Meeting the Millennium Poverty Reduction Targets in Latin America and the Caribbean

Economic Commission for Latin America and the Caribbean (ECLAC)

Instituto de Pesquisa Econômica Aplicada (IPEA)

United Nations Development Programme (UNDP)

Santiago, Chile, December 2002

Libros de la CEPAL

70

This report was prepared for the United Nations Development Programme (UNDP), the Economic Commission for Latin America and the Caribbean (ECLAC) and the Brazilian Instituto de Pesquisa Econômica Aplicada (IPEA) by the following team: Ricardo Paes de Barros, Dante Contreras, Juan Carlos Feres, Francisco H.G. Ferreira, Enrique Ganuza, Erwin Hansen, Phillippe George Leite, Luis Felipe López-Calva, Xavier Mancero, Fernando Medina, Rafael Diez de Medina, Rodrigo Montero, Jairo Núñez, Miguel Robles, Jaime Saavedra and Miguel Székely. Comments on an earlier (preliminary) version were received from staff at the Inter-American Development Bank (IDB) and UNDP and are gratefully acknowledged.

Cover design: Gilabert&Domeyko

United Nations Publication
LC/G.2188-P
ISBN: 92-1-121379-7

Sales No. E.02.II.G.125
Printed in United Nations, Santiago, Chile

Contents

Tables, figures and boxes

Tables

Figures

Boxes

Foreword

In the year 2000, the leaders of 189 nations agreed to support global development objectives referred to as the Millennium Development Goals (MDGs). The MDGs are composed of eight fundamental goals which are further divided into 18 specific targets designed to serve as a blueprint and plan of action. The forward momentum generated by the adoption of the Millennium Declaration was then reinforced at the International Conference on Financing for Development, held in March 2002, which examined means of mobilizing resources for development efforts focusing on the goals and targets set forth in the Declaration. The World Summit on Sustainable Development that concluded in Johannesburg, South Africa, in September 2002 endorsed the MDGs as a basic pillar of the global sustainable development agenda.

The United Nations Development Programme (UNDP) has been assigned the task of serving as the United Nations system's "campaign manager" to track progress towards the achievement of the MDGs. In collaboration with the Economic Commission for Latin America and the Caribbean (ECLAC) and the Institute for Applied Economic Research (IPEA), UNDP has worked with a team of specialists in the region to develop an innovative methodology for evaluating progress towards fulfilling the commitment to halve the proportion of the population living on less than one dollar a day by 2015. Using this methodology, the authors assessed 18 Latin American and Caribbean countries' chances of reaching their poverty reduction targets and explored the impact of different policy instruments in reducing poverty.

As the authors point out, the findings give grounds for both concern and optimism. On the one hand, only seven countries would meet the poverty reduction target if their performance in terms of economic growth and inequality reduction were to continue along the same lines as it did in the 1990s. But, on the other hand, the changes required to meet the targets appear to be feasible. However, although the general lesson is that even very small reductions in inequality can have very large positive impacts on poverty, the region's high levels of inequality have proved remarkably intractable thus far.

The United Nations system is working to ensure systematic, sustained monitoring and review of progress towards the MDGs in terms of achievements, trends and shortfalls, based on authoritative, disaggregated data. Monitoring at the country level is expected to focus on regular MDG reports. These reports will be public documents intended for a broad audience that will include the general public, the media, experts and policy makers. The MDG reports will serve as catalysts for mobilizing public opinion and fostering a more vigorous national debate on how the MDGs apply to each country's situation and how they are linked to development priorities and policy options.

José Antonio Ocampo
Executive Secretary
ECLAC

Elena Martínez
Regional Director for Latin America and the Caribbean
UNDP

Roberto Borges Martins
President
IPEA

Executive summary

- This report looks at the conditions under which 18 Latin American and Caribbean countries would individually be able to meet the extreme poverty reduction target established in the Millennium Declaration as one of the United Nations Millennium Development Targets.
- The 18 countries considered in this report are Argentina, Bolivia, Brazil, Chile, Colombia, Costa Rica, Dominican Republic, Ecuador, El Salvador, Guatemala, Honduras, Mexico, Nicaragua, Panama, Paraguay, Peru, Uruguay and Venezuela.
- The question that the report seeks to answer is whether or not each country will succeed in halving its extreme poverty rate as of 1999 (with respect both to an international poverty line which corresponds to the original dollar-a-day line and to a country-specific poverty line) by the year 2015.[1]
- Two scenarios are considered for each country: a "historical" one, which extrapolates the country's growth and inequality dynamics of the 1990s into the future; and an "alternative" one. The alternative scenario simulates movements that would take

[1] The "Road map towards the implementation of the United Nations Millennium Declaration" (United Nations, 2001) stipulates that the target is to halve the proportion of extreme poverty which existed in 1990; 1999 has deliberately been chosen as the reference year, however, because it is the most recent point in time for which household data are available for a large number of countries in the region.

each country closer to a hypothetical "regional ideal" (referred to in the report as "Maxiland"), which is both richer and more egalitarian than any country in Latin America or the Caribbean actually is today.

- Each of these scenarios is simulated by means of a simple procedure which generates counterfactual income distributions with higher means and lower inequality levels than those actually observed in 1999. The growth and inequality reduction parameters have been calibrated to generate all plausible (positive) combinations which yield the desired rates of poverty reduction. Steps were then taken to determine what it would take for each country to reach its target with respect to either line, along either path. For the alternative scenario, the analysis also covers a number of possible changes in employment levels, productivity, human capital stocks and transfers which would be statistically consistent with the simulated aggregate growth and inequality changes.
- The report's findings give grounds for both concern and (conditional) optimism.
- The simulations based on the countries' historical performances are what gives rise to that concern. If the countries in the sample were to continue to perform as they did in the 1990s, only 7 of the 18 would meet their poverty reduction targets (with respect to the international poverty line) by 2015. These countries are Argentina (pre-crisis), Chile, Colombia, Dominican Republic, Honduras, Panama and Uruguay.
- Another six countries would continue to reduce the incidence of extreme poverty, but at too slow a pace. These countries are Brazil, Costa Rica, El Salvador, Guatemala, Mexico and Nicaragua. The other five countries —Bolivia, Ecuador, Paraguay, Peru and Venezuela— would actually see higher levels of extreme poverty due either to increases in inequality, decreases in per capita income, or both.
- Simulations of the alternative scenario, on the other hand, give cause for conditional optimism. Using this scenario, which was used to see how the countries' income distributions would change if they were to succeed in becoming both progressively richer and less unequal, it was found that the changes required for every country to meet their poverty reduction targets appear to be quite feasible.

- With respect to the international poverty line, this alternative scenario indicates that 16 countries could meet the target by combining average annual growth rates of GDP per capita of 3% or less with cumulative reductions in inequality of less than 4%. The two exceptions are Bolivia and El Salvador.
- With respect to the country-specific extreme poverty lines, the alternative scenario indicates that only two countries —Bolivia and Nicaragua— would require both an average annual growth rate of GDP per capita of more than 2% and a reduction in inequality of more than 5% to meet the target.
- The findings therefore appear to indicate that even very small reductions in inequality can have very large positive impacts in terms of poverty reduction. For most of the countries that were considered, a one- or two-point reduction in the Gini coefficient would achieve the same reduction in the incidence of poverty as many years of positive economic growth would. A large part of the reason why recent poverty reduction efforts in Latin America and the Caribbean have yielded disappointing results is that the region's high levels of inequality have proved remarkably intractable. In the rare instances when countries have succeeded in reducing inequality, the pay-off in terms of poverty reduction has been large.
- While there exists a statistical trade-off between the rates of economic growth and inequality reduction required to reach certain poverty targets, there is no evidence that growth and inequality reduction are economic substitutes for one another. On the contrary, the balance of the evidence suggests that the region's high inequality levels are a hindrance to more rapid growth.
- The exercise covered in this report was based on the simulation of combinations of growth and inequality reductions which were statistically consistent with required rates of poverty reduction. Further research is needed on policy combinations that might generate such changes in an economically consistent manner.

Introduction

At the Millennium Summit held in 2000, all 189 United Nations Member States —and the international organizations to which their countries belong— pledged to meet a number of development targets that are set forth in the Millennium Declaration. These Millennium Development Targets give material expression to the expectations of the international community for social progress following a series of international conferences and summits that began in 1990 with the World Summit for Children.[2] In the case of poverty reduction, the target consists in halving the proportion of the population that was living in extreme poverty as of 1990 by the year 2015. This target was originally defined with respect to an international poverty line of approximately one United States dollar (US$ 1.00) per person per day, at 1985 United States prices, which were then converted to national currencies using purchasing power parity (PPP) exchange rates.[3]

---

[2] See United Nations (2000).

[3] The "dollar-a-day" per capita poverty line was first used by the World Bank (1990) to permit international comparisons of extreme poverty. The original line was measured in 1985 international prices, converted to national currencies at PPP exchange rates. The World Bank (2001, p. 320) later updated the line to US$ 1.08 per capita, measured in 1993 international prices. In this report, the United States consumer price index has been used to update that line from June 1993 to June 1999. As a result, the original 1985 US$ 1.00-a-day per-person poverty line is now equivalent to US$ 1.24 at 1999 prices. This corresponds to a monthly per capita line of US$ 37.20, which is used for most countries in this report. The same set of consumer-price-based PPP exchange rates, dating to 1993, were used to convert the poverty line to national currencies. Further details are provided in the statistical appendix.

Poverty is a complex social and economic phenomenon, the dimensions and determinants of which are manifold. In this report, the analysis is abstracted somewhat from the multidimensionality and context-specificity of poverty —without denying their importance— in order to focus on the universality of the need to reduce extreme poverty and deprivation. Poverty has, as Amartya Sen has put it, an "irreducible absolutist core" (Sen, 1983, p. 332). By focusing on the income dimension of deprivation and taking as its measure the incidence of extreme poverty, the researchers have sought to shed light on the economic policies and developments which would contribute to its eradication.[4]

In particular, whenever poverty is defined as some aggregate of income shortfalls, it is always the case that its reduction requires some combination of economic growth and reduction in inequality. The purpose of this report is to illustrate the combinations of economic growth and inequality reductions which would enable each of 18 countries in Latin America and the Caribbean to meet their individual Millennium poverty targets by reducing the incidence of extreme poverty by one half of what it was in 1999. A deliberate decision has been made to apply the spirit of the Millennium poverty targets (halving extreme poverty) to the rates prevailing at the most recent point in time (1999) for which household data are available for a large number of countries in the region.[5] The 18 countries covered in the report are Argentina, Bolivia, Brazil, Chile, Colombia, Costa Rica, Dominican Republic, Ecuador, El Salvador, Guatemala, Honduras, Mexico, Nicaragua, Panama, Paraguay, Peru, Uruguay and Venezuela.

The analysis presented in this report proceeds as follows. The next section contains a brief discussion of some of the economic background for the analysis, as well as the data on which it draws. In section 2, the incidence of extreme poverty is calculated for each of these countries using two different poverty lines: the international poverty line of approximately one dollar per person per day, and an extreme poverty line which is calculated specifically for each country by ECLAC. A set of simulated counterfactual income distributions are then constructed for

---

4 While this report focuses on the income dimension of poverty, a number of other Millennium Development Goals were established specifically for the purpose of addressing complementary dimensions, including literacy, health, gender equality and freedom from malnutrition. Additionally, this analysis concentrates even more narrowly on the incidence of poverty. ECLAC (2002a) presents the other two common Foster, Greer & Thorbecke (1984) measures for all the countries discussed here.

5 Because of this change, the simulations do not correspond exactly to the conditions set forth in the "Road map towards the implementation of the United Nations Millennium Declaration" (United Nations, 2001), which defines the target as being to halve the proportion of extreme poverty between 1990 and 2015.

each country. Each such distribution is designed so as to have exactly half of the country's original poverty rate, and each is derived from the actual 1999 distribution by a combination of two simple operations: raising all incomes by an equal proportion (β) and reducing inequality by some other fixed proportion (α).

Clearly, a given poverty target, such as half of the 1999 rate, can be reached through many different combinations of (distribution-neutral) economic growth rates (of β%) and reductions in inequality (of α%). This report therefore presents the complete set of (positive) growth and inequality-reduction combinations (α, β)-pairs which would generate the poverty reductions required to meet the Millennium target. We call these combinations the isopoverty sets or, when drawn on an (α, β)-space, isopoverty curves, and interpret them as the set of outcome combinations which would generate the poverty reductions desired by each national signatory to the Millennium Declaration.[6]

Section 3 goes one step further and suggests an accounting identity which allows for a consideration of different ways in which the required rates of economic growth and inequality reduction can be generated on the basis of different combinations of changes in the occupation ratio, the stock of human capital available in the economy, its average productivity and public transfers. A summary and conclusions are presented in section 4.

[6] Naturally, while each of these outcomes is statistically consistent with the desired rate of poverty reduction, the simulations provide no information about the behavioural consistency across economic agents. This issue involves policy questions which are substantially more complex. Nevertheless, while statistical consistency is not sufficient to ensure that each such combination is tenable, such consistency is necessary for meeting the target.

I. Background and data

After a more or less uniformly dismal decade in the 1980s, the 1990s saw considerable diversity in growth and poverty-reduction experiences across Latin America and the Caribbean. While most countries recorded positive rates of growth in GDP per capita, thereby making up for some or all of the considerable losses incurred during the "debt-crisis decade" (the 1980s), these gains were generally modest. On average, Brazil's GDP per capita grew at 1.0% per annum during 1990-1999. Over the same period and in the same terms, Mexico grew at 1.4%, Bolivia at 1.5%, Uruguay at 2.8% and Argentina at 3.3%. But there were outliers at both extremes: on the upside, the Chilean economy expanded at a remarkable 4.5% in per capita terms over this period. On the downside, Paraguay recorded an average annual decline in GDP per capita of some 0.6% over the decade.[7]

Somewhat smaller disparities were observed with respect to the behaviour of inequality in the distribution of household incomes across Latin America. Inequality levels are known to be usually rather stable.[8] Except in periods of systemic upheaval, such as during an economic transition from socialism to a market system, aggregate indicators of inequality seldom move abruptly. Bearing this generalization out, most countries in the sample recorded changes of either exactly zero or very close to that. These countries included Brazil, El Salvador, Guatemala, Nicaragua, Panama and Uruguay. There were, as always, exceptions. Bolivia, Ecuador, Paraguay and Venezuela saw non-negligible increases in the Gini coefficient between 1990 and 1999. In the opposite direction, Honduras recorded a substantial decline in inequality, on the order of 8.3%.

Where did this mix of economic performances leave the region at the start of the Millennium? Table 1 contains some relevant statistics on average living standards in each country (measured both by per capita GDP statistics taken from national accounts data and by mean per capita household income figures taken from household surveys); inequality (measured by the Gini coefficient for the distribution of household incomes per capita); dependency ratios (measured by their inverse, i.e.,

---

7 Reported growth rates (calculated on the basis of 1995 constant dollars) taken from ECLAC studies (2002b) may not correspond exactly to "historical path" growth rates used in each country's micro-simulations. On the other hand, while the average annual growth rates over 1990-1999 are informative, the reader should bear in mind that they obscure often substantial volatility. Three examples come to mind of countries with solid —if unspectacular— growth rates in the 1990s which suffered severe recessions at the turn of the century: Argentina, Ecuador and Uruguay.

8 See, for instance, Deininger and Squire (1998).

the share of the population aged over 15 years); and educational attainment (measured by the mean number of completed years of schooling).

It is immediately apparent that the region is very far from being homogeneous. GDP per capita ranges from US$ 473 per year in Nicaragua to US$ 7 435 per year in Argentina (pre-crisis). Assuming that there is some relationship between per capita GDP statistics and material living standards, these figures suggest that Argentines had access to over 16 times more resources in 1999 than did their Nicaraguan counterparts.

Table 1
BASIC BACKGROUND INFORMATION, 1999

Country	GDP per capita[a] (US dollars per year)	Mean household income per capita[b] (US dollars per year)	Gini coefficient in 1999 [b]	Inverse dependency ratio [b] (Percentage)	Mean years of schooling [b]
Argentina	7 435	580.02	0.53	73.00	9.4
Bolivia	955	168.75	0.60	60.96	5.6
Brazil	4 225	594.35	0.64	70.00	6.0
Chile	5 129	474.98	0.55	72.00	9.8
Colombia	2 266	496.40	0.55	68.94	5.6
Costa Rica	3 706	394.00	0.49	63.53	7.5
Dominican Republic	1 943	491.83	0.47	63.00	6.9
Ecuador	1 404	158.13	0.56	63.72	6.4
El Salvador	1 753	148.00	0.52	64.10	6.2
Guatemala	1 551	257.00	0.58	56.00	4.1
Honduras	694	146.00	0.57	56.90	5.3
Mexico	4 577	662.50	0.57	60.87	5.9
Nicaragua	473	238.00	0.59	58.10	5.9
Panama	3 274	506.00	0.56	68.10	5.3
Paraguay	1 603	305.88	0.54	69.00	7.6
Peru	2 310	178.12	0.50	65.94	7.6
Uruguay	6 016	570.43	0.44	75.00	9.3
Venezuela	3 037	365.20	0.49	70.00	7.1

[a] ECLAC, Statistical Yearbook for Latin America and the Caribbean 2001 (LC/G.2151-P), Santiago, Chile, 2002. United Nations publication, Sales No. E.02.II.G.1 (in 1995 US dollars).
[b] From household surveys; incomes are monthly.

National accounts statistics and household surveys seek to measure mean living standards in very different ways. Although most household surveys used for this report were adjusted in accordance with standard ECLAC procedures, which are designed in part to correct for reporting errors and discrepancies with national accounts, the two measures still yield clearly different results. This is due at least in part to differences among the methods and questionnaires of the survey instruments used in

each country. Some of the properties of each household survey used in the analysis are summarized in table B.1 of the statistical appendix. The appendix also contains brief accounts of the ECLAC adjustments and of the method used to compute the PPP exchange rate for each country.

Nevertheless, the disparities reported for mean household incomes per capita in the second column of table 2 confirm the diversity of living standards across the region. The ranking of each country varies somewhat, but the differences —say, between Honduras or El Salvador, at less than US$ 150 per month, on the one hand, and Argentina or Mexico, at over US$ 580, on the other— are still remarkable. Part (but clearly not all) of these differences stem from differences in educational attainment across these countries. For example, there is a difference of over four full years of schooling between the average attainment for adults in Bolivia or Colombia (5.6 years) and Chile (9.8 years).

While the disparities across countries in the region are clearly large, there is even greater inequality within each country. Latin America and the Caribbean consistently record the highest average level of inequality for any region in the world (see, for example, World Bank, 2001). And indeed, the income Gini coefficients reported in the third column of the above table —ranging from 0.44 in Uruguay to 0.64 in Brazil— are all high by international standards. For purposes of comparison, average Gini coefficients in other regions in the 1990s ranged from 0.29 in Eastern Europe to 0.47 in Sub-Saharan Africa. High-income countries averaged 0.34 during the decade (Ahuja et al., 1997, p. 26). Yet, while all the Latin American countries' Gini coefficients are, without exception, above both the international and OECD averages, it is still the case that the variation in this coefficient within the region should not be ignored either. After all, 20 Gini points separate Uruguay from Brazil. This is equivalent to almost half as much inequality as has been measured in the former.

What are the implications in terms of poverty of this array of recent experiences and this diversity both in mean living standards and in distribution? As one might expect, the result is also an enormous cross-country variation.

Poverty measures in general —and the incidence of poverty in particular— are defined in relation to specific poverty lines and thus vary considerably across them. In this report, two lines are used for each country. The first is the international "one-dollar-a-day" per capita poverty line. As discussed in footnote 3, this is actually equivalent to US$ 37.20 per month in 1999 dollar values. This line was used for all countries, as indicated in column 1 of table 2 below. In the next column is the Millennium poverty reduction target for each country, defined with respect to that line. Since that value is half of the incidence observed in

1999, it suffices to double it to obtain the 1999 poverty levels in each country.

In terms of the international extreme poverty line, the incidence of extreme poverty in 1999 ranged from 0.2% in Argentina, the Dominican Republic and Uruguay, followed by just over 2.0% in Chile, Costa Rica and Panama, all the way to around 18% in Ecuador and El Salvador, over 23% in Honduras and over 26% in Bolivia. In all, there were no fewer than six Latin American countries with a level of extreme poverty incidence above 10% in 1999, even in respect of this very stringent poverty threshold. They were Bolivia, Ecuador, El Salvador, Honduras, Nicaragua and Peru.

The second line is the ECLAC extreme poverty line. This line is calculated for each country specifically, and its value varies from country to country. In every case, however, it is clearly higher than the international one. The exact monthly values for each country are entered in column 5 of table 2. The next column indicates what the Millennium poverty reduction targets would have been if they had been defined with respect to this (higher) line. Incidence levels with respect to these lines in 1999 can be obtained, as before, by doubling this target figure. Detailed information about how these poverty lines are calculated can be obtained from ECLAC (2002a).

II. Meeting the target: the macro scenarios

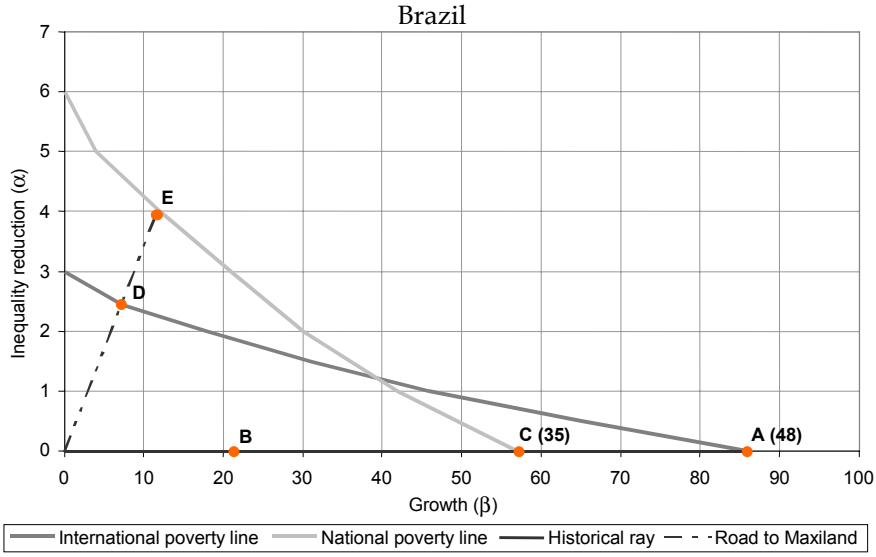
Clearly, given such disparate "initial" conditions, the various countries listed in table 2 will require different combinations of economic growth and inequality reduction to meet their respective Millennium targets. In order to determine the scale of the growth and inequality-reduction efforts which each country needs to make, simulations were prepared of a set of counterfactual income distributions for each nation which were constructed to have exactly the targeted incidence of poverty. This was done by scaling up every income in the distribution by a factor of $(1 + \beta)$ —which proxies for (distribution-neutral) economic growth of $\beta\%$ in aggregate terms— while simultaneously reducing inequality (as measured by the Gini coefficient) by $\alpha\%$. The details of this process are described in the methodological appendix.

Naturally, the higher the simulated growth rate (the greater the β), the less reduction in inequality will be needed to reach the Millennium poverty reduction targets (the smaller the α). In fact, it can be shown that, for each country and for each line, there exists an entire set of inequality reduction rates and rates of accumulated economic growth (α, β)-pairs which result in distributions with a poverty incidence exactly equal to the target. These sets are known as isopoverty sets, and are described formally by equation (6) in the methodological appendix. When plotted in a diagram with economic growth rates on the horizontal axis and rates of inequality reduction on the vertical axis ((β, α)-space), these sets are downward-sloping convex curves, known as isopoverty curves. Two examples —the isopoverty curves for Brazil and Panama— are given in figure 1 below.

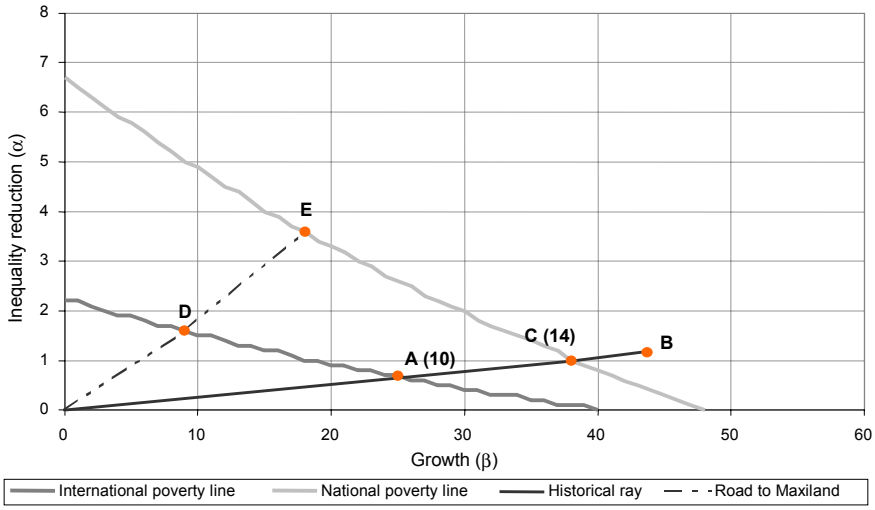
In both cases, there are two lines, one corresponding to the international "dollar-a-day" poverty line (always the curve with the lowest vertical intercept), and the other corresponding to the national extreme poverty line calculated by ECLAC. These diagrams are as follows: each point in an isopoverty curve corresponds to a distribution with exactly one half of the incidence of extreme poverty that was observed in the country in 1999 with respect to the relevant poverty line. How can that distribution be reached from 1999? Through a cumulative growth rate of $\beta\%$ (the coordinate of the point on the horizontal axis) combined with a reduction in inequality of $\alpha\%$ (the coordinate of the point on the vertical axis).

Figure 1
ISOPOVERTY CURVES FOR BRAZIL AND PANAMA

Brazil



Panama



Source: Authors' calculations based on the data from household surveys of the respective countries.

Analogous figures for each of the 18 countries are provided in the statistical appendix. In every case, they are downward sloping (indicating that a greater inequality reduction can substitute for some growth in the effort to reach given poverty reduction target) and convex (indicating that the marginal rate at which this substitution occurs is diminishing).

These figures are quite informative. Their position tells us something about how easy or difficult it is for a given country to meet the Millennium targets: the closer to the origin an isopoverty curve lies, the less growth and inequality reduction are required to reach it. Their slope tells us something about the trade-off between growth and inequality in the "mix" used to halve extreme poverty: the steeper the curve, the more reduction in the Gini coefficient is needed to offset the loss of one percentage point in economic growth. Their β-intercepts tell us how much economic growth each country would need in order to meet its own Millennium poverty reduction target if its inequality remained constant. And their α-intercepts tell us how much inequality reduction (as a share of their original Gini coefficient) each country would need in order to meet its own Millennium poverty reduction target if its mean income level remained constant (i.e., with zero growth).

Table 2
ISOPOVERTY CURVES: LINES, INCIDENCE RATES AND INTERCEPTS

Country	Poverty line 1 [a] US$	Target P_0 (%)	Intercepts of the isopoverty curve (%)		Poverty line 2 US$	Target P_0 (%)	Intercepts of the isopoverty curve (%)	
			α	β			α	β
Argentina	37.20	0.1	2.0	41	88.1	3.2	4.0	40.0
Bolivia	37.20	13.1	16.0	206.9	66.3	19.9	29.8	188.5
Brazil	37.20	2.0	3.0	86.0	82.7	6.9	6.0	57.0
Chile	37.20	1.0	6.0	45.0	67.7	3.1	5.0	42.0
Colombia	37.20	2.6	5.0	104.0	37.7	13.2	16.0	60.0
Costa Rica	37.20	1.2	6.0	65.0	75.1	6.8	5.0	90.0
Dominican Republic	37.20	0.1	3.1	22.0	122.7	4.3	6.0	24.0
Ecuador	37.20	8.9	11.7	76.2	59.7	16.2	20.3	73.6
El Salvador	37.20	9.3	12.8	78.0	47.0	12.3	16.0	73.0
Guatemala	37.20	3.4	4.3	36.0	92.0	18.0	16.8	57.0
Honduras	37.20	11.7	11.6	62.0	95.0	28.6	50.0	117.0
Mexico	37.20	3.2	7.0	55.0	113.6	11.6	5.0	70.0
Nicaragua	37.20	7.7	9.0	112.0	114.0	22.5	32.2	108.0
Panama	37.20	1.2	2.2	40.0	92.0	6.8	6.7	48.0
Paraguay	37.20	3.5	17.0	78.0	99.1	14.4	17.0	80.0
Peru	37.20	7.6	8.6	55.9	57.3	11.7	16.6	79.4
Uruguay	37.20	0.1	1.0	1.0	75.5	0.9	3.0	16.0
Venezuela	37.20	2.0	14.0	57.0	112.1	9.7	14.0	55.0

Source: Authors' calculations based on the data from household surveys of the respective countries.

[a] This is a monthly poverty line corresponding to the 1999 (June) value of the original poverty line (1995 US$ 1.00 per day per person). Its value is expressed in 1999 United States dollars at purchasing power parity exchange rates.

Table 2 above lists these intercepts for every country, for both lines. The results are rather remarkable: with no change in inequality, the cumulative rates of growth required to meet even reasonably modest poverty reduction targets are quite large. Only for countries that combine already high levels of mean income and low levels of inequality —such as Uruguay— are these β-intercepts low. For countries with a great degree of inequality, they can be quite high, even if the poverty reduction target does not seem large. Consider the case of Brazil, which would have to reduce the incidence of extreme poverty, with respect to the "dollar-a-day" line from 4% to 2%. It turns out that, if its Lorenz curve were not to move at all, this would require accumulated economic growth of 86%. To achieve this in 15 years would require an average annual per capita GDP growth rate of 4.0%. This is a substantially higher rate than the Brazilian economy has managed to achieve at any time in the last 20 years.

Brazil is not an exception. A cursory look at column 4 of table 2 will reveal often surprisingly large requirements for the growth rate, given stable inequality. With the exception of Uruguay, the required rates range from 22% for the Dominican Republic to 207% for Bolivia. The numbers are similarly high with respect to the national (ECLAC) poverty lines, shown in the eighth column. This similarity should prompt another observation: there is no proportionality between the poverty target and the growth rate required to meet it. In fact, the isopoverty curves for the two different lines in the same country often cross, indicating that more growth is required to halve a lower poverty rate (with respect to a lower line) than to halve a higher poverty rate (with respect to a higher line). The curves shown for Brazil in figure 1(a) are one example; others include the curves for Bolivia, Colombia, Chile, Ecuador, El Salvador, Mexico, Nicaragua and Venezuela.

This apparent puzzle is explained by the bell shape of the density curves for the distributions of (log) income. The closer a poverty line is to the mean of a distribution, the more mass lies close to it, from below. Hence, the larger the return of economic growth in terms of poverty reduction, "sliding" the density function past the poverty threshold. When the poverty incidence that remains is very small and the country is very unequal (such as Brazil, for example), one needs a great deal of rightward movement in the mean (growth) to slide half the mass below the very flat tail, past the poverty line.

For very low poverty incidences, this mechanism comes into play even for countries with relatively less inequality. This is the case, for instance, of the Dominican Republic, which still needs an accumulated rate of economic growth of 22% just to move 0.1% of its population above the poverty line.

However instructive the general shape of the isopoverty curves may be, even more can be learned if a few specific points on each curve are looked at more closely. For the purposes of this report, five such points are considered for each country. Three of these points lie along what is referred to here as the "historical ray", which is determined by its slope α_h/β_h; αh is the percentage decline in the Gini coefficient actually observed in the country between 1990 and 1999, while β_h is the actual accumulated percentage growth in GDP per capita observed in the country between 1990 and 1999.[9] By drawing this ray and considering the coordinates of points along it, it is possible to extrapolate the effectiveness of poverty reduction efforts by the country if its performance as regards these two dimensions remains unchanged since the 1990s.

Table 3
HALVING THE INCIDENCE OF EXTREME POVERTY WITH RESPECT TO THE US$ 1.00-A-DAY LINE

Country	Poverty line [a]	Target P_0 (%)	Historical ray: point A coordinates			Road to "Maxiland": point D coordinates	
			α	β	Years	α	β
Argentina [b]	37.20	0.1	1.0	15.0	7	2	5
Bolivia	37.20	13.1	n.c.*	n.c.	∞	4.7	90.6
Brazil	37.20	2.0	0.0	86.0	48	2.5	7.3
Chile [b]	37.20	1.0	2.0	60.0	10	3.0	20.0
Colombia	37.20	2.6	4.2	9.5	7	3.7	15.6
Costa Rica	37.20	1.2	1.6	39.0	30	2.4	33.0
Dominican Republic	37.20	0.1	1.6	9.5	2	1.2	12.6
Ecuador	37.20	8.9	n.c.*	n.c.	∞	2.2	53.0
El Salvador	37.20	9.3	0.0	78.0	52	1.8	60.0
Guatemala	37.20	3.4	0.0	34.0	22	1.6	20.0
Honduras	37.20	11.7	11.0	2.0	12	1.9	49.0
Mexico	37.20	3.2	1.4	40.0	44	3.3	23.0
Nicaragua	37.20	7.7	0.0	112.0	50	3.6	48.0
Panama	37.20	1.2	0.7	25.0	10	1.6	9.0
Paraguay [b]	37.20	3.5	4.0	5.0	25	2.0	25.0
Peru	37.20	7.6	n.c.*	n.c.	∞	1.5	42.4
Uruguay	37.20	0.1	0.3	0.6	1	0.07	0.9
Venezuela [b]	37.20	2.0	5.0	10	85	3.0	42.0

Source: Authors' calculations based on the data from household surveys of the respective countries.

[a] This is a monthly poverty line corresponding to the 1999 (June) value of the original poverty line (1995 US$ 1.00 per day per person). Its value is expressed in 1999 United States dollars at purchasing power parity exchange rates.

[b] Historical ray slopes for these countries reflect team estimates of future performance and are not based on actual historical performance.

Note: Entries "n.c." indicate that the historical performance would lead to an increase —rather than a reduction— in poverty, and the trajectory therefore never crosses this isopoverty line. In order for this situation to arise, either α or β (or both) must be negative. The * indicates which one is negative.

[9] For four countries —Argentina, Chile, Paraguay and Venezuela— the slope of the historical ray differs from their actual performance in the 1990s. Instead, the α, β coordinates of point C for these countries reflect the researchers' best estimates of how their economies are likely to perform in 2000-2015.

The three points along the "historical ray" that have been selected are its intersection with the dollar-a-day isopoverty curve (point A); its intersection with the national (ECLAC) isopoverty curve (point C) and the point whose coordinates are the accumulated growth (β) and inequality reduction (α) rates that the country would have after 15 years, given the annual rates observed in the 1990s (point B). These three points are shown for Brazil and Panama in figure 1. Those for all the other countries are given in the statistical appendix. The coordinates of point A are also reported for every country in table 3 above, whereas those of point C are shown in table 4 below. In both tables, the column entitled "years" indicates in how many years the corresponding point would be reached, given the historical growth and inequality reduction rates implicit in the construction of the ray.

Table 4
HALVING THE INCIDENCE OF POVERTY WITH RESPECT TO THE ECLAC EXTREME POVERTY LINE

Country	Poverty line (US dollars)	Target P_0 (%)	Historical ray: point C coordinates			Road to "Maxiland": point E coordinates	
			α	β	Years	α	β
Argentina	88.10	3.2	2.0	20.0	8	4.5	20.0
Bolivia	66.30	19.9	n.c.*	n.c.	∞	5.8	111.0
Brazil	82.73	6.9	0.0	57.0	35	4.0	11.3
Chile	67.75	3.1	0.0	48.0	8	3.5	20.0
Colombia	37.68	13.2	8.5	19.4	14	6.4	26.4
Costa Rica	75.10	6.8	1.8	40.5	39	2.0	34.0
Dominican Republic	122.70	4.3	2.3	13.5	3	1.6	16.3
Ecuador	59.72	16.2	n.c.*	n.c.	∞	2.5	59.5
El Salvador	47.00	12.3	0.0	73.0	49	1.8	60.0
Guatemala	92.00	18.0	0.0	57.0	32	3.4	41.0
Honduras	95.00	28.6	45.5	6.0	42	3.9	99.0
Mexico	113.60	11.9	3.2	22.0	48	2.5	23.5
Nicaragua	114.00	22.5	0.0	108.0	49	5.6	75.0
Panama	92.00	6.8	1.0	38.0	14	3.6	18.0
Paraguay	99.13	14.4	13.0	12.0	58	4.3	48.0
Peru	57.27	11.7	0.0	79.4	33	2.2	62.5
Uruguay	75.50	0.9	1.7	3.3	2	0.7	9.8
Venezuela	112.10	9.7	9.0	15.0	124	2.9	39.0

Source: Authors' calculations based on the data from household surveys of the respective countries.

Note: Entries "n.c." indicate that the historical performance leads to an increase —rather than a reduction— in poverty, and the trajectory therefore never crosses this isopoverty line. For this situation to arise, either α or β (or both) must be negative. The * indicates which one is negative.

The coordinates of points A and C reveal that Colombia and Honduras were the only Latin American countries to experience substantial inequality reductions in the 1990s. Costa Rica, the Dominican Republic, Mexico, Panama and Uruguay had positive —but small— inequality reductions over this period. Brazil, El Salvador, Guatemala, Nicaragua, and Peru experienced virtually no change.

Bolivia and Ecuador actually saw increases in inequality over this period. In fact, the increases were sufficiently large that, if extended forward and combined with the observed growth rates in the 1990s, poverty would continue to increase indefinitely and there would thus be no convergence towards the Millennium poverty targets at all. The same is true of Paraguay and Venezuela, although this cannot be seen in the table because a different set of growth and inequality reduction parameters was chosen for the construction of their macro-simulations.

The importance of inequality reduction helping to meet these targets is evident from the figures showing how long each country can be expected to take to meet its own target, given its performance in the 1990s. The Dominican Republic and Uruguay would meet it in one or two years. Argentina (pre-crisis) and Colombia would each take seven years. Chile and Panama would need a decade, while Honduras would reach its target in 12 years, which would still be before the 2015 deadline. No other country would do so, however. Even though Brazil only needs to reduce extreme poverty by two percentage points, it would still take it 48 years to do so. Mexico would take 44 years to get 3.2 percentage points of its population past the line.

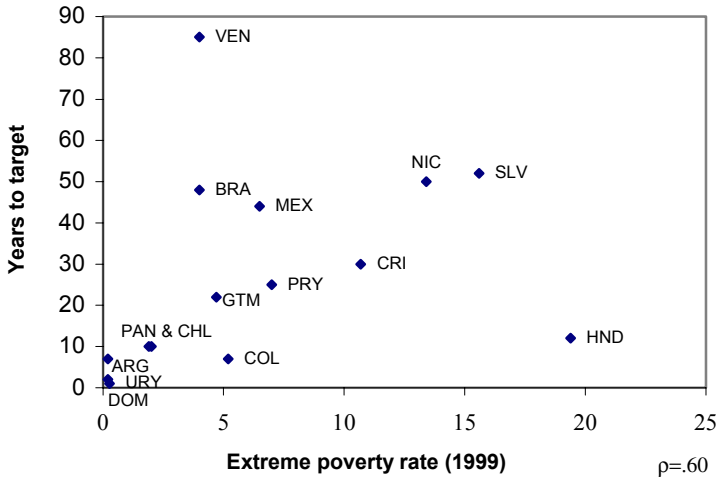
This can be clearly seen in figure 2, where the vertical axis measures the number of years each country would take to halve its extreme poverty rate (with respect to the dollar-a-day line) if its economy were to continue to perform (in terms of growth and inequality reduction) as it did in the 1990s for an indefinite amount of time into the future.[10] Bolivia, Ecuador and Peru are not on the chart since, along this historical path, extreme poverty would actually rise in those countries. In fact, only 7 of the 18 countries considered in this study would meet their Millennium poverty reduction targets: Argentina (pre-crisis), Chile, Colombia, the Dominican Republic, Honduras, Panama and Uruguay. Five of the seven are countries where inequality fell during the 1990s. The other two are Argentina, which was the richest country in 1999, and Chile, which was the region's growth leader by a comfortable margin.

---

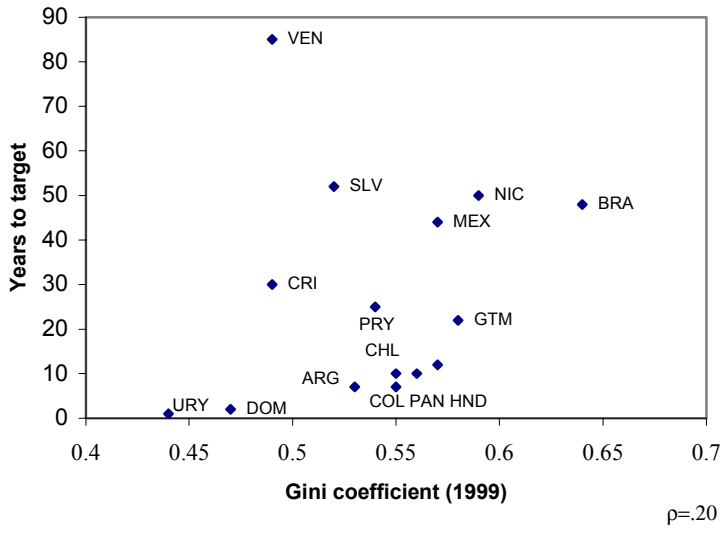
[10] Again, with the exception of Argentina, Chile, Paraguay and Venezuela. See previous footnote.

Figure 2
TIME REQUIRED TO HALVE EXTREME POVERTY IN THE REGION

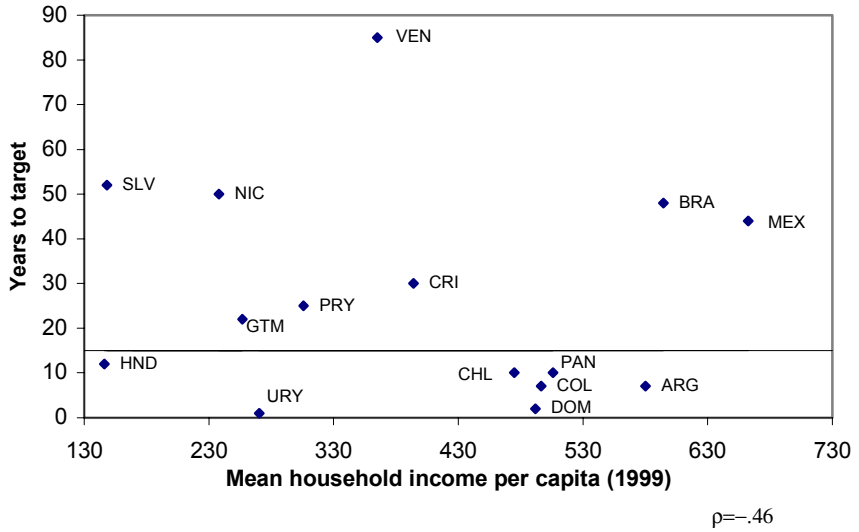
A) Years to target according to initial incidence of poverty



B) Years to target according to initial Gini coefficient



C) Years to target according to initial household income per capita



Source: Authors' calculations based on the data from household surveys of the respective countries.

Note: Bolivia, Ecuador and Peru are not shown in these figures because their historical paths do not lead to a reduction in poverty. □ is the correlation coefficient between the variables shown in each panel.

On the horizontal axis, figure 2 contains the 1999 values of three relevant indicators for each country. The initial incidence of extreme poverty is shown in panel A; the initial Gini coefficient is given in panel B, and the initial mean level of household per capita income is shown in panel C. The simple correlation coefficients between each of these variables and years are indicated in the corresponding panels. The correlations are positive for initial poverty and inequality levels, indicating that the more poverty there is to reduce, the longer it takes, and that being in a country with greater inequality makes it harder to do this. The correlation with mean income is negative, as expected.

In order to consider an alternative path to the historical ray, yet another hypothetical exercise has been undertaken. With admittedly less imagination than has been shown by some other Latin American writers, the authors of this report have constructed a little economists' utopia of their own, named "Maxiland".[11] This imaginary country has high average living standards (for Latin America) and a mean household income per capita of US$ 1 242 per month. It is also more egalitarian than any real country in the region, with a Gini coefficient of 0.4.

[11] Some other characteristics of Maxiland will be unveiled in the next section.

For each country, the ray through the origin in (α, β)-space with slope α_m/β_m was then considered, where α_m is the proportional difference between the country's Gini coefficient and that of "Maxiland" (0.4), and β_m is the proportional difference between the country's mean household income level and that of "Maxiland" (US$ 1 242). The position that "Maxiland" would occupy in any given country's (α, β)-space is not a point of interest per se. What *is* important is the slope of the "road" that leads there (α_m/β_m).

The reason that this road is interesting is because it is an alternative to the historical path designed to lead from the country's current situation towards one in which it is slightly richer than the richest countries and slightly more egalitarian than the least inegalitarian countries in the region. It is thus intended to embody (however imperfectly) the concept of an attainable ideal. Along the Road to Maxiland, two points have been selected. Point D is where it intercepts the "dollar-a-day" isopoverty line. Point E is where it intercepts the national (ECLAC) isopoverty line.

The coordinates of point D are given for each country in table 3, and those of point E are given for each country in table 4. The Roads to Maxiland are steeper than the historical path for every country except Colombia, Honduras and Uruguay.[12] Since the diagrams have been plotted with growth rates (β) on the horizontal axis and inequality reductions (α) on the vertical axis, a steeper ray implies a path towards the poverty reduction targets which relies more heavily on inequality reduction. The fact that, for all but three of the 18 countries, this hypothetical path to Maxiland is steeper than the one based on actual experience in the 1990s suggests that alternative strategies which rely more actively on redistribution might provide interesting alternatives to the current policy combinations, which have yielded very limited success in terms of inequality reduction.

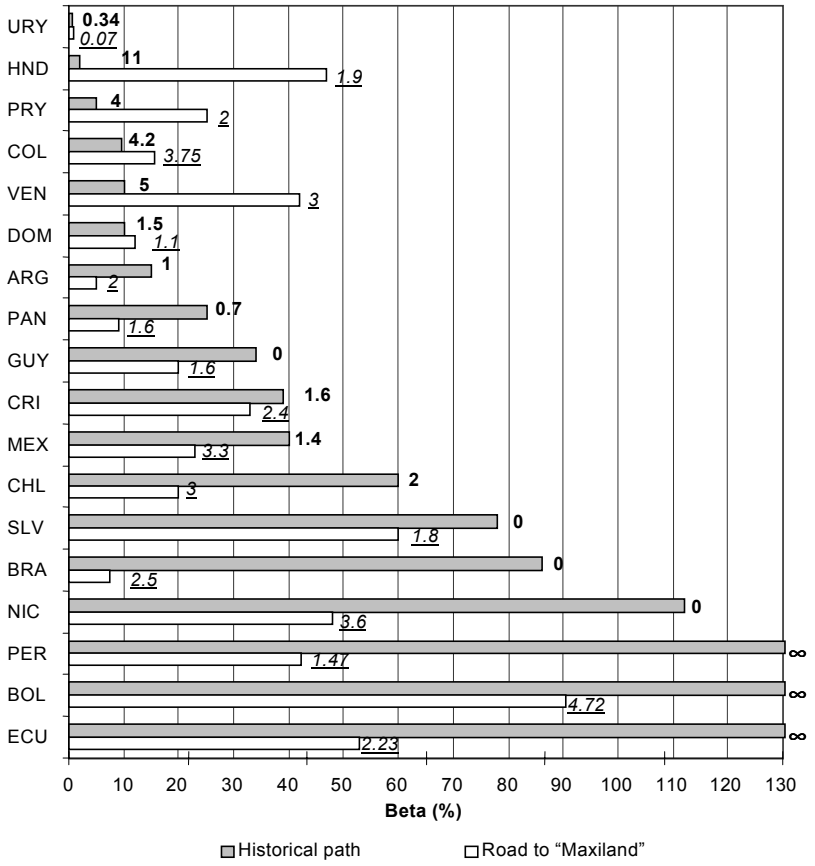
A comparison of the β-intercepts across columns 4 and 7 in tables 3 and 4 reveals how the accumulated growth requirements change as a country switches from the historical ray to the Road to Maxiland. For most countries, the reductions in the growth requirement that arise from relatively modest reductions in inequality are very considerable. In the case of Brazil, for instance, a move from stable inequality to a reduction of 2.5% in the Gini coefficient reduce the accumulated growth requirement from 86% to 7.3%.[13] These reductions are less dramatic for countries with less inequality, but they are still substantial. For Panama, a mere tweak in the rate of inequality reduction (from $\alpha = 0.7$ to $\alpha = 1.6$) reduces the

[12] And Paraguay, as drawn. As noted above, however, its "historical" path is not really historical.

[13] With respect to the dollar-a-day line, in table 3.

growth requirement by almost two thirds (from 25% to 9%). The nature of this trade-off is depicted in figure 3 below.

Figure 3
GROWTH-INEQUALITY TRADE-OFFS IN LATIN AMERICAN POVERTY REDUCTION



Source: Authors' calculations based on the data from household surveys of the respective countries.

Note: The dark-coloured bar measures the accumulated rate of economic growth required to meet the poverty reduction target based on the historical ray. The number at the end of each bar denotes the accumulated rate of reduction in the Gini coefficient which underlies that growth requirement. The light-coloured bar measures the growth requirement based on the Road to "Maxiland". The underlined number at the end of each light-coloured bar denotes the accumulated rate of reduction in the Gini coefficient which underlies that growth requirement.

Figure 3 shows that if Ecuador were to succeed in reducing its Gini coefficient by a mere 2.2% over a period of 15 years, it would require accumulated growth of just over 50% to halve its incidence of extreme

poverty. This contrasts with a historical performance which, if continued, would lead to ever-increasing poverty. Nicaragua, which did not reduce its inequality level in the 1990s and which would, under the same conditions, need to more than double its GDP per capita in order to halve extreme poverty, would need less than 50% growth if it managed to reduce its inequality by some 3.6%.

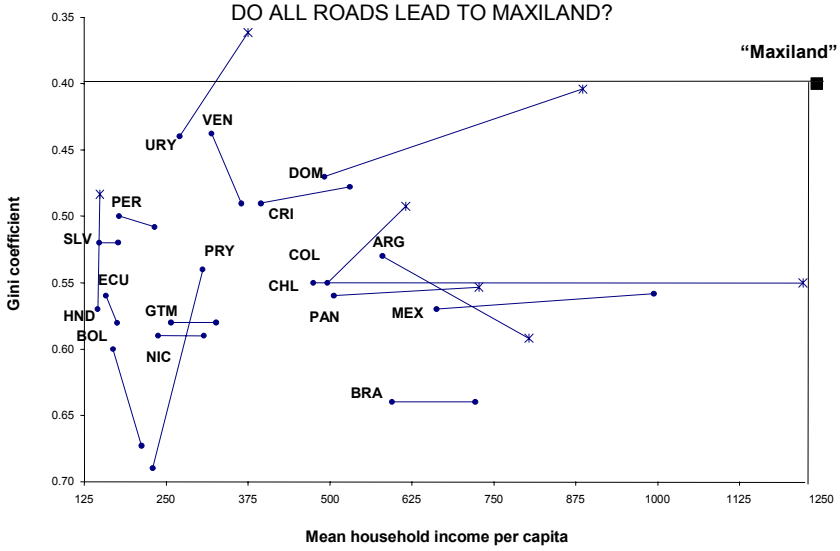
Another way to visualize the recent performance of Latin American and Caribbean nations with regard to poverty reduction is presented in figure 4 below. Here the horizontal axis measures monthly mean household income per capita in 1999 PPP United States dollars. The vertical axis measures the Gini coefficient on an inverted scale. The scales have been chosen so that the heavy square at the extreme upper right hand corner of the "box" marks the exact location of the hypothetical target, Maxiland. The real countries in the sample are scattered across the diagram, as follows: the point right next to each country's acronym denotes its initial (1999) position. The point at the other end of the line denotes its simulated final (2015) position based on the country's historical path (i.e., assuming that the country's average performance in terms of economic growth and inequality reduction over the next 15 years will be the same as its historical record for the 1990s).[14] This final point is marked with a star if —and only if— at that position the country would have met the poverty reduction target with respect to the international poverty line.

Figure 4 contains a great deal of information. First of all, it is possible to locate the seven countries which, as shown in figure 2 and table 4 above, would meet their Millennium targets. They are Argentina, Chile, Colombia, the Dominican Republic, Honduras, Panama and Uruguay. This group includes most of the countries that succeeded in reducing inequality during the 1990s. Note that Argentina manages to meet the target despite a sizeable increase in inequality, thanks to its good growth performance "on average" in the 1990s. Chile also succeeds, even though it failed to reduce its level of inequality, because of its superb growth performance. Among those that do not meet the target in these simulations, Costa Rica and Mexico have good performances, based on positive rates of growth and of inequality reduction. At the other extreme, the most worrisome cases are Paraguay, where growth was negative in per capita terms and inequality rose, and Bolivia, Ecuador and Venezuela, where the deterioration in inequality was so large that their modest historical growth rates would not suffice to reduce poverty.

---

[14] In this figure, actual historical records are used for all countries, including Argentina, Chile, Paraguay and Venezuela.

Figure 4
DO ALL ROADS LEAD TO MAXILAND?



Source: Authors' calculations based on the data from household surveys of the respective countries.

Note: Points are marked with a star if at that position the country would meet the poverty reduction target.

III. Meeting the target: the micro scenarios

So far, this discussion about meeting the Millennium poverty reduction targets has been couched in terms of different combinations of economic growth and reductions in inequality. While this has been informative, it is clear that both increases in average income and changes in the dispersion of the distribution are outcomes of a complex range of inter-related economic processes. This section will focus on some of the results from a second set of simulation exercises which consisted in identifying different ways in which one particular combination —a desired rate of growth (corresponding to a given β) and the corresponding rate of inequality reduction (α)— could be achieved. This was done through a decomposition based on the following aggregate accounting identity:

$$\mu(y) \equiv d\left[tqh + y_a + y_r\right]$$

Here, μ(y) denotes mean income per capita; d is the economy-wide ratio of the number of adults to the size of the population (the inverse of a dependency ratio); t is the ratio of employed adults to total adults in the population (a measure of the occupation rate); q is a measure of the productivity of aggregate human capital; h is a measure of the value of human capital per employed worker; y_a is mean income from non-human assets; and y_r is mean income from transfers. The last two terms are derived directly from reported incomes in the adjusted household-level data sets; h and q are calculated from a Mincer-type identity using a procedure that is described in the methodological appendix.[15]

It follows that a given rate of aggregate economic growth —denoted in section 2 as (1+β)μ— can be obtained by various different combinations of changes in the ratios on the right-hand side of the above identity. In particular, if the dependency ratio and incomes from assets remain unchanged, then:

$$(1+\beta)\mu(y) = d\left[(1+\delta_t)t(1+\delta_q)q(1+\delta_h)h + y_a + (1+\delta_r)y_r\right]$$

[15] This appendix also contains a derivation of the above aggregate identity from the underlying analogous identity at the household level and specifies the assumptions under which the aggregation is valid.

where the δs denote proportional variations in the respective variables. Clearly, from a purely algebraic point of view, combinations of positive δs can be chosen to support a given growth rate implied by a certain value of β, with three degrees of freedom. Since this simulation exercise is indeed statistical in nature, and no account is taken of the behavioural consistency across economic agents, it was deemed appropriate to restrict the set of δs to be considered to two specific combinations.

The two sets of δ parameters considered for each country were the underlying points C and E in section 2. The reader will recall that these points lie at the intersection between each country's isopoverty curve for the national (ECLAC) poverty line and the country's historical ray and Road to Maxiland, respectively. For each corresponding aggregate growth rate, the set (δ_t, δ_q, δ_h, δ_r) is chosen so as to lie on the line running from the country's current values (t, q, h, r) towards Maxiland's own (hypothetical) values (t, q, h , r). These values are presented in the bottom lines of tables 5 and 6. The exact location of the δs along that line is defined by the need to support the aggregate growth rate (β) for point C (or E) exactly.

Table 5
THE MICRO SCENARIOS UNDERLYING POINT C (ALONG THE HISTORICAL PATH)

Country	Rate of occupation (t)	% change of t ($\Delta t/t$)	Productivity of human capital (q)	% change of q ($\Delta q/q$)	Human capital stock (h)	% change of h ($\Delta h/h$)	Income from transfers (y_r)	% change of y_r ($\Delta y_r/y_r$)
Argentina	49.0	15.0	275.7	2.0	4.17	0.0	100.60	3.0
Bolivia[a]	55.0		90.1		4.60		27.38	
Brazil	54.0	12.0	257.0	24.0	3.00	34.0	165.00	43.0
Chile	49.0	16.0	214.6	34.0	4.74	4.0	5.16	36.0
Colombia	57.1	10.0	249.6	3.0	4.01	16.0	82.83	17.0
Costa Rica	64.0	3.2	250.0	56.3	4.10	0.25	130.00	65.0
Dominican Republic	54.0	19.0	288.3	2.0	3.19	10.0	137.34	18.0
Ecuador[a]	58.4		78.3		4.58		22.89	
El Salvador	51.2	21.0	120.0	21.0	3.20	23.0	32.00	28.0
Guatemala	63.9	21.0	161.0	22.0	3.28	18.0	43.00	29.0
Honduras	57.0	2.0	122.0	2.0	3.02	2.0	24.00	2.0
Mexico	68.0	7.9	320.0	16.0	4.70	17.5	225.00	80.0
Nicaragua	54.6	25.0	181.0	35.0	3.73	29.0	33.00	31.0
Panama	52.7	9.0	249.0	18.0	4.11	12.0	113.00	40.0
Paraguay	56.0	2.0	181.8	2.0	3.48	8.0	42.87	21.0
Peru	53.9	6.2	72.8	80.6	4.91	1.7	38.39	80.6
Uruguay	53.0	1.0	220.3	1.0	3.80	1.0	155.67	7.0
Venezuela	54.0	2.0	244.4	1.0	3.32	14.0	20.37	0.0
“Maxiland”	70.0		350		5		300	

Source: Authors' calculations based on the data from household surveys of the respective countries.

[a] Since Bolivia and Ecuador do not converge at the required isopoverty line, point C is not defined for them, and no micro-simulation was undertaken.

Table 5 reports the current (1999) levels of the four key parameters for each of the countries that could change in this exercise. These parameters are the proportion of adults who are employed, **t** (ranging from 49% in Argentina and Chile to 68% in Mexico); a measure of the productivity of human capital in job matches, **q** (which ranges from US$ 73 in Peru to US$ 288 in the Dominican Republic); a measure of the stock of human capital, which is some multiple of the exponential of one tenth of the completed years of schooling in each country, **h** (ranging from 3.0 in Brazil to 4.9 in Peru); and public transfer incomes, which range from US$ 5.00 in Chile to US$ 225 in Mexico.[16] The table then reports the relevant δs that would take each country from its 1999 position to point C, where its historical trajectory meets the national isopoverty curve.

In other words, these are the sets of proportional changes in employment, productivity, human capital and transfers which would support the growth rates required to halve the incidence of extreme poverty in each of these countries (with respect to the national poverty lines calculated by ECLAC), if the countries were to continue to perform as they did in the 1990s in terms of the growth/inequality reduction mix.

Table 6 contains exactly the same information for the levels of **t**, **d**, **q** and **h**, but the changes (i.e., δs) they report would take each country from its 1999 position to point E, where its Road to Maxiland meets the national isopoverty curve. In other words, table 6 reports the sets of proportional changes in employment, productivity, human capital and transfers which would support the growth rates required to halve the incidence of extreme poverty in each of these countries according to the national poverty lines calculated by ECLAC if, instead of performing as they did in the 1990s, the countries were to adopt a growth/inequality reduction mix which would taken them towards the hypothetical Maxiland combination.

A comparison of the columns showing the required changes in employment (or occupation rates) reveals that increases in employment rates would often be higher along the historical path than they would if countries changed their strategies and strove to become more like Maxiland. This is simply because, as has been seen, for most countries the latter strategy would require a higher reduction in inequality and less growth. Greater occupational ratios tend to increase growth rates, rather than reduce inequality, and hence would be relied upon less by a country moving along the Road to Maxiland than they have been on the historical ray. Honduras is an instructive example. It is not only one of the very few countries which would have to increase its β/α ratio if it were to move from

[16] Transfer data from household surveys are particularly perilous for cross-country comparisons, since, because of differences between questionnaires, the variables may be defined in very different ways across countries.

the historical ray to the Road to Maxiland, but it is also one of the very few that would require a greater increase in employment if it were to move along the latter than along the former.

Table 6
THE MICRO SCENARIOS UNDERLYING POINT E
(ALONG THE ROAD TO MAXILAND)

Country	Rate of occupation (t)	% change of t ($\Delta t/t$)	Productivity of human capital (q)	% change of q ($\Delta q/q$)	Human capital stock (h)	% change of h ($\Delta h/h$)	Income from transfers (y_r)	% change of y_r ($\Delta y_r/y_r$)
Argentina	49.00	4.2	275.70	15.2	4.17	5.9	100.6	2.9
Bolivia	55.05	9.6	90.06	88.2	4.60	8.6	27.38	88.2
Brazil	54.00	3.0	257.00	4.0	3.00	6.0	165.00	22.0
Chile	49.00	8.5	214.63	8.1	4.74	1.0	5.16	600.0
Colombia	57.07	9.0	249.53	4.0	4.01	21.0	82.83	6.0
Costa Rica	70.00	12.9	350.00	119.0	5.00	25.0	166.20	110.0
Dominican Republic	54.00	6.2	288.32	4.5	3.19	11.8	137.34	1.1
Ecuador	58.44	0.0	78.30	51.1	4.58	9.1	22.89	51.1
El Salvador	51.20	6.0	120.00	30.0	3.20	9.0	32.00	130.0
Guatemala	63.90	2.0	161.00	24.0	3.28	11.0	43.00	122.0
Honduras	57.00	6.0	122.00	50.0	3.02	17.0	24.00	298.0
Mexico	70.00	11.0	350.00	26.8	5.00	25.0	166.20	101.0
Nicaragua	54.60	9.0	181.00	31.0	3.73	11.0	33.00	268.0
Panama	52.70	6.0	249.00	7.0	4.11	4.0	113.00	30.0
Paraguay	56.00	2.4	181.81	30.7	3.48	18.6	42.87	6.9
Peru	53.88	6.2	72.83	62.1	4.91	1.7	38.39	62.1
Uruguay	53.00	4.0	220.33	7.4	3.80	3.9	155.67	0.2
Venezuela	54.00	15.2	244.38	2.8	3.32	22.5	20.37	14.7
“Maxiland”	70.00		350		5		300	

Source: Authors' calculations based on the data from household surveys of the respective countries.

Required changes in the productivity parameter **q** and in the measure of human capital stock **h** vary in a less consistent manner between tables 5 and 6. Naturally, in this simulation the countries with the lowest levels of human capital productivity, such as Bolivia, Ecuador, Honduras and Peru, are required to make very considerable increases indeed. This is particularly true when they are simulated to move towards the (relatively high) Maxiland levels.

Like required increases in employment, simulated required increases in the stock of human capital also tend to be higher along the historical ray (towards point C, in table 5) than along the Road to Maxiland (towards point E, in table 6). This is, once again, because these increases are more closely related to increases in mean income than to declines in inequality. According to the data shown in table 5, the

countries that need to make the greatest effort in terms of education and other investments in human capital are Brazil, Nicaragua and El Salvador.

Changes in transfers would be almost uniformly higher along the Road to Maxiland than along the historical path because they tend to contribute to a reduction in inequality. The simulations indicate that, in order to move towards the characteristics assumed for Maxiland while simultaneously halving the incidence of extreme poverty, some countries would need to increase the generosity of their fiscal systems by up to three or four times (as in Nicaragua and Honduras, for instance) or by even more in the case of Chile.

The reader should be aware, of course, that these simulations suffer from a number of natural limitations. First, they are based on an accounting framework (given by equations (7) and (8′) in the methodological appendix) which makes a set of fairly unrealistic assumptions about the nature of the relationship between labour incomes and education. The identities are identities, but an identity is only as good as the variables defined in it.

Second, the simulations take no account of behavioural consistency constraints. There is no guarantee that an equilibrium (of any sort) exists which supports the various changes that have been simulated. What the exercise shows is what the statistical outcomes of such an equilibrium would be in terms of poverty reduction should such an equilibrium (a) exist, and (b) be reached. Third, the results in this section, in particular, are entirely dependent on the assumptions underlying the imaginary construct of Maxiland. They are only as interesting as Maxiland itself.

The main lesson to be drawn from this second stage of the simulations is, however, a simple and powerful one: there are many ways to reach the cumulative rates of growth and inequality reduction which were calculated in section 2 as being required for these countries to meet their Millennium poverty reduction targets. For most countries in the sample (provided that eminently reasonable reductions in their very high levels of inequality are somehow achieved), most of the requirements for growth look plausible.

IV. Conclusions and policy implications

This report has presented the results of a set of macro- and micro-simulation exercises having two aims. The first was to assess the likelihood that each of 18 countries in Latin America would meet their Millennium targets for the reduction of extreme poverty by the year 2015, under the assumption that they replicated, in the period 2000-2015, their own growth and inequality-reduction performances of the 1990s. The second was to construct alternative scenarios, supposing that the same countries could depart from their previous track record and move along a new path. For the sake of concreteness, these alternative paths were simulated in such a way that they would take each country closer to a regional ideal: an imaginary country (dubbed Maxiland) that is both richer and more egalitarian than any in the region.

For this second exercise, the researchers went beyond the aggregate simulations and sought to illustrate how the required growth rates could be sustained microeconomically, through different combinations of increases in the quantity and productivity of human capital, the level of employment, and/or the level of public transfers.

The findings were actually quite surprising: surprisingly sobering with regard to the first objective and surprisingly optimistic with regard to the second. The simulations based on each country's recent (1990s) performance suggested that only 7 of the 18 countries would succeed in halving extreme poverty (with respect to the officially adopted international poverty line) by 2015. They are Argentina, Chile, Colombia, the Dominican Republic, Honduras, Panama and Uruguay. Apart from Argentina, which was the richest country in the sample according to the 1999 data and whose situation may need to be reviewed in light of the very sharp contraction in output seen during the past three years, the only feature common to all of these countries is that they had either reduced their inequality levels during the 1990s or, in the case of Chile, at least kept it from rising while undergoing very rapid growth.

This leaves 11 Latin American and Caribbean countries which are not expected to meet the target if their growth and inequality dynamics of the 1990s are replicated during 2000-2015. These countries can be divided into two subgroups. The first subgroup is composed of those countries whose recent performance has led to rising poverty rates. These countries, which will therefore never reach the target unless they change their trajectory, give cause for the most serious concern. They are Bolivia, Ecuador, Paraguay, Peru and Venezuela. The other six countries are ones in which inequality reduction and growth have been too sluggish to halve

poverty within the allotted 15 years, but which will eventually do so even if their performance remains as it was in the 1990s. This intermediate group consists of Brazil, Costa Rica, El Salvador, Guatemala, Mexico and Nicaragua.

These results say more about each country's performance in the 1990s than about how difficult it will be for the country to halve the incidence of extreme poverty in any absolute sense. As the alternative simulation exercises indicate, it would not be overly difficult for any of these 11 countries to reach their poverty reduction target, provided they were able to implement policy changes leading to more substantial reductions in their levels of income inequality. The main obstacle to poverty reduction has generally not been that the magnitude of the required poverty reduction is too great. Although there are six countries with initial poverty rates in excess of 10%, the example of Honduras shows that this could be reversed rather quickly if inequality is reduced. With 23.4% of the population living below the international poverty line in 1999, Honduras has the second highest initial incidence of extreme poverty in the sample. Nonetheless, it is among the seven countries which would be successful even on the basis of their past track record, thanks to the substantial reduction in its inequality level that occurred in the 1990s.

The alternative simulations run for each country, under a hypothetical scenario where each becomes more like Maxiland, are the simulations which give grounds for some conditional optimism. Except for Bolivia and El Salvador, all the countries in the sample could meet their targets with respect to the international poverty line by combining average annual growth rates in GDP per capita of less than 3%, with cumulative reductions in their Gini coefficients of less than 4%. For El Salvador, the Road to Maxiland would require a 1.8% reduction in the Gini coefficient but an annualized growth rate of 3.2%. Bolivia would need a little more: a 4.7% reduction in the Gini coefficient and a 4.4% annual growth rate in GDP per capita.

In order to check the robustness of the results with respect to the choice of poverty line, and also to allow for poverty thresholds slightly less severe than the original dollar-a-day line, analogous simulations were conducted with respect to country-specific extreme poverty lines proposed by ECLAC. Although the lines were often much higher than the international line, growth and inequality requirements were not much larger. This is not as surprising as it might appear at first glance since, when poverty lines are higher, there are many more people just below them. In such cases, halving the incidence of poverty may actually require less effort in terms of economic growth and inequality reduction, as it will be easier to move larger numbers of people over the line. As the

coordinates of point E (in table 4) indicate, only Bolivia and Nicaragua would require both a reduction in the Gini coefficient in excess of 5% and a annual growth rate in GDP per capita greater than 2% to meet the target with respect to their country-specific poverty lines.

The main problem appears to be that distribution-neutral economic growth is not a very powerful factor in improving the living conditions of the extremely poor. Proportional improvements in incomes which can make considerable dents in deprivation at higher echelons of the income distribution make little difference for the truly destitute. At a very basic level, it may be noted that 10% of fifty cents per day is only five cents. It may help, but not very much.

This does not imply that growth is either bad or irrelevant. Economic growth is a fundamental element in improving the living conditions of all members of society, including many who are very poor. It also helps to relax political-economy constraints on redistribution and other useful reforms. The results do indicate, however, that, for the specific purposes of reducing the incidence of extreme forms of income deprivation, redistribution is considerably more powerful than growth. The slopes of the isopoverty curves shown in figure 1 and in the statistical appendix, as well as the numbers in figure 3, reveal that rather small declines in the Gini coefficient (often as little as 2%-3%, which corresponds to less than two points of the coefficient) can reduce poverty by as much as 60% or 70% in accumulated growth rates.

It should be made very clear that the authors do not view growth and inequality reduction as economic substitutes. They are substitutes in terms of generating a given level of poverty reduction only in a statistical sense: if a country were to reduce its Gini coefficient by 2%, then it would need to grow less to meet a given poverty reduction target. If the country's growth rate —or its rate of inequality reduction— were higher than that statistical necessity, so much the better: poverty would go lower still.

In fact, there is every reason to suspect that some amount of redistribution, provided that it is implemented effectively and efficiently, might in fact contribute to more economic growth —largely by unleashing the human and material investment potential of poor people.[17] And in the other direction, more growth can probably make it easier to

[17] The theoretical and empirical literature on the economic relationships between income distribution and growth is now vast. Cross-country empirical results are often contradictory and inconclusive (see Forbes, 2000 and Banerjee and Duflo, 2000), but there is growing microeconomic evidence that equity and efficiency can often be jointly enhanced. See, for example, Banerjee et al. (2001).

reduce inequality, not only because of the direct creation of economic opportunity through more employment and higher profit possibilities, but also because it can help to relax the constraints on redistribution and thus make is more politically feasible. In other words, while the economics of the interaction between growth and redistribution lie outside the scope of this analysis, there is every reason to suspect that the two —just as they can serve as statistical substitutes for each other in reducing poverty— are complementary in terms of economic policy.

Further research is needed to determine what kinds of economic policies could help to achieve the reductions in inequality and the rates of economic growth used in these simulations and could be applied in an economically consistent manner —that is to say, in a way that respects incentive compatibility constraints and that supports market equilibrium. Such research could be of considerable interest to policy makers, since policy design needs to be concerned with incentive issues and economic consistency to a much greater extent than this statistical exercise has been. On the other hand, such research would involve complex general equilibrium issues, and the relevant applications are still in their infancy.[18]

The main conclusion to be drawn from this study is that the main obstacle to the success of poverty reduction efforts in Latin America and the Caribbean is that the medicine which is most effective in treating the poverty that afflicts the region —inequality reduction— is one that the region seems to find very difficult to dispense. A little inequality reduction would go a long way towards reducing extreme deprivation in this region. Yet very few of the region's economies seem to have been able to generate even small reductions of this type.

High social returns would certainly be yielded by policies that succeed in redistributing resources to those who need them most and in doing so at the least possible cost in terms of distorting the incentives that ultimately lead to economic growth. Such policies are both feasible and necessary.

---

[18] For complementary early approaches, see Bourguignon et al. (2002) and Robillard et al. (2001).

Bibliography

Ahuja, V. and others (1997), Everyone's Miracle?: Revisiting Poverty and Inequality in East Asia, Washington, D.C., World Bank.

Banerjee, A. and E. Duflo (2000), "Inequality and Growth: What Can the Data Say?", NBER Working Paper, No. 7793.

Banerjee, A. and others (2001), "Inequality, control rights, and rent seeking: sugar cooperatives in Maharashtra", Journal of Political Economy, vol. 109, No. 1.

Bourguignon, F., F.H.G. Ferreira and P.G. Leite (2002), "Beyond Oaxaca-Blinder: Accounting for Differences in Household Income Distributions across Countries", World Bank Policy Research Working Paper, No. 2828.

Deaton, A. (1997), The Analysis of Household Surveys, Baltimore, The Johns Hopkins University Press.

Deininger, K. and L. Squire (1998), "New ways of looking at old issues: inequality and growth", Journal of Development Economics, No. 57.

ECLAC (Economic Commission for Latin America and the Caribbean) (2002a), Social Panorama of Latin America, 2000-2001 (LC/G.2138-P), Santiago, Chile, March. United Nations publication, Sales No. Sales No. E.01.II.G.141.

___ (2002b), Statistical Yearbook for Latin America and the Caribbean 2001 (LC/G.2151-P), Santiago, Chile. United Nations publication, Sales No. E.02.II.G.1.

Forbes, K.J. (2000), "A reassessment of the relationship between inequality and growth", American Economic Review, vol. 90, No. 4.

Foster, J.E., J. Greer and E. Thorbecke (1984), "A class of decomposable poverty indices", Econométrica, No. 52.

Kakwani, N. C. (1980), Income Inequality and Poverty: Methods of Estimating and Policy Applications, Oxford, Oxford University Press.

Psachoropoulos, G. (1994), "Returns to investment in education: a global update", World Development , vol. 22, No. 9, September.

Robillard, A.S., F. Bourguignon and S. Robinson (2001), "Crisis and Income Distribution: A Micro-Macro Model for Indonesia", Washington, D.C., International Food Policy Research Institute (IFPRI).

Sen, A.K. (1983), "Poor, relatively speaking", Oxford Economic Papers, No. 35.

UNDP (United Nations Development Programme) (2000), Overcoming Human Poverty, New York.

United Nations (2001), "Road map towards the implementation of the United Nations Millennium Declaration. Report of the Secretary-General" (A/56/326), New York.

___ (2000), "United Nations Millenium Declaration. Resolution adopted by the General Assembly" (A/RES/55/2), New York.

World Bank (2001), Attacking Poverty: World Development Report, 2000/2001, New York, Oxford University Press.

___ (1990), World Development Report, New York, Oxford University Press.

Appendices

A. Methodological appendix

The decomposition exercises discussed in this analysis rely on simulations based on the construction of counterfactual income distributions. Whereas the macro scenarios described in section 2 are based on simple aggregate simulations, the micro scenarios discussed in section 3 required simulation at the level of the household data. Each of these procedures will be discussed here.

1. The macro scenarios

The main purpose of this exercise is to shed light on the different combinations of growth in mean incomes and reduction in inequalities which would generate the required reduction in the incidence of extreme poverty. A measure of poverty Π in a given (cumulative) income distribution F(y) is always defined with respect to a poverty line z, which separates the poor from the non-poor. It is therefore always the case that poverty is a function of the distribution of income and of the poverty threshold: Π = Π(F(y), z). Since the Millennium poverty reduction targets were formulated in terms of the poverty incidence indicator P_0, it actually follows that $P_0 = F(z)$.

$$L'(p) = \frac{F^{-1}(p)}{\mu_y}$$

In order to consider how economic growth and changes in inequality might contribute to changes in the incidence of poverty P_0, it is helpful to draw on the established result[19] that:

where L'(p) denotes the first derivative of the Lorenz Curve:

$$L(p) = \frac{1}{\mu_y} \int_0^{y(p)} xf(x)dx = \frac{1}{\mu_y} \int_0^p F^{-1}(p)dp$$

associated with the income distribution p = F(y). It immediately follows that:

$$L'(P_0) = \frac{F^{-1}(P_0)}{\mu_y} = \frac{z}{\mu_y}$$

and thus:

$$P_0 = L'^{-1}\left(z/\mu_y\right)$$

The above merely states that poverty incidence is completely determined by the poverty line, the mean of the distribution and its Lorenz Curve.

This is useful for the analysis of reductions in extreme poverty, since it means that the effects of economic growth can be simulated as changes in mean income (μ_y) and the effects of inequality can be simulated as changes in the Lorenz Curve, L(p). In particular, there should exist (possibly a number of) hypothetical distribution(s) F*, with mean level μ_y* and Lorenz curve L*(p), which would have a poverty incidence of $P^* = 0.5P_0$ exactly, with respect to the relevant extreme poverty line z:

$$P^* = \frac{P_0}{2} = L^{*'-1}\left(z/\mu_y^*\right)$$

In particular, consider a counterfactual income distribution F*(y*), where:

[19] See, for example, Kakwani (1980) and Deaton (1997).

(1) $y^* = (1+\beta)[(1-\alpha)y + \alpha\mu y], \quad \text{with } 0 < \alpha < 1 \text{ and } \beta > 0$

This transformation corresponds to a distribution-neutral increase of β% in everyone's income level, coupled with a redistribution policy composed of taxing 100α% of everyone's income, and then distributing the revenues equally across every person in the population.

It is easy to see that the mean of the resulting counterfactual distribution would be β% higher than in the original distribution:

(2) $\mu y^* = (1+\beta)\mu y$

It is also true that the Lorenz curve of the new distribution would be thus transformed:

(3) $L^*(p) = (1-\alpha)L(p) + \alpha p$

and, consequently, that the Gini coefficient of the counterfactual distribution would be α% lower than the coefficient for the original distribution:

(4) $G^*(y) = (1-\alpha)G(y)$

The values of α and β can be chosen so that equations (2) and (3) hold exactly, satisfying:

$$P^* = \frac{P_0}{2} = L^{*^{-1}}\left(z/\mu_y^*\right)$$

P* can then be written as a function of the original income distribution, of the relevant poverty line and of the simulation parameters α and β:

(5) $P^* = P^*(\alpha, \beta, F(y), z)$

Since α and β can be chosen independently, there is in fact a degree of freedom in the choice of simulation parameters. In other words, given a positive value of either α or β, there will exist a (positive or negative) value of the other parameter such that (5) holds.

Box A.1
PROOF OF EQUATION 4

This last result can be proved as follows. It is known that the Gini coefficient is given by:

$$G(y) = \frac{1}{2n^2\mu_y}\sum_i \sum_j |y_i - y_j|$$

It follows from (1) that: $|y_i^* - y_j^*| = (1+\beta)(1-\alpha)|y_i - y_j|$

Thus: $\sum\sum |y_i^* - y_j^*| = (1+\beta)(1-\alpha)\sum\sum|y_i - y_j|$

Dividing through by $2n^2 (1+\beta)\mu_y$:

$$(2n^2\mu_y^*)^{-1} \sum\sum |y_i^* - y_j^*| = (2n^2(1+\beta)\mu_y)^{-1}(1+\beta)(1-\alpha)\sum\sum|y_i - y_j|$$

which yields equation (4).

Restricting the analysis to the combinations of positive values of α and β, for each country and poverty line (F(y) and z pair) in this report, consideration can be given to the set of (α, β)-pairs:

(6) $$I(F(y), z) = \{(\alpha, \beta) \mid P^*(\alpha, \beta, F(y), z) = P0/2; \alpha, \beta > 0\}$$

This set I is the isopoverty set for the country with distribution F(y), with respect to poverty line z. Plotted on (α, β)-space, it was referred to in section 2 as the isopoverty curve. Any specific combination of a rate of inequality reduction (α) and a rate of economic growth (β) that belong to I will halve the incidence of poverty with respect to the extreme poverty line z in the relevant country.

Three caveats about these simulations are worth noting. First, a reduction of α% in the Gini coefficient, as implied by equation (4), can correspond to different proportional declines in other measures of

inequality. However, insofar as the alternative inequality measure satisfies the Pigou-Dalton transfer axiom, the change it will record from the original distribution to a counterfactual Lorenz curve generated according to equation (3) will be a decline.

Second, a reduction of α% in the Gini coefficient will translate into the new poverty incidence given by (5) only if the change in the Lorenz curve is exactly as given by equation (3). This is not inevitable, of course. There are many transformations which are different from (1) which are consistent with a fall of α% in the Gini coefficient. These transformations will not, in general, yield the predicted change in poverty incidence. This is because the incidence of poverty is determined by the poverty line, the mean income level and the entire Lorenz curve, not just the Gini coefficient.

Third, the nature of this simulation exercise should be well understood. All that has been done is to lay out the various combinations of growth in mean incomes and proportional reductions in inequality which are *statistically consistent* with the desired reductions in extreme poverty for various countries. The analysis then focused on two of these combinations: one given by the extrapolation of trends from the 1990s over the next 15 years, and another that corresponds to a particular view of an "ideal" path. No attempt has been made to address the (crucial) issue of economic consistency between the calculated rates of growth and redistribution. It is clearly possible that some rates of redistribution —particularly if implemented through inefficient or coercive policies— might be inconsistent with incentives for agents to undertake the accumulation decisions required for the posited rates of economic growth. It is therefore important that this analysis should not be construed as being a set of policy simulations, because it is not.

2. The micro scenarios

The second stage of the simulations, which has been discussed in section 3 above, goes a step further in the statistical decomposition of the economic changes required to achieve a target poverty rate P*. For two points on the isopoverty set defined for each country with respect to the extreme poverty line proposed for it by ECLAC (z_2), this step breaks down the required changes in mean growth (β) and inequality (α) into five components. The two points considered are the intersections of the isopoverty set with the historical path and with the Maxiland path. The five components are: changes in the rate of occupation; changes in the average productivity of human capital (sometimes also referred to as the "average quality of jobs in the economy"); changes in the stock of human

capital; changes in mean income from public transfers; and changes in conditional wage inequality.

The decomposition is based on a constructed identity. For each household h in the distribution, write:

(7)
$$\frac{y_h}{n_h} = \frac{n_{ah}}{n_h}\left[\frac{n_{th}}{n_{ah}}\frac{y_{th}}{n_{th}} + \frac{y_{ah}}{n_{ah}} + \frac{y_{rh}}{n_{ah}}\right]$$

where y_h denotes total household income; n_h denotes the number of household members, of which n_{ah} are of working age (18-65). Of these, n_{th} are actually gainfully employed. Let y_{th} denotes total household income from labour; y_{ah} represents total household income from other (non-human) assets; and y_{rh} denotes total household income from public transfers.

Multiplying out the terms in (7) while simplifying and taking averages across all households, the economy-wide aggregate analogue can then be written as:

(8)
$$E_h\left(\frac{y_h}{n_h}\right) = \frac{\sum y_h}{\sum n_h} = \frac{\sum y_{th}}{\sum n_h} + \frac{\sum y_{ah}}{\sum n_h} + \frac{\sum y_{rh}}{\sum n_h}$$

Let $d = \sum n_{ah}/\sum n_h$; $t = \sum n_{th}/\sum n_{ah}$, y_a denote the average asset income across households per adult ($y_a = \sum y_{ah}/\sum n_{ah}$) and y_r denote the average transfer income across households per adult ($y_r = \sum y_{rh}/\sum n_{ah}$). Then write that, for each individual worker i, labour income is related to education according to:

$$y_{ti} = Exp[\kappa + 0.1S_i + \varepsilon_i]$$

where S_i denotes the number of years of schooling completed by individual i. From the data, compute $h = E_i(Exp\ [0.1S_i + \varepsilon_i])$, which has been defined here as the average stock of human capital. It then becomes possible to define $q = Exp\kappa = E_i(y_{ti})/h$, residually.

Noting that:

$$\mu(y) = E_h\left(\frac{y_h}{n_h}\right) = \frac{\sum y_h}{\sum n_h}$$

(8) can now be rewritten as:

(8') $$\mu(y) = d[tqh + y_a + y_r],$$

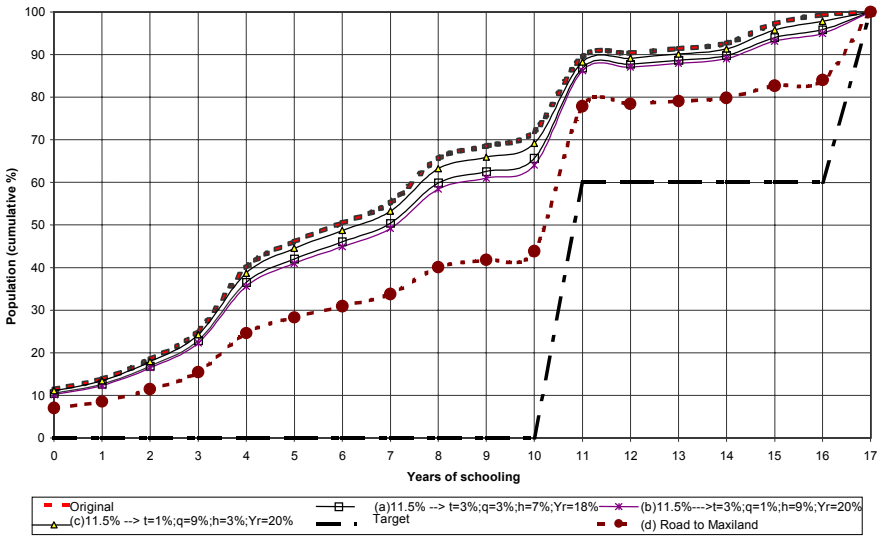
which is constructed as an identity and involves no econometric estimation. Note that each variable has a specific economic interpretation: d, which is the number of adults over the total population, is the inverse of the dependency ratio; t, which is the proportion of employed adults, is the occupation rate; q, defined as above, is the average productivity of human capital, or a measure of the average "quality" of worker-job matches in the economy; h is an approximate measure of the stock of human capital in the economy, relying on the Psacharopoulos, G. (1994) estimated international average for returns to education of 10%; y_a is average income from assets; and y_r is average transfer income.

It follows that the aggregate economic growth simulated in the macro scenarios as (1+β)μ can be obtained through various different combinations of changes in the ratios on the right-hand side of the above identity. In particular, if the choice is made to keep the dependency ratio and incomes from assets unchanged, then:

$$(1+\beta)\mu(y) = d\left[(1+\delta_t)t(1+\delta_q)q(1+\delta_h)h + y_a + (1+\delta_r)y_r\right]$$

Changes in each individual δ parameter are simulated straight-forwardly, except for δ_h, which corresponds to changes in the stock of human capital, and hence in the entire distribution of years of schooling over the population. The required mean value for h could be obtained from an infinite number of different transformations of the observed distribution of years of schooling, G(E). To avoid ambiguity, in every case the researchers chose to simulate the required counterfactual distribution of education as a convex combination of the observed distribution and of a "target" distribution of years of schooling T(E), which was postulated for Maxiland as: $G^* = kG(E) + (1-k)T(E)$, where k is determined so as to scale h up by a factor $(1 + \delta_h)$. The procedure is illustrated graphically below (see figure A.1):

Figure A.1
ORIGINAL, TARGET AND SIMULATED CUMULATIVE DISTRIBUTIONS OF EDUCATION



Source: Authors' calculations based on the data from household surveys of the respective countries.

The counterfactual income distribution simulated in this step has required changes in the levels of education, in the occupation rate and in some income sources at the household and individual levels. The aggregate inequality level for the ensuing counterfactual distribution is clearly not guaranteed to be identical to the one which is generated at the aggregate (macro) level by equation (4): G*(y) = (1-α)G(y). To ensure consistency across the macro- and micro-simulations, then, a final adjustment is required. This is carried out by scaling up or down, as needed, the variance of the residuals ε_i in the individual earnings equation defined earlier:

$$y_{ti} = Exp[\kappa + 0.1S_i + \varepsilon_i]$$

Once this adjustment has been made, while ensuring that the δ vector is consistent with the macro growth simulation parameter β and that the inequality in the counterfactual distribution arising from the micro-simulation is consistent with the macro inequality simulation parameter α, the simulation is complete.

B. Statistical appendix

The analysis presented in this report has drawn primarily on unit-record, household data from the following household surveys, which were conducted by national statistical agencies in each country. The survey names, coverage and sample size are listed in table B.1 below. The table also contains the name of each country's currency and the purchasing power parity (PPP) exchange rate applied to each.

Table B.1
HOUSEHOLD SURVEYS AND EXCHANGE RATES

Country	Household survey name	Survey reference date	Survey coverage	Sample size	National currency	PPP exchange rate
Argentina	Encuesta Permanente de Hogares	October 1999	28 Urban agglome-rations	24 079 households	Peso	1.213
Bolivia	Encuesta Continua de Hogares	November 1999	National	3 035 households	Bolivianos	0.427
Brazil	Pesquisa Nacional por Amostra de Domicílios	September 1999	National	80 972 households	Real	1.682
Chile	Caracterización Socioeconómica Nacional (CASEN)	November 1998	National	48 107 households	Peso	0.004
Colombia	Encuesta Nacional de Hogares	September 1999	National	34 882 households	Peso	0.002
Costa Rica	Encuesta de Hogares de Propósitos Múltiples	July 2000	National	9 830 households	Colón	0.011

(continued)

Table B.1 (concluded)

Country	Household survey name	Survey reference date	Survey coverage	Sample size	National currency	PPP exchange rate
Dominican Republic	Encuesta Nacional de Gastos e Ingresos de los Hogares	October 1997–October 1998	National	4 810 households	Peso	0.195
Ecuador	Encuesta de Condiciones de Vida	October 1998–September 1999	National	5 824 households	Sucres	0.0003
El Salvador	Encuesta de Hogares de Propósitos Múltiples	1999	National	16 164 households	Colón	0.188
Guatemala	Encuesta Nacional de Ingresos y Gastos Familiares	March 1998–March 1999	National	7 139 households	Quetzal	0.415
Honduras	Encuesta Permanente de Hogares	March 1999	National	6 611 households	Lempira	0.204
Mexico	Encuesta Nacional de Ingresos y Gastos de los Hogares (ENIGH)	July–September 2000	National	10 108 households	Peso	0.157
Nicaragua	Encuesta Nacional de Hogares sobre Medición de Nivel de Vida	April–August 1998	National	4 209 households	Córdoba	0.463
Panama	Encuesta de Hogares	August 1999	National	10 229 households	Balboa	2.414
Paraguay	Encuesta Permanente de Hogares	August–December 1999	National	5 101 households	Guaraní	0.0008
Peru	Encuesta Nacional de Niveles de Vida	2000	National	3 995 households	Sol	0.663
Uruguay	Encuesta Continua de Hogares	1999	Urban Areas	18 280 households	Peso	0.118
Venezuela	Encuesta de Hogares por Muestreo	July–December 1999	National	16 127 households	Bolívar	0.0023

Source: Authors' calculations based on the data from household surveys of the respective countries.

Two sets of adjustments were made to the data set from each of these surveys. First, all households with zero per capita incomes were excluded from the sample. Second, all of the ECLAC adjustments were used to correct for under-reporting. Adjustments such as these are suggested by ECLAC for most household surveys in Latin America and the Caribbean and are designed to bring broad aggregates implied by the surveys into line with the orders of magnitude estimated for the same aggregates from national accounts. Adjustments differ across countries, as needs differ from survey to survey. In general, the most common adjustments involve: (i) some correction for under-reporting of transfer incomes, often implemented by scaling up this income source for all recipient units so as to generate aggregates compatible with public disbursement data; (ii) a similar correction for under-reporting of capital incomes, implemented by scaling up such incomes reported by the top fifth of the household income per capita distribution (by individuals); and (iii) upward corrections in reported incomes for household that own their own dwellings (in lieu of imputed rent). See ECLAC (2001) for more detailed information on this subject.

Finally, since this report is part of an international research project and it is therefore important to facilitate cross-country comparisons, results are presented for all countries in 1999 United States dollars. The countries' currencies were converted to 1999 United States dollars using the 1993 CPI-based PPP exchange rates published by the World Bank. Since these rates are available only up to 1993, CPI inflation rates in national currencies and in the United States dollar were both taken into account. This was done by multiplying the national currencies by the following factor, which is given in the last column of table B.1 above:

$$e_{ct} = \frac{MN\$_{june1993}}{MN\$_{t}} \cdot \frac{U\$(PPP)_{1993}}{MN\$_{june1993}} \cdot \frac{U\$_{june1999}}{U\$_{june1993}}$$

where c denotes the country and t denotes the (central) reference month (and year) of the survey. The right-hand side (RHS) term 1 is the inverse of the national CPI (urban and rural; base June 1993 = 1) for period t; RHS term 2 is the original 1993 CPI-based PPP exchange rate for country c; RHS term 3 is the United States CPI, with a base of June 1993. This is 1.15 and reflects accumulated United States inflation from June 1993 to June 1999.

Figure B.1
ISOPOVERTY CURVES FOR ARGENTINA

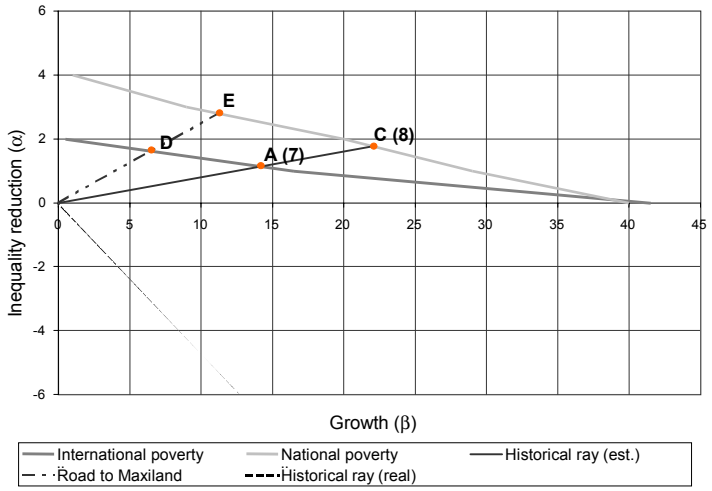
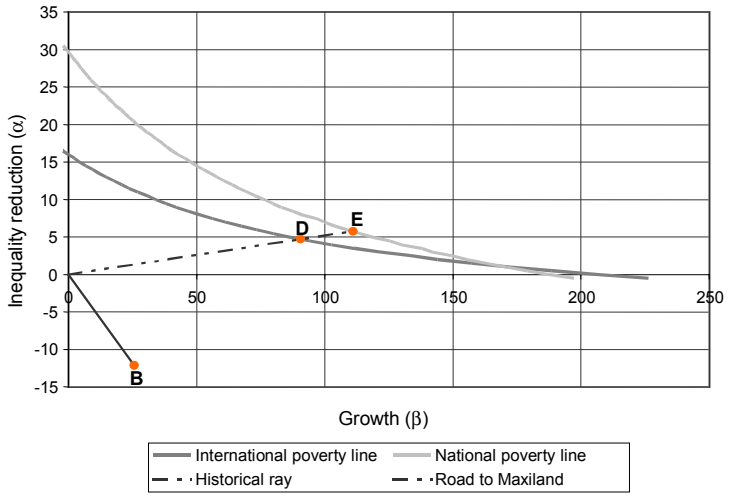


Figure B.2
ISOPOVERTY CURVES FOR BOLIVIA



Source: For figures B1 and B2: authors' calculations based on the data from household surveys of the respective countries.

Figure B.3
ISOPOVERTY CURVES FOR BRAZIL

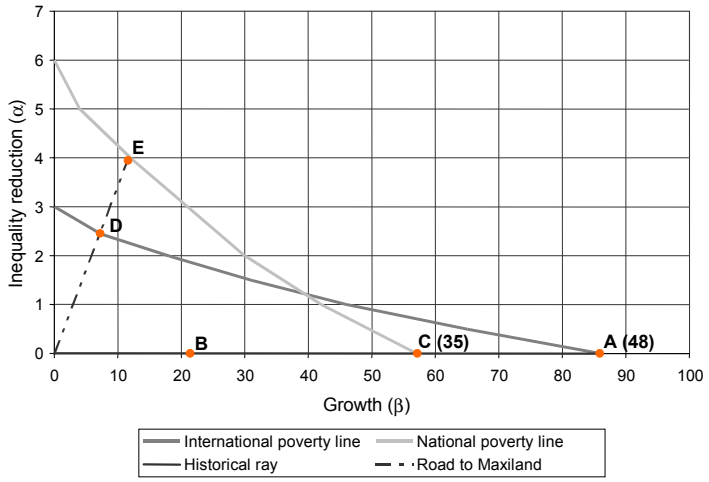
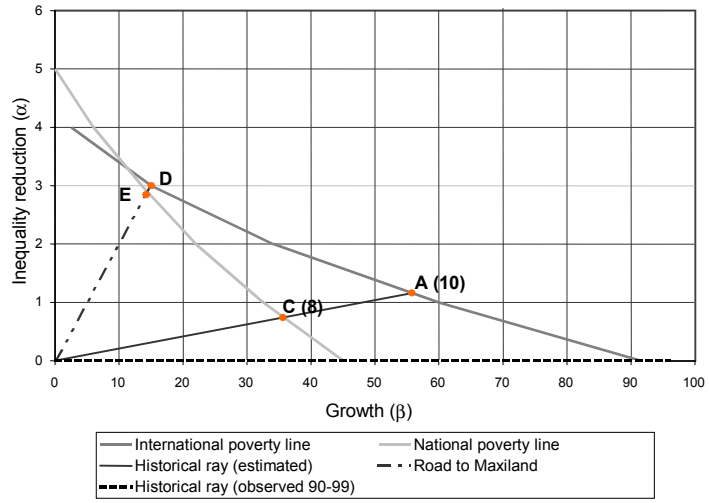


Figure B.4
ISOPOVERTY CURVES FOR CHILE



Source: For figures B3 and B4: authors' calculations based on the data from household surveys of the respective countries.

Figure B.5
ISOPOVERTY CURVES FOR COLOMBIA

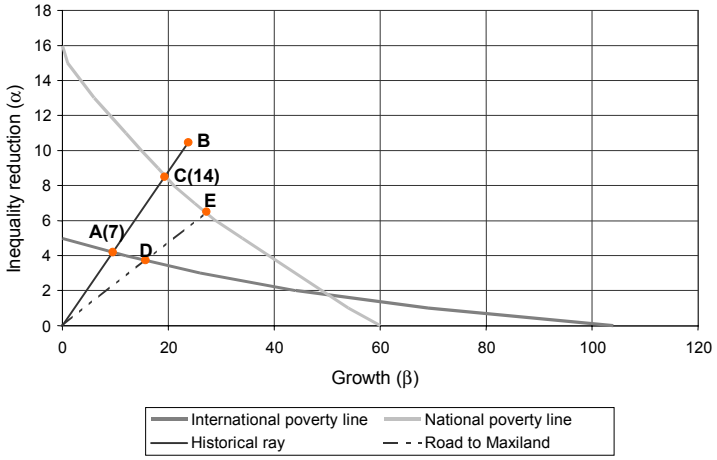
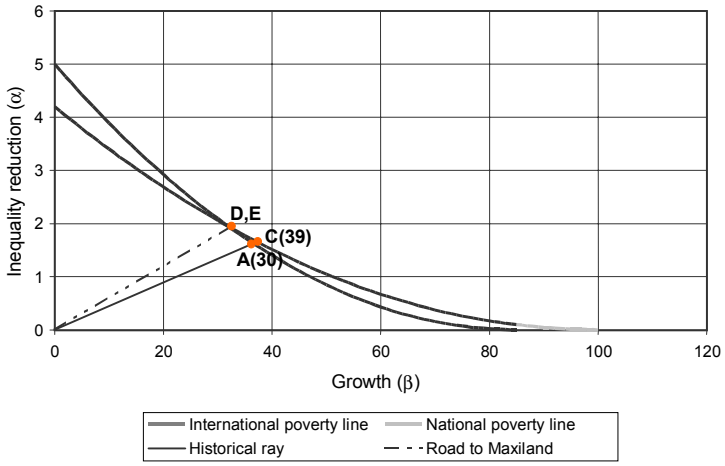


Figure B.6
ISOPOVERTY CURVES FOR COSTA RICA



Source: For figures B5 and B6: authors' calculations based on the data from household surveys of the respective countries.

Figure B.7
ISOPOVERTY CURVES FOR DOMINICAN REPUBLIC

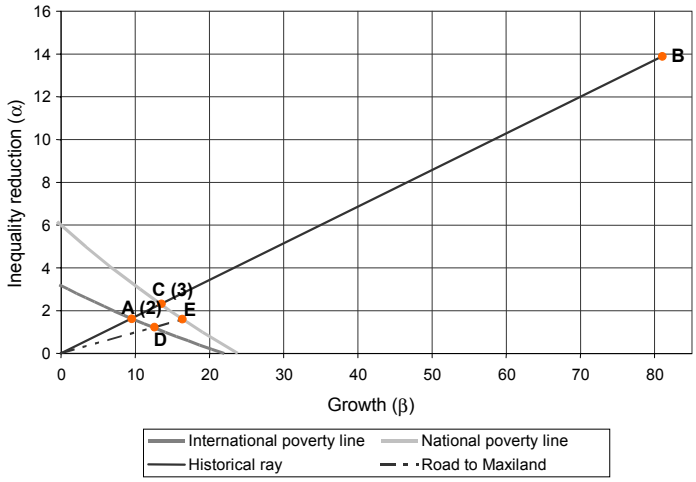
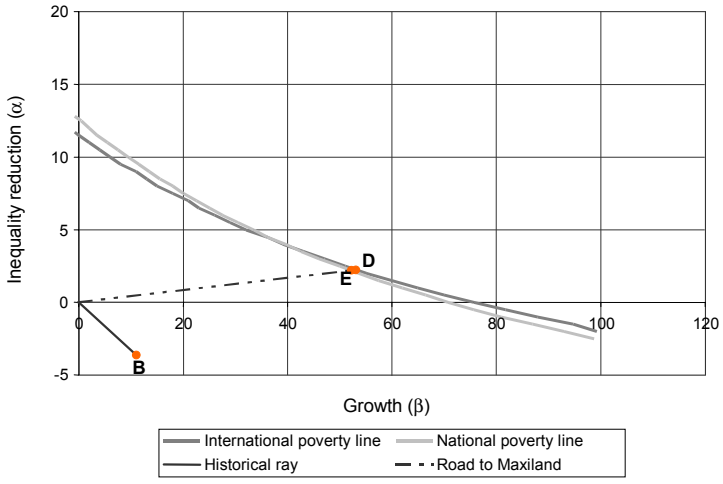


Figure B.8
ISOPOVERTY CURVES FOR ECUADOR



Source: For figures B7 and B8: authors' calculations based on the data from household surveys of the respective countries.

Figure B.9
ISOPOVERTY CURVES FOR EL SALVADOR

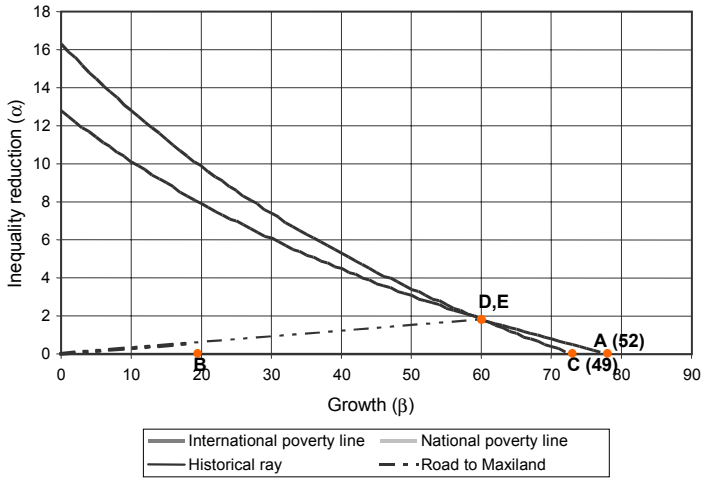
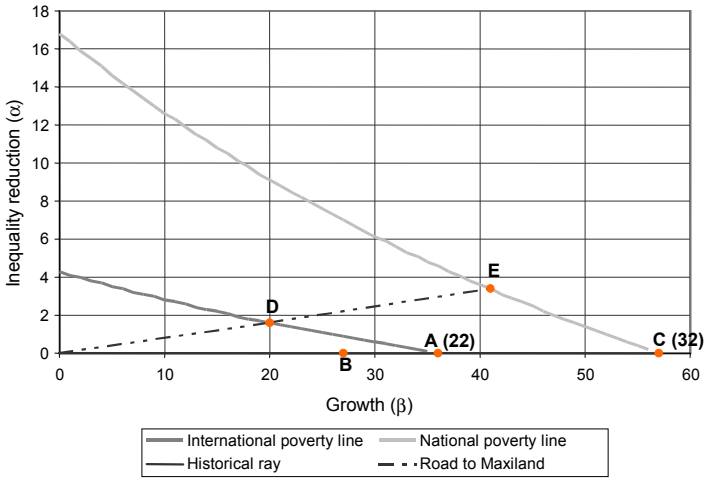


Figure B.10
ISOPOVERTY CURVES FOR GUATEMALA



Source: For figures B9 and B10: authors' calculations based on the data from household surveys of the respective countries.

Figure B.11
ISOPOVERTY CURVES FOR HONDURAS

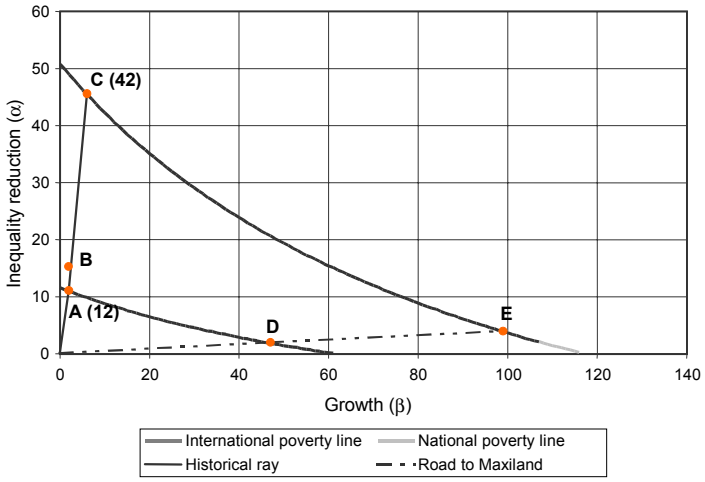
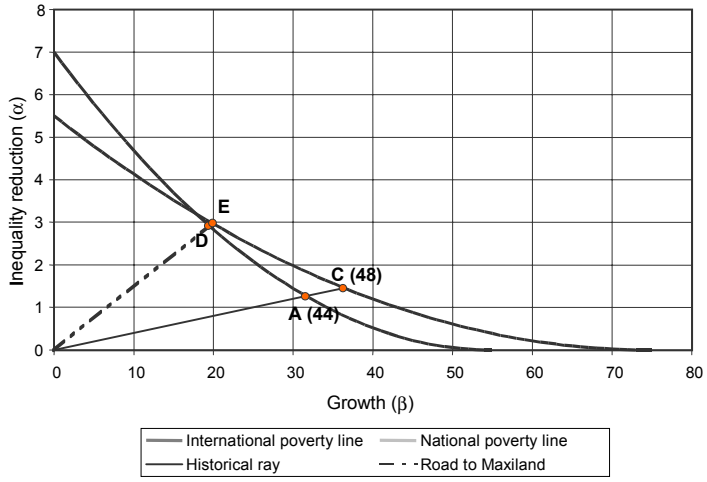


Figure B.12
ISOPOVERTY CURVES FOR MEXICO



Source: For figures B11 and B12: authors' calculations based on the data from household surveys of the respective countries.

Figure B.13
ISOPOVERTY CURVES FOR NICARAGUA

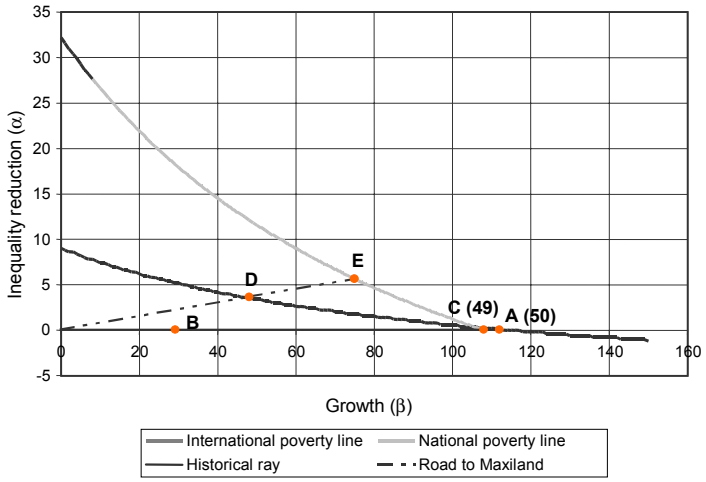
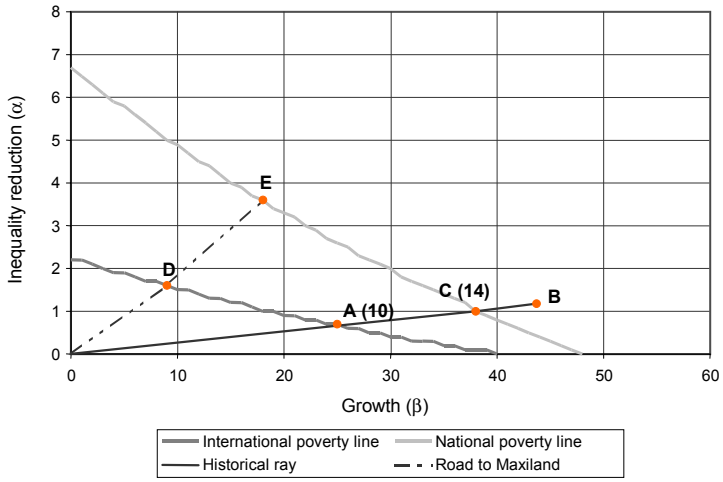


Figure B.14
ISOPOVERTY CURVES FOR PANAMA



Source: For figures B13 and B14: authors' calculations based on the data from household surveys of the respective countries.

Figure B.15
ISOPOVERTY CURVES FOR PARAGUAY

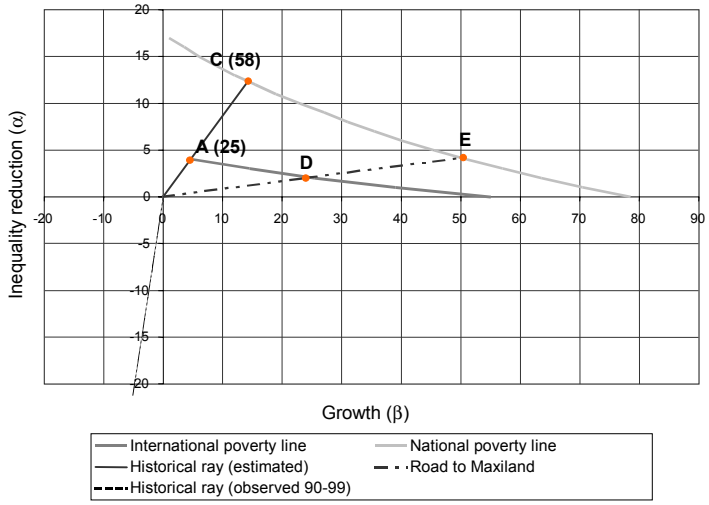
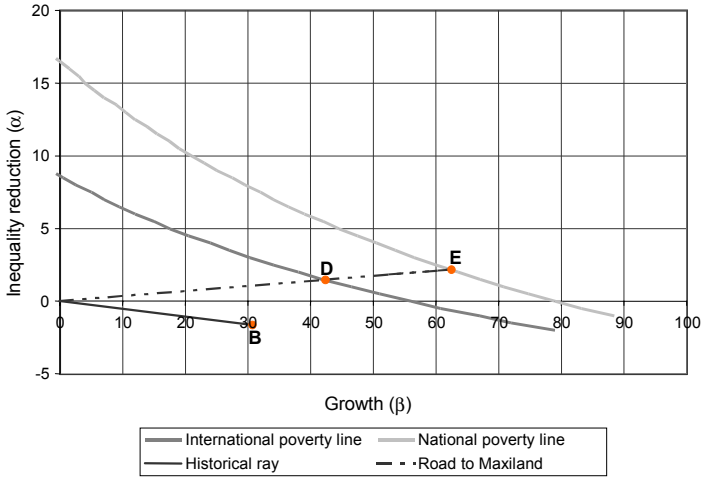


Figure B.16
ISOPOVERTY CURVES FOR PERU



Source: For figures B15 and B16: authors' calculations based on the data from household surveys of the respective countries.

Figure B.17
ISOPOVERTY CURVES FOR URUGUAY

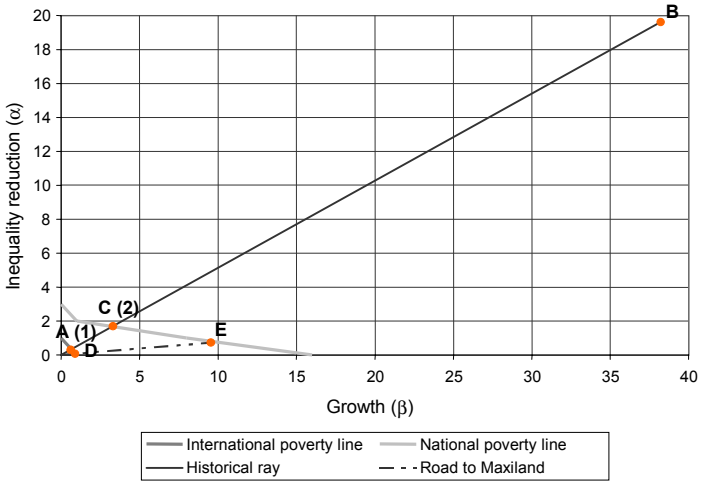
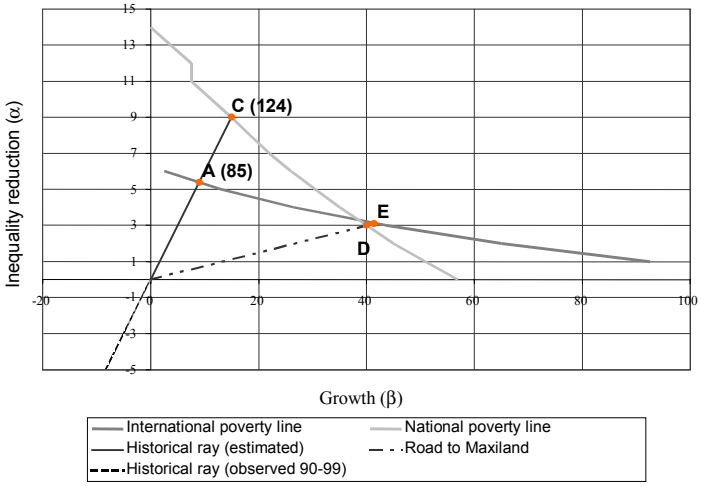


Figure B.18
ISOPOVERTY CURVES FOR VENEZUELA



Source: For figures B17 and B18: authors' calculations based on the data from household surveys of the respective countries.