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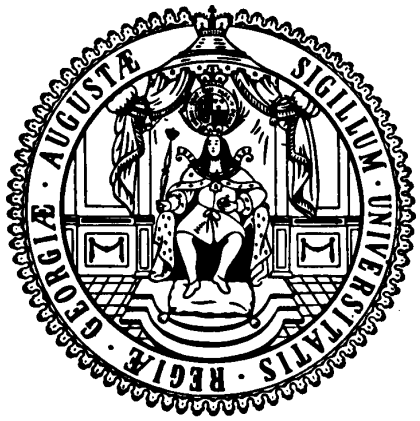

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Pro-Poor Growth Using Non-Income Indicators: An Empirical Illustration for Colombia

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Pro-Poor Growth Using Non-Income Indicators: An Empirical Illustration for Colombia

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June 23, 2009

Abstract

In this paper, we analyze how the distribution of selected non-income welfare indicators changed between 1997 and 2003 in Colombia. We use multidimensional pro-poor growth measurement techniques and create indices for assets, health, education, and subjective welfare using two alternative weighing techniques: polychoric principal components and normatively selected weights. Results show that while income and expenditures fluctuated according to economic growth, reflecting the effects of the 1999 economic crisis, non-income indicators had minor changes. While income and expenditures decreased for all income percentiles, and relatively more for the richest, the non-income dimensions stagnated and remained in 2003 as unequally distributed as in 1997.

***JEL* Classification:** D30, I30, O10, O12.

Key words: Pro-Poor Growth, Inequality, Welfare Measurement, Multidimensionality of Poverty, Latin America, Colombia

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1 Introduction

One of the major issues concerning poverty analysis during the last decades was the recognition that poverty cannot be only measured as lack of income, but that there are multiple dimensions by which deprivation can be observed. In the case of Colombia, multidimensional poverty has been approached using the Human Development Index (HDI), the Unmet Basic Needs Index (NBI) and the Life Conditions Index (ICV).[1] However, all three have methodological and conceptual shortcomings. Moreover, research on the effects of macroeconomic growth, stagnation, or recession on multidimensional poverty is scarce.

The objective of this paper is to analyze how the distribution of particular dimensions of welfare in Colombia changed between 1997 and 2003, and if there was a relation between changes in income and non-income dimensions. We create indicators reflecting human and physical capital (education and assets), health status, and subjective welfare and track relative and absolute changes in those indicators along percentiles. By applying the recently developed methodologies on multidimensional pro-poor growth (Klasen, 2008) to the Colombian Living Standard Measurement Survey (LSMS) we discuss whether changes in assets, education, and health were more beneficial to the poor than to the non-poor. For constructing indices, we select a subset of variables and apply principal component analysis (PCA) in a recently modified verion as polychoric PCA, suggested by Kolenikov and Angeles (2009) to define weights. This methodology allows to correctly calculate the correlation matrix before applying traditional principal components analysis, diverging from the standard procedure used up to now in the literature. Results are compared to the same indicators using normatively selected weights to enrich the discussion about the right weighting procedure.

Although the time span is short and covers a turbulent economic period with a large recession, it is quite relevant because it gives an insight into how it affected non-income dimensions like education, health, assets ownership, and access to public services. We find that multiple dimensions of welfare might contradict each other in the short run, particularly when they depend on public policies. Public spending can thus play an important role for counteracting the depth of economic crisis like the one experienced in Colombia in 1999. We also find that even though infrastructure conditions and access to education improved due to reforms and higher public spending, self reported welfare perception was largely driven by available income and thus by consumption possibilities.

[1] NBI and ICV are the abbreviations in Spanish, which we will keep in this document.

In contrast to the available literature on Colombia, our subjective welfare indicator does not show improvements in self reported welfare of Colombians between 1997 and 2003.

Results also show that while income and expenditures fluctuated according to economic growth, reflecting the effects of the 1999 economic crisis, non-income indicators proved to be more stable, less unequally distributed, and had minor improvements during the period of analysis. We find that income and expenditures decreased relatively more for the richest, while the non-monetary welfare dimensions stagnated and remained in 2003 as unequally distributed as in 1997.

2 Multidimensional Poverty Analysis: Concept and Measurement Issues

2.1 Concept and Use

Multidimensional poverty analysis is primarily concerned with poverty assessment in attributes different than income. Conceptually, it gained attention among academics and policy makers in the last two decades, inspired by the work of Sen (1985), who developed what is known in the literature as the capabilities approach. According to this approach, poverty is understood as deprivation of capabilities, or substantive freedoms, suggesting that poverty measures based solely on income and material status do not represent all aspects of human being, nor give information about people's capacities to achieve basic functionings. The capabilities approach also focuses on the individual's ability to participate in society, move across different spheres of life, and access markets, something that can hardly be captured by traditional income based poverty measures (Clark, 2005).

Although there is a consensus about the existence of multiple dimensions of poverty, there is not a unique combination of dimensions to be included, and there are big debates on how to determine a threshold for judging whether an individual is poor or not. Dimensions frequently included are health, nutrition, education, and dwelling characteristics, taken as tangible outcomes that reflect functionings. However, there are many dimensions that can hardly be measured, but affect the ability of an individual to escape out of poverty. Typical examples are freedom, human rights, and violence.

Some authors argue that the different dimensions of poverty are generally weakly correlated with income (or expenditures) and that links between income and indicators such as malnutrition, mortality, and school enrollment are difficult to be identified (Klasen, 2000; Günther and Klasen, 2009). Other authors affirm that multidimensional welfare

indicators and income give similar overall pictures of poverty (von Maltzahn and Durrheim, 2007). Using aggregated data, empirical cross-country literature focusing on convergence in indicators different than income shows that there is convergence, even in absence of convergence in per capita income (Kenny, 2005; Neumayer, 2003). Thus, such studies argue for giving less attention to per capita income, but shifting it to other welfare indicators.

An important range of studies on multidimensional poverty use variables reflecting physical, human, and social capital to create a composite index. The internationally best known indicator trying to capture multidimensional poverty is UNDP's Human Development Index (HDI), which combines indicators of longevity (measured by life expectancy at birth), education (a weighted average of the adult literacy rate and school enrollment rates), and living standards (GDP per capita converted to USD using PPP). This indicator has been criticized for having weak conceptual foundations, but has gained a key role in policy debate given its comparability across countries (Kanbur, 2002). With the HDI of 2006, Grimm, Harttgen, Klasen, and Misselhorn (2008) have addressed some of the critique raised against the HDI. They extend the analysis from the macro level of between country comparisons, i.e., of national averages, to the micro level in breaking down the HDI for comparisons within countries. They do so by disaggregating the HDI by income quintile for a sample of 13 countries using micro-level household surveys. In doing so, the authors address one of the main critiques towards the HDI. With their approach, looking at the distribution of multidimensional poverty within countries has become possible.

What Grimm et al. (2008) criticize (but not address themselves) is the weighting scheme by which each component gets the same arbitrary weight. In this paper, we address this critique and present two ways to avoid equal weighting. One is to define the weights based on researchers' own evaluation, thus on normative procedures, lined out in Section 3.2. The definition of normative weights are of course a very broad field which possibly exposes us to many discussions. However, equal weighting, despite having become a popular weighting scheme, should be exposed to even more discussion and critique because it sets weights normatively (or better said, cowardly) to be equal to each other. Another way to define weights is to use statistical procedures to generate an overall index. Particular attention has been given to aggregation and weighting procedures of asset indices, often used to proxy for socio-economic status in the absence of income or expenditures information, i.e., to evaluate long-term wealth independently of short-term or cyclic income fluctuations.

The most widely used technique in recent research is principal component analysis (PCA), which extracts the linear combinations between variables that best explain their variance and covariance structure. Intuitively, it allows aggregating several variables into a single dimension, giving each one a weight resulting from the eigenvalues and eigenvectors of the covariance matrix. An alternative to weight selected variables is to use the price of assets and value them in terms of the monetary welfare they provide. This is only possible if prices, quantities, and the current monetary value of each item are available. When trying to avoid equal weighting, the researcher can assign normative weights according to her own criteria of the welfare each item provides, a procedure which might be questionable, but allows to control for different valuations according to the household's environment, for example the use of a bicycle as transportation vehicle in rural areas versus its use in urban areas (Moser and Felton, 2009).

The use of PCA for creating asset indices as proxy measures for socioeconomic status was suggested by Filmer and Pritchett (2001). The authors transform selected categorical variables into binary ones, splitting each category into a set of dummy variables before using PCA. The resulting asset index for each household is defined as:

$$A_j = \frac{f_1 * (a_{j1} - a_1)}{s_1} + ... + \frac{f_N * (a_{jN} - a_N)}{s_N} \tag{1}$$

where f_1 is the scoring factor for the first asset as resulting from the first principal component, a_{j1} is the j^{th} household's value for the first asset and a_1 and s_1 are the mean and standard deviation of the first asset variable over all households.[2]

As discussed by Kolenikov and Angeles (2009), PCA is suitable when variables are multivariate normal, an assumption that does not hold when data are discrete. Breaking down categories into dummy variables results in perfectly negatively correlated variables, introducing spurious correlations. Additionally if the majority of the data points are concentrated in a single category, the method assigns larger weights to the most skewed variables and creates a biased correlation matrix. The authors propose using polychoric correlations in order to estimate the correlation matrix before using PCA. Polychoric PCA assumes that the ordinal variable has an underlying continuous variable and uses maximum likelihood to calculate how that continuous variable would have to be split up in order to produce the observed data. The resulting polychoric correlation matrix is used to calculate the eigenvectors. This procedure is particularly useful for ordinal data as

[2]Other authors using this procedure are for example Ram (1982), Sahn and Stifel (2000, 2003), and Klasen (2000).

it allows maintaining the original valuing and ordering of categories. Moreover it allows computing weights not only on owning but also not owning an asset (Moser and Felton, 2009) and it generates a larger percentage of explained variance by the first component as shown by Kolenikov and Angeles (2009).[3] To our knowledge polychoric PCA has not been applied in empirical research on multidimensional poverty in Colombia, but traditional PCA.

Whatever the weighting system is, such measures try to capture the relative importance of each asset or each dimension in welfare. After defining a poverty line, it is possible to track households or individuals under a certain threshold and calculate poverty indicators. Indicators have frequently different underlying concepts of what contributes to multidimensional poverty and use unique combinations of indicators. Thus, comparisons are difficult.

2.2 Multidimensional Poverty Dynamics: Pro-Poor Growth

Evident from above is the point that poverty is a multidimensional phenomenon that should be measured by one or several multidimensional indices. Furthermore, the within- and between-country distribution of multidimensional welfare is an important point having gained more attention in the last years. The HDI by income quintile of Grimm et al. (2008) is a one-time, static snapshot on this point. The next point is to look beyond statics and turn to dynamics, thus at multidimensional poverty and inequality over time.

Since the early 2000s, the concept of pro-poor growth has gained attention in research and policy. The term pro-poor growth refers broadly to economic growth that benefits the poor, and has been measured empirically mainly through household income or consumption expenditures changes, i.e., in the traditional income-based dimension of poverty. Studies on pro-poor growth can be classified according to their approach (weak or strong), and according to specific features of the measurement methodologies (complete/full or partial). For the weak (also called general) approach, any growth path leading to poverty reduction is considered pro-poor, so any positive income growth is defined as being pro-poor. In contrast, the strong (also called strict) approach considers growth to be pro-poor only when both poverty and inequality decrease.

The strong approach to pro-poor growth can be further subdivided into relative or

[3] An alternative to overcome the problem of using PCA for discrete data is multiple correspondence analysis (MCA), see for example the application of Booysen, van der Berg, Burger, Maltitz, and Rand (2008).

strong absolute. The relative approach focuses on proportional changes in income between poor and non-poor and considers growth to be pro-poor when relative inequality decreases. This is only possible if incomes of the poor rise by a higher proportion than incomes of the non-poor. For the strong absolute approach, growth is pro-poor if absolute income gains of the poor are as high or higher than those of the non-poor, meaning that absolute inequality (defined as the absolute difference in income between the poor and non-poor) decreases.[4]

As shown by Grosse, Harttgen, and Klasen (2008a) and Klasen (2008) for Bolivia, it is possible to extend pro-poor growth measurement to non-income variables such as education or health by specifying non-income growth incidence curves (NIGIC). The income-based growth incidence curve (GIC) graphs the rate of growth of real income (or real expenditure) (shown at the y axis) for each percentile of the distribution (shown the x axis with increasing order by income) between two periods of time.

A curve below 0 at all points of the distribution indicates that all households suffered income losses. The contrary indicates income gains for all percentiles and consequently a poverty decrease compared with the initial period. An upward-sloping curve indicates that rich households (the richer income percentiles) benefited more than others, while a downward-sloping curve indicates that the poor benefited more, giving evidence of pro-poor growth in a relative sense (i.e., that relative inequality has fallen). Following Ravallion and Chen (2004), the GIC is formally derived from the following equations:

$$y_t(p) = F_t^{-1}(p) = L_t^{'}(p)\mu_t \quad \text{with} \quad y_t^{'}(p) > 0 \tag{2}$$

$$GIC : g_t(p) = \frac{y_t(p)}{y_{t-1}(p)} - 1 \tag{3}$$

$$g_t(p) = \frac{L_t^{'}(p)}{L_{t-1}^{'}(p)}(\gamma_t + 1) - 1 \tag{4}$$

where p is the corresponding percentile, F_t^{-1} is the inverse of the cumulative distribution function at the p^{th} percentile (which gives the income of that percentile), $L_t(p)$ is the

[4] An example given by Ravallion and Chen (2004) illustrates the difference between changes in relative and absolute inequality. Consider only two households: a poor one with an income of USD 1,000 and a non-poor one with an income of USD 10,000 in the first period. After an income increase of 100 percent for both households in the second period, the poor household earns USD 2,000 while the non-poor one earns USD 20,000. In this case, the distance from each household to the mean remains unchanged and thus relative inequality does not change. According to the strict approach, growth would have been neither pro-poor nor anti-poor. But since the absolute difference between the two households increases from USD 9,000 to USD 18,000, absolute inequality rises sharply and growth can be considered anti-poor in the strong absolute sense.

Lorenz curve (with slope $L_t^{'}(p)$) and $\gamma_t = \frac{\mu_t}{\mu_{t-1}} - 1$ is the growth rate in the mean (GRIM) of income (or expenditure) per capita.

The GIC can be defined as the growth rate in income of the p^{th} percentile as shown in Equation (3) or as shown in Equation (4) after replacing (2) into (3). If all percentiles exhibit the same growth rate, then the Lorenz curve does not change, inequality remains unchanged and $g_t(p) = \gamma_t$ in Equation (4) for all p. Should the ratio between the growth rate of the p^{th} percentile to the GRIM increase over time (i.e., $\frac{y_t(p)}{\mu_t} > \frac{y_{t-1}(p)}{\mu_{t-1}}$), then the growth rate of the p^{th} percentile is higher than the GRIM, $g_t(p) > \gamma_t$. Following this, inequality falls if $g_t(p)$ is a decreasing function for all p (Ravallion and Chen, 2004).

The graphical analysis of the GIC would not demand using a poverty line to determine whether growth was beneficial to the poor. However this is only possible when the slope of the curve has a clear trend.[5] In practice, the GIC often has different slopes at different points and switches along percentiles, making it impossible to draw clear conclusions. To overcome this problem Ravallion and Chen (2004) suggest calculating the rate of pro-poor growth (PPGR) as the area below the GIC up to the selected poverty line of the initial period. This area equals total income growth of the poor. The PPGR is equivalent to the ordinary rate of growth times a distributional correction given by the ratio of the actual change in poverty over time (using the Watts index) to the poverty change that would have been observed if growth had not affected the income distribution. If the PPGR is higher than the GRIM, growth is pro-poor, while the opposite result indicates that distributional changes negatively affected the poor. Formally this is defined as follows:

$$PPGR = g_t^p = -\frac{dW_t}{dt} = \frac{1}{H_t}\int_0^{H_t} g_t(p)dp \tag{5}$$

where

$$W_t = \int_0^{H_t} \log[\frac{z}{y_t(p)}]dp \tag{6}$$

is the Watts poverty measure, z is the poverty line, and H_t is the headcount ratio H at time t.

The extension of GIC to non-income indicators is particularly interesting to depict changes in variables expressing social welfare (or functionings of households) by income centiles and thus investigating how the progress was distributed over the income distribution (Grosse et al., 2008a). It is particularly useful to analyze absolute changes in

[5] First-order dominance of the distribution at date t over $t-1$ exists when the GIC is above 0 for all percentiles, a conclusion that cannot be drawn if the GIC switches sign.

non-monetary indicators, which is additionally informative to using using only growth rates. In the framework of pro-poor growth analysis, such changes are defined through the following set of equations:

$$GIC_{absolute} : c_t(p) = y_t(p) - y_{t-1}(p). \tag{7}$$

$$PPCH = c_t^p = \frac{1}{H_t} \sum_{1}^{H_t} c_t(p) \tag{8}$$

$$CHIM = \delta_t = \mu_t - \mu_{t-1}. \tag{9}$$

Equation (7) expresses absolute changes of the selected indicator for each centile (in this case as example income y), Equation (8) defines the pro-poor change (PPCH) as the average absolute change of the poor, and Equation (9) is the change in mean (CHIM). If the PPCH exceeds the CHIM, growth is pro-poor in the strong absolute sense. Thus it is possible to measure pro-poor growth using the three definitions of weak absolute, weak relative, and strong absolute introduced above. It is also useful to present results conditional to income (sorted by income percentiles) and unconditional.[6]

As mentioned already, in this paper we concentrate on selected variables reflecting dwelling characteristics and asset ownership, education, health, and subjective welfare. For constructing an asset index we follow the methodology proposed by Kolenikov and Angeles (2009). We do not intend to assess the magnitude of poverty in the selected non-income dimensions, i.e., we do not define poverty lines for each dimension. Our goal is rather to compare the distribution along percentiles in our proposed non-income indicators with the same distribution according to the income dimension and particularly of people classified as income poor. Interpretations are done thus in light of the moderate and extreme income poverty lines as will be explained in detail in Section 3.2.

[6]For the curves defined in Equations (7) and (3) and for the single measures (PPGR, GRIM, PPCH, CHIM), the accuracy of estimates can be questioned. The easiest method is to use bootstrap techniques for creating confidence intervals or standard errors, for example. For simplicity and better visuality of graphs, we show only the point estimates here. As can be seen in Grosse et al. (2008a), confidence intervals of conditional results are wider than of unconditional due to higher variation of non-income outcomes in income percentiles. Another example of showing an indication of accuracy of poverty and inequality results is given in Grosse, Klasen, and Spatz (2007).

3 Application to Colombia

3.1 Macroeconomic Issues and their Expected Relation to Multidimensional Poverty

At the beginning of the 1990s, Colombia undertook several political and economic reforms by which the economic model moved from an import substituting to an open and liberalized one. Several changes in the labor, financial, and exchange rate markets were undertaken, together with drastic reductions in average tariffs and the removal of barriers to foreign direct investment and capital exports (Cardozo, 2008).

The role of the state in providing education and health was also modified. The constitution of 1991 accelerated the fiscal decentralization process. The new model increased the responsibility of departments and municipalities in the administration of resources and placed them as primary providers of basic services to the population, particularly in education and health (Sánchez, 2006; Bès, Hernández, and Oliva, 1998). Reforms were expected to increase public spending efficiency through participation of local governments that are much more aware of population needs.

Decentralization had positive effects on access to basic services, although not in the expected magnitude. Changes in the education system contributed to progressive increases of gross enrollment rates, particularly concerning secondary education, but the quality of public education continued to be very low and even weakened, showing dramatic differences compared to private schools.[7]

In the health sector coverage increased, especially after further reforms undertaken in 1993,[8] moving from 20 percent of the total population in 1993 to 32 in 1995 and 75 in 2004 (Sánchez, 2006). However, the goal of achieving universal health coverage by 2000 as well as equal access for all individuals was not reached, and quality of services remained largely dependent on the purchasing power of the households.[9]

At the end of the 1990s, the economic and political environment became particularly difficult due to the combination of the second largest recession experienced during the 20^{th} century and the dramatic escalation of the armed conflict. Large unemployment rates due

[7] Access to pre-school education increased from 51 percent in 1995 to 88 percent in 2006 and gross enrollment rates in middle and secondary education also rose, although there is still an important lag in achievements of secondary schooling, especially in rural areas, where even though gross enrollment rates almost doubled since 1995 they were only 55 percent in 2006 (Sánchez, 2006). Widespread primary education explains high literacy rates (of 98 percent) among the youth.

[8] Law 100 of 1993.

[9] Recent studies show that only 48.1 percent of population in the 1^{st} quintile of income are covered by the health system, compared to 83.7 percent of the 5^{th} quintile (Jazmín, Rivera, and Castañeda, 2004) and that public spending in health benefits the richest 4^{th} and 5^{th} quintiles (González, 2001).

to the crisis as well internally forced displacement due to violence increased poverty to levels last observed in 1985. The recession that started in 1996 and lasted until 2001 achieved a peak in 1999 with a contraction of -5.52 percent in per capita GDP. All poverty indicators increased up to 1999 (headcount of 57 percent), slowed down from 2000 to 2001, rose again in 2002, and improved since then. By 2005, national poverty and inequality indicators as well as real income had returned to the levels of the early to mid-1990s, but unemployment remained higher than in 1996, at around 12 percent (Cardozo, 2008).

The temporary effects of the recession on households were certainly channelled through unemployment, and thus reduction of income. It is not clear in how far that affected non-income dimensions, particularly those in which the government was increasing public spending. The final outcome on other dimensions of poverty might have depended on the counteracting effect of reforms at that time. One could expect households in the upper quintiles of the income distribution to have overcome the crisis easily, restructuring expenditures towards maintaining education and health status but reducing luxurious expenditures. The effect on middle income groups is much harder to be predicted: the most vulnerable might have become at least temporarily poor, others might have turned to using more public services, particularly education, as suggested by Barrera and Domínguez (2006). Finally, income related deprivation of the poorest quintiles might have accelerated drop out of students, reduced asset ownership, and slowed down the pace of improvement in access to public services (Sarmiento, Angulo, and Espinoza, 2005).

Periodical analysis of multidimensional poverty in Colombia is done using the Human Development Index (HDI), the Unmet Basic Needs Index (NBI) and the Life Conditions Index (ICV) as proxies. The NBI includes five basic needs: inadequate dwelling, dwellings without basic services, households being overcrowded, no attendance to school, and high economic dependence. It classifies a household as poor if it lacks one of these basic needs, and extremely poor if it lacks two or more. Using Census data, the NBI can be calculated at the municipal level (the smallest administrative unit) and is used to determine distribution of transfers from the central government (for example to infant primary care and education (DNP, 2008)), to target social programs, and also to create poverty maps, thus to assess the geographical distribution of poverty. This indicator has several well known shortcomings. The selection of the included basic needs is subjective as well as the fact that they have the same weight. Thus, two households are equally poor if one lacks good dwelling characteristics and if schooling-age members of the other

do not attend school. Moreover, it does not allow to make assessments on the depth of poverty nor judgements on the amount of poor persons as it is calculated by household, making the classification dependent on the demographic characteristics of it. Finally, components of the NBI are strongly oriented towards infrastructure conditions, some of which are not relevant to measure poverty in urban areas due to nearly full coverage of service infrastructure in urban areas (DNP (2006); Feres and Mancero (2001)).

The ICV ranks from 0 to 100, with the latter representing the highest possible welfare. It captures in a single measure variables corresponding to quality of housing, access to public services, education, and the size and composition of the household. The corresponding weights are calculated using PCA. This index has become an important tool for targeting of social programs, but is criticized for leaving completely aside the income dimension, and being built based purely on statistical procedures.

Recent research on multidimensional poverty has been done by Vélez and Robles (2008), who apply axiomatically derived poverty indices to three socio-economic dimensions: consumption, education, and security, in order to explain improvements of welfare perceptions by Colombians between 1997 and 2003. The authors apply seven types of three-dimensional poverty indicators[10] to the mentioned dimensions and test four types of normative weights among them using data from the Colombian Living Standard Measurement Survey (LSMS) in 1997 and 2003.[11] Consumption is calculated in two ways: excluding and including subsidies; education corresponds to years of education of the household head, security to a dichotomous variable on how the person feels in the neighborhood, and welfare to the persons' perception of the households' current economic conditions.

The authors conclude that the negative effects on welfare induced by the lower per capita consumption due to the economic recession of the late 1990s, were more than compensated by the increasing progressiveness of subsidies due to social programs and the improvement in the educational endowments of household heads. However, conclusions are very sensitive to the chosen normative weights among dimensions, and the relation with improvement in self reported welfare cannot be directly derived from the resulting reduction in the multidimensional poverty indices.[12]

[10] Intersection, Union, Chakravarty 1 and Chakravarty 2, Bourguignon-Chakravarty-Substitutes, Bourguignon-Chakravarty-Complements and Bourguignon-Chakravarty-Leontief.

[11] First, equal weighting; second, 50 percent for consumption and 25 percent for education and security each; third, 50 percent for education and 25 percent for consumption and security each; and fourth, 25 percent for consumption and education each and 50 percent for security.

[12] Hernández Flórez (2007) presented at the 50 years CEDE conference on 2008 results of her Master Thesis. The author tested if progress in non-monetary dimensions substitute or complement for progress

3.2 Non-Income Indicators

Our approach consists of creating indices reflecting three key areas of welfare: basic assets and infrastructure endowment of the household (including access to public services), education, split up into education of children in schooling age and education of adults, and health. We also construct a fourth index on welfare self perception in order to discuss if welfare reported by households increased or decreased with economic conditions that deteriorated dramatically between 1997 and 2003. The indices on assets, health, and subjective welfare were created using two weighting alternatives: polychoric PCA and normative own weighting.

Constructing non-income indicators has two challenges: selection of adequate variables, constrained usually by data availability, and selection of the weighting procedure. In this study we focused on three non-income dimensions. The first one comprises durables ownership, dwelling characteristics, and access to services, combined together into what we call an asset index. This dimension is intended to reflect accumulated long-term welfare beyond fluctuations in income. Note that it is calculated at the household level, as it reflects items and services shared by all its members. The asset index can be used to complement the income dimension, overcoming problems of seasonality and high variability in income, particularly of households engaged in informal markets. It is also useful to overcome income measurement error (Moser and Felton, 2009).

To construct the asset index, we selected a subset of eight basic household items, five dwelling characteristics, number of rooms per person, and access to public services (Table 1). Each asset corresponds to a binary variable, in which having it is associated with higher welfare.[13] To capture overcrowding in an ordinal variable, we calculated the number of rooms per person and created five groups (at reasonable cutoffs) on it. The services variable includes access to electricity, piped gas (which is a relatively new available service in Colombia), water, sewage, litter collection, and telephone (fixed line network). We entered all of these service separately into the overall asset index.[14]

in monetary dimensions applying a two-dimensional axiomatically derived poverty index. After making pairwise comparisons between income and safety or income and education variables, she concluded that multidimensional poverty increased when considering safeness as non-income dimension, regardless of income, and that when considering education, results are mixed: poverty increased in urban areas and decreased in rural.

[13] We aggregated categories with very low frequencies into a single one for cooking material, wall material, floor material, and type of toilet.

[14] We did not include property of the house in the asset index, due to its large variation in value and therefore in interpretation, as well as because that information is available only for urban areas in the two survey rounds.

Normative weights were assigned according to two criteria: the weight of each item inside the corresponding sub-category composing an index (for example each durable) what we call within weights, and the value inside the index, what we call between weights. Due to lack of information on the amount of each of the eight selected durables a household has, as well as its value, we gave this subset of variables the lowest weight for constructing the asset index. These minimal basic items facilitate household functioning, thus the importance relies on having them, while lack of them is a clear indicator of deprivation. Floor material, wall material, and type of toilet were assigned the highest weights for constructing the asset index, followed by material used for cooking, rooms per person, and services. The same logic applies for the health and subjective welfare indices.

Polychoric PCA weights were calculated using the STATA routine proposed by Kolenikov and Angeles (2009). The baseline results shown here are generated using a pooled sample. For sensitivity, and due to different sample designs, sample sizes, and weighting of the 1997 and 2003 surveys we also calculated them separately for each year. Resulting weights in both years are very similar to the ones shown in Table 1.

With the second non-income dimension using the LSMS data we try to capture health. To construct a health index we selected four variables: reported health status of the person, having or not a chronic health disease, having or not a sickness in the last month, and being affiliated to a medical service. Although the first of these variables is subjective in nature, it is the only one available giving an overall judgement of each person's health and thus is a good proxy for health status. Combinations of other proxy variables for health were tested, but proved to be poorly correlated among each other and thus were not taken into account for the final analysis.

Third, we create a life satisfaction index, which takes into account various spheres of subjective perception: current living conditions compared to 5 years before, perception of whether income is enough for household needs, having had problems with death or serious illness of a family member in the last year, and safety perception in the neighborhood. This combination captures four important aspects: changes in the general welfare perception, subjective judgement of income, major events affecting the whole household, and a proxy for the effects of violence and criminality. For the indicators mentioned above we apply the two weighting alternatives: normatively determined weights and statistically determined weights.

The fourth and last non-income indicator we selected is education. We created sepa-

rately an index for individuals not older than 20 years and one for adults older than that. The main objective of the former is to track progress in population in schooling age taking two aspects into account: years of schooling and being in the right degree for the corresponding age. We assume that children are expected to start primary education at the age of 6, which would drive them to have completed at least 1 year of primary education by the age of 7. If the education process is continuous, at the age of 17 students must be finishing secondary education (11^{th} degree).[15] By subtracting the age of each individual younger than 20 years from the reported years of schooling (YOS) we should ideally get a difference of 6, indicating the student started schooling at 6 and never repeated any degree nor stopped studying. We allow individuals up to 20 years to fall into these indicators, to capture young adults still enrolled in school. The indicator can be defined as follows:

$$E_{children} = Age - YOS. \tag{10}$$

Students enrolled in degrees lower than the right one for their age are considered overaged, and would get a value higher than 6, while students with values lower than 6 were early starters. The maximum and minimum possible values for this indicators are 4 and 20, the first one accounting for a child having started school early or having skipped one year and last one accounting for an illiterate young adult.[16] Improvements in education through this indicator should be reflected in less students being overaged. For adults older than 20 years, we calculate the average years of education by adult household members as follows:

$$E_{adults} = \frac{\sum YOS_{adults}}{\sum N_{adults}}. \tag{11}$$

The detailed overview of all variables used and their weights according to each procedure is shown in Table 1. The normatively assigned weights in Table 1 correspond to weights for each index independently of the others, not to weights for an overall index which would not be interpretable given that some indices are presented at the household level and others at the individual. Inside each index, we chose two different weights: within

[15] According to Law 115 of 1994, all Colombians should receive a minimum of 1 year of preschool education and 9 years basic education divided into 5 of primary schooling and 4 of basic secondary schooling. Schooling grades 10 to 11 are considered as middle education degrees ending up into complete secondary schooling. Upper and lower age bounds for each degree can be defined by each school, but most of them expect children to finish mandatory preschool degree at age 5, primary at 10, basic secondary at 14 and middle education at 17.

[16] One might question if 4 is really better than 6 or if 4 is rather as good as 6. We suggest that 4 is better than 6 since it reflects that the child has higher abilities than others to be able to complete the educational system more quickly and to enter the labor market earlier.

variables and between variables. The weights within variables are higher the higher the welfare provided. The weights between variables were selected according to the relative importance we wanted the variable to have in the index. The final weight is the results of multiplying both. To make this procedure clearer, look at Table 1 again. The asset index, for example, consists of household durables, dwelling quality (material used for cooking, wall, and floor; quality of toilet and shower; crowding), and access to public infrastructure and services. Within-weights show that we consider a fridge more important compared with a video, i.e., within the duralbes sub-index. Between-weights show how important we consider having durables compared to having high quality toilet facilites, i.e., we consider it more important to have a good toilet rather than many durables.

To transform indices into the same scale and ease comparability we normalize them from 0, the worst possible achievement, to 10, the best, following the methodology of the Human Development Index (HDI) and Grosse, Harttgen, and Klasen (2008b).[17] Once normalized, results are averaged by percentile to draw the corresponding NIGIC. We draw for each indicator two types of curves: sorted by income, what we will call hereafter conditional, (e.g., education outcomes for the income-poorest to the income-richest) and in their original form, or unconditional (e.g., from the education-poor to the education-rich). Both, conditional and unconditional will be presented in relative and absolute terms. Relative curves show growth rates in percentages and absolute curves show differences between the two years for each indicator.

3.3 Data

For the current study we used the Living Standard Measurement Survey (LSMS) (Encuesta de Calidad de Vida, ECV) of 1997 and 2003, due to the richness of its questionnaire in non-income aspects compared to the yearly Household Survey (Encuesta de Horares, EH) which focuses strongly on the labor market. Moreover, the ECV includes income and expenditures, for which we draw as well relative and absolute GIC.

Expenditures and income are presented in per capita monthly terms and reported in local currency units constant of 1997. Colombian peso is the local currency, corresponding to an average of 2000 pesos per USD in 1997. We used as deflator the consumer price index for low income groups, available separately for each of the 13 metropolitan areas,

[17] $Index = 10 * \frac{1}{n} \sum_{i=1}^{n} \frac{individual_n - min}{max - min}$. Other possible standardization is dividing by the standard deviation. However, the proposed range between 0 and 10 is simple to explain and understand, and it allows the reader to intuitively and quickly see the distributional difference between each indicator.

rest of urban areas, and rural areas. This same deflator is used to update the poverty lines, which exist for the same subdivisions (Official poverty lines version 2005).[18]

The total amount of observations included in 1997 is 37,735 individuals and in 2003 is 83,757. The sample of 2003 is much higher because it is also representative for sub-urban areas of Bogota and sub-regions of the department of Valle. The ECV is representative at the national, urban, rural, and regional level (five regions) in both years. Monthly household per capita expenditures include all expenditures on food, clothes, leisure, household durables, health, education, services, and finance costs but could neither be corrected for agricultural home production nor household property because this information is only partially available in the 2003 round.

A check for outliers in income and expenditures was done constructing box plots by subgroups, as well as scatter plots of income vs. expenditures to track implausible values. Extreme cases where the difference between income and expenditures is large, checked using scatter plots, were double checked for consistency and possible mistakes in the original information. Outliers were finally identified as values greater or less than three standard deviations from the median of log income or log expenditures and were not used for the analysis.[19] Zeros and missing values were not taken into account to calculate the medians. This procedure skipped out of a total of 854 households in 1997 and 1476 in 2003, corresponding to 2 percent and 1.7 percent of each samples.

4 Results

4.1 Inequality and Distribution by Deciles

Table 1 shows a first snapshot of non-income welfare and the trends from 1997 to 2003. For all indicators (except education) we present the sample means of the variables included. Of the durables included in the assets index, TV and washing machine ownership go up, the other six go down. Stronger changes can be observed for some elements of the dwelling quality, with a strong increase of piped gas as cooking material. Minor improvements are found for wall material, toilet facility, and crowding. Hardly any change show wall material and shower facility. Public services and access to infrastructure increase for all six services. For the variables forming the health index (which is the only one that can be evaluated

[18] For methodological details on the poverty lines, see DNP (2006) and for details on effects of price deflators on pro-poor growth measurement see Günther and Grimm (2007).

[19] These outliers coincide with those showing large difference between income and expenditures, so no additional cases had to be excluded.

at the individual level), we find an overall trend to the second best option ("good") for health status out of four answer options (with less people reporting very good, regular, or bad health status). Chronic diseases go up, temporary diseases go down, affiliation to a medical service system improves. For subjective welfare and living conditions, less households consider their life as better than 5 years ago and more as equal. The share of households that consider their household income as being enough or more than enough for fulfilling their need goes down. Severe health problems or even death of a family member which affect the household as a whole go down. The strongest deterioration occurred for the safety perception which goes down more strongly.

After this overall picture, we aggregate the variables shown in Table 1 to composite welfare indices. In the next step, the distribution of the aggregated indices is shown in Table 2 in which each indicator is calculated for the sample deciles and means, first sorted by income (conditional) and second sorted by the indicator itself (unconditional). For each indicator, the table shows also inequality measures: the ratio of the richest to poorest decile (10:1 ratio), the Gini coefficient, and the Theil Index. Three main issues emerge in these tables: (i) indicator means calculated using normative weights and polychoric PCA are very close, (ii) there are minor improvements in almost all deciles with means staying nearly equal between 1997 and 2003, and (iii) inequality in non-income indicators is low compared to income and expenditures (Table 3), the latter all being higher than 0.5 for the Gini coefficient. Among non-income indicators, inequality measured by the Gini is highest for adult education (0.35 in 1997 compared to 0.34 in 2003) and assets (around 0.22 to 0.24). Inequality is lowest for children's education, and children's education is the only one with increasing inequality over time, only slightly but for all inequality indicators (10:1 ratio, Gini coefficient, Theil index). For all other variables, the indicators show the same trends for all variables: slightly decreasing inequality.

Conditional to income, results are similar between polychoric PCA and normative weights. Unconditional results are not that similar, particularly regarding changes in the 10:1 relation for health and subjective welfare. The relation doubles when using normative weights. In general results using both methods confirm that the 10:1 relation is much lower when percentiles are lined up by income, indicating that not necessarily the income poorest (richest) correspond to the non-income poorest (richest). As expected, we find an income gradient, i.e., means of non-income deciles increase the higher the income decile. Such differences suggest that there are reasons beyond income facilitating or impeding access to

certain assets and services. This might be of course related to geographic location, public policies, and the existence of markets for non-income indicators. Similar results are also found in Grosse et al. (2008a) and Klasen (2008) for Bolivia.

The different outcome between indicators sorted or not by income is very evident in adults' education: approximately 3 versus 20 in both years (Table 2) for the 10:1 ratio.[20] While low inequality in children's education outcomes reflects the nearly full coverage of primary schooling, irrespective of the income decile, high inequality in adult education can be explained by the limited access to public tertiary education, thus depending on households' ability to pay for it in the private sector. It can also reflect persisting low education levels (or even illiteracy) of older cohorts, which do not catch up once they enter the labor force.

The second most unequally distributed indicator, assets, also seems to have an important relation to income, partly explained by the households' ability to pay for public services. Breaking down this indicator to track access to services, one finds very low values for the first income deciles but almost full coverage for the the last.

Comparison of decile means among indicators shows that children's education is (for almost all deciles) the closest one to the upper bound followed by subjective welfare, while the asset index is the most distant from the highest possible limit. Disparities increase the lower the income decile, indicating that poor people do have access to education, at least for children, but cannot afford basic assets, good dwelling characteristics, or access to public services.

Lower inequality in non-income indicators compared to income or expenditures must be interpreted cautiously, given that those indicators have a natural upper bound while income does not. As already mentioned, inequality measures of income and expenditures are pretty high. The Gini coefficient is above 0.5 in both cases, although it decreases over time (Table 3). The 10:1 ratio also decreased over time. As explained by Klasen (2008), inequality in non-income indicators turns out lower, given that most likely rich households already achieved the upper limit while poor households are getting closer to it. Particularly health and children's education have an upper limit, which is 11 years for education. To summarize, there were low improvements in deciles below the income poverty line and a lack of correspondence between decile outcomes sorted or not by income. Inequality prevailed in dimensions less influenced by public policies, that are at the same

[20] Note that the Gini and Theil inequality indicators are calculated only unconditionally, but not conditionally.

time those highly correlated with income.

4.2 Pro-Poor Growth Analysis

4.2.1 Income versus Expenditures

Analysis based on growth incidence curves and pro-poor growth rates show that mean income and expenditures by percentile decreased from 1997 to 2003. Poverty increased (Table 4) and means fell for the overall income distribution. However, contraction was higher for the richest in relative as well as in absolute terms (growth rates and absolute changes).

Table 5 shows pro-poor growth rates (PPGR) and pro-poor changes (PPCH). We present first relative results (growth rates) and then absolute (changes), both divided further into unconditional and conditional to income. The table shows that growth rates in mean (GRIM) for income and expenditures were negative, but contraction was much larger in income (-3.65 versus -2.45). We present PPGR using two different poverty lines: moderate (PPGR mod.) and extreme (PPGR extr.). PPGR were higher than the GRIM but still negative, confirming the contraction of income and expenditures for households in percentiles below the poverty line. Results indicate that on average, percentiles below the extreme poverty line were affected to a lesser extent from contraction in income and expenditures than those up to the moderate poverty line. In absolute terms, the change in mean income (CHIM) was -38,118 Colombian pesos (monthly per capita real of 1997). If considering only households up to the moderate poverty line, the PPCH was -6,939. Once again losses for households up to the extreme poverty line are lower, but proportional to their initial income of a higher magnitude.

As a result, when analyzing income and expenditures, growth was not pro-poor according to the weak (general) nor to the absolute approach. However, relative to the non-poor losses were lower for the poor. The richest percentiles of the distribution experienced the hardest contraction, while households below the extreme poverty line seemed to be less affected by the 1999 economic recession in absolute and relative terms.

The graphical analysis confirms these results. Figure 1 shows the GIC based on income and Figure 2 on expenditures.[21] On the left hand scale we present the relative GIC and on the right absolute changes. In both figures, we observe downward sloping GIC below the 0 axis except for the first 5 percentiles of the income GIC. Although relative losses of the

[21] Note that the graphs exclude the first and last 2 percentiles for better visuality and due to some degree of uncertainty of these values at the extremes of the distribution.

poor were less than those of the non-poor, negative growth rates for almost all percentiles point to an increase in poverty. As can be seen in Table 4 the incidence of poverty (FGT0) increased from 55 to 60 percent between 1997 and 2003. The income based absolute GIC is downward sloping and below the 0 axis, consistent with higher income losses for the richer percentiles. Relative and absolute GIC for expenditures are also downward sloping and below 0 for all percentiles. It is not surprising to observe larger absolute decreases in expenditures the higher the percentile, given that poor households have less scope for reducing expenditures.

Income losses were more severe for urban than for rural households (Figures 3 to 6). The GRIM was around -2.0 for rural, while the urban GRIM was around -4.0. Also in absolute terms, losses were much higher in urban areas, which can also be explained by higher mean incomes in the former. The urban GIC is clearly downward sloping, thus showing higher losses for the richer, while the rural GIC is u-shaped with higher losses for the middle part of the distribution.[22]

4.2.2 Assets, Health, and Subjective Welfare

Figure 7 shows relative GIC for assets, health, and subjective welfare. The left figure corresponds to indicators using normative weights, while the right figure those using polychoric PCA weights.[23]

Graphs for assets show very similar results regardless of the weighting system chosen. The unconditional GIC is above 0 and downward sloping for almost all percentiles, with growth rates up to 6 percent for the poorest percentiles and closely towards 0 from the 5^{th} decile onwards, thus it is pro-poor according to the weak and relative approaches. The conditional GIC is also above 0 for all percentiles and around 3 percent for the poor and slightly less for the non-poor. There is hardly any trend for the first half of the distribution and a downward sloping trend for the second half. Growth rates are highest for income deciles just below the poverty line (percentiles from 40 to 50).

[22] As an exercise we compared results for the same years using the EH and ECH. Overall, growth rates are also negative at the national level, but to a lesser degree in EH results. While the national GIC shows basically the same picture, just shifted upward, the GIC for urban areas is clearly different with strongly negative growth rates for the poorest. Even stronger are differences in rural areas. The growth rates are positive for the whole rural population and there is also a clear downward sloping trend compared to the flat part in the middle of the distribution of the rural ECV data. These differences can be explained by sampling issues, questionnaire design as well as by adjustments to national accounts undertaken in the income variables of EH.

[23] The smoothed version has the only purpose of easing readiness of the conditional curves given their volatile form.

The GIC on the health indicator shows different results. The normative weights seem to justify a slight increase, the polychoric PCA confirms that there was a moderated decrease in welfare. The GIC on subjective welfare has a similar result. For the unconditional case there is a clear increase for the poor, and a slight decrease from the 50^{th} percentile onwards. Variation is low in the conditional case and the GIC is just above 0 for polychoric PCA, but below 0 for normative weights, without any clear slope. However, using polychoric PCA weights, there is a slightly upwards-sloping trend, indicating anti-poor growth.

A more rigorous analysis is possible using pro-poor growth rates, presented in Table 5. For comparison purposes we use the percentiles derived from the moderate and extreme headcount index (54 for moderate and 18 for extreme) based on income poverty lines to calculate PPGR. The GRIM are very close to 0, independently of the weighting system chosen. For assets, PPGR for percentiles below the moderate and extreme poverty lines are higher than the GRIM, indicating that the poor exhibited larger increases in assets. For health we obtain two different results depending on the weighting scheme: using normative weights we find pro-poor growth, using PPCA weights we find anti-poor growth. Lined up by income percentiles, PPGR were positive but only slightly higher than for the whole distribution.

The GRIM for the subjective welfare indicator is close to 0 using normative weights and slightly lower using polychoric PCA weights. For both weighting schemes, the poorest have positive growth rates, thus a PPGR above 0 in the unconditional case, whereas the income-poorest percentiles have negative growth rates.

To summarize, sorted by income the poorest percentiles improved their asset ownership, did not have major improvements nor draw backs in health, but reported being worse off in 2003 than 1997 according to the composite indices we created. The magnitude of welfare loss is higher if one uses the normatively selected weights we proposed. However, growth rates correspond to minimal absolute changes, close to 0 (Figure 8).

4.2.3 Education

As a lagged result of the economic crisis in the late 1990s, gross enrollment rates declined by 2001 (Table 6). The largest fall was in pre-school enrollment rates, followed by secondary education. There is also evidence of decreases in net enrollment of the poorest quintiles in secondary education, as well as higher demand from middle income households for public education (Barrera and Domínguez, 2006).

Figure 9 shows the GIC for children's education. The unconditional relative and unconditional absolute GIC (dashed lines) show large decreases for the education-poorest children (up to the extreme income-poverty headcount). This is reflected in a PPGR of -3.15 when using the extreme poverty line and confirms higher overage rates for households sorted in the lowest percentiles in 2003. All other percentiles show no major variation but growth rates slightly above 0.

Observing results lined up by income, overage for children is clearly higher the poorer the household. However, between 1997 and 2003 one observes minor but positive growth rates for the income-poorest percentiles, in contrast to the falls observed in the unconditional case. As a consequence, inequality between the first and last income deciles of the distribution decreased. The PPGR confirms these results (Table 5). The GRIM and the CHIM are both positive but very close to 0 (0.07 and 0.03) with the conditional PPGR and PPCH slightly above them. The puzzling result of the educational poorest regardless of income raises the question about their socioeconomic characteristics and if these results can be explained by inadequate educational supply in rural areas.

The generational effect of improvement in access to education in recent years can be seen in higher average years of schooling for younger generations, where those adults between 18 and 45 years show the largest average years of education compared to the elderly. However, educational outcomes are still much better for those ranking higher in the income distribution. While the poorest 10 percent of households have on average just 3 years of education (including children and adult education) the richest achieve up to 11. Although this average increased slightly from 1997 to 2003, differences between poor and rich remained the same.[24]

Figure 9 shows relative and absolute GIC on adults' average years of education. The relative GIC conditional to income is above 0 and downward sloping up to the 90^{th} percentile, thus covering people below the poverty line. The PPGR is about 4 times higher than the GRIM indicating that the poorest percentiles in 2003 had higher average adult education in 2003. In absolute terms, changes in average years of education were positive up to the 80^{th} percentile, but very small and equally distributed, relativizing results obtained using growth rates. Sorted only by average years of education, the resulting

[24] Coverage of tertiary education shows a much lower participation of the poorest quintiles, with only 6 percent of the 18-25 years old students enrolled in 2003 belonging to the 1^{st} quintile of income. New entrance to tertiary education was also affected by the crisis, when the number of new entrants from 1997 to 1999 declined by 19 percent (World Bank, 2003).

PPGR is negative (-1.75) and less than the GRIM (0.54), due to the sharp fall in the first 6 percentiles. This result points to a fall in the average years of adult education for the poorest 6 percentiles of the distribution in 2003 compared to 1997 (Table 5).

Summarizing, average years of adult education changed only slightly in the period of analysis, although these changes were proportionally larger for the income poor. However it is not clear in how far this result is affected by better-educated adults who became poor in 2003. Interesting to note is that growth rates for the education-poorest correspond to very small changes in absolute terms, thus their real welfare gain in terms of human capital accumulation is questionable.

4.3 Discussion and Possible Limitations

For a critical discussion on pro-poor growth we start underlying some issues relevant to explain the results. The first one is that many variables are bounded due to questionnaire design and concepts. Even if the household has, for example, a large and varied set of assets, only 18 possible are listed in the survey. Thus, middle income and rich households who already have all items do not show improvements in the data set, although they might have had in real life. Similar arguments hold for dwelling characteristics. Concerning access to public services, the variables included are all bounded: It is not possible to have more than "one" access to a service. Once having access, differences depend on the consumption and tariff paid for it.[25] Research on particular services show that coverage of water and sanitation did not show major improvements between 1993 and 2003 (Sánchez, 2006). Natural piped gas became available to households in the major cities at the beginning of the 1990s and its access increased considerably since then (Libhaber and Foster, 2003). As shown in Table 1 the percentage of households having access to piped gas increased from 20 percent in 1997 to 36 percent in 2003. This explains why it adds up one of the largest weights inside the asset index but it is not a major deprivation if a household does not have it. Electricity had already in 1997 high coverage rates, thus large improvements on it between 1997 and 2003 were not feasible.

Another important issue to keep in mind is that while facing income variations and temporary draw backs during economic crisis, dwelling characteristics and access to services might not change as rapid as income, given that the initial response of the household is to reduce expenditures, take credits (also in form of delaying debt payments), and use

[25] The single variable that is unbounded, at least in the questionnaire, is number of rooms per person.

savings. A simple tabulation of the question on how households responded to the loss of employment or income sources during the five years previous to the 2003 survey showed that 23 percent of them opted for reducing expenditures in clothing, 21 percent in food, and 21 percent took credits. Only 10 percent confirmed having used savings, 4 percent moved to a cheaper dwelling, while 3 percent enrolled their children in a less expensive school.

These issues contextualize the resulting GIC of our asset index. Growth rates are positive for all households and downward sloping, indicating pro-poor growth. Absolute changes though are very low and equally distributed for all income percentiles reflecting rather stagnation in the asset index. In light of privatization and decentralization reforms undertaken in the early 1990s, designed to improve coverage and efficiency in the provision of basic services, one would have had expected higher improvements in the asset index. However the combined effect of implementation problems and the economic crisis slowed the progress, particularly due to the reduction of public funds. In this context, increases in access to public services were modest, and poor households had in 2003 almost the same coverage as in 1997 excepting for fixed line telephone service (Figure 10).

Results on education and health can also be related to reforms. Provision structure of health services was transformed in 1993 from a system based on subsidies to supply (direct transfers to public hospitals) to a system based on subsidies to demand.[26] Research on this area shows that the reform had a large impact on increasing health affiliation, but did not achieve the desired increase in competitiveness of public health providers and ended up doubling the sectors budget due to the coexistence of subsidies to demand and subsidies to supply. One particular disadvantage is that the system in place, composed by a subsidized and a contributive regime, has encouraged informal employment and has hampered the creation of formal one, threatening the sustainability of the system (Gaviria, Medina, and Mejia, 2006).

Our summary statistics confirmed an increase in affiliations to a medical service, but this category does not have a large weight in the index. The outcome variable, subjective health status, is the one having the largest weight. In that variable we see that the average health status had no major changes, and that most Colombians report having good health in both years. The small changes do not affect poor households more or less than rich ones and inequality in health according to this index is low. When sorting households from the

[26] Law 100 of 1993.

health-poor to the health-rich, this result changes. The average for the 10^{th} decile is 5 times larger than for the 1^{st} one. This suggests a lack of relation between being income-poor and health-poor, and vice versa. However interpretation should consider that the included questions reflect perceptions, and are no supported by objective health measures like infant mortality rates, prenatal care, or nutritional status which use to be inversely correlated with income. Furthermore, the way people value their own health status and that of their family members can differ considerably from a physician's valuation.

With respect to the education indices, the low growth rates found in children's education sorted by income can be linked to stagnation in enrollment rates in primary and secondary schooling during the crisis, as well as quality deterioration leading to high repetition rates. This combined effect is stronger the higher the educational level. Thus, although gross enrollment rates increased, net enrollment (which takes into account children in the right age for the level they are doing) did not. Studies focusing on education show that public schools absorbed part of the enrollment decline of high income groups in private schools, while the lower-income students dropped out. As a consequence the educational gap between poor and rich increased, particularly due to immense quality differences between private and public schools (Velez, Harding, and Sarmiento, 2003).

The subjective welfare index has also some limitations. Ideally the question on current living conditions should be in the index, but this question is not comparable to the one in 1997.[27] We used only variables that had the same response alternatives in both years, in this case how the person values the current household situation compared to that 5 years before. The three available response categories (better, equal, and worse) have each a share of around one-third in both years, raising doubts on whether responses are driven by each persons understanding on the question and what each one consider as "better", rather than by a conscious and comparable answer across households. One would have expected more variability as the period between 1997 and 2003 was particularly turbulent due to the economic crises, the rise in unemployment, and more problems with violence. Furthermore, there seems to be no relation between this variable and having enough income for household needs. Around 50 percent of households report that income is just enough for their needs and 40 that it is not.

[27] The number of possible answer options changed from 3 to 4.

5 Conclusion

Empirical multidimensional poverty assessment poses two important challenges: selection of indicators and weighting procedures. When looking for implementation of indices one finds a large variety and combination of variables, usually focused on education, health, and asset ownership. Few studies or indices include proxies for political and social participation, burden of violence, and environmental issues, due to lack of appropriate data among others.

In this paper we ranked households according to four indices: one on asset ownership (including access to public services), one on health, another on education, and finally one on subjective welfare. Education was calculated for two population groups: individuals in schooling age and adults. We did not combine these indicators into a single one, but analyzed them as separate dimensions of welfare. In contrast to existing indices, we applied polychoric PCA instead of "traditional" PCA, since the latter is not appropriate for categorical variables and yields misleading weights (Kolenikov and Angeles, 2009). Additionally, we compared results with normative weights for robustness check.

Several interesting issues emerged. The assets adding the highest weight for the average Colombian household using polychoric PCA are: having high quality floor, having a car, and using electricity as cooking material. Among public services, piped gas has the highest weight followed by phone connection. Those most diminishing the household's score are: lack of access to electricity, lack of toilet, low quality wall material and lack of shower facility. Concerning health, the best (worst) subjective health status of the person has the largest (lowest) weight inside the index, followed by not having a chronic disease. In the subjective welfare index, not having had severe health problems and having more than enough money for household needs are the ones contributing with the largest weight, while the general perception of life being worse than 5 years ago subtracts the most.

Dynamic results using GIC shows minor changes in the indices considering people's perceptions regardless of the income percentile (health and subjective welfare). It is questionable if this result is driven by lack of comparability on how people value what they get out of goods and services. In contrast to this, the asset index had positive growth rates, larger for the poorest. However, absolute changes relativizes results and showed that changes were small. As discussed in Section 4.3 this can be explained by stagnation in the provision of public services and strategies undertaken by households when

affronting income or employment losses which prioritize reducing expenditures in items not included in this index like clothing and food. Such reduction is confirmed with the GIC for expenditures (Figure 2).

Given that household needs as well as valuation of those needs change in time, the weights obtained by any selected procedure need to be revised regularly, particularly when using indices for selecting social program beneficiaries. An example of this is the provision of piped gas which was almost non-existing in the 1980s and has now a large weight in the asset index. Another classical example is the valuation of a black and white television 20 years ago with its value today.

Our proposed indices differ considerably from the existing ICV in the literature due to the weighting system, combination of variables, and data source.[28] To the best of our knowledge, the ICV uses PCA and combines in a single measure asset ownership, variables accounting for human capital, and variables on household composition. The NBI index, which is currently used to distribute government transfers to social sectors, is not comparable at all, given that it considers all categories included as having the same weight. This index underestimates poverty, particularly in urban areas, due to problems with the current irrelevance of the included categories since most categories show nearly full coverage in urban Colombia.

Other plausible alternatives for selecting variables to be included in each index exist as well as weighting procedures. We offered here two opposed methodologies to calculate weights: one based on statistical procedures and the other based only on the researchers' criteria. Results are very close when analyzing growth rates by percentile. Graphs have similar scales and shapes, with some exceptions when calculating absolute changes in each indicator. A limitation is that the time period of analysis is too short for indicators that might need even generations to exhibit significant changes. Low variability is a possible explanation for the similar results obtained, as well as the large sample size.

Although non-income indicators are easier to measure and less prone to error as discussed by Günther and Klasen (2009), low variation, the existence of upper boundaries, and the fact that some of them depend on public policies are challenging for interpreting them. However, our results are consistent with previous analysis on multidimensional pro-poor growth using longer time spans (Grosse et al., 2008a): inequality in non-income

[28] Detailed documentation on how the ICV is currently calculated is not available. We base our description on DNP (2006) and internal unpublished documents of DANE and DNP (see for example: unstats.un.org/unsd/methods/poverty/RioWS-Colombia.pdf).

indicators is lower than income indicators and they change little as time passes.

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Table 1: Composition of Variables of Non-Income Indices

	1997 mean	2003 mean	Normative weights Wthn.	Btwn.	Final	PPCA pooled
ASSETS						
Household durables						
Fridge	65.4	63.9	5	2	10	0.13
No	34.6	36.1	0	0	0	-0.23
Mixer	75.4	67.8	1	2	2	0.10
No	24.6	32.2	0	0	0	-0.25
Color TV	69.5	73.0	3	2	6	0.11
No	30.5	27.0	0	0	0	-0.29
Radio	43.4	40.9	2	2	4	0.19
No	56.6	59.1	0	0	0	-0.15
Car	12.7	10.1	8	2	16	0.32
No	87.3	89.9	0	0	0	-0.04
Oven	21.5	17.5	7	2	14	0.28
No	78.5	82.5	0	0	0	-0.07
Washing machine	19.3	23.1	6	2	12	0.29
No	80.7	76.9	0	0	0	-0.10
Video	17.2	13.8	4	2	8	0.32
No	82.8	86.2	0	0	0	-0.07
Dwelling quality						
Cooking material						
Electricity	19.5	10.5	4	5	20	0.33
Gas tube	18.8	35.0	3	5	15	0.12
Gas cilinder	37.1	33.9	2	5	10	-0.06
Kerosene, coal, other, wood	24.6	20.6	1	5	5	-0.27
Wall material						
Brick, block, stone, prefabricated, polished wood	76.5	81.2	4	6	24	0.08
Adobe, or compressed earth material	6.8	4.8	3	6	18	-0.21
Bahareque (combination cane + mud)	10.6	6.5	2	6	12	-0.28
Crude wood, guadua (bamboo), organic material, zinc, cardboard, residuals, plastic	6.1	7.6	1	6	6	-0.43
Floor material						
Marble, parquet, polished wood	3.4	2.6	4	7	28	0.48
Carpet	2.0	1.7	3	7	21	0.35
Vinly, sheet tiles, ceramic tiles, brick	40.2	42.2	2	7	14	0.13
Crude wood, wood planks, concrete, fine gravel, earth, sand	54.5	53.5	1	7	7	-0.18
Toilet facility						
Toilet to sewer	66.9	68.7	4	6	24	0.13
Flush toilet	12.9	14.4	3	6	18	-0.17
Toilet without conection, letrine	9.1	8.1	2	6	12	-0.27
No facility	11.1	8.9	0	6	0	-0.44
Shower facility						
Watering can in shower room	74.1	74.2	3	4	12	0.10
Shower room without watering can	12.4	14.1	2	4	8	-0.23
No Shower room	13.5	11.7	0	4	0	-0.41

to be continued

Table 1 continued

	1997 mean	2003 mean	Normative weights			PPCA pooled
			Wthn.	Btwn.	Final	
Number of rooms per person						
up to one-third	16.9	12.9	1	5	5	-0.23
one-third to one-half	9.1	8.4	2	5	10	-0.13
one-half to three-quaters	26.9	27.3	3	5	15	-0.05
three-quaters to one	29.5	31.5	4	5	20	0.06
more than one	17.6	19.9	5	5	25	0.20
Access to services						
Electricity	93.5	95.4	2	4	8	0.03
No	6.5	4.6	0	0	0	-0.53
Piped gas	20.3	36.4	1	4	4	0.19
No	79.7	63.6	0	0	0	-0.10
Water	84.1	85.7	2	4	8	0.07
No	16.0	14.3	0	0	0	-0.36
Sewage	67.9	69.5	1	4	4	0.13
No	32.1	30.5	0	0	0	-0.28
Litter	70.2	72.1	1	4	4	0.12
No	29.8	28.0	0	0	0	-0.31
Phone	46.3	55.9	1	4	4	0.18
No	53.7	44.1	0	0	0	-0.23
HEALTH						
Health status of the person						
Very good	12.6	9.1	4	7	28	1.14
Good	57.3	63.0	3	7	21	0.17
Regular	26.5	25.0	2	7	14	-0.69
Bad	3.7	2.9	1	7	7	-1.46
Does not have a chronic health disease	88.4	86.0	1	5	5	0.15
Does	11.6	14.0	0	0	0	-1.01
Has not been sick in the last month	83.8	88.5	1	1	1	0.10
Has been	16.2	11.5	0	0	0	-0.72
Is affiliated to a medical service	57.4	61.8	1	3	3	0.07
Is not	42.6	38.2	0	0	0	-0.04
LIVING CONDITIONS AND SUBJECTIVE WELFARE						
Life compared to 5 years ago is						
better	36.6	33.4	3	4	12	0.59
equal	32.5	36.5	2	4	8	-0.30
worse	30.9	30.1	1	4	4	-1.19
Household income is						
more than enough	6.7	6.0	3	4	12	0.68
just enough	50.3	52.5	2	4	8	0.02
not enough	43.0	41.5	1	4	4	-0.65
Household / Household members						
had no severe health problem (last year)	86.4	92.4	1	4	4	0.72
had	13.6	7.6	0	0	0	-0.08
had not experienced a death (last year)	94.7	96.1	1	2	2	0.53
had	5.3	4.0	0	0	0	-0.02
feels save in neighborhood	77.7	73.2	1	5	5	0.23
does not	22.3	26.8	0	0	0	-0.09

Notes: PPCA stands for Polychoric principal component analysis; Whtn. stands for within weights; Btwn. stands for between weights.
Source: Own calculations. Based on Encuesta de Calidad de Vida (ECV) 1997 and 2003.

Table 2: Non-Income Deciles, 1997 and 2003

	1	2	3	4	5	6	7	8	9	10	10:1	Gini/Theil[a]	Mean
	Normative weights												
	Mean of the Deciles (conditional), 1997												
Assets	2.92	3.24	3.65	3.98	4.38	5.03	5.38	5.95	6.64	7.51	2.57	0.24	5.20
Health	5.31	5.40	5.50	5.62	5.68	5.87	5.99	6.26	6.51	6.94	1.31	0.20	5.96
Subj. welf.	5.25	5.33	5.40	5.61	5.82	6.03	6.08	6.35	6.70	7.31	1.39	0.19	5.93
	Mean of the Deciles (unconditional), 1997												
Assets	1.07	2.62	3.80	4.58	5.15	5.69	6.18	6.76	7.50	8.56	7.97	0.10	5.20
Health	1.95	3.33	3.33	6.36	6.67	6.67	6.67	6.67	7.32	10.00	5.12	0.10	5.96
Subj. welf.	2.26	3.88	4.22	5.40	5.56	6.33	7.04	7.07	8.49	8.93	3.96	0.07	5.93
	Mean of the Deciles (conditional), 2003												
Assets	3.40	3.72	4.27	4.75	5.19	5.64	6.03	6.45	6.98	7.86	2.31	0.22	5.31
Health	5.41	5.52	5.61	5.75	5.86	5.91	6.01	6.20	6.34	6.82	1.26	0.18	5.94
Subj. welf.	5.16	5.27	5.37	5.60	5.62	5.75	5.96	6.09	6.31	6.85	1.33	0.18	5.92
	Mean of the Deciles (unconditional), 2003												
Assets	1.25	3.01	4.10	4.79	5.31	5.76	6.20	6.70	7.37	8.57	6.87	0.09	5.31
Health	1.63	3.33	3.48	6.67	6.67	6.67	6.67	6.67	6.67	9.37	5.74	0.08	5.94
Subj. welf.	2.30	3.82	4.28	5.21	5.56	5.98	7.04	7.04	8.17	8.83	3.84	0.06	5.92
	Polychoric PCA weights												
	Mean of the Deciles (conditional), 1997												
Assets	2.87	3.25	3.71	4.10	4.54	5.30	5.69	6.32	7.00	7.78	2.71	0.25	5.47
Health	6.64	6.64	6.69	6.72	6.75	6.82	6.88	6.96	7.12	7.36	1.11	0.15	6.89
Subj. welf.	5.16	5.05	4.98	4.75	4.45	4.23	4.14	3.81	3.43	2.71	0.53	0.27	4.30
	Mean of the Deciles (unconditional), 1997												
Assets	0.88	2.44	3.77	4.82	5.59	6.23	6.78	7.35	7.99	8.80	9.95	0.12	5.47
Health	2.89	4.75	5.90	6.14	7.69	7.70	7.77	7.93	8.03	9.86	3.41	0.04	6.89
Subj. welf.	1.08	1.87	2.94	3.32	3.81	4.60	5.11	5.84	6.54	7.78	7.23	0.13	4.30
	Mean of the Deciles (conditional), 2003												
Assets	3.48	3.85	4.51	5.08	5.58	6.14	6.53	6.96	7.45	8.19	2.35	0.23	5.60
Health	6.68	6.73	6.76	6.84	6.87	6.86	6.90	6.98	7.02	7.27	1.09	0.14	6.87
Subj. welf.	5.10	4.93	4.80	4.56	4.50	4.34	4.10	3.92	3.68	3.05	0.60	0.25	4.23
	Mean of the Deciles (unconditional), 2003												
Assets	1.06	2.76	4.09	5.05	5.71	6.30	6.86	7.37	7.95	8.89	8.40	0.10	5.60
Health	2.73	4.88	5.89	6.39	7.70	7.70	7.70	7.93	7.93	9.42	3.45	0.05	6.87
Subj. welf.	0.86	1.89	2.88	3.35	3.86	4.38	4.86	5.44	6.50	7.42	8.61	0.11	4.23
	Education												
	Mean of the Deciles (conditional), 1997												
Adults	1.99	2.25	2.51	2.89	3.03	3.68	4.12	4.83	5.93	6.95	3.49	0.35	4.07
Children	7.30	7.49	7.56	7.50	7.43	7.79	7.89	7.95	8.30	8.48	1.16	0.10	7.85
	Mean of the Deciles (unconditional), 1997												
Adults	0.44	1.39	2.07	2.78	3.37	4.08	4.91	5.81	6.90	8.79	20.02	0.20	4.07
Children	4.33	6.36	7.17	7.66	8.05	8.47	8.67	8.89	9.30	9.51	2.20	0.02	7.85
	Mean of the Deciles (conditional), 2003												
Adults	2.49	2.63	2.96	3.42	3.84	4.17	4.67	5.19	5.65	6.33	2.54	0.34	4.00
Children	7.49	7.61	7.73	7.76	7.76	7.90	8.02	8.08	8.13	8.18	1.09	0.12	7.88
	Mean of the Deciles (unconditional), 2003												
Adults	0.42	1.42	2.10	2.75	3.30	4.07	4.83	5.65	6.70	8.56	20.32	0.20	4.00
Children	3.55	6.15	7.12	7.71	8.15	8.65	8.87	9.20	9.33	9.69	2.73	0.03	7.88

Notes: [a]Two inequality measures are shown. For simplicity, the Gini Index can be found in the conditional parts of the table, the Theil Index can be found in the unconditional parts. This does not mean, however, that the indices are calculated conditionally or unconditionally.
Source: Own calculations Based on Encuesta de Calidad de Vida (ECV) 1997 and 2003

Table 3: Income and Expenditures Deciles, 1997 and 2003

	1	2	3	4	5	6	7	8	9	10	10:1	Gini	Mean
	Mean of the Deciles (conditional). 1997												
Income (ECV)	20.475	39.453	55.324	72.106	92.013	117.017	151.575	207.655	319.473	797.519	38.95	0.55	190.829
Consumption (ECV)	46.837	47.963	59.693	69.972	80.585	101.088	115.867	169.757	239.465	445.803	9.52	0.53	145.226
	Mean of the Deciles (unconditional). 1997												
Consumption (ECV)	16.927	32.310	44.896	58.569	75.566	96.123	123.701	164.278	245.499	569.579	33.65	0.53	145.226
	Mean of the Deciles (conditional). 2003												
Income (ECV)	19.797	36.154	49.141	63.585	80.274	101.008	129.481	171.521	256.454	641.587	32.41	0.52	152.712
Consumption (ECV)	41.406	44.954	54.027	67.474	82.143	95.045	117.737	151.754	212.926	430.511	10.40	0.51	125.143
	Mean of the Deciles (unconditional). 2003												
Consumption (ECV)	15.783	29.695	41.632	54.054	67.691	84.566	108.538	145.532	212.960	502.475	31.84	0.51	125.143

Notes: Income and expenditures are in 1000 Pesos.
Source: Own calculations based on Encuesta de Calidad de Vida (ECV) 1997 and 2003.

Table 4: Poverty and Inequality Measures by Area 1997–2003

	Moderate poverty line			Extreme poverty line			Inequality measures		
	FGT0	FGT1	FGT2	FGT0	FGT1	FGT2	Gini	Theil	Pop Share
	Income based using ECV data								
National									
1997	54.06	24.85	14.64	18.02	6.40	3.29	0.55	0.59	100
2003	60.34	27.85	16.28	20.53	6.83	3.32	0.52	0.52	100
Urban									
1997	46.46	20.23	11.59	13.11	4.65	2.41	0.53	0.53	72.14
2003	55.37	24.75	14.25	16.66	5.45	2.67	0.51	0.47	73.61
Rural									
1997	73.71	0.37	0.23	30.72	10.96	5.56	0.45	0.39	27.86
2003	74.19	36.81	22.53	31.32	10.65	5.13	0.44	0.38	26.39
	Expenditure based using ECV data								
National									
1997	55.18	25.55	15.09	19.05	6.63	3.28	0.53	0.52	100
2003	63.13	30.62	18.50	23.83	8.56	4.27	0.52	0.49	100
Urban									
1997	45.41	18.25	9.76	10.44	3.09	1.39	0.49	0.44	72.14
2003	57.10	25.74	14.75	43.16	17.08	9.05	0.48	0.42	73.61
Rural									
1997	80.47	44.44	28.87	41.33	15.81	8.19	0.45	0.38	27.86
2003	79.95	44.24	28.97	16.89	5.55	2.56	0.47	0.41	26.39

Notes: Own calculations based on ECV.

Table 5: Mean Growth Rates, Mean Absolute Changes, Pro-Poor Growth Rates, and Pro-Poor Changes

	Relative NIGIC 1997-2003					Absolute NIGIC 1997-2003				
		(unconditional)		(conditional)			(unconditional)		(conditional)	
	GRIM	PPGR mod.	PPGR extr.	PPGR mod.	PPGR extr.	CHIM	PPCH mod.	PPCH extr.	PPCH mod.	PPCH extr.
Income (ECV)	-3.65	-1.73	-0.82	-1.73	-0.82	-38,118	-6,939	-1,646	-6,939	-1,646
Consumption (ECV)	-2.45	-1.56	-1.26	-1.18	-1.91	-20,082	-5,568	-2,089	-4,044	-4,737
	Non-income indices using normative weights									
Assets	0.35	1.44	2.76	2.54	2.40	0.11	0.24	0.29	0.60	0.43
Health	-0.05	1.16	2.06	0.33	0.25	-0.02	0.21	0.15	0.11	0.08
Subjective welfare	-0.02	0.50	1.40	-0.27	-0.21	-0.01	0.07	0.18	-0.09	-0.07
	Non-income indices using PPCA weights									
Assets	0.42	1.58	3.32	3.18	2.97	0.13	0.22	0.27	0.78	0.54
Health	-0.05	-0.20	-1.36	0.19	0.08	-0.02	0.07	-0.05	0.08	0.03
Subjective welfare	-0.26	0.39	0.57	-0.29	-0.27	-0.07	0.04	0.03	-0.09	-0.08
	Education									
Education of children	0.07	-0.93	-3.31	0.48	0.29	0.03	-0.10	-0.47	0.21	0.12
Education of adults	-0.28	-0.54	-2.31	3.13	3.30	-0.07	0.01	0.00	0.52	0.41

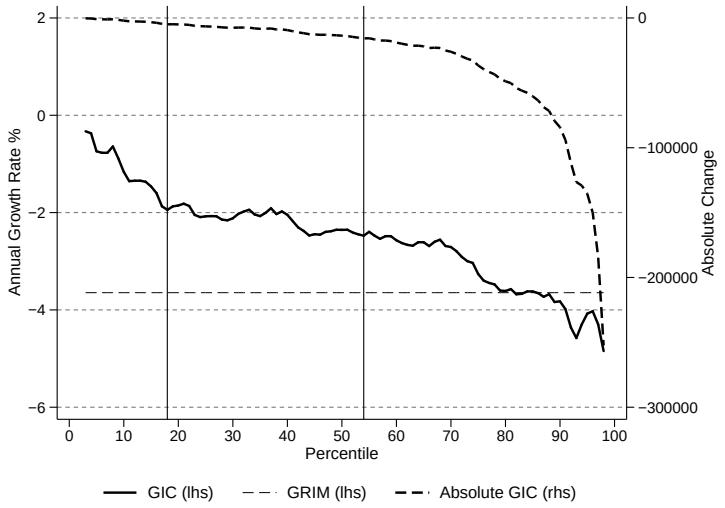
Notes: Own calculations based on Encuesta de Calidad de Vida (ECV) 1997 and 2003.

Table 6: Gross Enrollment Rate 1995 to 2006 (percentage)

Year	Pre- scholar	Primary	Media	Secondary	Total
1995	51	114	72	46	77
1996	55	108	72	47	75
1997	58	108	72	51	76
1998	64	115	78	57	81
1999	66	115	78	58	82
2000	69	114	78	57	82
2001	54	112	73	51	79
2002	71	112	79	56	82
2003	84	112	83	60	84
2004	82	111	83	61	85
2005	89	111	86	65	88
2006	88	112	88	69	90

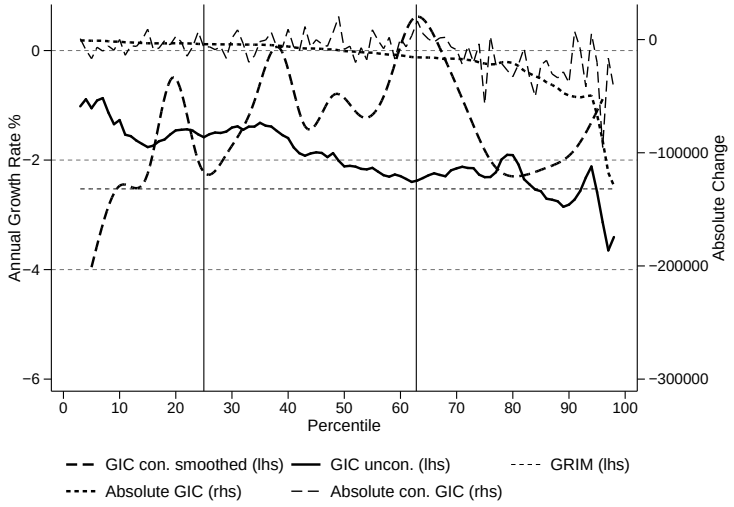
Source: Ministry of Education.
Note: Gross school enrolment ratio corresponds to the number of children enrolled in a level regardless of age, divided by the population of the age group that officially corresponds to the same level.

Figure 1: GIC Using Income, 1997–2003



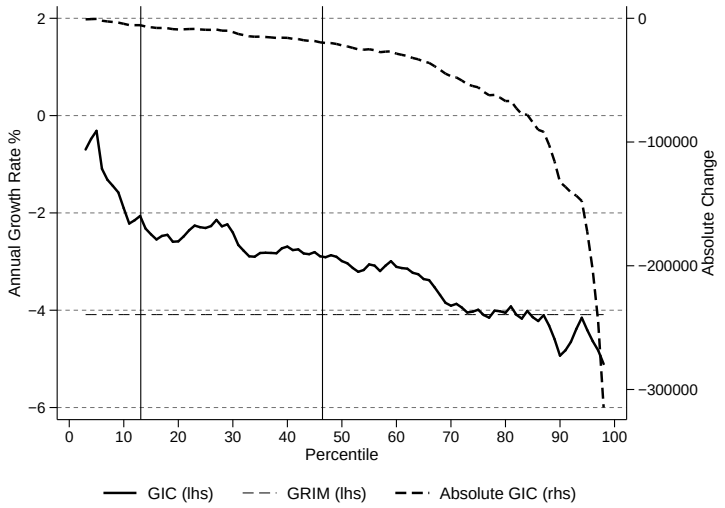
Notes: The vertical lines mark the extreme and moderate poverty headcount.
Source : Own Calculations based on data from ECV.

Figure 2: GIC Using Expenditures, 1997–2003



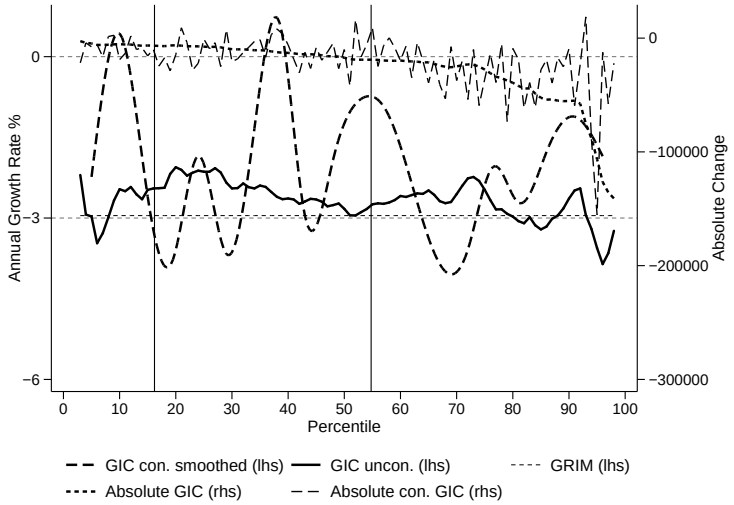
Notes: The vertical lines mark the extreme and moderate poverty headcount.
Source : Own Calculations based on data from ECV.

Figure 3: GIC Using Income, Urban, 1997–2003



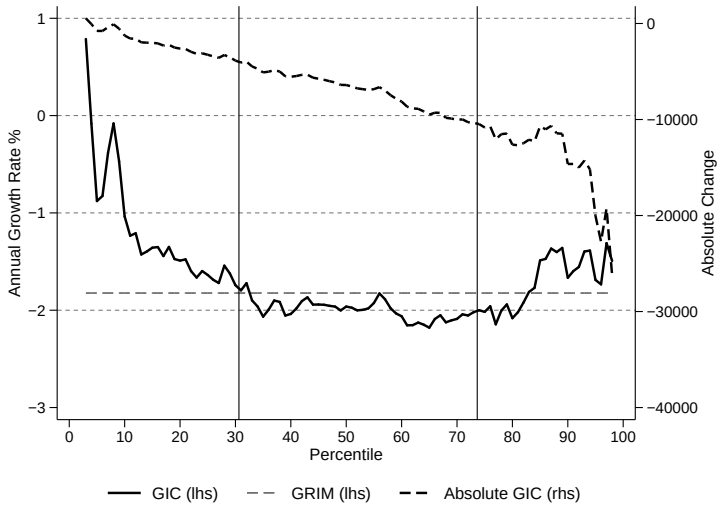
Notes: The vertical lines mark the extreme and moderate poverty headcount.
Source : Own Calculations based on data from ECV.

Figure 4: GIC Using Expenditures, Urban, 1997–2003



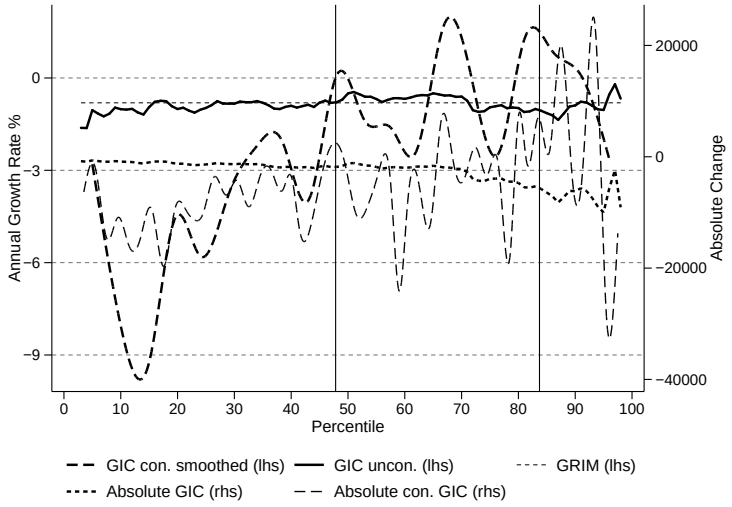
Notes: The vertical lines mark the extreme and moderate poverty headcount.
Source : Own Calculations based on data from ECV.

Figure 5: GIC Using Income, Rural, 1997–2003



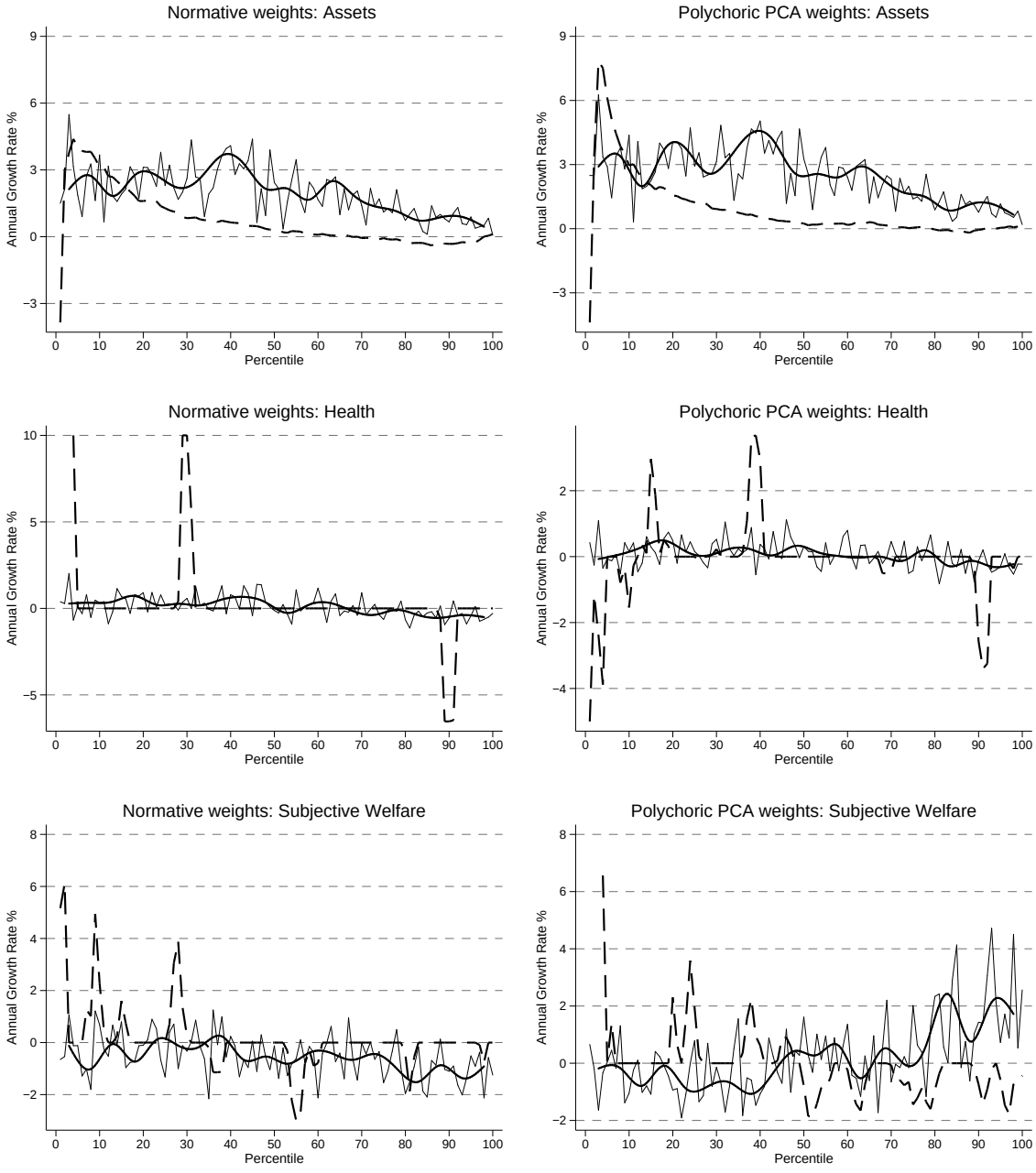
Notes: The vertical lines mark the extreme and moderate poverty headcount.
Source : Own Calculations based on data from ECV.

Figure 6: GIC Using Expenditures, Rural, 1997–2003



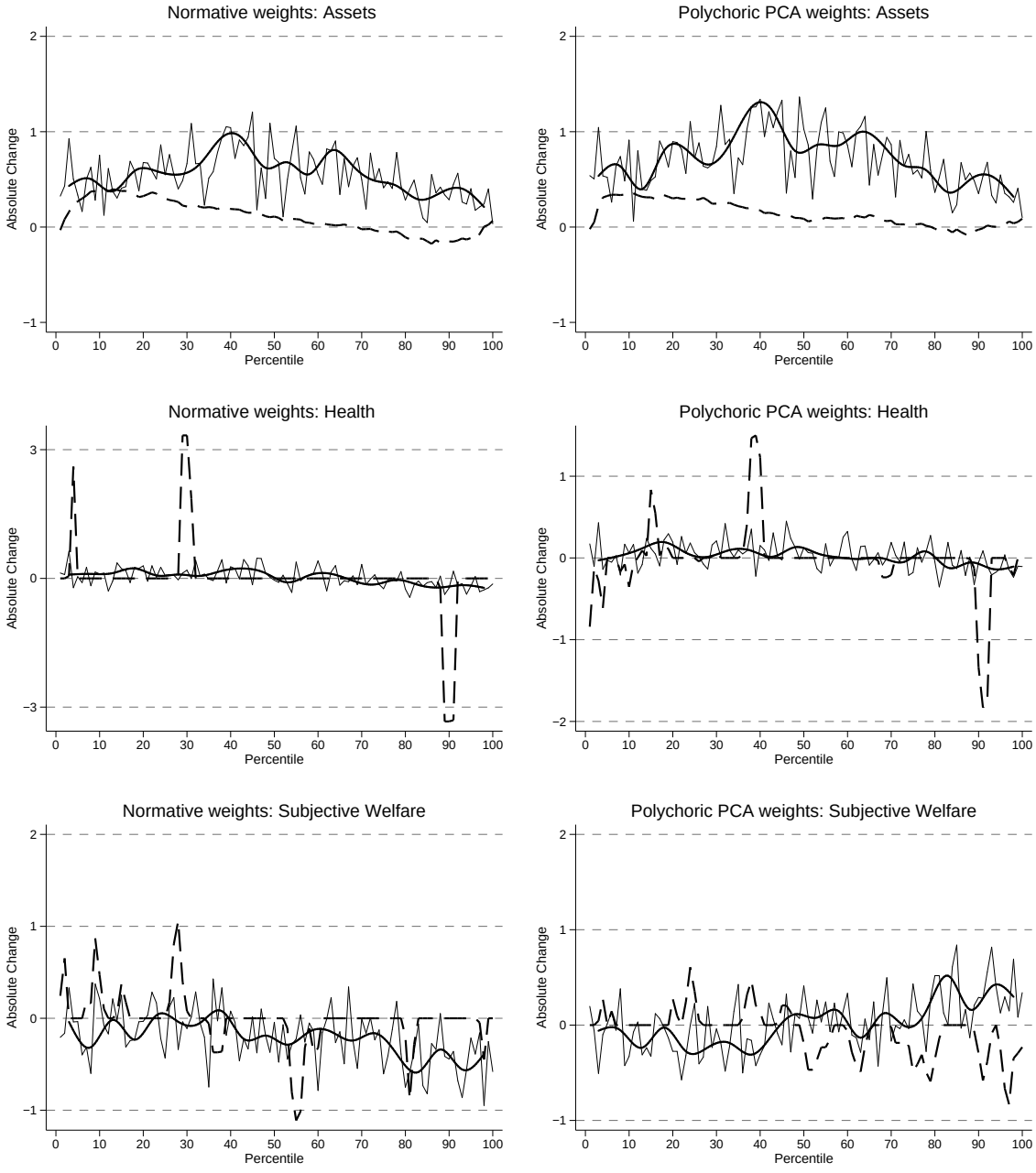
Notes: The vertical lines mark the extreme and moderate poverty headcount.
Source : Own Calculations based on data from ECV.

Figure 7: Assets, Health, Subjective Welfare: Relative NIGIC, 1997–2003



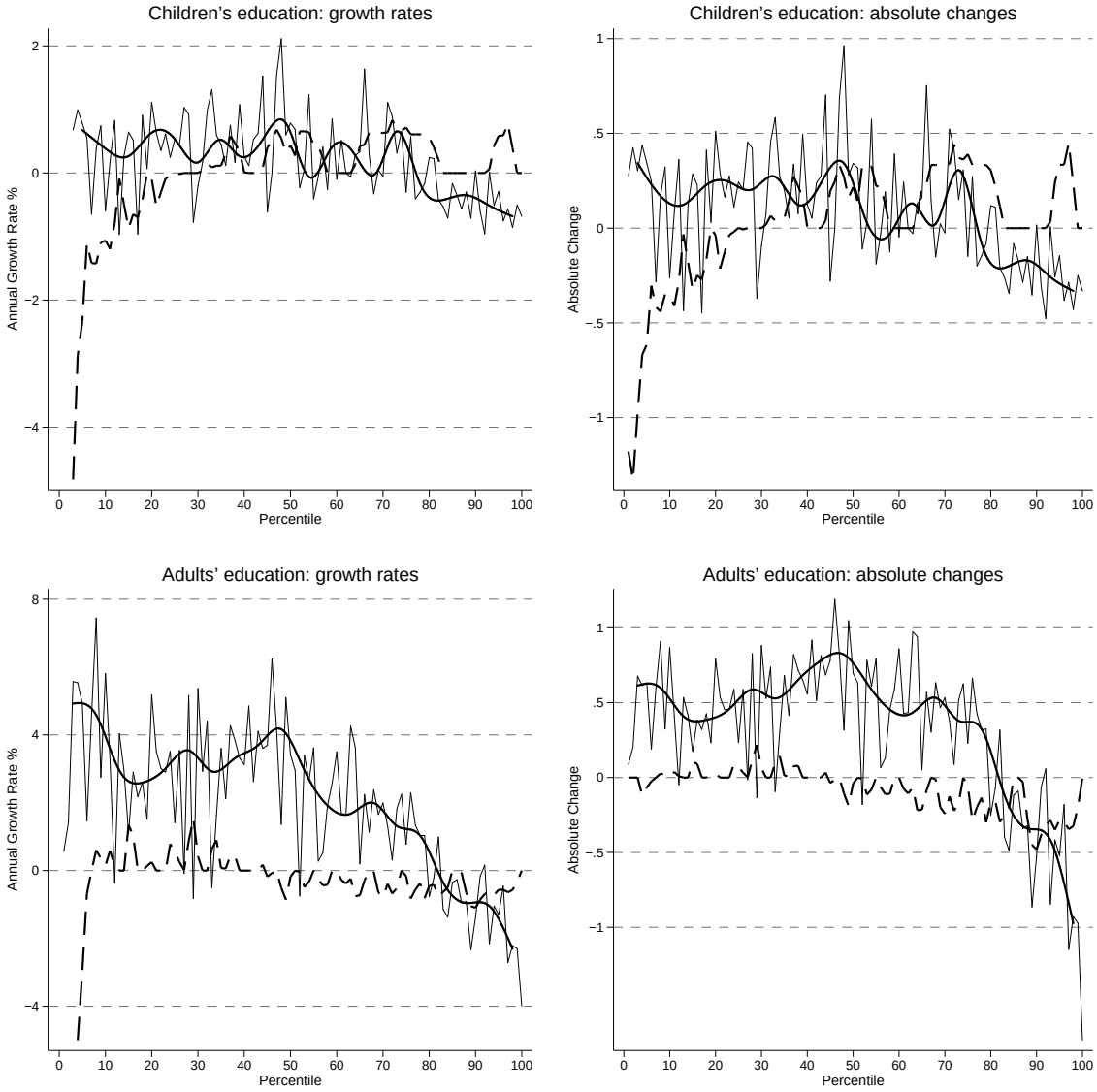
Legend: - NIGIC cond.smoothed – NIGIC conditional –– NIGIC unconditional
Source : Own Calculations based on data from ECV.

Figure 8: Assets, Health, Subjective Welfare: Absolute NIGIC, 1997–2003



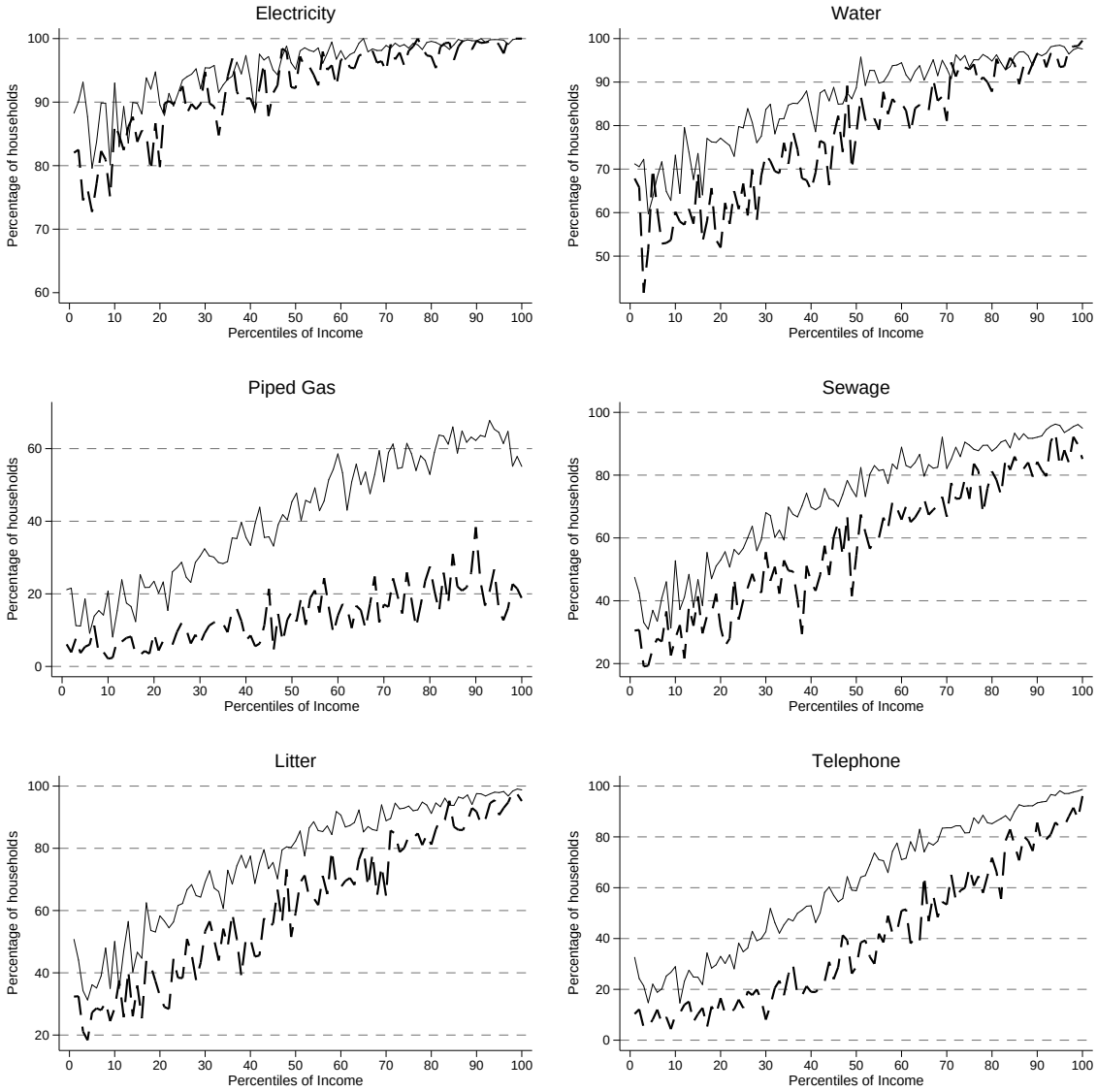
Legend: - NIGIC cond.smoothed – NIGIC conditional –– NIGIC unconditional
Source : Own Calculations based on data from ECV.

Figure 9: Education: Relative and Absolute NIGIC, 1997–2003



Legend: - NIGIC cond.smoothed – NIGIC conditional –– NIGIC unconditional
Source : Own Calculations based on data from ECV.

Figure 10: Households with Access to Basic Services by Income Percentile, 1997–2003



Legend: - -1997 – 2003
Source : Own Calculations based on data from ECV.