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The Poverty Elasticity of Growth

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Abstract

How much does economic growth contribute to poverty reduction? I discuss analytical and empirical approches to assess the poverty elasticity of growth, and emphasize that the relationship between growth and poverty change is non-constant. For a given poverty measure, it depends on initial inequality and on the location of the poverty line relative to mean income. In most cases, growth is more important for poverty reduction than changes in inequality, but this does not tender inequality unimportant. Reduction in inequality may be triple effective: (1) it will reduce poverty for a given level of income, (2) it will accelerate the poverty reducing impact of economic growth, and (3) according to cross-country growth regressions, it may contribute to a larger rate of growth.

Keywords: poverty, poverty reduction, economic growth, inequality

JEL classification: I31, O40

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The Growth Elasticity of Poverty

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Abstract

How much does economic growth contribute to poverty reduction? I discuss analytical and empirical approaches to assess the growth elasticity of poverty, and emphasize that the relationship between growth and poverty change is non-constant. For a given poverty measure, it depends on initial inequality and on the location of the poverty line relative to mean income. In most cases, growth is more important for poverty reduction than changes in inequality, but this does not render inequality unimportant. Reduction in inequality may be triple effective: (1) it will reduce poverty for a given level of income, (2) it will accelerate the poverty reducing impact of economic growth, and (3) according to cross-country growth regressions, it may contribute to a larger rate of growth.

JEL-codes: I31, O40.

1 Introduction

Social scientists have long debated the relationship between growth and poverty. One side in this discussion is represented by growth-optimists, who believe in "trickle-down", i.e. the notion that growth in average incomes automatically sinks down to and benefit the poor. The opposing view puts the distribution of income and wealth at the centre-stage, and argue that reductions in inequality are required to combat poverty. This includes adherents of the notion of "immiserizing growth", i.e. the idea that growth in average income may well occur at the same time as large groups of people are being increasingly impoverished. During the 1990s, the proliferation of quality data on income distribution from a number of countries has allowed rigourous empirical testing of standing debates such as this one.

Datt and Ravallion (1992) developed a method to decompose changes in poverty into a "growth effect", stemming from change in average income, and a "distribution effect", caused by shifts in the Lorenz curve holding average income constant. Using data from India and Brazil, they found the growth effect to explain the largest part of observed changes in poverty. Similar results have been found in a number of other developing countries by other researchers. White and Anderson (2001), looking not at poverty but at the income of the bottom 20 percent, also found growth to be, on average, much more important than distributional change. Significant work has also been done based on cross-country comparisons of data "spells", meaning instances where two or more comparable household surveys are available from the same country at different points of time. Such spells provide the data needed for detailed household-level analysis of growth, poverty and inequality. Analyses based on spells have found that increases (decreases) in mean income tend to be strongly and significantly associated with falling (increasing) poverty rates (e.g., Ravallion, 1995 and 2001).

Fields (2001, pp. 97-98) summarizes the literature this way: "twenty years of research has shown convincingly that in a cross section of countries, those with higher per capita income or consumption have less poverty. The cross-sectional version of the absolute impoverishment hypothesis has been thoroughly discredited". Moreover, there is substantial evidence to indicate that, usually, distributional change is too little and too slow to be relied upon for poverty reduction. Growth is, in practice, the main tool for fighting poverty (Bruno, Ravallion and Squire, 1998; Squire, 1993).

However, the imperative of growth for combating poverty should not be misinterpreted to mean that "growth is all that matters". Growth is a necessary condition for poverty alleviation, no doubt, but inequality also matters and should also be "on the agenda" (Kanbur and Lustig, 1999). Growth and distribution are interconnected in numerous ways, and the effectiveness with which growth translates into poverty reduction depends crucially on initial inequality. Although emphasized by Ravallion (1997), this simple and obvious fact is too often overlooked. For example, poverty projection studies by Hanmer and Naschold (1999) and Dollar and Collier (2001) are based on a constant elasticity linking poverty reduction to the rate of growth. Such projections yield imprecise results because they fail to take account of how the growth elasticity of poverty depends on initial inequality and level of development (poverty line relative to mean income).

This short paper surveys the literature on the growth-poverty relationship, seeking to synthesise empirical and theoretical work in this important and still emerging field. I argue that the "growth-versus-distribution" dichotomy is false: the growth elasticity of poverty is non-constant, and depends on factors such as initial inequality and the level of development. Inequality therefore does matter to poverty alleviation.

2 Analytics of the growth elasticity of poverty

There are some precise analytical results on the growth elasticity of poverty provided one is willing to make the rather drastic assumption that the Lorenz curve is constant, i.e. that inequality does not change. Alternatively, some analytical results are also possible if one imposes simplifying assumptions about either the nature of change in the income distribution or the shape of the distribution. This section reviews the major insights on the growth elasticity of poverty that appear from literature that embodies these assumptions. In section 3, I review empirical results based on spell data, in which no assumptions on the nature of the distribution or its change are imposed.

Let $F(x)$ denote the distribution function of individual income. If z is a poverty line, then $H = F(z)$ is the proportion of poor in the society. H is usually called the head-count ratio, and is the most popularly used measure of income/consumption poverty. As a poverty measure, H has some drawbacks because it fails to take into account both the size of the aggregate income shortfall of the poor and the distribution of income among the poor. A more general class of poverty measures can be written

$$\theta = \int_0^z P(z, x) f(x) dx, \tag{1}$$

where $f(x)$ is the density function of x and $\partial P/\partial x < 0$, $\partial^2 P/\partial^2 x > 0$, $P(z, z) = 0$ and $P(z, x)$ is homogenous of degree zero in z and x (Kakwani, 2001). The most famous incarnation of equation (1) is the P_α measure proposed by Foster, Greer and Thorbecke (FGT) (1984). The FGT P_α measure is given by

$$P_\alpha(z, x) = \int_0^z ((z - x)/z)^\alpha f(x) dx. \tag{2}$$

If the inequality aversion parameter, α, equals zero, we have $P_0 = H$ i.e., the headcount measure. P_1 is termed the poverty gap measure, and indicates the aggregate income shortfall, or depth of poverty, of those below the poverty line. P_2 is referred to as the squared poverty gap measure, or severity of poverty, because it places greater weight on those far below the poverty line.

2.1 Analytical elasticities

For any poverty measure that satisfies equation (1), Kakwani (1993) derived its elasticity with respect to mean income, while holding the distribution constant (i.e. assuming a growth process in which the entire Lorenz curve is shifted in a constant proportion). The elasticity is

$$\eta_\theta = \frac{1}{\theta}\int_0^z x\frac{\partial P}{\partial x}f(x)dx. \quad (3)$$

This is always negative. For headcount poverty, this implies an elasticity of $\eta_H = -zf(x)/H$, which shows the percentage of the poor who will cross the poverty line if all incomes increase by 1 percent (Kakwani, 1993 and 2001). For the FGT-measures with $\alpha \neq 0$, the elasticity is

$$\eta_\alpha = -\frac{\alpha(P_{\alpha-1} - P_\alpha)}{P_\alpha} \quad (4)$$

which will always be negative. For the poverty gap measure, $\alpha = 1$, this gives $\eta_1 = -\mu^*/(z-\mu^*)$, where μ^* is the average income of the poor. Since μ^*/z is the inverse of the depth of poverty, this shows that the poverty elasticity increases (decreases) in absolute value the lower (higher) is the depth of poverty. Chen and Ravallion (2001) use this formula to calculate the elasticity of P_1 poverty, and find a global average of -2.39 for the 1$/day line. The corresponding regional averages range from -4.4 for the Middle East and North Africa to just -1.67 for Sub-Saharan Africa, probably reflecting differences in the incidence of poverty.

2.2 An illustration

It may be useful to illustrate these elasticities using real-world income distributions. This helps bring out the magnitudes and the non-linearities involved in the growth elasticity of poverty for specific developing countries. To do so, I used household survey data from Mozambique, Vietnam and South Africa. Mozambique was chosen for its high level of poverty, Vietnam for its equal distribution and rapid poverty reduction during the 1990s, and South Africa for its high degree of inequality. Table 1 summarises for each country its headcount rate (based on national poverty lines, and therefore not comparable across countries), Gini coefficient, sample size and the source of the data. All data come from nationally representative household surveys. The income variable used here is total real per capita daily expenditure in line with most of the literature.

Table 1: Summary statistics for income data

	Mozambique	Vietnam	South Africa
Headcount ratio	0.69	0.37	0.25
Gini index	0.396	0.345	0.586
Sample size	8250	5999	8783
data source	IAF 1996-97	VLSS 1997-98	Integrated Household Survey 1993-94

I simulated the impact of distribution-neutral growth by maintaining the income distribution fixed, and calculating the growth elasticity for a range of artificial "poverty lines" spanning from the 1st percentile (where 99 percent are poor) to the 99th percentile, where just 1 percent is poor.[1] In Figure 1-4, the horizontal axis shows the location of the poverty line, with the movement from left to right mimicking the impact of distribution-neutral growth in terms of reducing $z/\overline{x}$. Elasticities are shown on the vertical axes. Figure 1 compares the elasticities for headcount poverty, η_H, for these three countries, Figure 2 compares P_1 elasticities, $\eta_{P_{1,}}$ and Figure 3 η_{P_2}.

The figures show that for a given income distribution, the absolute value of the poverty elasticity increases as average income grows relative to the poverty line. Thus, poverty is more (less) elastic to growth the lower (higher) is poverty. For any given location of the poverty line and P_α, poverty elasticities are largest (in absolute value) in Vietnam, which has the most equal income distribution, and lowest in South Africa, which is the most unequal of these countries. The dependence of the poverty elasticity on $z/\overline{x}$ appears even more pronounced for Vietnam than for the other countries. This is because Vietnam is more equal, also at the bottom of the distribution, than Mozambique and South Africa. It can be seen that the poverty elasticity increases with α: depth and severity of poverty responds more elastically to growth than the headcount.

These results may be hard to understand intuitively. One may ask, rigtly, if the impact of growth on poverty does not depend on the location of the poverty line vis-à-vis the bulk of the income distribution? After all, if many people are located at, or slightly below, the poverty line, economic growth should have a large impact. The key to understand the above results is that they refer to the *percentage change* in poverty, not the *absolute change* in the number of poor. To illustrate this point, I plot in Figure 4 the change in headcount level (number of people moving from below to above the poverty line) for South Africa in response to changes in mean income. It can be seen that at the location of the current national poverty line (indicated by a vertical bar), a substantial number of people will be shifted out of poverty by distribution-neutral growth. Yet the impact on the headcount rate will quickly reduce in absolute magnitude if growth in mean income is sustained. If, on the other hand, mean incomes were to fall, a large number of people would be moving into poverty in South Africa.

The Development Assistance Committee (DAC) of the OECD has set some official development targets, one of which is to cut global poverty by half between 1990-2015. Existing projection studies (Hanmer and Naschold, 1999; Collier and Dollar, 2001) use constant elasticities to answer that question. The approach

[1] The following approximation was used:

$$\eta_\alpha(\frac{z}{\overline{x}}, \alpha; L) \simeq -\frac{[P_\alpha(z_j) - P_\alpha(z_{j-1})]/P_\alpha(z_{j-1})}{[z_j - z_{j-1}]/z_{j-1}}, j = 1, 2, ..., 99;\ \alpha = 0, 1, 2 \qquad (5)$$

where $\overline{x}$ is average income, L is the Lorenz curve (kept fixed), and j denotes the percentile of the income distribution. The nominator is the proportionate change in the FGT poverty measure (for $\alpha = 0, 1, 2$) and the denominator is the proportionate change in the poverty line as it is being shifted from the j-1 to the jth percentile. This illustrates the process of development and growth in real-world income distributions, but maintaining the assumption of no changes in distribution.

adopted in this section can be used to provide a more precise answer. Based on the actual data for these three countries, I calculated how much growth in mean household income is required to reduce poverty by half (relative to the survey year) in 25 years. I assume constant distribution and constant share of household income to GDP. The result is shown in Table 2. Mozambique needs 2.1 percent real annual per capita growth to halve poverty in 25 years. For Vietnam just 1.1 percent growth p.a. per capita will suffice, whereas for South Africa 1.8 p.a. per capita is required. Given their past growth record, achieving the target of halving headcount poverty in 25 years seems feasible for Vietnam and Mozambique. South Africa will need substantial improvement in the rate of growth, in distribution, or in both to achieve the development target. This clearly illustrates the importance of inequality: Vietnam's highly equal income distribution means that economic growth in that country translates into poverty reduction in a very effective manner. To achieve a comparable rate of poverty reduction, countries with unequal income distribution have to grow a lot faster. In this context, poverty alleviation in South Africa is facing the double hurdle of sluggish growth in income and unequal distribution.

Table 2: Actual and required growth rates

	Annual real per capita growth rates		
	Mozambique	Vietnam	South Africa
Required to halve poverty in 25 years	2.1	1.1	1.8
Actual GDP growth rate 1995-99	6.0	5.96	0.43

2.3 A log-linear approximation

Because inequality can change in countless ways, it is hard to say anything general about the growth-poverty relationship when the distribution is allowed to change during growth. Kakwani (1993) developed a formula for the inequality elasticity of poverty under the assumption of an equal proportionate change in the Lorenz curve. Another road ahead is to assume a particular functional form for the income distribution, and work out the growth-inequality-poverty relationship for that distribution. In a recent unpublished paper, Bourguignon (2000) does this, assuming incomes follow the log-linear distribution. He derives an explicit formula linking the growth-elasticity of headcount poverty to mean income and inequality in the log-linear case:

$$\widetilde{\eta_H} = -\frac{\Delta H}{H_t}\frac{1}{\Delta Log(\overline{x})} = \frac{1}{\sigma}\lambda[\frac{Log(z/\overline{x})}{\sigma} + \frac{\sigma}{2}] \tag{6}$$

where $\Delta Log(\overline{x})$ is the proportionate change in income, $\Delta H/H_t$ is the proportionate change in headcount poverty, σ is the standard deviation of log income and λ is the ratio of the density to the cumulative function - or hazard rate - of the standard normal distribution. Expression (6) shows that the growth elasticity of poverty is an increasing function of development - the inverse of $z/\overline{x}$ - and a decreasing function of income inequality as measured by σ. Bourguignon

(2000) also develops a formula for the elasticity of P_1 poverty. Both these formulae provide explicit proof, in the case where income follows the log-normal distribution, for the points made above, namely that the growth elasticity of poverty increases with development and decreases with rising inequality.

3 Regression estimates of the growth elasticity of poverty

In reality, inequality can and does change in numerous ways in response to growth and multiple other factors. How responsive is poverty to growth in mean income when the Lorenz curve is free to vary? Clearly, this is an empirical issue. One might naively try to address this issue by regressing the rate of poverty on mean income for a range of countries. However, such level-based poverty comparison across countries suffers from numerous shortcomings, and could potentially be misleading due to problems arising from currency conversions, measurement errors and omitted country-specific fixed effects correlated with income (Ravallion, 1995). Differencing provides a solution because it removes any country-specific fixed effects.

Therefore, as mentioned in the Introduction, data on growth spells from multiple countries are appropriate for helping to determine the size of the average poverty elasticity in actual growth experiences, i.e. without imposing distributional assumptions. Data on spells can also help determine if there is symmetry in the way that increasing and decreasing average incomes affect the poor. During the 1990s, there has been a rapid expansion in the number of nationally representative household surveys, and many countries now have two or more surveys available. This has resulted in a much better understanding of the poverty-inequality-development nexus (Fields, 2001).

Ravallion (1995) regressed changes in headcount (based on the \$1/day Purchasing Power Parity International poverty line used by the World Bank and others) on growth for a sample of 16 countries with observations at two or more points in time, and found an elasticity of -2.4 ($R^2 = 0.64$). The squared poverty gap, P_2, was found to be more elastic, as theory predicts, at -4. Squire (1993) used a data set consisting of 21 spells to regress the change in the headcount index on growth in mean income while controlling for the initial headcount index. Growth was found to be significant and have an elasticity equal to -2.4 ($R^2 = 0.70$). Ravallion and Chen (1997) used data on 64 spells. Based on the \$1/day poverty line, they found an (highly significant) elasticity of -3.12 ($R^2 = 0.37$). When instead they fixed the poverty line at 50 percent of the mean, the elasticity was -2.6 ($R^2 = 0.84$). When Eastern Europe and Central Asia is excluded the elasticity drops in absolute value to -1.57 (N=43; $R^2 = 0.58$). Since Eastern Europe and Central Asia are, or at least used to be, low inequality countries, it is unsurprising that their growth elasticity is larger in absolute value. Ravallion and Chen (1997) also experimented with even higher poverty lines, and found, as one would expect, that the elasticity drops: it was -1.29 for a poverty line at 75 percent of mean income for the full sample, and -0.69 when the poverty line was 100 percent of mean income. The sample of household survey spells continues to grow. Based on 115 spells, Ravallion (2001) reports $\eta_0 = -2.5$ ($R^2 = 0.44$) based on the \$1/day international poverty line.

An implication of these studies is symmetry in the manner in which rising and falling mean income affects the poor. Equal economies have a high absolute value of the growth elasticity, implying that the poor gain a larger share of growth and loose more from contraction. Conversely, unequal societies have a small absolute η, and this protects the income of the poor during contraction.

The above regressions likely suffer from misspecification because they treat the growth-poverty relationship as governed by some fixed elasticity, ignoring its dependency on inequality and level of development. Recent literature has therefore moved on to address directly the dependence of the growth elasticity on inequality. Ravallion (1997) regressed the rate of poverty reduction (based on a \$1.50/day PPP line) on an encompassing model including growth, inequality as measured by the Gini index, interaction terms betwen them, and all of their squared terms. He found a statistically acceptable restricted form of the general model to be

$$\frac{\Delta H}{H_t} = 4.435(1 - Gini_t)\frac{\Delta x}{x_t} + \text{residual } (N = 41;\ R^2 = 0.36). \tag{7}$$

Based on this, Ravallion (1997) concludes that it is the *distribution-corrected rate of growth ([1- Gini]*·the rate of growth) that matters. The estimates imply that, at the lowest Gini in his sample (0.25), the growth elasticity of \$1.5/day headcount poverty is -3.3, while at the highest Gini (0.59) it is -1.8. At the mean Gini index (0.41), the elasticity is -2.6. Ravallion (2001) repeated the exercise on a larger data set, and found a quite similar result: $\Delta Log P_0 = -3.74(1 - Gini_t)\Delta Log(x)$+residual ($N = 115$; R^2 not reported).

The distribution-corrected rate of growth is an interesting concept that helps us understand better how inequality shapes the impact of growth on poverty. Since the distribution-corrected rate of growth does not explicitly take into account the dependence of the growth elasticity of poverty on the level of development ($z/\overline{x}$), it is potentially vulnerable to the misspecification of imposing a constant elasticity to a more complex non-linear relationship. Ravallion (1997) tested for this and found (7) statistically acceptable. Future studies seeking to apply the distribution-corrected rate of growth as an explanatory variable will also need to pay careful attention to this issue.

Bourguignon (2000) explored various models based on a data set comprised of 116 growth spells from 52 different countries. The best fit was obtained by the following model

$$\frac{\Delta H}{H_t} = 0.05 + 5.23\Delta Gini - 1.14 x_t \widetilde{\eta_H} + \text{residual } (N = 116;\ R^2 = 0.508) \tag{8}$$

where $\widetilde{\eta_H}$ is the theoretically expected value of the growth-poverty elasticity that can be obtained from equation (6) i.e., based on assuming incomes are log-normal. Bourguignon (2000) refers to this as an "identity check" on the logical identity linking growth and poverty (equation 6) under the assumption that incomes are log-normal. This identity is "confirmed" by finding a parameter not significantly different from unity. Unfortunately, Bourguignon (2000) did not directly compare his model to the distribution-corrected rate of growth, $(1 - Gini_t)\Delta Log(x)$. However, although the regression in (8) incorporates the log-normal growth-poverty "identity", it does not give a perfect fit with 50 percent of the variation in the data unaccounted for. It therefore appears that real-world distributions and distributional changes are more complex than what is captured by the log-normal. The best fit is likely to incorporate non-linearities and interactive terms between the poverty line relative to average income, inequality and growth.

4 Conclusions

Summing up, the conclusions of this paper are the following. First, the magnitude of the poverty elasticity of distribution neutral changes in mean income depends on the location of the poverty line and hence should not be treated as a constant across countries or time. It increases monotonically with increasing mean income, holding the poverty line constant.

Second, as Ravallion (1997) emphasized, the poverty elasticity depends strongly on the degree of inequality. An unequal income distribution is a serious impediment to effective poverty alleviation. Third, as a consequence of this the

"growth versus redistribution" dichotomy is false. It is uninformative to decompose poverty changes into a growth and a distribution component. The growth effect is itself a function of the degree of inequality.

It is true that redistribution often has limited potential and that growth is a necessary condition for poverty alleviation. Yet the level of inequality, and changes therein, still matters. This is because (i) for any given level of average income, the level of inequality affects the degree of poverty; (ii) inequality strongly affects the growth elasticity of poverty, and lower inequality contributes to an acceleration of poverty reduction for a given rate of growth; (iii) if recent cross-country regression studies are true, initial inequality, especially asset inequality, is harmful for growth (see for example Deininger and Olinto, 2000). For these reasons, inequality still matters, and the search for effective policies for reducing inequalities, or at least prevent them from rising, goes on.

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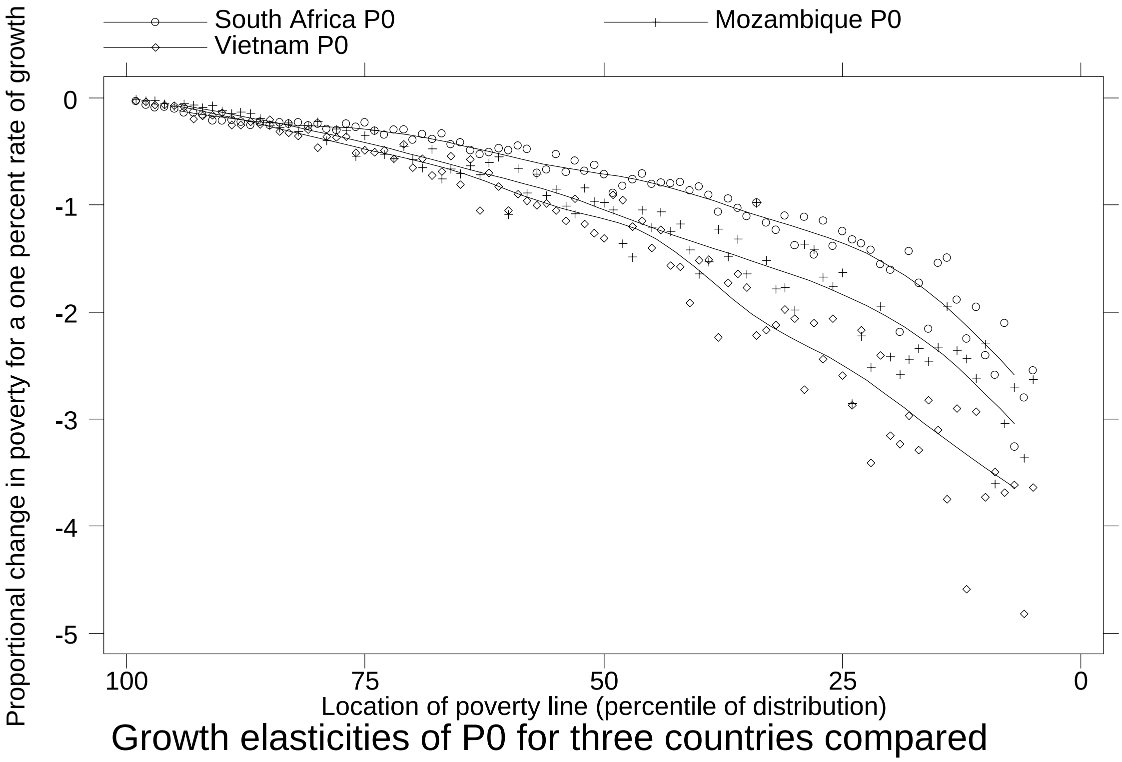
South Africa P0
Mozambique P0
Vietnam P0
Proportional change in poverty for a one percent rate of growth
0
-1
-2
-3
-4
-5
100
75
50
25
0
Location of poverty line (percentile of distribution)
Growth elasticities of P0 for three countries compared

Figure 1:

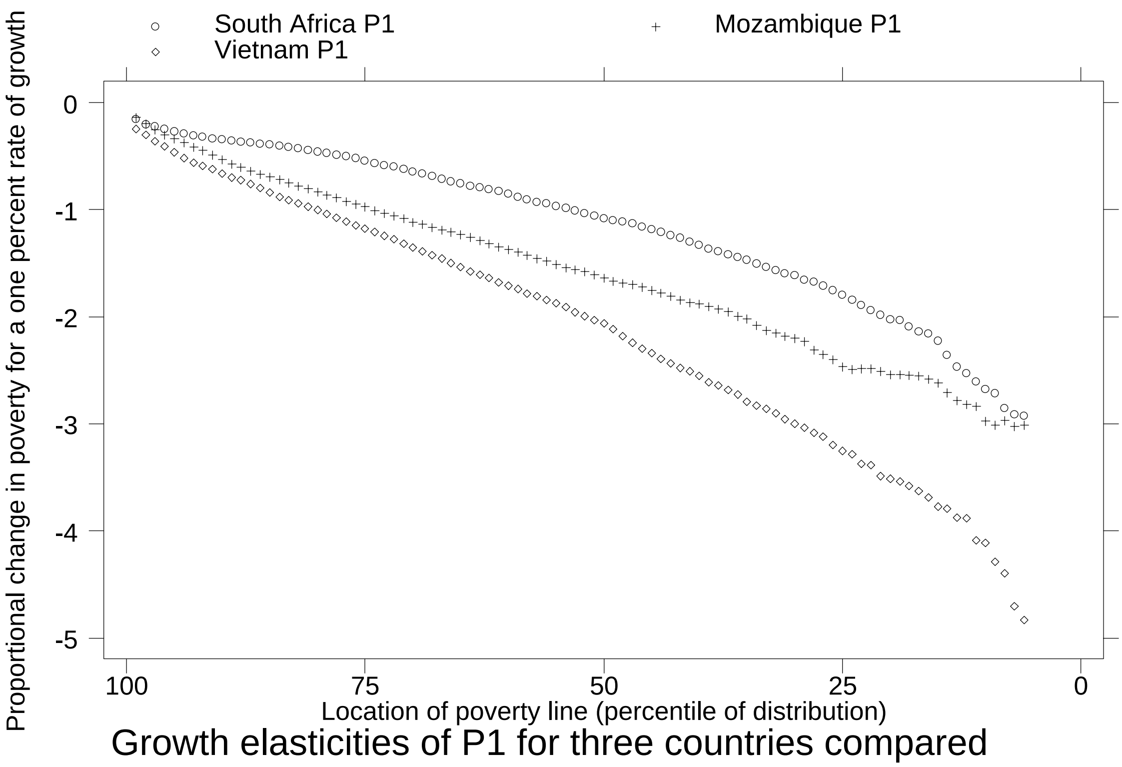
South Africa P1
Mozambique P1
Vietnam P1
Proportional change in poverty for a one percent rate of growth
0
-1
-2
-3
-4
-5
100
75
50
25
0
Location of poverty line (percentile of distribution)
Growth elasticities of P1 for three countries compared

Figure 2:

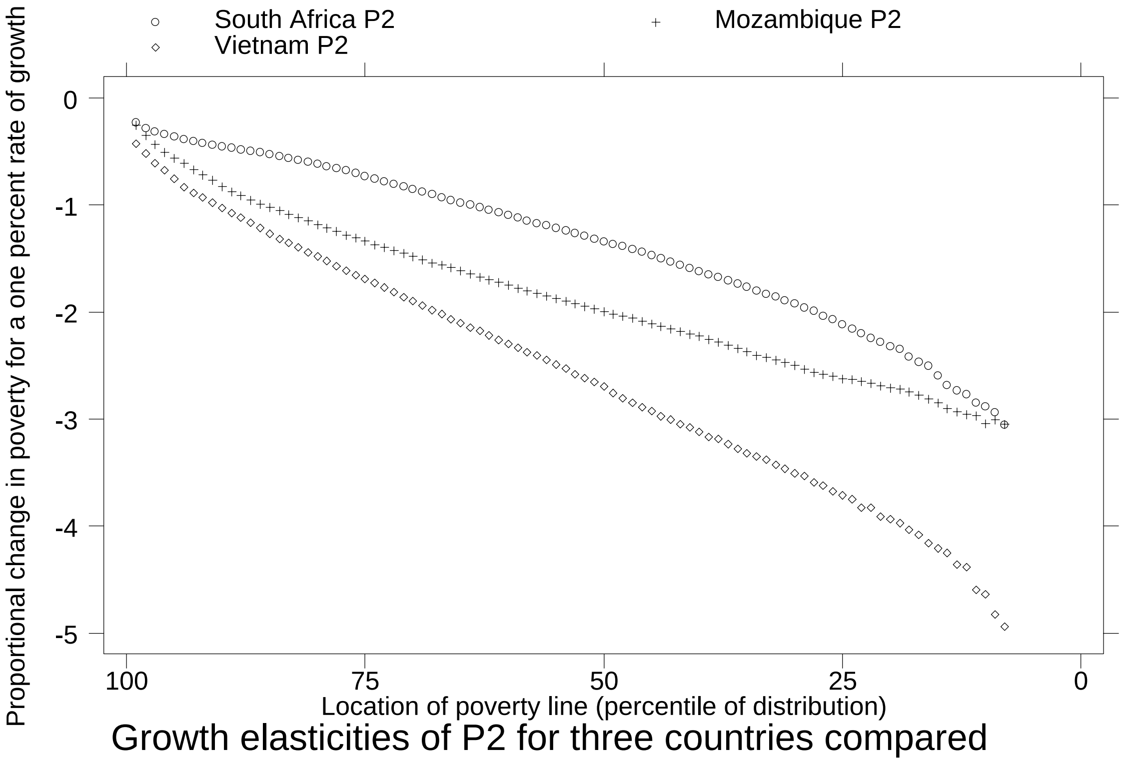
South Africa P2
Mozambique P2
Vietnam P2
Proportional change in poverty for a one percent rate of growth
0
-1
-2
-3
-4
-5
100
75
50
25
0
Location of poverty line (percentile of distribution)
Growth elasticities of P2 for three countries compared

Figure 3:

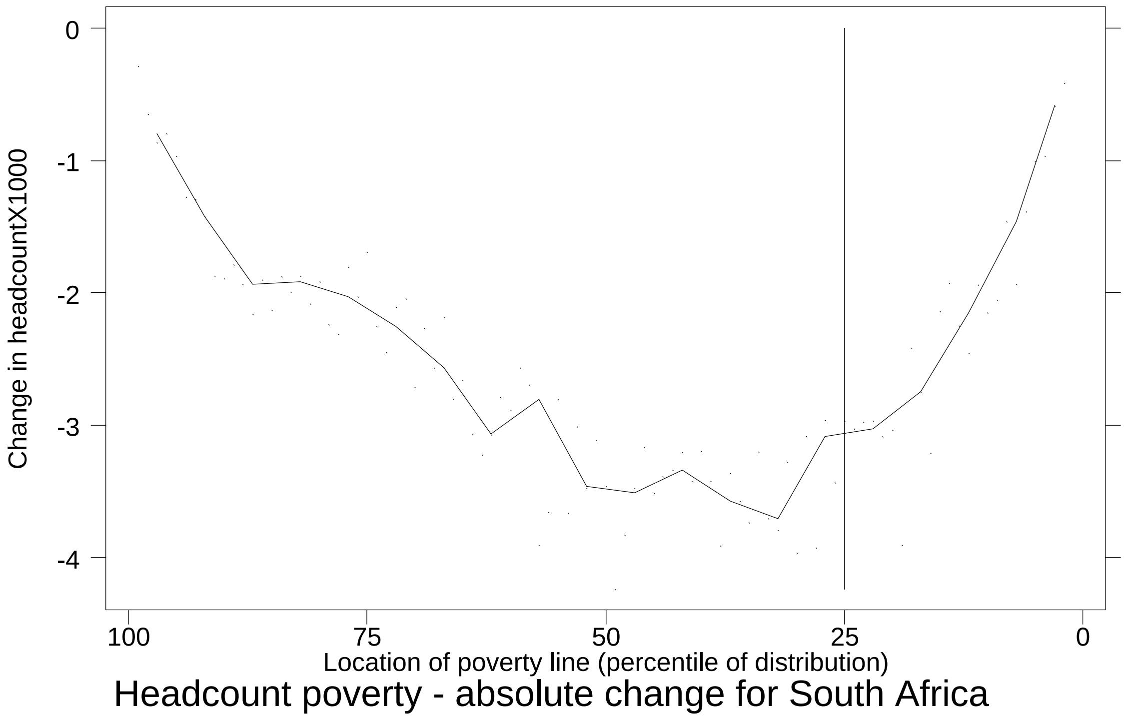
0
-1
-2
-3
-4
Change in headcountX1000
100
75
50
25
0
Location of poverty line (percentile of distribution)
Headcount poverty - absolute change for South Africa

Figure 4: