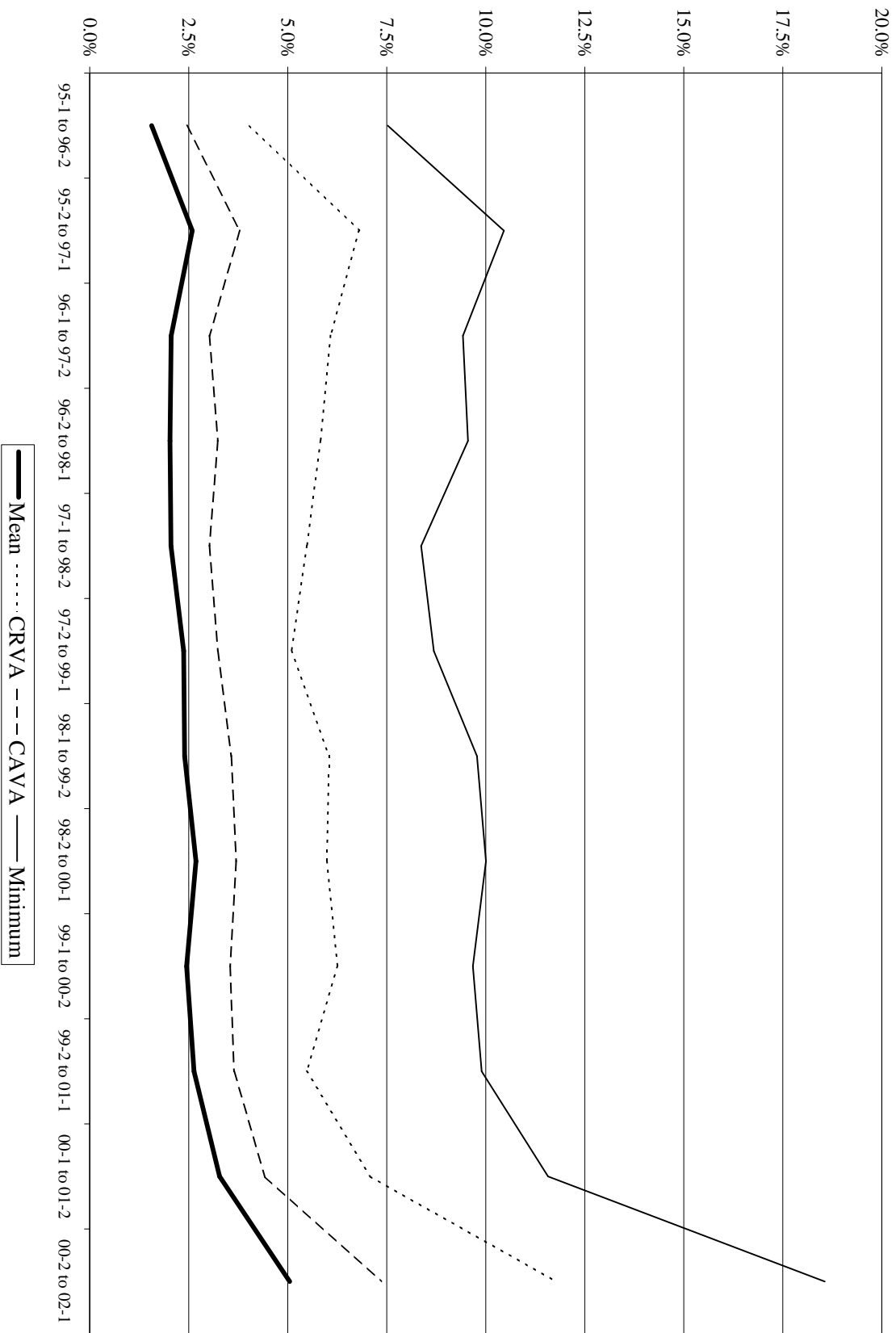
3.3.2 Variability adjusted poverty and sensitivity to discounting

Figure 11 presents the population squared poverty gap for the different evaluation functions considered above, with $\rho = 2$, $\eta = 2$ and $\delta = 1$. These poverty measures are based on the stability equivalent incomes presented in Figure 10: as expected, the order of the series is reversed with respect to that Figure, with higher poverty when using the minimum income over the period and the lowest when using the average over time. The difference between these two series is again sizeable, but the most notable fact from the Figure is the evolution of the CRVA series. While the averaging of incomes over time smooths income and poverty measures – a fact discussed at length in Cruces and Wodon (2003b)– the CRVA formulation is more sensitive than the CAVA to the variability of the underlying incomes. This can be appreciated in its higher curvature at the points where the poverty measure based on average income changes its trend.

Finally, while the previous examples concentrated on functional forms for v and thus considered cases with no discounting, Table 3 illustrates the effect of different values of δ in Equation 10 on the evaluation of past incomes.³³ The left hand side panel of the Table presents five benchmark cases of income trajectories with $T = 4$

³³The introduction of $\Delta(t)$ with $\delta \neq 1$ in the GBA examples given by Figures 10 and 11 shifts the level of the stability equivalents and poverty measures. Table 3 is more informative since it illustrates the effect of δ on household income trajectories.

Figure 11: Variability Adjusted Squared Poverty Gap with Different Evaluation Functions, Greater Buenos Aires, 1995-2002



Source: Author's estimations based on EPH household survey data (INDEC).

($\mathbf{y} = [y_1, y_2, y_3, y_4]$) and $\bar{y} = 1$ and their standard deviations σ , while the right hand side panel reports the resulting stability equivalent based on a CRVA function with $\rho = 2$ and four values of the discount factor: $\delta \in \{1, 0.9, 0.5, 0.1\}$.

With $\delta = 1$, the discounting weight is equal to $\Delta(t) = 1/T$ for every period, which is the case of the previous applications. The first line of the Table represents a “flat” income trajectory, which results in a stability equivalent (given by Equation 13) equal to $\tilde{y}_{se} = \bar{y} = 1$. The following rows of the Table illustrate the effect of a mean-preserving spread in \mathbf{y} on \tilde{y}_{se} : with a mean of $\bar{y} = 1$, the stability equivalent falls to 0.86 (second and third rows) and 0.83 (fourth and fifth rows) as the standard deviation increases.

The comparison between the second and third (and fourth and fifth) rows of the Table illustrates invariance of the stability equivalent with respect of the ordering of incomes y_t in \mathbf{y} when no discounting is applied. The second and third row represent mean preserving spreads of the “flat” income trajectory, the difference being that for the former the spread occurs at $t = 1$ and $t = 2$, while for the latter it occurs closer to the present at $t = 3$ and $t = 4$. The stability equivalent \tilde{y}_{se} with $\delta = 1$ is the same in both cases, since this implies that $\Delta(t) = 1/T$ and thus $V(\mathbf{y}) = V(\mathbf{y}')$ when \mathbf{y}' is a permutation of \mathbf{y} . However, the Table shows that the introduction of discounting changes this invariance result: with $\delta = 0.9$, the stability equivalents are 0.85 and 0.83, respectively, and the difference between the two reflects the fact that more weight is given to the low realisation for $t = 4$ in the “late MPS” trajectory. The \tilde{y}_{se} resulting from $\delta = 0.5$ and $\delta = 0.1$, in turn, reflect the trade-off between mean and dispersion: while $\bar{y} = 1$ for all trajectories in the Table, the discount weights imply that \bar{y}_Δ changes with δ . With $\delta = 0.1$, most of the weight is placed on $t = 4$ and very little to $t = 1$, which explains the large difference in \tilde{y}_{se} between the second and third row.³⁴

Finally, the fourth and fifth rows of Table 3 present the same incomes as an increasing and a decreasing trajectory. As discussed above, the dynamic structure of \mathbf{y} does not affect the stability equivalent for $\delta = 1$, but as this parameter increases, \tilde{y}_{se} is higher for the increasing case and lower for the decreasing trajectory. This example shows that the discounting function $\Delta(t)$ incorporates the dynamics of income streams into the evaluation framework.

4 Conclusion

This paper explored the theoretical basis for the incorporation of income fluctuations in the measurement of poverty and well-being over time. A general framework and a series of related methodologies were illustrated with panel data on

³⁴For $\delta = 1$ and $T = 4$, $\Delta(t) = 0.25$ for all periods. For $\delta = 0.9$, the discounting weights are 0.21, 0.24, 0.26 and 0.29 (for $t = 1, 2, 3$ and 4 respectively); for $\delta = 0.5$, the weights are 0.07, 0.13, 0.27 and 0.53; and for $\delta = 0.1$, the weights are 0.001, 0.01, 0.09 and 0.90.

income for Argentina.

The framework for the evaluation of well-being based on panel data on household income relies on an analogy with choice under uncertainty and the expected utility model to define a family of welfare-based indicators of well-being and variability over time. This is achieved by means of a two-step procedure, which involves aggregating vectors of observations over time for a household into a scalar and then studying the distribution of this aggregate.

The methodology was discussed in the context of alternative approaches, such as the transient-chronic poverty and measures of vulnerability. The evaluation framework differs from the latter in that its measures are money metric, and in that it explicitly recognises the ex-post nature of observed data, allowing the incorporation of the dynamic nature of income processes through time preferences. Moreover, an advantage of the proposed approach is its flexibility: the first step – the derivation of a summary measure of well-being over time – does not depend on an *ad hoc* statistical procedure but on an explicit normative evaluation function of past incomes. The researcher can also choose the appropriate measure (poverty, inequality, etc.) for the analysis in the second step.

The main conclusion from this paper is that accounting for the dynamic dimension of poverty provides a substantially different picture from the usual static analysis, with far-reaching implications for theoretical analysis, empirical applications and policy formulation. The empirical findings of this paper imply that income fluctuations matter in at least three important dimensions.

The first dimension refers to the nature and extent of poverty analysis. Section 3.2, which documented different aspects of household welfare over the 1995-2002 period in Argentina, found that changes in poverty rates between two periods were the result of large offsetting movements into and out of poverty. Moreover, these movements, which were not apparent in the simple analysis of changes in poverty rates between two periods, were not confined to economic crises: a substantial fraction of the population was found to enter poverty even when rates were falling on aggregate.

The high proportion of individuals who changed poverty status in a relatively short period of time (about six months in the Argentine data), and the fact that these changes occurred in all stages of the business cycle, imply that traditional poverty studies based on cross-sectional data might be missing some fundamental information.

The second dimension refers to the relative importance of income fluctuations for household well-being. The framework developed in Section 2 provided a rationale, based on an analogy with the concept of risk aversion, for imputing a negative impact of fluctuations on welfare. However, the magnitude of this effect is an empirical question.

The evidence for Argentina demonstrated that income fluctuations substan-

tially reduced household welfare under relatively mild assumptions. The trade-off was that when income observations over time are aggregated at the household level, welfare measures increase and poverty evaluations decrease when compared to indices based on punctual observations. This is because the averaging mitigates the impact of negative shocks. This smoothing effect, however, was more than offset once the disutility from income fluctuations was taken into account, assuming only moderate levels of risk aversion in line with most estimates of the uncertainty literature.

Most importantly, the sizeable effects of fluctuations on welfare and poverty were not limited to periods of crisis or downturns. The findings indicate that income fluctuations at the household level have substantial effects on well-being even during periods of aggregate growth, for instance during the 1996-1998 period in Argentina. This result reflects the finding that a substantial fraction of the population entered poverty even when aggregate rates were falling.

Finally, the third dimension refers to the effects of an economic crisis from a dynamic perspective. The empirical results in this paper indicate that major macroeconomic shocks, like the 2001-2002 crisis in Argentina, not only reduce income levels, but also increase income risk, which magnifies their overall negative impact on poverty and well-being.

While the importance of dealing with the effects of aggregate shocks has long been recognised, in terms of policy implications, the main conclusion from this paper is that safety nets and other social protection mechanisms, while vital during major crises, should also be implemented on a continuous basis, irrespective of the short term evolution of macroeconomic aggregates. This conclusion is based on the empirical findings on the incidence of income fluctuations on household welfare. While the results indicate that major macroeconomic shocks substantially reduce income levels and increase income risk, the detrimental effect of income fluctuations at the household level was also found to be significant during periods of stability or recovery. Moreover, irrespective of changes in GDP, during the whole 1995-2002 period in Argentina a substantial proportion of the population entered poverty between two periods of time, even when poverty rates were falling, and a significant proportion of observed poverty was attributed to its transient component.

This conclusion is reinforced by recent figures that have uncovered some hysteresis of poverty in Argentina: the strong recovery in GDP growth observed in 2003 has reduced unemployment levels, but poverty rates are not falling as fast (INDEC, 2004). The implication for future interventions is that it is as important to insure households against income risk and to avoid entry into poverty on a continual basis as it is to provide coping mechanisms during future crises.

Finally, the results in this paper indicate that the design of long term policies for social protection must draw both on traditional static poverty profiles and on

studies of income dynamics. Panel datasets, though not without their problems, provide vital information about the underlying movements that result in aggregate poverty changes, and thus their collection should be given a higher priority within statistical agencies in developing countries.

In terms of further research, the evaluation framework presented in this paper could be extended by developing a formal axiomatisation of the resulting measures, as Calvo and Dercon (2003) do for vulnerability measures, and by relating it to the literature on income mobility, as done by Gottschalk and Spolaore (2002). The analogy with risk theory provided the concept of variability aversion, but studying the underlying axioms would facilitate the incorporation of additional principles for intertemporal analysis. Some of the limitations of the expected utility model for the evaluation of past incomes were addressed by incorporating discounting into the framework, which accounts for important issues in a dynamic setting such as path-dependence and time preferences. However, extensions to the evaluation framework could mimic the existing departures from the standard theory of risk and expected utility, for instance with reference-based utility, loss aversion (Kahneman et al., 1991) and experienced utility (Kahneman et al., 1997).

References

- ARROW, K. J. (1970): *Essays in the Theory of Risk-Bearing*, North-Holland, Amsterdam.
- ATKINSON, A. B. (1970): "On the Measurement of Inequality," *Journal of Economic Theory*, 2, pp. 244–263.
- (1987): "On the Measurement of Poverty," *Econometrica*, 55(4), pp. 749–64.
- ATKINSON, A. B., AND F. BOURGUIGNON, eds. (2000): *Handbook of Income Distribution*, North Holland, Amsterdam.
- BESLEY, T. (1995): "Savings, Credit and Insurance," in *Handbook of Development Economics Volume 3*, edited by J. BEHRMAN AND T. N. SRINIVASAN, chap. 36, pp. 2122–2207, Elsevier Science, North-Holland.
- BLACKORBY, C., AND D. DONALDSON (1987): "Welfare Ratios and Distributionally Sensitive Cost-Benefit Analysis," *Journal of Public Economics*, 34(1), pp. 265–290.
- BONVECCHI, A. (2003): "Business as Usual. Political Methods and Economic Normalcy in Argentine Fiscal Policymaking during Structural-Reforms Processes (1983-1999)," Ph.D. thesis, Department of Government, University of Essex.
- BROWNING, M., AND A. LUSARDI (1996): "Household Saving: Micro Theories and Micro Facts," *Journal of Economic Literature*, 34, pp. 1797–1855.
- CALVO, C., AND S. DERCON (2003): "Vulnerability: an Axiomatic Approach," Unpublished, Oxford University.

- COULTER, F. A. E., F. A. COWELL, AND S. P. JENKINS (1992): "Differences in Needs and Assessment of Income Distributions," *Bulletin of Economic Research*, 44, pp. 77–124.
- COWELL, F. A. (1979): "The Definition of Lifetime Income," Institute for Research on Poverty Discussion paper 566-79, University of Wisconsin, Madison.
- (1982): "Introduction," in *Panel Data on Incomes*, edited by A. B. ATKINSON AND F. A. COWELL, ICERD, LSE, London.
- (1989): "On the Distribution of Lifetime Income in a Lognormal Model," in *Essays on Income Distribution, Economic Welfare and Taxation*, edited by R. HAGFORS AND P. VARTIA, ETLA, Helsinki.
- (1995): *Measuring Inequality*, London School of Economics Handbooks in Economics, Harvester Wheatsheaf/Prentice Hall, London.
- (2000): "Measurement of Inequality," in *Handbook of Income Distribution*, edited by A. B. ATKINSON AND F. BOURGUIGNON, p. 16, Elsevier Science, North-Holland.
- (2003): *The Economics of Poverty and Inequality*, Edward Elgar, Cheltenham.
- (2005): *Microeconomics. Principles and Analysis*, Forthcoming, Oxford University Press.
- CRUCES, G., P. MAKDISSI, AND Q. WODON (2004): "Poverty Measurement Under Risk Aversion Using Panel Data," *Contributions to Economic Analysis & Policy*, 3(1), p. Article 13.
- CRUCES, G., AND Q. WODON (2003a): "Argentina's Crises and the Poor, 1995-2002," *Económica*, 49(1-2).
- (2003b): "Risk-Adjusted Poverty in Argentina: Measurement and Determinants," In World Bank (2003), *Argentina Crisis and Poverty 2003. A Poverty Assessment*, Volume 2. Also available as *Distributional Analysis Research Programme Working Paper 72*, STICERD, London.
- (2003c): "Transient and Chronic Poverty in Turbulent Times: Argentina 1995-2002," *Economics Bulletin*, 9(3), pp. 1–12.
- DEATON, A. S. (1997): *The Analysis of Household Surveys*, Johns Hopkins Press for the World Bank, Baltimore, Maryland.
- DEATON, A. S., AND J. MUELLBAUER (1980): *Economics and Consumer Behavior*, Cambridge University Press, Cambridge.
- DRÈZE, J., AND F. MODIGLIANI (1972): "Consumption Decisions Under Uncertainty," *Journal of Economic Theory*, V, pp. 308–35.
- FELLI, L. (2003): "Advanced Economic Theory, Lecture 1," Unpublished lecture notes, London School of Economics.
- FOSTER, J., J. GREER, AND E. THORBECKE (1984): "A Class of Decomposable Poverty Measures," *Econometrica*, 52(3), pp. 761–66.
- FRIEDMAN, M., AND L. J. SAVAGE (1948): "The Utility Analysis of Choices Involving Risk," *Journal of Political Economy*, 56, pp. 1–23.
- GALIANI, S., D. HEYMANN, AND M. TOMMASI (2003): "Great Expectations and Hard Times: The Argentine Convertibility Plan," *Economia, The Journal of the Latin American and Caribbean Economic Association*, 3(2).

- GASPARINI, L. (2003): "Perfil Demográfico de Pobres y Nuevos Pobres," in *Características Demográficas y Pobreza en Argentina*, edited by CENTRO DE ESTUDIOS DISTRIBUTIVOS, LABORALES Y SOCIALES (CEDLAS), chap. 4, Universidad Nacional de La Plata, and Inter-American Development Bank.
- GERCHUNOFF, P., AND L. LLACH (2004): *El Ciclo de la Ilusión y el Desencanto*, Ariel, Buenos Aires.
- GOTTSCHALK, P., AND E. SPOLAORE (2002): "On the Evaluation of Economic Mobility," *Review of Economic Studies*, 69, pp. 191–208.
- HAMMOND, P. J. (1975): "A Note on Extreme Inequality Aversion," *Journal of Economic Theory*, 11, pp. 465–467.
- (1981): "Ex-Ante and Ex-Post Welfare Optimality under Uncertainty," *Economica*, 48(191), pp. 235–250.
- INDEC (2002): "Incidencia de la Pobreza y de la Indigencia en los Aglomerados Urbanos," Información de Prensa, Instituto Nacional de Estadísticas y Censos, Buenos Aires.
- (2004): "Incidencia de la Pobreza y de la Indigencia en los Aglomerados Urbanos," Información de Prensa, Instituto Nacional de Estadísticas y Censos, Buenos Aires.
- JALAN, J., AND M. RAVALLION (1998): "Transient Poverty in Postreform Rural China," *Journal of Comparative Economics*, 26, pp. 338–357.
- (2000): "Is Transient Poverty Different? Evidence for Rural China," *Journal of Development Studies*, 36(6), pp. 82–99.
- KAHNEMAN, D., J. KNETTSCH, AND R. THALER (1991): "Anomalies: The Endowment Effect, Loss Aversion, and Status Quo Bias," *Journal of Economic Perspectives*, 5, pp. 193–206.
- KAHNEMAN, D., P. WAKKER, AND R. SARIN (1997): "Back to Bentham? Explorations of Experienced Utility," *Quarterly Journal of Economics*, 112(2), pp. 375–405.
- KIMBALL, M. S. (1990): "Precautionary Savings in the Small and in the Large," *Econometrica*, 58(1), pp. 53–73.
- KUROSAKI, T. (2003): "Measurement of Chronic and Transient Poverty: Theory and Application to Pakistan," Unpublished, Institute of Economic Research, Hitotsubashi University, Japan.
- LANJOUW, P., AND M. RAVALLION (1995): "Poverty and Household Size," *Economic Journal*, 105(433), pp. 1415–34.
- LELAND, H. E. (1968): "Saving and Uncertainty: The Precautionary Demand for Saving," *Quarterly Journal of Economics*, 82(3), pp. 465–473.
- LEWIS, C. M. (2002): *Argentina: A Short History*, Oxford: Oneworld.
- LIGON, E., AND L. SCHECHTER (2003): "Measuring Vulnerability," *Economic Journal*, 113(486), pp. C95–110.
- (2004): "Evaluating Different Approaches to Estimating Vulnerability," Unpublished, Department of Agricultural and Resource Economics, University of California, Berkeley.

- MAS-COLELL, A., M. D. WHINSTON, AND J. R. GREEN (1995): *Microeconomic Theory*, Oxford University Press, Oxford.
- MILNE, F., AND H. M. SHEFRIN (1988): "Ex Post Efficiency and Ex Post Welfare: Some Fundamental Considerations," *Economica*, 55(217), pp. 63–79.
- MORALES, E. (1988): "Canasta Básica de Alimentos - Gran Buenos Aires," Documento de trabajo no. 3., INDEC / IPA, Buenos Aires.
- NEWBERY, D. M. G., AND J. E. STIGLITZ (1981): *The Theory of Commodity Price Stabilization*, Clarendon Press, Oxford.
- O'DONOGHUE, E. D., AND M. RABIN (1999): "Doing It Now or Doing It Later," *American Economic Review*, 89, pp. 103–124.
- PRATT, J. W. (1964): "Risk-Aversion in the Small and in the Large," *Econometrica*, 32(1-2), pp. 122–36.
- RAVALLION, M. (1988): "Expected Poverty under Risk-Induced Welfare Variability," *Economic Journal*, 98(393), pp. 1171–82.
- (1994): *Poverty Comparisons: Fundamentals of Pure and Applied Economics*, Harwood Academic Publishers, London.
- (1998): "Poverty Lines in Theory and Practice," Living Standards Measurement Study Working Paper 133, World Bank, Washington DC.
- ROTHSCHILD, M., AND J. E. STIGLITZ (1969): "Increasing Risk: A Definition and its Economics Consequences," Cowles Foundation Discussion Paper 275; published in two parts in the *Journal of Economic Theory*, Volumes 2 (1970) and 3 (1971).
- SANDMO, A. (1970): "The Effect of Uncertainty on Saving Decisions," *The Review of Economic Studies*, 37(3), pp. 353–360.
- THORBECKE, E. (2003): "Conceptual and Measurement Issues in Poverty Analysis," Presented at the UNU / WIDER Conference on Inequality, Poverty and Human Well-being, 30-31 May 2003, Helsinki.
- VON NEUMANN, J., AND O. MORGENSTERN (1944): *Theory of Games and Economic Behavior*, Princeton University Press, Princeton, New Jersey.
- WORLD BANK (2000): "Argentina: Poor People in a Rich Country," Report 19992-AR, Poverty Reduction and Economic Management, Washington DC.
- (2003): "Argentina Crisis and Poverty 2003. A Poverty Assessment," Report 26127-AR in two volumes, Poverty Reduction and Economic Management, Washington DC.