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Measuring Pro-Poor Progress towards the Non-Income Millennium Development Goals

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Abstract

In order to track progress in MDG1 and explicitly link growth, inequality, and poverty reduction, several measures of 'pro-poor growth' have been proposed in the literature and used in applied academic and policy work. These measures, particularly the ones derived from the growth incidence curve, allow a much more detailed assessment of the distributional impact of growth and its link to poverty reduction. However, there are no corresponding measures for tracking the distribution of progress in non-income dimensions of poverty, and thus the distribution of progress towards MDGs 2-7. In this paper, we propose to extend the pro-poor growth measurement to non-income dimensions of poverty (particularly health and education). We empirically illustrate the approach for Bolivia and show that it allows a much more detailed assessment of progress towards MDGs 2-7 by focusing on the distribution of progress. Furthermore, this extension also allows an explicit assessment of the linkage between progress in MDG1 and MDGs 2-7 as well as extends traditional incidence analysis by quantifying outcomes in non-income dimensions of poverty along the income distribution.

Keywords: multidimensionality of poverty, Millennium Development Goals, pro-poor growth, growth incidence curve, Bolivia

JEL classification: D30, I30, O10, O12

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1 Introduction

More than half of the time period to reach the Millennium Development Goals (MDGs) has passed and much effort has been undertaken to achieve the goals by 2015. However the latest progress report towards the MDGs shows that progress is often very slow and, more worrisome, in some countries there have been reversals, particularly among the poor (UN 2005). This leads to a crucial question concerning the progress made so far: How is the progress towards the MDGs distributed within a country? Have the very poor benefited disproportionally more than the less-poor or even the non-poor from improvements in reducing both the income and non-income dimension of poverty? To reach the MDGs, it will be critical that both the development path and the policies to accomplish the goals are pro-poor (UN 2003). Thus these questions have to be considered when monitoring the progress towards the MDGs.

In order to track progress in MDG1 and explicitly link growth, inequality, and poverty reduction, several measures of 'pro-poor growth' have been proposed in the literature and used in applied academic and policy work. These measures, particularly the ones derived from the growth incidence curve (GIC) by Ravallion and Chen (2003), allow a much more detailed assessment of the distributional impact of growth and its link to poverty reduction. At the same time, this toolbox has been developed and to date only applied to tracking progress in reducing the income dimension of poverty along the entire income distribution. But what about improvements in non-income indicators? There are no corresponding measures for tracking the distribution of progress in non-income dimensions of poverty, and thus the distribution of progress in MDGs 2-7.[1] But poverty reduction and, thus, progress towards the non-income MDGs should not only be seen as a byproduct of economic growth, even if it is pro-poor, but pro-poor policies should also focus on the non-income dimension of poverty and ensure pro-poor progress in non-income dimensions of well-being.

The aim of this paper is to extend the pro-poor growth measurement to assess the distribution of progress towards the non-income MDGs. As discussed in Grosse, Harttgen, and Klasen (2005), this could be done by assessing the distribution of progress along the distribution of the non-income MDG in question (e.g., relate progress in schooling to the initial distribution of schooling) which we refer to as an unconditional assessment. It can also be done by relating progress in non-income dimensions to the initial distribution of incomes (e.g., relate progress in schooling to the initial distribution of income) which we call a conditional assessment as it is conditional on the position of households in the income distribution. In this paper we focus on the distribution of progress towards the non-income MDGs along the income distribution, i.e., the conditional assessment which we refer to as the conditional non-income growth incidence curve (NIGIC).[2] The focus on the conditional NIGIC is for three reasons.

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1 The MDGs 1-7 are: MDG1: Eradicate extreme poverty and hunger. MDG2: Achieve universal primary education. MDG3: Promote gender equality and empower women. MDG4: Reduce child mortality. MDG5: Improve maternal health. MDG6: Combat HIV/AIDS, malaria, and other diseases. MDG7: Ensure environmental sustainability.

2 See Grosse, Harttgen, and Klasen (2005) and Klasen (2005) for related analyses also considering an unconditional assessment.

First, since the income poor are already suffering under the deprivation associated with low incomes, improvements in non-income dimensions of well-being are particularly important to them, particularly if one sees poverty as a multidimensional concept. Second, the income poor particularly need non-income improvements (particularly in health and education) to improve their earning opportunities to escape income poverty. Third, the conditional NIGIC is particularly important and relevant for policy making. It provides us with an additional tool to investigate how the progress in non-income dimensions of the MDGs is distributed over the income distribution. This is very useful supplemental information to standard incidence analysis (Van de Walle and Nead 1995; Lanjouw and Ravallion 1998; Roberts 2003), which investigate how public resources and interventions were reaching various income groups. For example it provides an instrument to assess not only if public social spending programmes have reached the targeted income-poorest population groups but also if the public resources have generated the intended outcomes for different income groups. In this respect the conditional NIGIC might be a useful tool in pro-poor spending analysis or, more generally, in the evaluation of pro-poor policies.

We illustrate our approach by using household survey data from Bolivia for 1989 and 1998. We order Bolivian households by their per capita income and investigate based on this income ranking the changes of non-income indicators with respect to the position of the household in the income distribution. In addition to investigating relative changes (i.e., growth or progress) we also investigate absolute changes of the non-income MDGs. As shown below, we find pro-poor progress towards the non-income MDGs in Bolivia, particularly when relative changes are used; the picture is much less clear when absolute changes are used (see below).

The rest of the paper is organized as follows. First, we briefly give an overview of how to measure pro-poor growth and pro-poor progress in a multidimensional way. Second, we explain how we apply the growth incidence curve (GIC) to non-income MDGs. Third, we describe the data and present the results of the GIC and the NIGIC, conditional on the position in the income distribution, for selected MDGs. Last, we summarize and give an outlook for future research.

2 The concept of pro-poor progress

The most glaring shortcoming of all attempts to define and measure pro-poor growth is that they rely exclusively on income as the only indicator of well-being or poverty.[3] This means that they are only focussed on MDG1 but leave out the multidimensionality of poverty which is at the heart of the MDGs which see income poverty reduction as only one of several goals.[4]

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3 In this paper, we only mention 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).

4 See Sen (1988, 1998) for a discussion on the multidimensionality of poverty.

Measuring pro-poor growth only in the income dimension implicitly assumes that income growth is accompanied by non-income progress, or, to put it differently, that improvements of non-income indicators are a natural byproduct of (pro-poor) economic growth. As it is well known in the theoretical and empirical literature, this need not be the case.[5] While non-income indicators have recently received more and more attention in the concept and measurement of poverty[6] they have not been incorporated in the analysis of pro-poor growth, and no attempts have been made to date to measure pro-poor growth on the basis of non-income indicators.

In line with the MDGs (UN 2000a) but subject to some data constraints, we have selected several non-income MDGs and use the conditional NIGIC to measure growth and the distribution of these non-income MDGs along the income distribution. Regarding the definition of pro-poor growth, we follow Klasen (2005) and use three different definitions of pro-poor growth: 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 growth rates are above 0 for the poor. Pro-poor growth in the relative sense means that growth rates of the poor are higher than average growth rates, thus, that relative inequality falls (i.e., some measure in which the relative gap between the rich and the poor is reduced). Pro-poor growth in the strong absolute sense requires that absolute income increases of the poor are stronger than average increases, thus, that absolute inequality falls (i.e., some measure in which the absolute gap between the rich and the poor falls). For a numerical illustration of these different definitions, see Klasen (2005).[7] The latter definition can be seen as the strictest definition of pro-poor growth and hardest to be met. Therefore it is often ignored. But this neglects that decreases in relative inequality might be—and often are—accompanied by increases in absolute inequality which many people judge as unfair (e.g., Atkinson and Brandolini 2004; Duclos and Wodon 2004; Klasen 2004). Increasing absolute inequality is arguably a particularly severe problem when considering non-income dimensions of well-being, as discussed in more detail below.

One final note concerns terminology. In order to distinguish improvements in income and non-income dimensions, we refer to improvements in the income dimension as income growth while we refer to improvements in non-income dimensions as non-income progress. This way we recognize that the term growth is, in most minds, inextricably bound up with incomes and thus we coined the term ‘progress’ for improvements in non-income dimensions.

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5 See, for example, Sen (1998), Anand and Ravallion (1993), Ravallion (2001), World Bank (2006), Klasen (2000), or Grimm, Guénard, and Mesplé-Somps (2002)

6 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., World Bank 2000; UN 2000a; UN 2000b)

7 Most inequality measures, including the Gini, Theil, and Atkinson measures as well as decile or quintile ratios, are relative inequality measures; for a discussion of the merits of also considering absolute inequality measures, see Atkinson and Brandolini (2004).

3 Methodology

For the calculation of the non-income growth incidence curves (NIGIC) we follow the general approach outlined in Grosse, Harttgen, and Klasen (2005) which we describe briefly now. An often used measure of pro-poor growth is the growth incidence curve (GIC) by Ravallion and Chen (2003) which plots the mean growth rate in income at each per centile of the distribution between two points in time. It shows how different population groups, i.e., income groups, have benefited from income growth. In line with the definitions used above, if the GIC is above 0 it indicates weak absolute pro-poor growth. If the GIC is negatively sloped it indicates relative pro-poor growth. To see weak absolute and relative pro-poor growth in a single number one can also compute the pro-poor growth rate (PPGR), which is the area under the GIC up to the headcount, and compare it with the growth rate in the mean (GRIM). Accordingly, if the PPGR is above 0 we call this growth weak absolute pro-poor growth, and if the PPGR is higher than the GRIM than we can consider growth as being pro-poor in the relative sense. The calculation of the NIGIC[8] broadly follows the concept of the GIC. Instead of income we use selected non-income indicators to measure pro-poor progress directly via outcome-based welfare indicators. Thus, the NIGIC measures pro-poor progress 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 points in time for each centile of the income distribution.

To study pro-poor progress in the strong absolute definition, we define the absolute NIGIC which shows the absolute changes in the non-income MDGs for each centile of the income distribution. If the absolute NIGIC is negatively sloped it indicates strong absolute pro-poor progress. Analogously to the PPGR and the GRIM we define the 'pro poor change' (PPCH) and the 'change in mean' (CHIM) for the absolute NIGIC. If the PPCH is greater than the CHIM we call this progress as being strong absolute pro-poor progress.

Because of the different dimensions of the income and non-income indicators, the fact that many of the non-income indicators are bounded above (e.g., there is an effective upper limit to survival prospects or to educational achievements), and different levels of tolerance of inequality in different dimensions, it may well be plausible that different definitions of 'pro-poor growth' would be appropriate for different indicators. While one may be willing to accept the relative definition of pro-poor growth (the poor have higher income growth rates than average) in the income dimension, one may only be willing to call progress in educational achievements or vaccination rates pro-poor only if the poor have higher absolute increments than the average, as only then the absolute gap in achievements between the poor and the non-poor would fall.[9]

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8 One could also name them non-income progress incidence curves

9 A different way to deal with this problem would be to re-scale the non-income variables by, for example, transforming the education indicator into a percentage shortfall from a maximum level, of say 18 years of education, and then define progress as the percentage reduction in that shortfall. With such an indicator one may well decide to choose the relative definition as sufficient to define pro-poor progress. As discussed in Grosse, Harttgen, and Klasen (2005), this issue will also arise when comparing the Gini coefficients of incomes with Gini coefficients in non-income indicators.

When extending the concept of pro-poor growth to non-income dimensions, a range of conceptual issues regarding the nature of the non-income indicators including their scale, boundedness, ordinality versus cardinality, and other issues need to be considered. These issues are taken up in detail in Grosse, Harttgen, and Klasen (2005) and Klasen (2005) who show that the approach can well be extended but that special care is needed when interpreting the results of the NIGICs. One last important point to note is that the data used here is not a panel data set and thus the percentiles of the income distribution in the initial and final period contain different households and we thus do not consider mobility of households, but the development of income groups.[10]

4 Data

For the empirical illustration we use Demographic and Health Survey (DHS) data from Bolivia for the years 1989 and 1998. These data sets include households with at least one woman of reproductive age, i.e., aged between 15 and 49 who serve as respondents. The data sets contain information on several non-income MDGs for 6053 and 8444 households for 1989 and 1998, respectively, for which we apply the pro-poor progress analysis. As not all variables are available for all households (e.g., infant and child health and nutrition variables are only available for household who have children), the sample size varies across the variables we use.[11] For the purpose of this paper, we have constructed the variables in such a way that they are as similar as possible to the formulation in the MDG targets. The results that we present are only valid for the indicators themselves, but results might differ if we had used other indicators and there might sometimes be better ways to track MDGs which was, however, not possible with the data at hand. For example, literacy rates (see details below) are a very crude measure of education as compared to years of schooling, for example. When interpreting the results, one should be aware that there is limited comparability across the variables since they are measured in different scales. And depending on the scales (i.e., on the variation of the indicators), the relative and absolute improvements can be quite similar if, for example, the values of the indicators are close to 100 per cent.

For MDGs 1-7 we investigate several targets directly. Analysing MDG1 we have information on the headcount ratio (Target 1a), the poverty gap (Target 2), and on the prevalence of stunted children aged between 1 and 5 years as an indicator of the nutritional status, thus, an indicator of Target 4 (prevalence of underweight children). Here, we use the stunting z-score that measures chronic undernutrition for children and we consider children as stunted if the z-score is below -2 standard deviations from the median of the reference category (WHO 1995).[12] For MDG2 we have information on

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10 For an extension of these tools to panel data see Grimm (2005).

11 For example for the variable that measures undernutrition, the sample size drops to 1599 and 3287 households for 1989 and 1998, respectively.

12 We have transformed the z-score so that all numbers are strictly positive (by adding the lowest absolute value of the given z-scores (of about -6) to all numbers so that the lowest z-score is 0) for the calculations. In the Tables and Figures, absolute values are given as z-score*100 for better visualization. The reason we use the height-for-age (stunting) z-score rather than the weight-for-age (underweight) z-score included in the MDGs is that data on weight-for-age are distorted by the presence of overweight children. 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

primary completion rates (Target 7b) of adults[13] and on literacy rates for female adults aged between 15 and 24 years (Target 8).[14] For MDG3 the data sets contain information about the ratio of years of education of women to their partners (Target 10)[15] and about the share of women in wage employment in the non-agricultural sector (Target 11). For MDG4 we can analyse both under five and under one mortality rates (Targets 13 and 14).[16] MDG5 is analysed using the proportion of births in the household attended by skilled health personnel (Target 17). We use another variable for health concerning child immunization and the combat against diseases. Here, we take the households' average number of vaccinations of children aged between 1 and 5 years, with a maximum of 8 possible vaccinations for each child.[17] The average number of vaccinations per household represents access to healthcare and preventive medicines and can therefore be seen as an indirect measure of the MDG4 and of MDG6. A similar variable has for example been used in monitoring the health sector reform project in Bolivia in 1999 (Montes 2003). For MDG7, we have information on both access to clean water and access to sanitation (Targets 30 and 31).

Unfortunately the DHS data sets do not contain information on income or consumption due to its focus on demographics, health, and fertility. To overcome this problem, in our DHS data set, we use simulated incomes based on a dynamic cross-survey microsimulation methodology (Grosse, Klasen, and Spatz 2005).[18] The basic idea of

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appear because the parents are genetically short so that the child is small but well nourished. We only use the z-score for children above 1 to reduce the noise that would arise due to the fact that, typically, stunting only develops during the first year of life.

13 This indicator cannot be calculated for children due to missing information in the DHS of 1989. 'Male adults' here are only partners of the respondents in the households, but no single men, since there is no male module in the DHS of 1989. Thus, 'partners' are not a random sample of males.

14 We have used the question whether the respondent is able to read easily. This indicator cannot be calculated for males due to missing information of partners' literacy in the DHS of 1989.

15 We cannot use information on literacy because this information is not given for men, so we use the ratio of average years of schooling of all respondents with partners in the household relative to their partners instead (it is not possible to calculate it just for the age group of 15-24 years due to missing age information of partners). We think that this indicator might be even better then literacy itself to measure the educational status because years of schooling better reflect the level of education than mere literacy.

16 In our calculation, we use 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 20 per cent to 10 per cent is transformed into an increase in child survival from 80 per cent to 90 per cent. Different from the other indicators, we use the average individual survival rates by centile (and do not produce average household survival rates first) and we compute them using life table estimations to be consistent with official estimates (thus the indicator is the probability that a child reaches its first or fifth birthday, respectively). For under 5 mortality, we restrict the sample to those children born 10 years prior to the survey and for under 1 mortality to those born 5 years prior to the survey.

17 The possible vaccinations are three against polio, three against DPT, one against measles, and one against BCG. We do not include children under 1 as they cannot be expected to have completed the eight recommended vaccinations.

18 For the calculation of the PPGR in the next section, we use the headcount of 77 per cent as found in Klasen et al. (2004) for the moderate poverty line and of 56 per cent for the extreme poverty line. We use the same headcounts for the calculation of the PPGR for all non-income indicators.

this simulation methodology is to estimate incomes by combining information from two surveys: first, the DHS (of 1989 and 1998) and, second, the Bolivian household surveys (LSMS, i.e., the 2nd EIH of 1989 and the ECH of 1999). With this they estimate an income correlation in the household survey, apply the coefficients to the DHS, and predict, i.e., simulate, incomes in the DHS (including a stochastic error term).[19] As shown in Klasen et al. (2004) such an approach generates more plausible estimates of incomes than asset indices that are often used in place of incomes when DHS data are analysed (e.g., Filmer and Prichett 1998; Sahn and Stifel 2003).

5 Results

5.1 Descriptive statistics

Compared to other regions such as some countries in South Asia and most of sub-Saharan Africa, countries in Latin America have better chances to reach the MDGs, particularly the ones where some absolute achievement is the target (UN 2005). For instance, many Latin American countries already have near universal primary schooling rates (MDG2), have low gender gaps in education (MDG3), have comparatively good access to reproductive health services, water and sanitation access (individual targets for MDGs 5 and 7).

In addition, Bolivia experienced relatively high income growth rates in the 1990s (which also were pro-poor in both urban and 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. In addition, Bolivia is one of the countries in Latin America with a very unequal income distribution. And as concerns social indicators such as life expectancy or literacy, despite improvements since the 1980s, Bolivia still has quite poor outcomes compared to other countries in Latin America (see, e.g., Klasen et al. 2004). The high income inequality and the persisting poverty motivates us to investigate the distributional pattern of the progress towards the MDGs, i.e., to investigate if the improvements towards the MDGs made so far are higher for the poor than for other population subgroups.

Table 1 shows the aggregate progress for selected MDGs in Bolivia between 1989 and 1998. Comparing the two points in time we see an overall sizable progress towards reaching the MDGs during this decade. The very high headcount ratio for moderate

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19 The authors estimate an income/consumption expenditure model in the 1999 LSMS data restricting the set of covariates to those which are also available in the 1998 DHS data and interacting all variables with a rural/urban dummy. They then use the regression to predict incomes in the DHS and add a randomly distributed error term. They then repeat the procedure for the 1989 LSMS, which is only available in urban areas. When imputing incomes in rural areas, they use the model for urban areas in 1989 and add the results of the rural interaction terms from 1999, assuming that the difference in the impact of income correlates between 1989 and 1999 did not change over time. While the results work well in several validation tests, there is a tendency that the simulated income growth is higher than the observed one, a subject that currently under investigation. This overprediction should not bias the results in this paper, but it might be useful to test the results generated here with a survey that contains detailed information both on income and on non-income variables.

poverty falls from 77 per cent to 60 per cent and the one for extreme poverty from 56 per cent to 35 per cent between 1989 and 1998 for simulated incomes. However, Bolivia is still far from reaching the goal of a headcount ratio of 38 per cent and 28 per cent, for moderate and extreme poverty, respectively. More progress has been made halving the poverty gap, especially for those suffering from extreme poverty.[20] Much progress is also observed in reducing the prevalence of stunted children. In 1989 the prevalence of stunted children was 38 per cent. This means that the goal for the year 2015 is to reach 19 per cent. In 1998 we see that the prevalence rate of stunted children has already decreased to 23 per cent which can be seen as a large step towards achieving the target. Concerning the achievement of universal primary education, the literacy rate has increased from 71 per cent to 83 per cent, which is an increase of almost 17 per cent, and primary completion (of adults) has increased from 57 per cent to 71 per cent. For the goal to promote gender equality, we also see much progress. The ratio of female to male years of schooling has risen considerably, and the share of women in wage employment outside the agricultural sector has also considerably increased. Turning to the health indicators, we find relatively high but well decreasing rates of child and infant mortality, e.g., child mortality rates decreased from 135/1000 to 97/1000. The vaccination level increased only slightly from 5.30 to 5.48 of eight possible vaccinations. Looking at the maternal healthcare indicator, we find also considerable progress: the birth attendance rate in Bolivia increased by around 40 per cent (from 41 per cent to 57 per cent). Last, water and sanitation access in Bolivia has been notably improved. In particular, the proportion of those who have access to clean water has increased from 47 per cent to 70 per cent.

A first evidence of the distribution of this progress can be seen when looking at Table 2 which shows the decile means (conditional on the income situation) of the selected MDGs and their 90:10 ratio. Overall the table reflects the positive and encouraging picture of Table 1. Progress has been made for nearly all deciles for all indicators between the two points in time. For instance, the primary completion rate of the income poorest decile increased between 1989 and 1998 from 30 per cent to 40 per cent. The ratio of female to male years of schooling (i.e., of respondents and their partners) increased considerably and in several deciles even exceeds one.[21] Very strong improvements can also be seen for access to infrastructure and to assistance at giving birth where access for the poorest decile strongly increased. The mean number of vaccinations did not change much for all deciles but child survival increased considerably.

Looking at inequality the 90:10 ratio in the last column of Table 2 shows evidence of high inequality in Bolivia both for income and for the non-income indicators of poverty along the income distribution. Most apparently, as expected, we find very high income

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20 Please note that the progress in poverty reduction is larger than suggested in Klasen et al. (2004) where actual incomes were used in the final period. The discrepancy is currently under investigation.

21 This result should be treated with caution for two reasons. First, it only reflects relative education of female respondents and their partners where such partners actually existed. This is a rather narrow indicator as it neglects women without partners as well as single men. Also, the results are not only due to educational investments along the income distribution, but marriage market effects which affect how females and their partners match and form households.

Table 1 Selected MDGs in Bolivia (1989 and 1998)

	1989	1998
Eradicate extreme poverty and hunger		
Poverty headcount ratio*	0.77 (0.56)	0.60 (0.35)
Poverty gap*	0.45 (0.28)	0.30 (0.14)
Prevalence of stunted children	0.38	0.23
Achieve universal primary education		
Primary completion rate	0.57	0.71
Literacy rate (females, aged 15-24)	0.71	0.83
Promote gender equality		
Ratio of education of women to men	0.71	1.05
Share of women in wage employment in non-agricultural sector	0.24	0.45
Reduce child mortality		
U5 mortality rate (*100)	13.50	9.73
U1 mortality rate (*100)	7.60	6.51
Improve maternal health		
Vaccinations	5.30	5.48
Birth attendance rate	0.41	0.57
Water and sanitation		
Access to water	0.47	0.70
Access to sanitation	0.50	0.68

Source: Own calculations.

Notes: The explanation of the variables for the Tables and Figures is the following. Prevalence of stunted children: Stunting z-score of the last born child aged 1-5 of each respondent (averaged over the household) with a child defined to be stunted if her z-score is below -2. Primary completion rate: Primary completion can only be measured for respondents and their partners due to missing information on children in the DHS 1989. Literacy rate: It can only be computed for women (restricted to age 15-24 as in the MDG target) due to missing information for males. We use the answer 'reads easily' to the question on literacy, thus those who answer 'cannot read' or 'reads with difficulty' are concerned as illiterate. Ratio of education of women to men: We use years of schooling of respondents (only those who have a partner and know their partners' education) to their partners, averaged over the household. Share of women in wage employment in non-agricultural sector: We use the occupation codes and take the share of respondents in the household who are working outside the agricultural sector. Under 5 (1) mortality: We use life table estimates and take the sample of children born 10 (5) years prior to the sample. Here, we do not average over the household or over the mother, but treat each child separately. Vaccinations: Average vaccinations of the children in the household older than 1, where the possible vaccinations are three against polio, three against DPT, one against measles, and one against BCG. Birth attendance rate: The share of children born in the household in the past 12 month for which a doctor attended during delivery. Access to water: Share of households with access to piped water. Access to sanitation: Share of households that have a toilet. *Two poverty lines are used. The first number refers to the extreme poverty line and the number in parentheses refers to the moderate poverty line.

inequality with a 90:10 ratio of almost 40 that has decreased only slightly in the 1990s. The same holds for the share of women in wage employment. While Table 1 shows high overall progress, Table 2 shows high inequality both in 1989 and 1998 which indicates that the very poor have not benefited disproportionally from the progress. The 90:10 ratio has only decreased from 10.80 to 9.67. A slightly different picture shows the birth attendance rate. Although the level of inequality was also quite high in 1989, we can see

Table 2 Non-income achievements by income decile (conditional on income, Bolivia, 1989 and 1998)

	1	2	3	4	5	6	7	8	9	10	90:10
	Mean of the deciles (conditional on income), 1989										
Income*	21.88	40.27	57.50	77.33	100.61	132.39	177.08	246.12	368.36	863.39	39.46
Prevalence of stunted children	0.43	0.45	0.53	0.41	0.38	0.28	0.33	0.29	0.16	0.15	0.34**
Stunting z-scores (*100)	-180.19	-174.40	-183.05	-156.47	-151.49	-127.47	-128.45	-130.67	-89.68	-74.66	0.41**
Primary completion rate	0.30	0.34	0.41	0.49	0.58	0.63	0.70	0.75	0.82	0.88	2.93
Literacy rate (females, aged 15-24)	0.43	0.57	0.64	0.65	0.75	0.78	0.81	0.83	0.84	0.86	2.00
Ratio of education of women to men	0.53	0.65	0.61	0.70	0.71	0.85	0.80	0.81	0.91	0.90	1.71
Share of women in wage employment in non-agricultural sector	0.05	0.08	0.13	0.17	0.22	0.27	0.30	0.33	0.42	0.54	10.80
U5 survival rate	0.85	0.87	0.87	0.85	0.86	0.88	0.89	0.89	0.91	0.91	1.07
U1 survival rate	0.91	0.91	0.92	0.93	0.92	0.94	0.94	0.95	0.94	0.93	1.01
Vaccinations	5.01	4.94	5.36	5.10	5.43	5.82	5.73	6.04	6.32	6.45	1.29
Birth attendance rate	0.07	0.20	0.29	0.38	0.47	0.58	0.73	0.80	0.86	0.90	12.86
Access to water	0.16	0.27	0.32	0.40	0.47	0.52	0.59	0.68	0.70	0.82	5.13
Access to sanitation	0.16	0.21	0.28	0.37	0.49	0.58	0.70	0.76	0.86	0.92	5.75

Table 2 continues…

Table 2 continued

	1	2	3	4	5	6	7	8	9	10	90:10
	Mean of the deciles (conditional on income), 1998										
Income*	36.37	63.60	89.26	119.22	155.89	203.15	269.64	369.20	555.27	1242.66	34.17
Prevalence of stunted children	0.38	0.34	0.32	0.27	0.23	0.22	0.19	0.14	0.13	0.07	0.18**
Stunting z-scores (*100)	-157.37	-136.99	-133.95	-124.03	-115.69	-106.45	-89.53	-83.75	-71.39	-39.75	0.25**
Primary completion rate	0.40	0.50	0.57	0.63	0.69	0.72	0.80	0.83	0.86	0.95	2.38
Literacy rate (females, aged 15-24)	0.60	0.67	0.72	0.79	0.81	0.88	0.88	0.88	0.93	0.97	1.62
Ratio of education of women to men	0.83	0.90	0.97	1.00	1.09	1.17	1.26	1.10	1.13	1.01	1.21
Share of women in wage employment in non-agricultural sector	0.16	0.20	0.29	0.31	0.39	0.48	0.50	0.62	0.64	0.73	9.67
U5 survival rate	0.87	0.91	0.90	0.89	0.91	0.90	0.90	0.93	0.93	0.95	1.09
U1 survival rate	0.92	0.94	0.94	0.93	0.92	0.94	0.93	0.95	0.95	0.96	1.04
Vaccinations	5.20	5.18	5.03	5.39	5.40	5.73	5.94	5.97	6.09	6.61	1.27
Birth attendance rate	0.28	0.36	0.40	0.53	0.64	0.74	0.74	0.86	0.90	0.90	3.21
Access to water	0.37	0.43	0.52	0.57	0.65	0.72	0.81	0.85	0.87	0.95	2.57
Access to sanitation	0.27	0.40	0.45	0.53	0.63	0.71	0.78	0.84	0.88	0.97	3.59

Source: Own calculations.

Notes: For the explanation of the variables, see Table 1. *Real household income per capita in Bolivianos per month household. **In the case of the prevalence of stunted children the 90 to 10 ratio indicates higher inequality for a low value and lesser inequality for higher values.

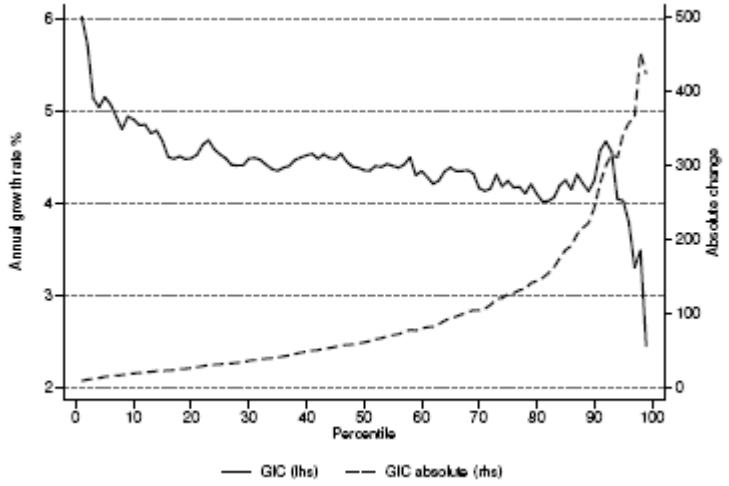
that in 1998 the 90:10 ratio decreased from 12.86 to 3.21 indicating a reduction in relative inequality. The same hold also, but to a lesser extent, for the infrastructure indicators of access to water and sanitation. Also here the relative inequality decreased.

Table 2 already gives an overview of how the progress is distributed across the income deciles and how this distribution has changed over time. The income gradient becomes obvious for most of the indicators, and it continues to be relevant over time. In the next section we visualize the changes of the distribution in a more detailed way by using the NIGIC. The NIGIC is basically the graphical implementation of how the distribution along the centiles of the Table 2 has changed, absolutely and relatively, using percentiles instead of deciles. Using the NIGIC and the PPGR-to-GRIM and PPCH-to-CHIM comparisons we asses the pro-poor progress towards the MDGs. We investigate the questions, first, how the progress of non-income indicators in Tables 1 and 2 is distributed over the entire income distribution and, second, to what extent this progress can be considered as pro-poor using the various definitions.

5.2 Pro-poor progress towards the non-income MDGs

Starting our analysis with the income growth assessment, Figure 1 shows the GIC for Bolivia from 1989 to 1998. Over the whole distribution the GIC is above 0 indicating weak absolute pro-poor growth. Furthermore, it is negatively sloped, especially for the very poor centiles of the distribution which fulfills the requirement of relative pro-poor growth. This finding of relative pro-poor growth and the relatively high growth rates of the 1990s are also reflected in Table 3 which shows the growth and progress rates and absolute changes of the selected MDGs.

Figure 1 Growth incidence curve and absolute change for income



Source: Own calculations.

Table 3 shows a GRIM of 3.88 per cent for income. The PPGR of 4.53 per cent exceeds the GRIM reinforcing the finding of relative pro-poor growth. Using the extreme poverty line with a headcount of 56 per cent, the growth process is even more pro-poor. Investigating strong absolute pro-poor growth one can look at the absolute NIGIC in Figure 1 which shows anti-poor growth using the strong absolute definition as the

absolute NIGIC is positively sloped. This finding is also reflected in that the CHIM is higher than the PPCH for both poverty lines, where the PPCH of the extremely poor is even lower than of the moderately poor. This finding of anti-poor income growth in the strong absolute sense is not surprising since the criterion of absolute pro-poor growth is very hard to be met in reality, as shown empirically by White and Anderson (2000). However, especially for the non-income dimensions of poverty, it is even more important for the poor to be able to catch up and it might also be met more easily due to the bounded-above character of most of the variables.

Table 3 Pro-poor growth and pro-poor progress in Bolivia (between 1989 and 1998)

Indicator	Pro-poor growth (progress) rate** (PPGR)	Growth (progress) rate in mean (GRIM)	Pro-poor change** (PPCH)	Change in mean (CHIM)
Eradicate extreme poverty and hunger				
Income*	4.53 (4.62)	3.88	54.66 (37.63)	97.71
Stunting z-scores	0.91 (0.81)	0.78	38.98 (33.95)	36.15
Achieve universal primary education				
Primary completion rate	2.43 (2.87)	1.67	0.12 (0.13)	0.11
Literacy rate (females, aged 15-24)	1.61 (1.79)	1.28	0.10 (0.10)	0.10
Promote gender equality				
Ratio of education of women to men	3.96 (4.02)	3.40	0.33 (0.32)	0.30
Share of women in wage employment in non-agricultural sector	7.94 (8.69)	5.57	0.17 (0.15)	0.18
Reduce child mortality				
U5 survival rate	0.34 (0.38)	0.33	3.01 (3.35)	2.98
U1 survival rate	0.10 (0.15)	0.13	0.92 (1.33)	1.20
Improve maternal health				
Vaccinations	0.13 (0.10)	0.08	0.06 (0.04)	0.04
Birth attendance rate	4.17 (5.43)	1.81	0.13 (0.15)	0.10
Water and sanitation				
Access to water	4.60 (5.10)	3.22	0.19 (0.18)	0.18
Access to sanitation	3.70 (4.55)	1.96	0.14 (0.15)	0.12

Source: Own calculations.

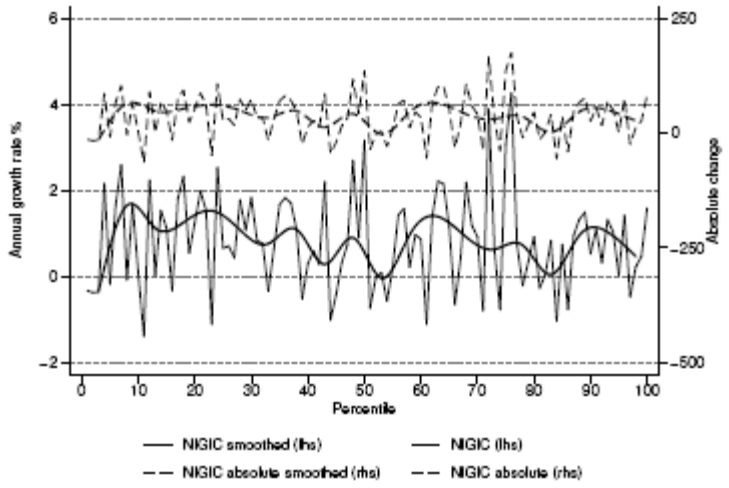
Notes: For the explanation of the variables, see Table 1. *Real household income per capita in Bolivianos per month. **Two poverty lines are used. The extreme poverty line leads to a headcount of 77 per cent. The numbers in parentheses refer to a moderate poverty line with a headcount of 56 per cent.

From Figure 2 onwards, we show the conditional NIGIC and the absolute conditional NIGIC for the selected MDG variables. As the conditional curves are very volatile, we additionally include the smoothed curves in the figures to better show the trend of the variables.[22] Figure 2 shows the results for the prevalence of stunted, i.e., chronically malnourished, children. As the NIGIC is above 0 for nearly all centiles, we find weak absolute pro-poor progress. However, there is no clear trend in the curve, although it seems to be slightly downward sloping on average. This is also reflected in the fact that

[22] As mentioned before, we consider improvements in non-income indicators as progress rather than growth. However, we keep the abbreviations of PPGR and GRIM in order not to confuse the reader.

the PPGR is slightly larger than the GRIM indicating slightly pro-poor progress using the relative definition. When considering absolute improvements, there is less evidence of a downward sloping absolute NIGIC and the comparison of the PPCH and the CHIM show that absolute progress was evenly spread across the distribution.

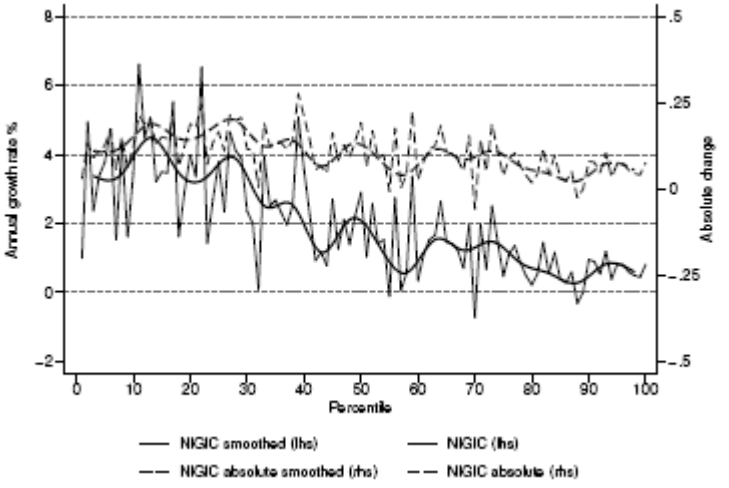
Figure 2 Conditional NIGIC and absolute change for stunting (z-score*100)



Source: Own calculations.

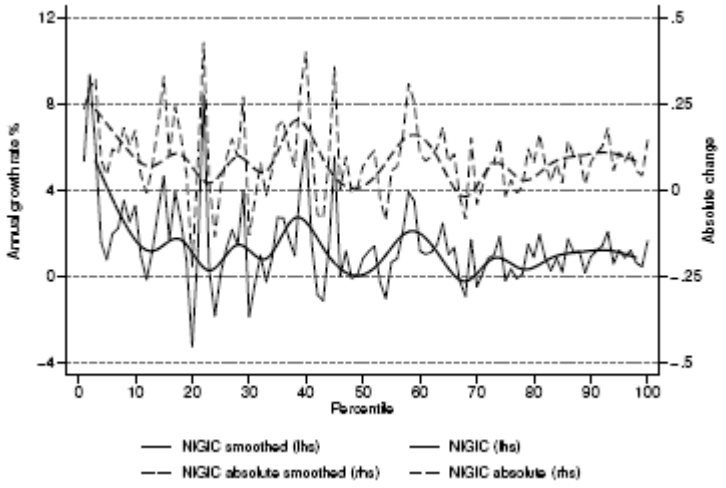
Figures 3 and 4 monitor the distribution of progress towards MDG2. The primary completion rate of poor households increases, and these increases are higher for the income-poor compared to the income-non-poor. Thus, with the NIGIC being above 0 and strongly negatively sloped, we find weak absolute and relative pro-poor progress. We also find strong absolute pro-poor progress, although of lower magnitude. The absolute increases in primary completion are higher for the poor than for the non-poor which is also reflected in the (slightly) higher PPCH compared to the CHIM. Nearly the same findings hold for the literacy rate (of females aged 15-24), but the relative and the strong absolute pro-poor progress are less pronounced.

Figure 3 Conditional NIGIC and absolute change for primary completion rate



Source: Own calculations.

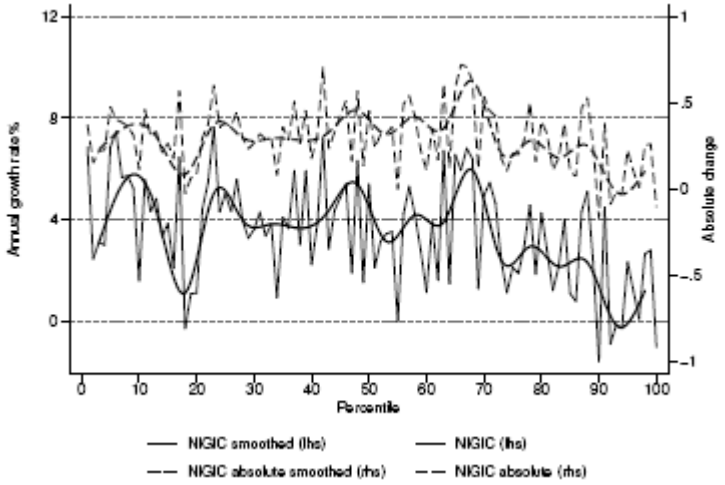
Figure 4 Conditional NIGIC and absolute change for literacy rate



Source: Own calculations.

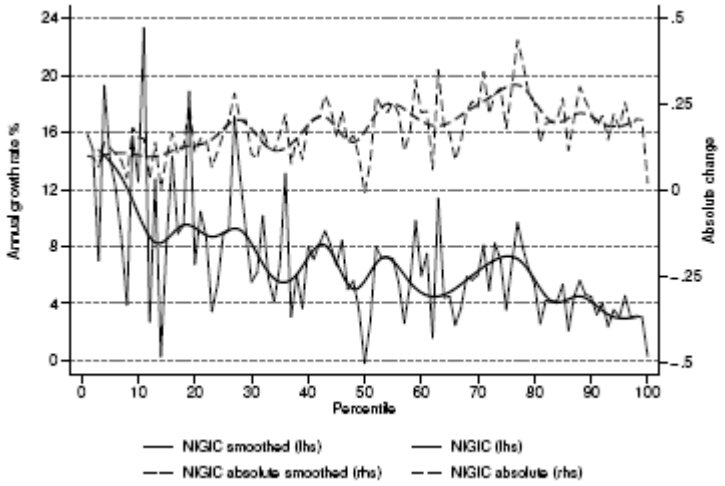
Figures 5 and 6 show the trends for the selected targets of MDG3. For the ratio of educated women to men we find that progress is high for all income groups with both high proportional increases and absolute changes. Especially in the income-poorest groups of, say, the first 3 deciles, gender equality increased a lot, as shown in Table 2. The share of women in non-agricultural wage employment has strongly increased across the income distribution, but the increases where not the same everywhere. We find very pronounced weak absolute and relative pro-poor progress, especially for the very poor. This is reflected in the overall high progress with a GRIM of 5.57 per cent and the PPGR for the moderately poor is 7.94 per cent which is exceeded by the PPGR of 8.69 per cent of the extremely poor. However, as concerns absolute changes, the increases are higher for the non-poor than for the poor, reflected in the positively sloped absolute NIGIC and the higher CHIM as compared to the PPCH. Clearly the expansion of female employment has been higher in absolute (i.e., percentage point) terms among the rich than among the poor, suggesting that better-off women have benefited more from expanded female employment opportunities, which should be of some concern for those concerned about gender equality in the labour market as well as those worried about further progress in poverty reduction which will greatly depend on improving female employment opportunities.

Figure 5 Conditional NIGIC and absolute change for ratio of education of women to men



Source: Own calculations.

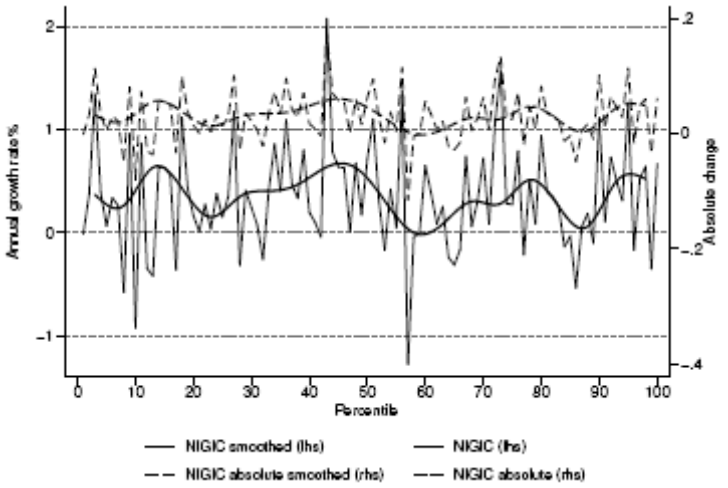
Figure 6 Conditional NIGIC and absolute change for share of women in wage employment



Source: Own calculations.

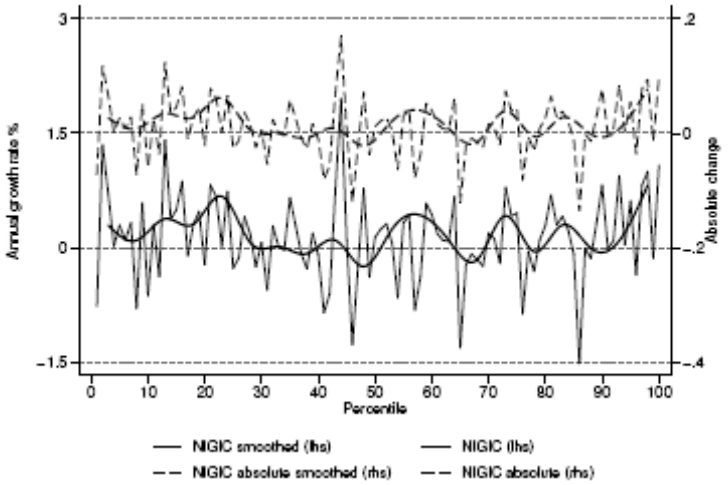
The Figures 7 and 8 report pro-poor progress in under 5 survival and under 1 survival. The NIGICs are very volatile due to the relatively small number of deaths per centile and thus have to be interpreted with caution. The results in Table 3 show that there was weak absolute pro-poor progress, but that the income poor did not benefit more than the rich, either in absolute or in relative terms. For the other variables measuring health (in the sense of child and maternal health and access to healthcare) we find mixed evidence for pro-poor progress. The number of vaccinations that children have received has increased only slightly and for some centiles it has even decreased, and there is no clear sign for pro-poor progress (see Table 3 and Figure 9). For the proportion of births attended by a doctor we find quite impressive weak absolute and relative pro-poor progress, so the income-poor had better chances to deliver being attended by skilled health personnel. Also the strong absolute criterion is fulfilled, both in the aggregate numbers (the PPCH exceeds the CHIM) and the curves (the absolute NIGIC in Figure 10 is negatively sloped on average).

Figure 7 Conditional NIGIC and absolute change for under 5 survival rate



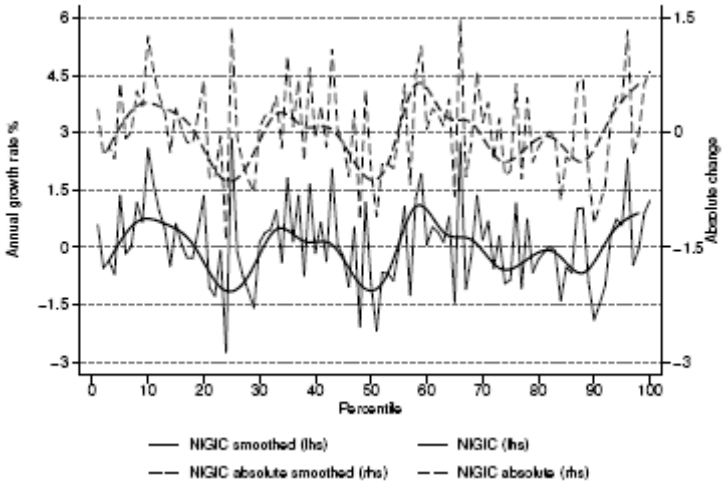
Source: Own calculations.

Figure 8 Conditional NIGIC and absolute change for under 1 survival rate



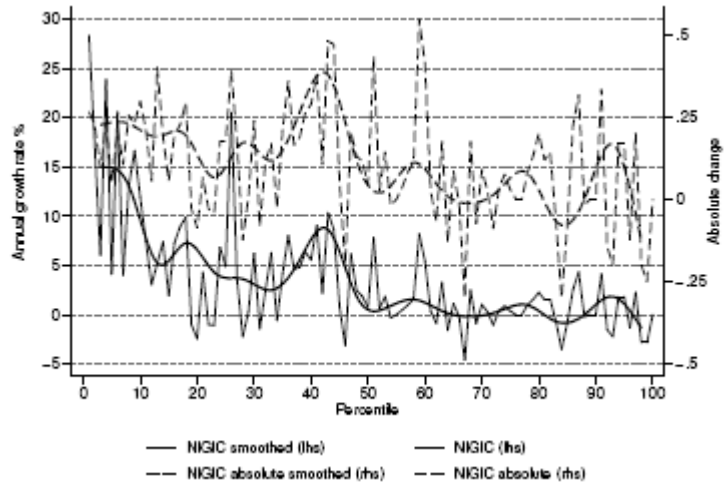
Source: Own calculations.

Figure 9 Conditional NIGIC and absolute change for vaccinations



Source: Own calculations.

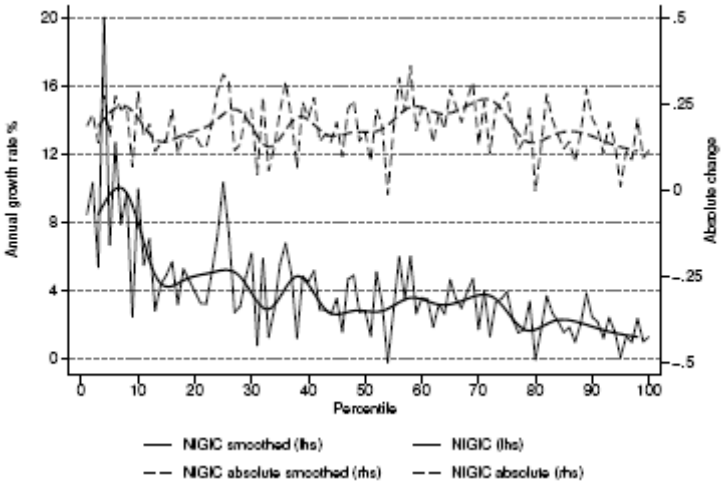
Figure 10 Conditional NIGIC and absolute change for birth attendance rate



Source: Own calculations.

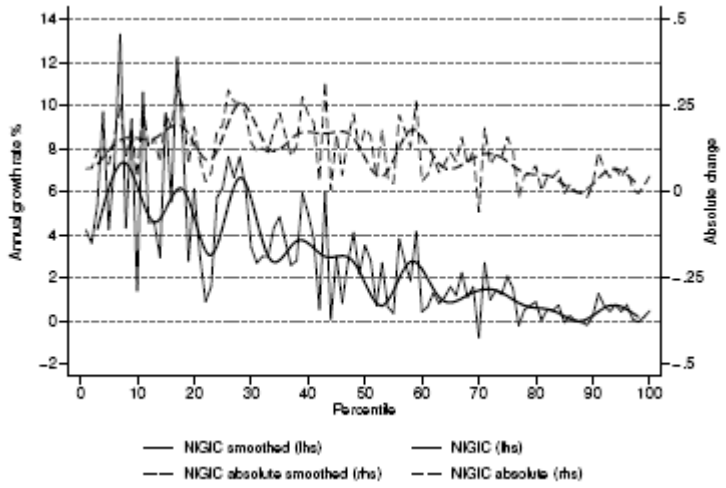
Figures 11 and 12 shows progress in access to piped water and to basic sanitation by income group. Both variables show tremendous increases in access across the income distribution. For the income-poor population groups, progress was higher in relative terms and, in the case of sanitation, the increases are furthermore in line with the strong absolute criterion of pro-poor progress whereas the absolute changes (measured in percentage points) in access to water are more equally distributed over the income distribution.

Figure 11 Conditional NIGIC and absolute change for access to water



Source: Own calculations.

Figure 12 Conditional NIGIC and absolute change for access to sanitation



Source: Own calculations.

6 Conclusion

In this paper we have extended the methodology of pro-poor growth measurement to the assessment of pro-poor progress along the income distribution. This way we are able to see whether the income poor have been able to benefit disproportionately from progress in non-income dimensions of well-being. As stated above, this is important from a well-being perspective, will influence income poverty reduction in future, and allows us to assess success of public policies in reducing disparities in non-income dimensions of well-being. The illustration from Bolivia has demonstrated that such an approach is feasible and yields a range of important and interesting new insights about the distribution of progress in non-income dimensions of well-being which is critical for a more comprehensive assessment of progress towards the non-income MDGs.

The overall picture of income growth and non-income progress in Bolivia is quite positive for the period from 1989 to 1998. For nearly all targets of the MDGs we find an improvement when looking at mean improvements. For most of the targets we also find that this progress was pro-poor, at least in the weak absolute and in the relative sense, suggesting that the poor participated in this progress at higher rates than the non-poor. This is particularly the case for the expansion of education, health attendance, female employment, and access to water and sanitation. It is much less the case in the income dimension, stunting, as well as in infant and child mortality rates where progress was similar in relative terms across the income spectrum.

Regarding absolute improvements, the record is much more mixed. While in education, sanitation access, and birth attendance absolute improvements were at least slightly pro-poor, they were of equal magnitude in most other indicators with the exception of income where they were strongly anti-poor.

How are we to interpret these findings from Bolivia? A few observations are of importance. First, the poor have benefited from progress in non-income dimensions of well-being. This suggests that government policies in the 1990s to expand health and education services have reached the poor and led to significant improvements in their well-being and human capital.[23] Bolivia in the 1990s is likely to be a case where pro-poor progress was particularly large. It would be interesting to replicate this analysis in sub-Saharan Africa where overall progress and the distribution of progress is likely to have been much more unfavorable. Second, the achievement is much less impressive if one considers that many of the indicators are variables that are effectively bounded above and where the rich were already close to the upper bound and further progress for them was thus much harder to achieve. This is particularly the case for the education, mortality, birth attendance, and water and sanitation access indicators. In those situations, one would expect that any average progress would be pro-poor in the strong absolute dimension as only the poor have a long way to go in these dimensions. Thus the findings of only slight pro-poor progress in the strong absolute definition using some of these indicators and the lack of such pro-poor growth in others is actually a disappointment. Third, this also suggests that public policies aimed at improving health and education were affecting in reaching the poor but not successful in significantly narrowing the absolute gaps between the poor and the rich in quite a few of these indicators. This suggests that more effort should be placed on ensuring that the poor are the disproportionate beneficiary (in an absolute sense) of public policy interventions. Lastly, the analysis shows that strong absolute pro-poor progress in non-income dimensions is feasible but very difficult to achieve in the income dimension where the absolute gap between the poor and the non-poor has continued to widen substantially. To what extent this is the natural state of affairs or something that should be tackled by policymakers is an interesting question for further research.

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[23] For a discussion of these policies, see Klasen et al. (2004).

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