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Measuring Pro-Poor Growth with Non-Income Indicators

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Abstract

One existing shortcoming of current pro-poor growth concepts and measurements is that they are completely focused on income. But growth that is declared to be pro-poor where the measure is based only on income must not automatically imply improvement in the non-income (or social) dimension of poverty. In our paper, we introduce the multidimensionality of poverty into the pro-poor growth measurement by applying the growth incidence curve to non-income indicators. We investigate if growth in non-income indicators was absolutely and relatively pro-poor. Furthermore, we investigate if the income-poor benefited from social improvements in linking the development of non-income indicators to the position in the income distribution. We illustrate this empirically for Bolivia between 1989 and 1998 and find that growth was pro-poor both in the income and in the non-income dimension, but results are less clear for the non-income development of the income-poor.

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

Key words: Pro-Poor Growth, Multidimensionality of Poverty, Growth Incidence Curve, Bolivia.

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1 Introduction

Pro-poor growth has recently become a central issue for researches and policy makers, especially in the context of reaching the Millennium Development Goals (MDG). However, one existing shortcoming of current pro-poor growth concepts and measurements is that they are completely focused on income, thus focused only on MDG1 which aim is to halve the incidence of poverty until 2015. The shortcoming of the one-dimensional focus on income is that a reduction in income poverty does not guarantee a reduction in the non-income dimensions of poverty, such as education or health. This means that finding income pro-poor growth does not automatically mean that non-income poverty has been also reduced. For this reasons, multidimensionality of poverty and pro-poor growth as two main research areas have to be combined.

The aim of this paper is to introduce the multidimensionality of poverty into the pro-poor growth measurement and to provide an instrument that allows a better monitoring of the MDGs. The distribution of non-income welfare within countries has important policy implications, which will for example be a central issue of the World Development Report 2006 (Worldbank 2004b). The basic idea of this approach goes back to Sen (1988) who considers poverty as a multidimensional phenomenon. His capability approach focusses on non-income indicators for which income is only a means to obtain certain functionings. Thus he directly considers outcomes of poverty like being healthy or being well educated. Based on this approach many empirical poverty assessments including social indicators have been undertaken (e.g., Klasen 2000; Grimm, Guénard, and Mesplé-Somps 2002). However, non-income indicators are not considered in the pro-poor growth measurement so far.

We do this exemplarily by applying the growth incidence curve (GIC) by Ravallion and Chen (2003) to non-income indicators and call our approach non-income growth incidence curves (NIGIC). We illustrate this approach using microsurvey data for Bolivia for 1989 and 1998. We distinguish between ranking the sample by each non-income indicator and ranking the sample by income and investigate based on this income ranking the changes of the non-income indicator with respect to the position in the income distribution. In addition to investigate growth rates, we investigate absolute changes of the non-income indicators. We find that growth was pro-poor both in the income and in the non-income dimension, but results are less clear for the non-income development when the poor are ranked by income.

The paper is organized as follows. First, we briefly give an overview of the concept of pro-poor growth and the need to investigate it in a multidimensional perspective. Second, we explain our methodology to apply the GIC to non-income indicators and discuss some limitations. Third, we present the results of the GIC and the NIGIC for selected variables and for a composite welfare index. Last, we summarize and give an outlook for future research.

2 The Concept of Pro-Poor Growth

2.1 Definition of Pro-Poor Growth

According to international organizations pro-poor growth is simply defined as economic growth that benefits the poor (e.g., UN 2000a; OECD 2001). This definition, however, provides little information how to measure or how to implement it. What remains to be specified is, first, if economic growth benefits the poor and, second, if yes to what extent. Klasen (2004) provides more explicit requirements that a definition of pro-poor growth needs to satisfy. The first requirement is that the measure differentiates between growth that benefits the poor and other forms of economic growth, and it has to answer the question by how much the poor benefited. The second requirement is that the poor have benefited disproportionately more than the non-poor. The third requirement is that the assessment is sensitive to the distribution of incomes among the poor. The fourth requirement is that the measure allows an overall judgement of economic growth and not focuses only on the gains of the poor. Besides this definition there exist several other attempts conceptualizing pro-poor growth.[1]

Categorizing the often controversially discussed definitions, we use three definitions of pro-poor growth in our paper: weak absolute pro-poor growth, relative pro-poor growth, and strong absolute pro-poor growth. Pro-poor growth in the weak absolute sense means that the income growth rates are above 0 for the poor. Pro-poor growth in the relative sense means that the income growth rates of the poor are higher than the average growth rates, thus, that relative inequality falls. Pro-poor growth in the strong absolute sense requires that absolute income increases of the poor are stronger than the average, thus, that absolute inequality falls (e.g., Klasen 2004).

The latter definition is obviously the strictest definition of pro-poor growth and the hardest to be met as shown empirically by White and Anderson (2000). This is why one concentrates in general on the weak absolute and relative definition. But this ignores that decreases in relative inequality might be – and often are – accompanied by increases in absolute inequality (e.g., Atkinson and Brandolini 2004; Duclos and Wodon 2004; Klasen 2004). The question of absolute inequality is important to sustainably reduce poverty and should therefore be included in the concept of pro-poor growth. While this is true for income, it is even more important for examining and achieving pro-poor growth in the non-income dimension of poverty.

[1] For a detailed review on the different definitions and measures of pro-poor growth see for example Son (2003). Other approaches to define pro-poor growth are provided for example by White and Anderson (2000), Ravallion and Datt (2002), Klasen (2004), Hanmer and Booth (2001). The most common measures that have evolved in pro-poor growth measurement are the "poverty bias of growth" of McCulloch and Baulch (2000), the "pro-poor growth index" of Kakwani and Pernia (2000), the "poverty equivalent growth rate" of Kakwani and Son (2000), the "poverty growth curve" of Son (2003), and the "growth incidence curve" of Ravallion and Chen (2003).

2.2 Multidimensionality of Pro-Poor Growth

The most glaring shortcoming of all attempts to define and measure pro-poor growth is that they rely exclusively on one single indicator which is income.[2] This means that they are only focussed on MDG1 but leave out the multidimensionality of poverty which is taken into account in the other MDGs. In this context, Kakwani and Pernia (2000) note that it would be "futile" if one operationalizes poverty reduction via pro-poor growth using just one single indicator because poverty is a multidimensional phenomena, and thus pro-poor growth is also multidimensional.

Income enables households and/or individuals to obtain functionings. This means, income serves to expand people's choice sets (capabilities) (Sen 1988) and is therefore an indirect measure of poverty. In contrast, non-income indicators measure the functionings of households and individuals directly. Measuring poverty only with income assumes that income growth is accompanied by non-income growth. However, the problem of focussing only on MDG1 is that an improving income situation of households need not automatically imply an improving non-income situation, thus, reaching the other MDGs is not automatically guaranteed (for example, as shown in Klasen (2000) or Grimm, Guénard, and Mesplé-Somps (2002)). While non-income indicators have recently received more and more attention in the concept and measurement of poverty[3] they have not in the concept of pro-poor growth and no attempts have been made to measure pro-poor growth on the basis of non-income indicators.

Following Sen (1988) our conceptual approach to introduce non-income

[2] In this paper, we only consider income as the money-metric measure of living standard and do not distinguish between income and consumption. For a detailed discussion on the debate of income versus consumption as a measure, see, for example, Deaton (1997).

[3] Examples for recent studies examining the multidimensional casual relationship between economic growth and poverty reduction are Bourguignon and Chakravarty (2003), Mukherjee (2001), and Summer (2003). Also international organizations point to the importance of the direct outcomes of poverty reduction such as health and education (e.g. Worldbank 2000; UN 2000a; UN 2000b).

indicators in the pro-poor growth measurement starts with the selection of non-income indicators determining the most important functionings of human welfare. In line with the MDGs (UN 2000a) we select education, health, nutrition, and mortality as non-income indicators of poverty and follow the most prominent multidimensional poverty indices like the Human Development Index, the Human Poverty Index, and the Physical Quality of Life Index by UNDP (1991, 2000). After having selected the indicators and defined related variables we investigate whether non-income growth was pro-poor between two periods. We do this exemplarily in applying the methodology of the GIC to non-income indicators, but non-income pro-poor growth can also be applied to other pro-poor growth measures. Next, we compare the results based on non-income indicators with those based on income.

3 Methodology

3.1 The Growth Incidence Curve

To answer the question if and to what extent growth was pro-poor one can investigate the growth rates of the poor by focusing on the lower tail of the income distribution. A useful tool for this purpose is the GIC (Ravallion and Chen 2003) which shows the mean growth rate g_t in income y at each centile p of the distribution between to points in time, t–1 and t. The GIC is links the growth rates into one curve and is given by

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

By comparing the two periods, the GIC plots the population centiles (from 1–100 ranked by income) on the horizontal axis against the annual per capita growth rate in income of the respective centile. If the GIC is above 0 for all centiles ($g_t(p) > 0$ for all p), then it indicates weak absolute pro-poor growth. If the GIC is negatively sloped it indicates relative pro-poor growth.

Starting from the GIC Ravallion and Chen (2003) define the pro-poor growth rate (PPGR) as the area under the GIC up to the headcount ratio H. The PPGR is formally expressed by

$$PPGR = g_t^p = \frac{1}{H_{t-1}} \int_0^{H_t} g_t(p)dp \tag{2}$$

which is equivalent to the mean of the growth rates of the poor up to the headcount. What is normally done in poverty assessments is to compare the PPGR with the growth rate in mean (GRIM). The GRIM is defined by

$$GRIM = \gamma_t = \frac{\mu_t}{\mu_{t-1}} - 1 \tag{3}$$

where μ is mean income. If the PPGR exceeds the GRIM growth is declared to be pro-poor in the relative sense.

Examining pro-poor growth in the strong absolute sense one has to concentrate on the absolute changes in income of the population centiles between the two periods. We define the absolute GIC or "change incidence curve" (CHIC) by

$$CHIC : c_t(p) = y_t(p) - y_{t-1}(p) \tag{4}$$

which links the absolute changes for each centile into one curve. By comparing the two periods, the absolute GIC plots the population centiles on the horizontal axis against the annual per capita change in income of the respective centile on the vertical axis. If the absolute GIC is negatively sloped it indicates strong absolute pro-poor growth.

Starting from the absolute GIC we define the "pro-poor change" (PPCH) as the area under the absolute GIC up to the headcount H. The PPCH is formally expressed by

$$PPCH = c_t^p = \frac{1}{H_{t-1}} \sum_{1}^{H_t} c_t(p) \tag{5}$$

which is equivalent to the mean of the changes of the poor up to the headcount. We compare the PPCH with the change in mean (CHIM) which is defined by

$$CHIM = \delta_t = \mu_t - \mu_{t-1}. \tag{6}$$

If the PPCH exceeds the CHIM growth is declared to be pro-poor in the strong absolute sense.

3.2 The Non-Income Growth Incidence Curve

3.2.1 Concept

The calculation of the non-income growth incidence curves (NIGIC) broadly follows the concept of the GIC. In addition, instead of income (y) we apply formulas (1) to (6) to variables of selected non-income indicators to measure pro-poor growth directly via outcome-based welfare indicators. Thus, the NIGIC measures pro-poor growth not in an income sense but in a non-income sense, e.g., the improvement of the health status or the educational level between two periods for each centile of the distribution.

We calculate the NIGIC in two different ways. The first way we call the unconditional NIGIC in which we rank the individuals by each respective non-income variable and calculate based on this ranking the population centiles. For example, using average years of schooling of adult household members, the "poorest" centile is now not the income-poorest centile but the one with the lowest average household educational attainment.

The second way we call conditional NIGIC in which we rank the individuals by income and calculate based on this income ranking the population centiles of the non-income variable. With the conditional NIGIC, we capture the problem that the assignment of the households to income centiles on the one hand (GIC) and to non-income centiles on the other hand (unconditional NIGIC) might not be the same. For example, the income-poorest group might not be the education-poorest group at the same time. This means that, in the conditional NIGIC, the centiles are income centiles, thus that the poorest centile is the one with lowest income, but that the growth rates are non-income growth rates, thus are calculated for, e.g., years of schooling of the income centiles. With the conditional NIGIC, we measure how the development of the non-income indicators is distributed for the income groups.

Both ways of calculating the NIGIC are of particular relevance for policy making. The unconditional NIGIC mirror the development of the social indicators that are relevant for human welfare. Thus it can monitor how the other MDGs have developed over time for specific population groups. The conditional NIGIC give an additional tool to investigate how the progress in social welfare was distributed over the income distribution. This is also of relevance when evaluating distributional welfare impacts of aid and public spending. Standard benefit incidence studies for example analyze the impact of public spending in imputing shares of the total spendings to each centile and comparing the shares of the income poorest with the income richest centile (see, e.g., Van de Walle 1998; Van de Walle and Nead 1995; Lanjouw and Ravallion 1998; Roberts 2003). But the share of public spending for the poor serves only as a proxy for a real welfare impact. With the conditional NIGIC it is than possible to analyze the actual improvements in the particular social sector over the income distribution. For example it provides an instrument to assess if public social spending programs has reached the targeted income-poorest population groups and if the public resources are effective allocated. In this respect the conditional NIGIC might be a useful tool in the pro-poor spending analysis to understand who benefits from public spending and to what extent.

Two interpretation issues: First, in comparing the GIC and the NIGIC, one cannot deduce any causality between income and non-income indicators. For example, from the curves we can neither say that an improvement in income causes an improvement in the health status nor that an improvement in the health status causes an improvement in income. Second, one cannot compare the absolute values of the growth rates of income and non-income variables because the variables are measured in different dimensions such as monthly income and years of schooling. One can only compare if the growth rates are positive or negative and by how much the PPGR exceeds the GRIM.

3.2.2 Specification of the Non-Income Indicators

We calculate the unconditional and conditional NIGIC for education, health, nutrition, and for a composite welfare index (CWI) as described below. We are working with DHS data for Bolivia from the years 1989 and 1998 that do not contain information on income or consumption due to its focus on demographics, health, and fertility. However, in our DHS data set, we use simulated incomes based on a dynamic cross-survey microsimulation methodology (Grosse, Klasen, and Spatz 2004).[4] The basic idea of this simulation methodology is the following. The authors use two kinds of surveys: first, the DHS (of 1989 and 1998) and, second, the Bolivian household surveys (the 2^{nd} EIH of 1989 and the ECH of 1999). Then they estimate an income correlation in the household survey, apply the coefficients to the DHS, and predict, i.e., simulate, incomes in the DHS.[5]

For each indicator, we identify alternative variables to capture different

[4]For the calculation of the PPGR in the next chapter, we use the headcount of 77 percent as found in Klasen et al. (2004) for the moderate poverty line. We use the same headcount for the calculation of the PPGR of all non-income indicators. Note that for the GIC we always use the same household sample as for the NIGIC, thus, having different GIC in all figures.

[5]A bit more detailed, the authors estimate an income/consumption expenditure model in the LSMS data restricting the set of covariates to those which are also available in the DHS data. Then they multiply for each household in the DHS its covariates with the corresponding regression coefficient from the income/consumption expenditure model and add a randomly distributed error term. As there is no data for rural areas in the EIH of 1989, the authors make some assumptions about the behavior of the coefficient and the error term over time. There is a tendency that the simulated income growth is higher than the observed one. This overprediction should not bias the results in this paper, but it might be useful to test the results for a survey that contains detailed information both on income and on non-income variables.

trends and dynamics. For education, we specify eight different variables. We calculate average years of schooling for all adult household members and for males and females separately.[6] Furthermore, we restrict the sample to women aged between 20 and 30 to capture more dynamics of changes in the educational system and to separate the dynamics from demographic changes. Then, we calculate the maximal education per household instead of the average for all adults, males, females, and females aged between 20 and 30. The idea behind using these variables as an indicator is that it might be sufficient that one household member is well educated to generate income for the whole household and to provide a stimulating atmosphere for other members (i.e., intra-household externalities) (Basu and Foster 1998).[7]

For health we specified three different variables. We calculate infant survival rates of children aged under 5 years and also for children aged under 1 year.[8] Furthermore, we take the average vaccinations of children aged between 1 and 5 per household, with a maximum of 8 possible vaccinations for each child.[9] The vaccination rate is a variable that represents access to health care and preventive medicines. A similar variable has for example been used in the monitoring of the health sector reform project in Bolivia in 1999 (Montes 2003).

[6]The DHS only includes households with at least one woman in reproductive age, i.e., aged between 15 and 49 who serve as respondents in the DHS. The education for the male household members has to be taken from the memory of the respondents concerning the education of their husband or partner (with the age of the men being unknown). Households without women in reproductive age are excluded and unmarried men in the households as well.

[7]In important issue is to be noted here: An overall problem of years of schooling as a variable for educational attainment is that years of schooling do not a priory say anything about educational quality and thus, the indicator should be treated with some caution. This problem might be solved by using other data such as education test scores (like Pisa scores). However, these data are not always available and if, not in the same data sources.

[8]In our calculation, we use household child survival rates instead of child mortality rates. An improvement in child mortality comes out as a lower value but this lower value is mathematically interpreted as a deterioration. The linear transformation used is: survival rate = (mortality rate $-$ 1) $*$ (-1). This means for example that a reduction of child mortality from 80 percent to 60 percent is transformed into an increase in child survival from 20 percent to 40 percent.

[9]The possible vaccinations are 3 against polio, 3 against DPT, 1 against measles, and 1 against BCG.

For nutrition we use stunting z-scores as the variable that measures chronical undernutrition for children aged between 1 and 5 years. The stunting z-scores are defined as the ratio of height over age minus the median of the reference population and the standard deviation of the reference population. It takes values between approximately -6 and 6, where values below -2 are considered as being moderately undernourished and below -3 as being severely undernourished (see, e.g., Klasen 1999). Problematic might be that the z-score contains a lot of "genetic noise" in the sense that for example a low z-score interpreted as being undernourished might simply appear because the parents are genetically short but the child is small but well nourished and vice versa.

An alternative possibility to address the issue of the multidimensionality is to aggregate several indicators to a composite welfare index (CWI). Here, we follow the methodology of the Human Development Index (HDI) (UN 1998). Each variable that enters the index is normalized to be between 0 and 1 in subtracting the individual value from the minimum value observed in the dataset divided by the subtracting the maximum value from the minimum value

$$CWI = \frac{1}{n}\sum_{i=1}^{n}\frac{individual_n - minimum}{maximum - minimum} \tag{7}$$

The CWI is constructed by simply averaging the sum of the selected variable scores n. It includes four of the above explained variables: average education of all adult household members, stunting z-scores, under 1 survival, and average vaccinations.[10]

As not all variables are given for all households (e.g., health and nutrition variables are only available for households who have children), we calculate the CWI for two different samples. The first sample, called small sample, is

[10]The latter two variables do not enter separately but form a health sub-index as the simple average of the two scores. In contrast to the HDI, we use the maximum and minimum values defined by the data sets and do not use fixed maximum and minimum values.

the one for which all variables are available for all households. This reduces the sample size enormously (in 1989, e.g., from 6,053 to 1,306 households) and, more importantly, in a non-random fashion. The second sample, called big sample, includes all households, but the index is averaged over fewer variables for those households which do not have data for nutrition and/or health variables. The advantage of creating the CWI based on the big sample is the higher underlying number of observations but the disadvantage is that the results for some centiles are driven by very few or only one variable. The smaller sample has fewer observations but contains for all households the same number of variables. For both the small and the big sample, we in addition augment the indices by also including simulated income as a fourth indicator.

3.3 Limitations of the Indicators

The first limitation is the informational value of the calculated growth rates of the NIGIC. This is related to principal problems of the utilitarism approach of measuring welfare in which the ordinal preference structure needs to provide cardinal information to measure the differences in the preference order. Examining an ordinally scaled variable one can say that 6 years of schooling is better than 3 years but one cannot give insightful information to what extent in the sense that the household is twice as good educated.[11] This ordinal scaling leads to two different kinds of interpretation problems.

First, averaging an ordinally scaled variable leads to a ranking problem when assuming that education is one of the most important determinants to generate income and reduce poverty (Osberg 2000). For example, comparing two households A and B with two adults in each household where the household members of A have 0 and 12 years of schooling and of B have 6 and 7 years of schooling, household B has a higher average education than A. Now,

[11] The same is true for income but normally neglected in any discussion.

when B is ranked higher than A one ignores any kind of educational degrees and the resulting differentials in returns to education. This means that the person with 12 years of schooling might earn disproportionally more income than both members of household B together, thus, household A should be ranked higher than B. We address this problem in also using maximal education per household.

Second, concerning increases in years of schooling, just comparing growth rates might be misleading. For example, Table 1 shows for average education an increase of 71 percent for the 2nd decile compared to 8 percent of the 9th decile which might be overstating the improvement for the poor because the years of schooling of the poor increase from 1.74 to 2.97 years of schooling and those of the non-poor from 11.61 to 12.54. We address this problem in calculating absolute NIGIC and pro-poor changes. However, even when we use absolute changes which equal approximately 1, a further question remains open. An increase of 1.23 years of schooling of the 2th decile might be less beneficial, because perhaps the persons are still more or less illiterate, compared to the increase of 0.93 years of schooling in the 9th decile, which means completing secondary schooling and getting a degree.

Another example of problems in comparing relative changes is the stunting z-score. In our data sets, it ranges roughly from -6 to 6. Relative changes in the stunting z-score cannot be calculated because of the coexistence of negative and positive values in the variable range. For example, how to compare an improvement from -2 to -1 with an improvement from 1 to 2 from the year 1989 to 1998? We reduce this problem by transforming the z-score in such a way that all values are positive, that means by adding the minimum value of both data sets (in our case -5.89) to each z-score to get a range of only positive numbers.

The second limitation is the problem of weighting which we illustrate with the example of child mortality. For example, comparing two households A and B where A has 1 child and B has 10 children the households should be weighted differently when in each of the two households 1 child dies. Household A has a child mortality rate of 100 percent whereas B of "only" 10 percent. From an intrinsic point of view, it is obvious that both deaths are cruelly. In this case one could think of just counting the death per household independently of the total number of children. However, it is less obvious from an economic point of view where children can be partly considered as investment goods. Here, a higher mortality rate mirrors the more heavy loss of one child in the one-child household A compared to the 10-children household B. The investment-good character comes from absence or lack of social security systems in which case the children care for the parents in the cases of unemployment, sickness, and old age (e.g., Ehrlich and Lui 1997).[12] Following these two extreme points of view, one might think of weighting the death of children in households taking both arguments somehow into account. But any weighting would, however, be quite arbitrary and induce difficulties in justifying it with economic or welfare-theoretical judgments. Keeping this critical issue in mind we use unweighted child survival rates (leaving the weighting problems unsolved).

Weighting problems are also difficult with the nutrition indicator. A negative stunting z-score indicates malnourishment. But the z-score should not be interpreted as a linear variable in the sense that an increasing z-score is always equivalent to an improvement in the nutritional status. From a certain threshold onward, increasing z-scores might reflect no longer improvements of the nutritional status but indeed quite the opposite. For example a child with a very high z-score of 3 might not be better off as one with 0 because it might be too tall for its age. This problematic holds even stronger if one would consider wasting z-scores (weight over age). Here, increasing z-scores

[12]One complicating aspect arises when taking gender preferences for the children into account. The loss of one child when considered as an investment good might depend on the cultural habits (e.g., labor market opportunities for females and males, marriage agreements, and the question who takes care of the parents in old age).

strongly above 0 reflect instead overnourishment that affects the health status in a negative manner.

The third limitation calculating the NIGIC is that some variables of the non-income indicators do not vary much. This holds especially for under 5 and under 1 survival which is very low in Bolivia at the household level. For both years, Table 1 shows that up from the 2^{nd} decile, the maximum value 100 percent is already reached in both years, so that no improvement is possible any more. This translates into growth rates of 0, so that the unconditional NIGIC becomes flat and takes the value of 0 from the 2^{nd}decile onward. The problem of flat curves always arises when the variable values are bounded (as for example a maximum of 19 years of schooling or 8 vaccinations).

Dealing with this limitation in a more general way the discussed variables have a more discrete character in the sense that one either has survived or not which makes it difficult to observe relative differences among individuals, households, and over time. The only, but small, variation evolves from taking household averages instead of individual data. This is why these variables – and all kinds of dummy variables – are barely or not feasible for the pro-poor growth analysis using GIC.

More interesting to examine are in these cases the conditional NIGIC, in which we link the survival rates and vaccination to income. Here, low or 0 variation is less problematic than for the unconditional NIGIC because the variables are ranked by income. As Table 2 and all figures show there is no flat part any more. Now we yield interesting information regarding the changes on the non-income indicators when ranked according to their income situation and how improvements are distributed.

4 Empirical Illustration

4.1 Inequality

Bolivia is one of the countries with a very unequally distributed income in Latin America. We find high and persisting income inequality as measured with the Gini coefficient that falls from 0.56 in 1989 to 0.54 in 1998 (Table 1). This high inequality is also reflected in the high and only slightly falling 90:10 ratio. Turning from inequality to growth we find that all deciles increased their incomes. Especially in the 1990s, Bolivia experienced relatively high growth rates (which also were pro-poor as well for urban as rural areas). However, Bolivia was and is one of the poorest countries of the region, and the positive economic trend has reversed since 1999 combined with some episodes of social and political turmoil. As concerns social indicators such as life expectancy or literacy, Bolivia shows worse outcomes compared to other countries in the region. However, there have been notable and sustained improvements in many social indicators since the late 1980s which continued to improve during the economic slowdown (see, e.g., Klasen et al. 2004).

The Ginis for education variables are all in the range of 0.40.[13] For all educational variables the Ginis fall between 1989 and 1998. Interesting to note is that the highest Ginis exist for the group of all respondents both for average and maximal education indicating a gender bias in educational achievements. These findings are also reflected in the 90:10 ratio. The conditional deciles also show that the level of schooling increases with increasing income for all educational variables, but the 90:10 ratio is much lower than in the unconditional case. We find that an improvement has been made for all educational variables in all deciles for both the unconditional and the conditional case (Tables 1 and 2).

[13] One should be aware of the fact that the calculation of the Ginis of the social indicators are based on discrete variables. Thus no continuous Lorenz curve exists, so the simple Ginis should be interpreted with caution. An attempt to face this problem would be to follow the methodology of Thomas, Wang, and Fan (2000) who calculate Gini coefficients for education.

The extremely low Ginis for the under 1 and under 5 survival rates can be explained by the low overall incidence of child mortality in Bolivia at the household level. For both age groups, child mortality is below 10 percent. The conditional deciles indicate that mortality seems to be more or less randomly distributed over the income distribution.[14] For vaccination the Gini falls strongly from 1989 to 1998, and we find clear improvements, especially for the lower deciles. The inequality of the stunting z-score is relatively low and falls slightly. Malnutrition decreases with an increasing position in the income distribution, but the differences for the income deciles are quite low. The CWI reflects the findings from above where the Gini coefficients decrease for the selected variables (Table 3). Both for the CWI excluding and including income the Gini coefficient is higher for the big sample than for the small sample indicating between-group inequality.[15]

4.2 Pro-Poor Growth

Figure 1a shows the unconditional and conditional (normal and smoothed[16]) NIGIC for average education per household and the GIC. Figure 1b shows for this variable the absolute changes measured both unconditionally and conditionally and the absolute changes in income.

[please insert Figure 1a and 1b here]

The GIC shows weak absolute (curve lies above 0) and relative pro-poor growth (negative slope) for Bolivia between 1989 and 1998. For the unconditional NIGIC, we find weak absolute as well as relative pro-poor growth.[17] The relative pro-poorness is reflected comparing the PPGR with

[14] As explained below, reasons for this might be the overall low mortality risk in Bolivia, the small sample size of the DHS, and the tendency for underreporting among poorer population groups.

[15] This between-group inequality is driven by the higher degree of homogeneity in the small sample.

[16] As the conditional are very volatile, we additionally include the smoothed conditional NIGIC in the figures to so the major trend of the curves.

[17] A noteworthy point appears when looking at the upper part of the unconditional NIGIC and their absolute changes. In the range of the 7^{th} and 8^{th} decile, all curves

the GRIM where the first is with 3.83 percent around double as high as the latter with 1.86 percent (Table 4). The conditional NIGIC is more volatile than the unconditional NIGIC and also shows weak absolute and relative pro-poor growth but to a lower extent. Thus, the conditional NIGIC shows that the income-poor have experienced slightly higher educational growth than the average. This is also reflected in the higher PPGR (1.9 percent) compared to the GRIM (1.43 percent).

We do not find strong absolute pro-poor growth because for both the absolute unconditional and the absolute conditional NIGIC the slope is not negative, but even positive for the poorest deciles. This is quite interesting because it relativizes the findings of the unconditional NIGIC in Figure 1a where we have found high relative pro-poor growth for the first 3 deciles. This seemingly contradictory finding is largely due to the high growth rates for the lower deciles which results from the very low base in 1989. The absolute conditional NIGIC is virtually flat, meaning that the income-poor have not been able to improve their educational attainment by more than the average. These findings are also reflected in comparing the pro-poor change with the change in mean. As Table 4 shows the unconditional pro-poor change is still larger than the change in mean, however, only slightly: the average years of schooling only increased by 1.27 years in mean and by 1.39 years for the poor. For the absolute conditional changes, both changes are nearly identical (0.98 compared to 1.02 years).

For all the other educational variables we confirm the findings above.[18] Comparing the results for females with males, we again find signs for gender inequality which are most obvious in the lower percentiles. But we suppose that the gender inequality seems to have been reduced because the average and maximal education for females increased by more years than for the

fall below 0 and become positively sloped afterward. This reduction might not be a deterioration but might be due to a reform of the schooling system.

[18]Graphs are not shown here but available on request.

other groups, especially for males (Tables 1 and 4). However, the women in the all respondents sample started from a lower level and are on average still worse educated.

Figures 2a and 2b show the results for average vaccination. The unconditional NIGIC shows pro-poor growth in the weak absolute and relative sense. Table 4 confirms the pro-poorness in the relative sense. Here the PPGR (10.04 percent) exceeds the GRIM (6.02 percent).

[please insert Figure 2a and 2b here]

The conditional NIGIC is also pro-poor in the weak absolute sense and has a slightly negative slope. This is reflected in the higher PPGR compared to the GRIM. The unconditional absolute NIGIC shows no strong absolute pro-poor growth but is positively sloped for the lower end of the distribution. This finding reveals that the relative pro-poor growth might not be enough for the poor and that absolute increases (the amount of additional vaccinations) are of particular weight. Finally it is essential for the health status of children and the country as a whole to have all possible vaccinations. The conditional absolute NIGIC shows that the improvements are relatively equally distributed amongst the income groups.

The variable vaccination is a good example for one problem in calculating NIGIC. Especially for the bottom percentiles (where one would like to focus the research), there are many percentiles for which no unconditional NIGIC can be defined due to a variable value of 0 in the base year (thus one cannot calculate growth rates). Furthermore, the first calculable growth rates then tend to be very high and cause the unconditional NIGIC to be very steeply falling. Only after the undefined and the very steep part, the unconditional NIGIC is more "normally" shaped.

For both survival variables the unconditional NIGIC and the absolute NIGIC are barely interpretable because they become flat from the 2nd decile onward since 100 percent survival is already reached. Also the conditional NIGIC, which oscillate closely around 0, reflect the generally low and more or less equally distributed mortality risk for the income groups.[19]

Figures 3a and 3b show the NIGIC for stunting. The unconditional NIGIC indicates weak absolute and relative pro-poor growth. This holds also broadly for the conditional NIGIC but less pronounced. These results are also found when looking at the PPGR and the GRIM for the stunting z-score. Both absolute NIGIC show that the absolute changes are distributed nearly equally over the sample.

[please insert Figure 3a and 3b here]

Aggregating the several variables in the CWI, Figures 4a and 4b summarize the development of the social indicators in one single NIGIC.

[please insert Figure 4a and 4b here]

As expected we find pro-poor growth in the weak absolute and relative sense for the unconditional NIGIC. Looking at Table 4 we find very high relative pro-poor growth as the PPGR exceeds the GRIM by almost 30 percent. As being somewhat more volatile the conditional NIGIC shows also pro-poor growth in the weak absolute and in the relative sense. Asking for pro-poor growth in the strong absolute sense we find a anti-poor trend for the lower end of the distribution for the unconditional absolute NIGIC and a more or less equally distributed trend for the conditional absolute NIGIC.

Altogether, for nearly all variables, we find the strongest increases in the unconditional absolute NIGIC for some medium groups and not for the poorest groups. For most of the centiles, we find weak absolute pro-poor growth, but we do not find relative pro-poor growth, especially not for the poorest. These outcomes mirror the findings of previous analyses about

[19]This finding might be driven by the small sample size and the trend of underreporting among the poorer population groups.

poverty in Bolivia (Bolivia 2001; INE 2004; Worldbank 2004a) which also find improvements in income and non-income poverty but not for the very poor.[20] Nevertheless, Bolivia remains one of the poorest countries in Latin America as well in the income as in the non-income dimension.

5 Conclusion and Outlook

We introduced the multidimensionality of poverty into the pro-poor growth measurement. The purpose is to overcome the major shortcoming of the existing pro-poor growth measurements which are exclusively focussed on income but give no information on how social indicators changed over time for poor population groups. The aim is to better monitor the MDGs and not only to focus on MDG1.

In our approach, we apply the methodology of the GIC to non-income indicators and investigate pro-poor growth of non-income indicators. We analyze how income and non-income indicators changed in favor of the poor. Also we analyze how social indicators have developed when they are linked to position in the income distribution. This is of special interest when evaluating distributional welfare impacts of aid and public spending. Furthermore we take absolute inequality explicitly into account and analyze if absolute improvements are large enough for the poor to catch up. Reducing absolute inequality in social indicators is crucial for sustainable development and for equal choices.

We exemplarily illustrate this approach using data for Bolivia from 1989 to 1998. We find improvements both in the income and non-income dimensions of poverty which is a common finding for Bolivia. Growth was pro-poor in the weak absolute and the relative sense both for income and non-income indicators whereas we find no pro-poor growth in the strong absolute sense

[20] Most of the improvement furthermore benefited mainly the urban population with little improvement in the rural areas.

for income and only limited strong absolute pro-poor growth for the middle centiles for non-income indicators. Summarizing the results when social indicators are linked to income, we find that improvements are more or less equally distribution over the income groups.[21] Thus, there is not at all a perfect overlap of income-poor and of non-income-poor households. The absolute changes show that the poor have not benefited over-proportionally from the achieved improvements. This means that relative pro-poor growth does not automatically mean that the poor catch-up with the non-poor in absolute terms because we find that relative income and non-income inequality have fallen but not absolute inequality.

When calling for pro-poor growth as the most significant policy measure to achieve the MDGs policy makers should not only focus on income pro-poor growth rather on multidimensional dimensions of pro-poor growth and thus take non-income indicators explicitly into account. As we have shown the income-poor are not automatically the ones that benefit most from growth in social indicators. In addition, policy makers should also give attention to pro-poor growth in the strong absolute sense in reducing absolute inequality and to accelerate sustainable development.

[21] One has to note again that the data used is not panel data. Additionally, for the two-dimensional view of the conditional NIGIC it is even more crucial to keep in mind that we do not consider the same households and that the trends of social indicators of the income-poor have nothing of a panel character XXX.

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Table 1
Non-Income Indicators and Related Variables
(Unconditional, Bolivia, 1989 and 1998)

	1	2	3	4	5	6	7	8	9	10	Mean	90:10	Gini
	Mean of the Deciles (unconditional), 1989												
Income*	21.88	40.27	57.50	77.33	100.61	132.39	177.08	246.12	368.36	863.39	213.39	39.46	0.56
Education**													
Average education	0.42	1.74	2.76	3.75	4.81	6.27	7.99	9.68	11.61	14.59	6.23	34.95	0.40
Average education of all respondents	0.00	0.98	1.97	2.95	4.51	5.92	7.45	9.37	11.65	15.09	5.62	n.d.	0.46
Average education of respondents (between 20 and 30)	0.32	2.00	2.99	4.60	5.99	7.52	9.51	11.78	11.78	14.69	6.69	45.49	0.39
Average education of partners	0.00	1.78	2.99	4.59	5.98	7.54	9.45	11.84	14.12	16.93	6.86	n.d.	0.42
Maximal education per household	0.98	3.00	4.61	6.00	7.00	8.43	11.50	11.50	15.04	17.51	7.86	17.93	0.36
Maximal education per household of all respondents	0.00	1.00	2.00	3.43	5.00	6.44	8.42	11.43	11.43	15.46	6.13	n.d.	0.45
Maximal education per household (between 20 and 30)	0.34	2.00	3.00	4.60	4.60	7.11	9.52	9.52	11.81	15.03	6.58	43.58	0.40
Maximal education of partners	0.00	1.79	3.00	4.61	6.00	7.57	9.47	11.86	14.20	16.95	7.00	n.d.	0.42
Health													
Under 5 child survival rate (%)	63.42	100	100	100	100	100	100	100	100	100	96.43	1.58	0.03
Under 1 child survival rate (%)	78.33	100	100	100	100	100	100	100	100	100	97.77	1.28	0.02
Average vaccination per child (age>=1)	0.00	0.76	1.45	1.95	2.55	2.97	3.81	4.84	6.14	8.00	3.04	n.d.	0.43
Nutrition													
Stunting z-score	-4.29	-3.16	-2.68	-2.29	-2.00	-1.67	-1.36	-1.00	-0.51	0.80	-1.84	4.18	0.19
	Mean of the Deciles (unconditional), 1998												
Income*	36.37	63.60	89.26	119.22	155.89	203.15	269.64	369.20	555.27	1242.66	312.10	34.17	0.54
Education**													
Average education	1.16	2.97	4.50	5.75	6.75	7.96	9.16	10.19	12.54	15.81	7.48	13.67	0.33
Average education of all respondents	0.21	2.54	3.95	4.96	6.36	7.91	8.91	9.94	12.15	16.01	7.01	77.35	0.36
Average education of respondents (between 20 and 30)	0.99	3.45	5.00	6.45	7.98	8.99	9.99	9.99	13.71	16.59	8.05	16.70	0.31
Average education of partners	0.59	2.57	4.64	6.04	7.67	8.99	9.99	9.99	15.78	18.60	7.89	31.73	0.35
Maximal education per household	1.96	4.62	6.57	8.00	9.00	10.00	10.00	13.27	16.55	18.60	9.07	9.48	0.29
Maximal education per household of all respondents	0.20	2.56	4.60	6.00	7.66	9.00	10.00	10.00	13.81	16.77	7.53	83.21	0.36
Maximal education per household (between 20 and 30)	1.00	3.44	5.00	6.00	7.63	9.00	10.00	10.00	13.90	16.72	7.82	16.77	0.32
Maximal education of partners	0.60	2.58	4.65	6.79	8.00	9.00	10.00	10.00	15.91	18.63	8.02	30.87	0.35
Health													
Under 5 child survival rate (%)	72.60	100	100	100	100	100	100	100	100	100	97.42	1.38	0.03
Under 1 child survival rate (%)	82.02	100	100	100	100	100	100	100	100	100	98.16	1.22	0.02
Average vaccination per child (age>=1)	0.24	2.48	3.89	4.94	5.91	6.93	7.97	8.00	8.00	8.00	5.48	33.14	0.29
Nutrition													
Stunting z-score	-3.77	-2.61	-2.10	-1.76	-1.46	-1.17	-0.81	-0.40	0.10	1.25	-1.28	3.36	0.19

Notes: *Real household income per capita in Bolivianos per month. **All variables for education are measured in single years per household.
Source: Own Calculations

Table 2
Non-Income Indicators and Related Variables
(Conditional, Bolivia, 1989 and 1998)

	1	2	3	4	5	6	7	8	9	10	Mean	90:10
	Mean of the Deciles (conditional), 1989											
Income*	21.88	40.27	57.50	77.33	100.61	132.39	177.08	246.12	368.36	863.39	213.39	39.46
Education**												
Average education	3.23	3.74	4.36	5.01	6.03	6.49	7.46	8.23	9.19	11.01	6.22	3.41
Average education of all respondents	2.63	3.31	3.74	4.52	5.47	6.03	7.05	7.68	8.69	10.35	5.62	3.94
Average education of respondents (between 20 and 30)	3.28	4.47	4.89	5.72	6.54	7.70	8.50	8.52	9.28	10.49	6.69	3.20
Average education of partners	3.84	4.14	4.92	5.31	6.43	6.88	7.71	8.77	10.03	12.23	6.86	3.18
Maximal education per household	4.57	5.09	5.79	6.50	7.59	8.16	9.20	10.00	11.20	13.09	7.86	2.86
Maximal education per household of all respondents	2.93	3.65	4.13	4.96	5.96	6.55	7.67	8.26	9.48	11.23	6.13	3.83
Maximal education per household (between 20 and 30)	3.22	4.31	4.69	5.51	6.31	7.57	8.46	8.24	9.48	10.91	6.58	3.39
Maximal education of partners	3.97	4.22	5.00	5.44	6.57	7.06	7.93	8.96	10.19	12.36	7.00	3.12
Health												
Under 5 child survival rate (%)	97.31	96.34	93.27	96.89	96.36	95.18	96.07	96.76	97.28	97.36	96.43	1.00
Under 1 child survival rate (%)	98.29	98.30	97.22	97.48	98.12	97.99	97.95	97.53	97.73	97.78	97.77	0.99
Average vaccination per child (age>=1)	2.62	2.69	3.01	2.83	3.41	3.49	3.52	3.98	3.83	3.04	1.46	
Nutrition												
Stunting z-score	-2.10	-2.04	-2.02	-1.86	-1.73	-1.43	-1.46	-1.64	-1.01	-1.03	4.05	1.28
	Mean of the Deciles (conditional), 1998											
Income*	36.37	63.60	89.26	119.22	155.89	203.15	269.64	369.20	555.27	1242.66	312.10	34.17
Education**												
Average education	4.15	4.81	5.58	6.10	6.82	7.45	8.38	9.15	10.08	12.10	7.48	2.92
Average education of all respondents	3.54	4.28	5.05	5.66	6.41	7.13	8.08	8.70	9.70	11.62	7.01	3.28
Average education of respondents (between 20 and 30)	4.56	5.21	5.76	7.30	7.62	8.60	8.83	9.76	10.46	11.83	8.05	2.60
Average education of partners	4.74	5.31	6.00	6.36	7.12	7.69	8.53	9.61	10.40	13.09	7.89	2.76
Maximal education per household	5.60	6.20	7.00	7.49	8.31	9.14	10.06	10.90	11.85	13.79	9.07	2.46
Maximal education per household of all respondents	3.87	4.63	5.45	6.05	6.85	7.68	8.64	9.38	10.40	12.43	7.53	3.21
Maximal education per household (between 20 and 30)	4.34	4.99	5.54	6.99	7.50	8.42	8.55	9.65	10.38	12.25	7.82	2.82
Maximal education of partners	4.82	5.41	6.09	6.45	7.26	7.81	8.64	9.77	10.58	13.18	8.01	2.74
Health												
Under 5 child survival rate (%)	96.37	96.50	96.61	98.02	96.38	97.17	97.95	95.75	98.67	98.51	97.42	1.02
Under 1 child survival rate (%)	98.14	98.34	98.00	98.15	98.15	97.84	98.61	97.36	98.61	99.02	98.16	1.01
Average vaccination per child (age>=1)	5.21	5.18	5.02	5.39	5.40	5.72	5.94	5.97	6.09	6.61	5.48	1.27
Nutrition												
Stunting z-score	-1.85	-1.67	-1.56	-1.47	-1.35	-1.22	-1.04	-0.94	-0.87	-0.50	4.61	1.34

Notes: *Real household income per capita in Bolivianos per month. **All variables for education are measured in single years per household.
Source: Own Calculations

Table 3
Deciles of the Composite Welfare Index
(Bolivia, 1989 and 1998)

	1	2	3	4	5	6	7	8	9	10	Mean	90:10	Gini
	Mean of the Deciles (unconditional), 1989												
Composite welfare index*													
Small sample	0.26	0.33	0.37	0.40	0.42	0.45	0.49	0.54	0.59	0.69	0.46	2.44	0.14
Big sample	0.12	0.28	0.35	0.42	0.48	0.54	0.59	0.65	0.73	0.86	0.50	7.20	0.24
Composite welfare index* (including income)													
Small sample	0.21	0.25	0.28	0.30	0.32	0.35	0.38	0.41	0.46	0.53	0.35	2.49	0.15
Big sample	0.07	0.18	0.24	0.29	0.33	0.36	0.40	0.44	0.50	0.60	0.34	8.31	0.25
	Mean of the Deciles (unconditional), 1998												
Composite welfare index*													
Small sample	0.35	0.42	0.47	0.50	0.53	0.56	0.60	0.63	0.68	0.75	0.55	2.17	0.13
Big sample	0.20	0.38	0.46	0.51	0.56	0.61	0.66	0.70	0.76	0.88	0.57	4.48	0.19
Composite welfare index* (including income)													
Small sample	0.26	0.32	0.35	0.38	0.40	0.43	0.46	0.48	0.52	0.59	0.42	2.22	0.13
Big sample	0.12	0.24	0.31	0.36	0.39	0.42	0.46	0.49	0.53	0.61	0.39	5.31	0.20
	Mean of the Deciles (conditional), 1989												
Composite welfare index*													
Small sample	0.39	0.41	0.42	0.43	0.47	0.50	0.50	0.50	0.57	0.61	0.46	1.54	-
Big sample	0.36	0.40	0.44	0.45	0.50	0.51	0.56	0.58	0.62	0.70	0.50	1.94	-
Composite welfare index* (including income)													
Small sample	0.30	0.31	0.32	0.33	0.36	0.38	0.38	0.39	0.44	0.49	0.35	1.66	-
Big sample	0.24	0.27	0.30	0.30	0.33	0.34	0.38	0.39	0.42	0.50	0.34	2.06	-
	Mean of the Deciles (conditional), 1998												
Composite welfare index*													
Small sample	0.47	0.49	0.51	0.52	0.54	0.56	0.59	0.60	0.63	0.69	0.55	1.46	-
Big sample	0.46	0.47	0.49	0.53	0.54	0.57	0.60	0.63	0.66	0.74	0.57	1.59	-
Composite welfare index* (including income)													
Small sample	0.36	0.37	0.38	0.40	0.41	0.43	0.45	0.46	0.49	0.56	0.42	1.56	-
Big sample	0.32	0.33	0.34	0.36	0.36	0.39	0.41	0.43	0.46	0.53	0.39	1.65	-

Notes: *The composite welfare index includes average education of household, under one survival rate, average vaccination per child (age>=1), and stunting.
Source: Own Calculations

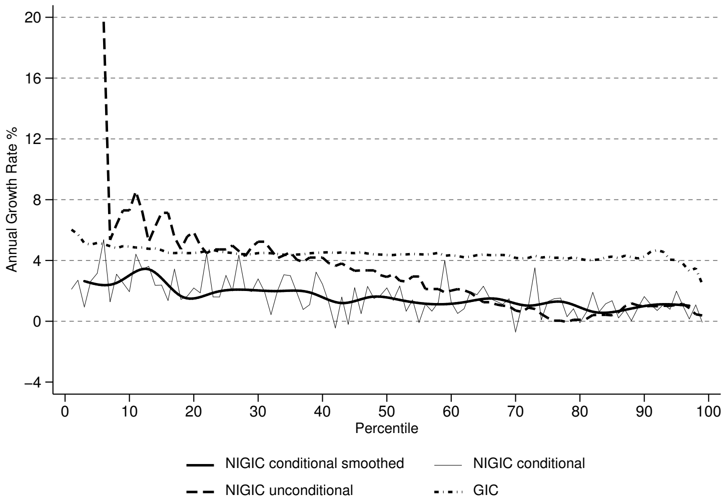
Table 4

Mean Growth Rates, Mean Absolute Changes, Pro-Poor Growth Rates, and Absolute Pro-Poor Changes
(Bolivia, 1989 and 1998)

Indicator	NIGIC 1998-1998 (unconditional)				NIGIC 1998-1998 (conditional)			
	Pro-poor growth rate****	Growth rate in mean	Pro-poor change****	Change in mean	Pro-poor growth rate****	Growth rate in mean	Pro-poor change****	Change in mean
Income*	4.53	3.88	47.32	88.60	4.53	3.88	47.32	88.60
Education**								
Average education	3.83	1.86	1.39	1.27	1.90	1.43	1.02	0.98
Average education of all respondents	4.42	2.20	1.58	1.39	2.23	1.67	1.08	1.07
Average education of respondents (between 20 and 30)	3.55	1.86	1.41	1.37	1.76	1.42	1.01	1.05
Average education of partners	2.63	1.41	1.13	1.04	1.69	1.17	0.97	0.87
Maximal education per household	2.79	1.45	1.19	1.23	1.47	1.06	1.01	0.91
Maximal education per household of all respondents	4.30	2.06	1.56	1.41	2.06	1.51	1.08	1.05
Maximal education per household (between 20 and 30)	3.52	1.72	1.31	1.24	1.73	1.35	0.96	0.99
Maximal education of partners	2.60	1.33	1.10	1.00	1.62	1.12	0.95	0.84
Health								
Under 5 child survival rate (%)	0.17	0.11	1.31	1.02	0.12	0.11	1.07	1.06
Under 1 child survival rate (%)	0.05	0.03	0.39	0.32	0.03	0.04	0.28	0.40
Average vaccination per child (age>=1)	10.04	6.02	2.77	2.44	6.01	5.70	2.38	2.41
Nutrition								
Stunting z-score	1.65	1.29	0.55	0.56	1.01	0.91	0.41	0.40
Composite welfare index***								
Small sample	2.22	1.89	0.10	0.09	1.66	1.50	0.08	0.08
Big sample	2.40	1.35	0.08	0.07	1.30	1.04	0.06	0.06
Composite welfare index*** (including income)								
Small sample	2.20	1.87	0.07	0.07	1.66	1.48	0.06	0.00
Big sample	2.51	1.41	0.06	0.05	1.41	1.10	0.04	0.05

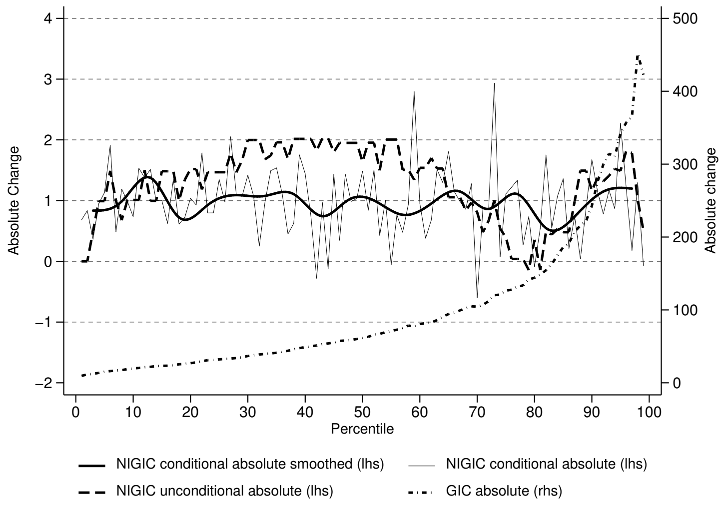
Notes: *Real household income per capita in Bolivianos per month. **All variables for education are measured in single years per household. ***The composite welfare index includes average education of household, under one survival rate, average vaccination per child (age>=1), and stunting. ****The headcount is 77 percent.
Source: Own Calculations

Figure 1a
GIC, Conditional, and Unconditional NIGIC for Average Education



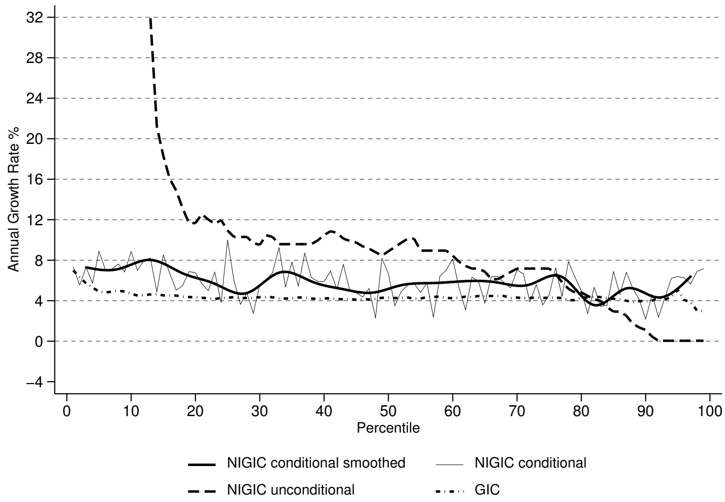
Source : Own Calculations

Figure 1b
Absolute Change in Income and Average Education



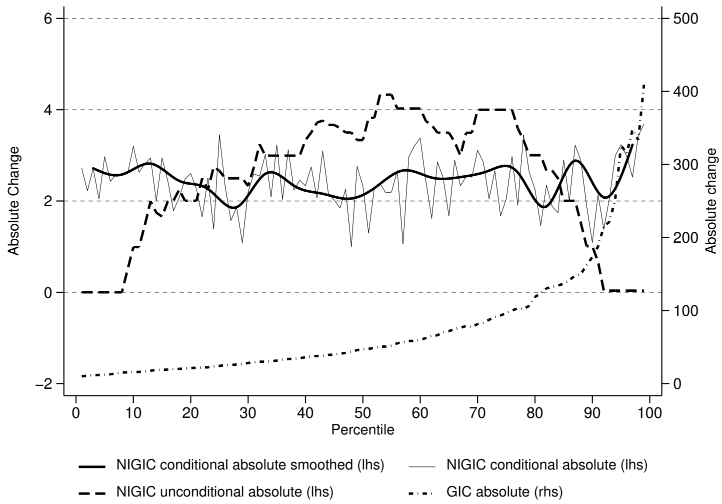
Source : Own Calculations

Figure 3a
GIC, Conditional, and Unconditional NIGIC for Average Vaccinations



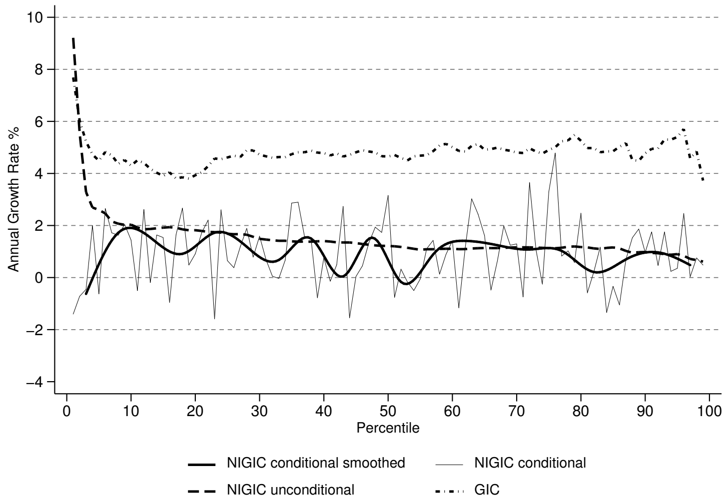
Source : Own Calculations

Figure 3b
Absolute Change in Income and Average Vaccinations



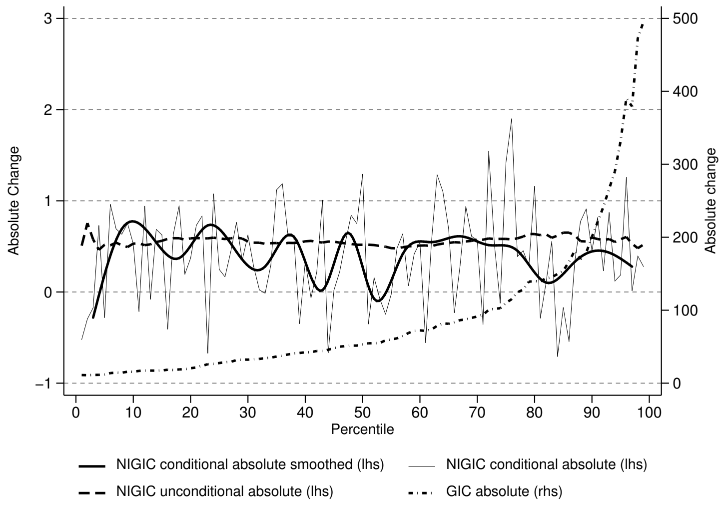
Source : Own Calculations

Figure 4a
GIC, Conditional, and Unconditional NIGIC for Stunting



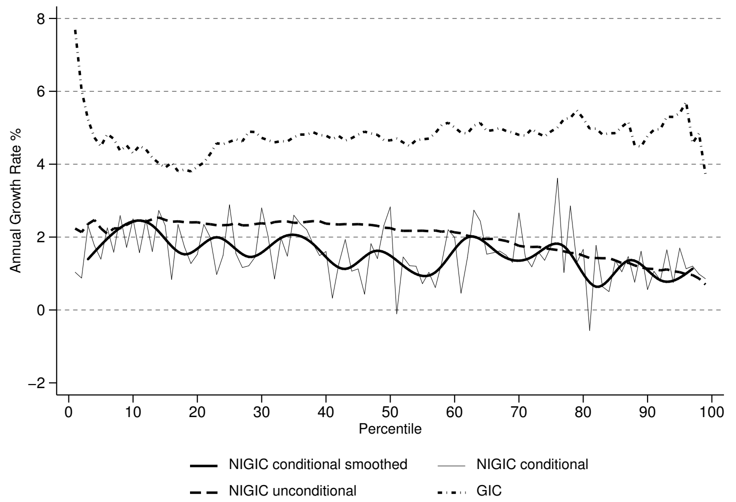
Source : Own Calculations

Figure 4b
Absolute Change in Income and Stunting



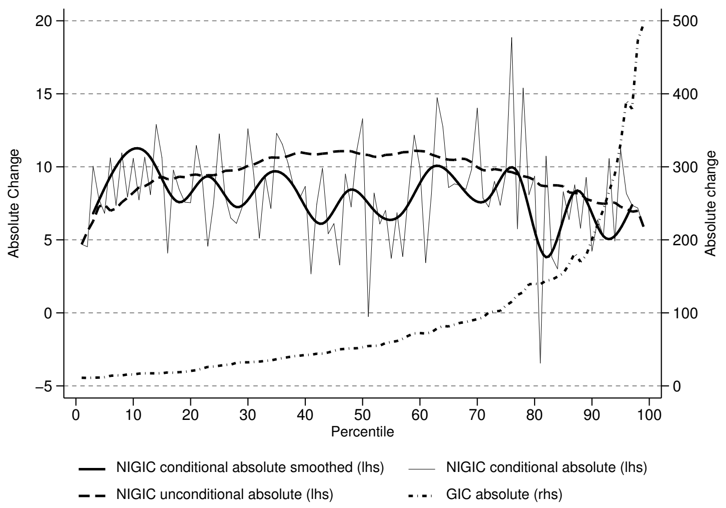
Source : Own Calculations

Figure 5a
GIC, Conditional, and Unconditional NIGIC for the CWI (Small Sample)



Source : Own Calculations

Figure 5b
Absolute Change in Income and CWI (Small Sample)



Source : Own Calculations