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# When Unstable, Growth Is Less Pro-Poor

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**Abstract**

Macroeconomic instability has been increasingly considered as a factor lowering average income growth and, in this way, is a factor slowing down poverty reduction. But it can also result in slower poverty reduction for a given average rate of growth, due to poverty traps, often examined at the microeconomic level. Testing a model of poverty change on a panel of data for more than 80 countries from 1981 to 2005, we find that income instability results in a lower poverty reduction for a given growth. It reflects a distributional effect not fully captured by a change in the Gini coefficient.

Keywords: income instability, poverty, inequality, economic growth, growth elasticity of poverty, poverty trap

JEL classification: E32, I30, I32, O15, D31, O40



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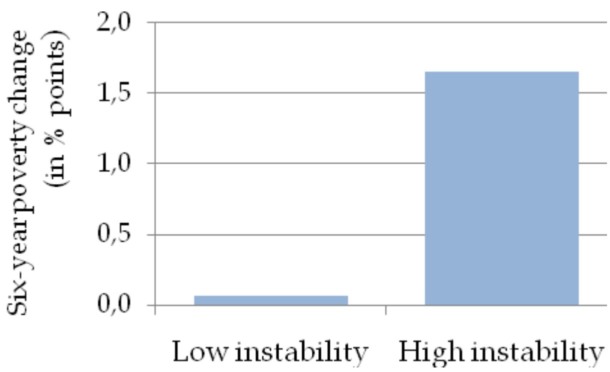
## 1 Introduction

The analysis of the determinants of poverty change across countries considers their impact through both the growth of income *per capita* and the change in distribution, the latter being generally measured by a Gini coefficient. The impacts of the change in these two variables have been shown to depend on their initial level (Bourguignon 2003; Heltberg 2004; Klasen and Misselhorn 2006). It might be a reason why so few cross-section studies have found evidence an impact of macroeconomic factors on poverty change. We argue in this paper that the instability of average income does matter.

Indeed, macroeconomic instability has been increasingly considered as a factor lowering average income growth and, in this way, a factor of slower poverty reduction. But it can also be a factor of slower poverty reduction for a given income growth. Here we argue that income volatility slows down poverty reduction because of the existence of poverty traps, often examined at the microeconomic level (for a review see Dercon 2006). While several micro-studies evidence the impact of shocks and vulnerability on poverty, this relationship is hardly considered at the macroeconomic level. This paper aims to fill in this gap. Using poverty data for about 85 countries, we find that income instability generally results in a lower reduction of poverty for a given growth of income.

Figures 1 and 2 illustrate the intuition behind the paper. Poverty increases more (or decreases less) when there is high instability (Figure 1). This relation, however, can come from the fact that instability negatively affects income growth, and, by this way, dampens the poverty reduction. To control for this correlation, Figure 2 divides the sample in four categories: observations are classified according to the income growth level (high or low, i.e., greater or lesser than the median) and to the instability level. In this sample, when income growth is low, there is poverty reduction, and conversely. More interestingly, in the case of low income growth, poverty increases more when instability is high. Also, in the case of high income growth, poverty decreases less when instability is high. These two points suggest that the negative impact of instability on poverty reduction is not necessarily driven through a lower income growth: it may be driven by a change in the income distribution.

Figure 1
Lower poverty reduction when income instability is higher.

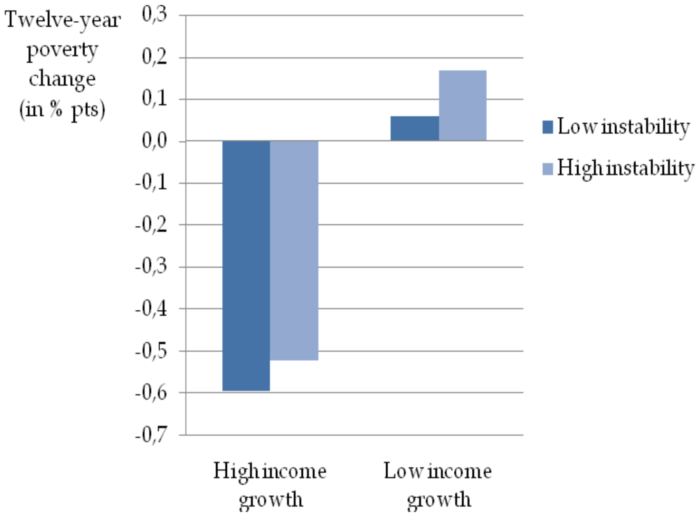



Note: Low/high instability means below/above the median observation of the sample.

Six-year poverty change means a relative change in the poverty headcount index during the six-year periods observed between 1981 and 2005.

Source: Authors' calculations.

Figure 2
Whatever the level of income growth,
poverty grows more (or is less reduced) when income instability is higher




.Note: Low/high means below/above the median observation of the sample

Twelve-year poverty change means a relative change in the poverty headcount index during the twelve-year periods observed between 1981 and 2005

Source: Authors' calculations.

The paper is organized as follows. The first section describes the ways by which instability may have an impact on poverty at the macro level. The second section develops a model of poverty change taking income instability into account. The third section presents some econometric estimates corresponding to this model. Finally, the last section summarizes the results and implications and suggests some further research in that field.

## 2 How income instability affects poverty change

Many works have examined the effects of income growth on poverty (Ravallion and Chen 1997; Bourguignon 2003; Dollar and Kraay 2002; Adams 2004; Heltberg 2004). But only few studies deal with the effects of income instability on poverty (see, however, Guillaumont, Korachais and Subervie 2008). Yet, the effect of shocks on poverty is often considered in the literature, in microeconomic literature, in particular: negative shocks on income increase the number of people below the poverty line, at least in the short term. Conversely, positive shocks do not result in a proportionate decrease in the extent of poverty (see, for example, De Janvry and Sadoulet 2000). For this reason, we are interested here in income instability, i.e., in the succession of positive and negative shocks of income. Instability so defined generally has two types of effects on income: *ex ante* risk effects, and *ex post* asymmetry effects due to different responses to the fall and rise of income (Guillaumont 2006). Asymmetry effects are of particular interest with regard to the impact on poverty, but both types of effects are at work through the two channels of transmission by which instability affects poverty: the growth channel and the income distribution channel.

## 2.1 Effects resulting from lower growth

Poor countries are often characterized by strong macroeconomic instability. This observation has led to a significant literature on the relation between instabilities and growth (for an overview see Guillaumont 2006). Several works have found evidence of the negative effect of income growth instability on income growth in general (Ramey and Ramey 1995; Hnatkovska and Loayza 2005; Norrbin and Pinar Yigit 2005; Aizenmann and Pinto 2005), but more particularly in Africa (Guillaumont, Guillaumont-Jeanneney and Brun 1999). The negative effects of instability on income growth are generally assumed to come from uncertainty and risk-aversion (*ex ante* effect). But they can also result from asymmetric responses to positive and negative shocks (*ex post* effect).

As income growth is a major factor of poverty reduction, income instability hurts the poor through its negative effect on income growth. Depending on the initial level of income distribution, a lower average income level leads to a higher percentage of population below a ‘poverty line’ (poverty headcount index), and conversely.

In this study, we mainly consider the effects of instability on poverty that do not result from a lower average income.[1] It means that the relation between instability and income growth is not re-examined *per se*. Focus is directed on the effects of instability on poverty which are channelled through income distribution.

## 2.2 Effects resulting from a change in income distribution

If income instability affects income distribution, it affects poverty for a given average income level. And it is reasonable to suppose that for a given income, growth instability affects income distribution and then poverty. This assumption relies on permanent asymmetrical effects of instability on the living conditions of the poor (people below the poverty line) and the ‘almost poor’ (people close to the poverty line). The poor and the ‘almost poor’ are particularly exposed to negative shocks and are, therefore, more vulnerable to the cyclical nature of growth than the rich. Indeed, during downward periods, quite poor and uninsured people may be pushed under the poverty line while during upward swings they may not be able to recover enough to return above the line. This corresponds to the underlying idea of the poverty trap.

Referring to microeconomic results (see, for example, Dercon 2006), Agénor (2002, 2004) as well as Laursen and Mahajan (2005), Guillaumont-Jeanneney and Kpodar (2005) examine the main reasons as to why the poor are more vulnerable than the non-poor: the poor have few diversified sources of income and they are less qualified and less mobile between sectors and areas. Likewise, they have little access to credit and insurance markets and they depend more on public transfers and social services.

Therefore, during a crisis, the poor and the ‘almost poor’ are the first people to suffer from shock induced decisions. For instance, they cannot easily smooth their consumption and subsequently their nutritional status (see Dercon and Krishnan 2000 for Ethiopia 1994-95), and parents may remove their children from school (see Thomas

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1 However, we take this effect into account in the last part in order to estimate the overall effect of income instability on poverty change.

et al. 2004 for Indonesia 1998). Furthermore, non-qualified workers are the first to be fired (Agénor 2002) and people may also sell their productive assets (Dercon 2006), to mention a few scenarios. The common point of all these events is that they are asymmetrical: they are not easily reversible once the crisis goes away.

These are the reasons why we hypothesize that crises push poor and ‘almost poor’ people into a poverty trap, whereas richer people may be better protected, and as such are less vulnerable to instability. Thus, the instability effect on income distribution is analysed as coming from two types of asymmetries: the asymmetry of responses to positive and negative shocks, and the asymmetry of reaction of different income groups to the falls and rises in income.

Despite these facts, only a few cross-country econometric analyses on the effects of income instability on the change in income distribution have been conducted (Breen and Garcìa-Peñalosa 2005; Laursen and Mahajan 2005). The analyses of instability effects among income groups show that the next to last quintile—rather than the last one—appears to be the most severely affected. We can therefore suppose that under unstable conditions the ‘almost poor’ may become the ‘durably poor’.

This last piece of information leads to the conclusion that income distribution in the presence of volatility does not respect the ‘log normality’ distribution assumption, as assumed by Bourguignon (2003) and Klasen and Misselhorn (2006). It follows that the impact of volatility on income distribution may not be fully captured through the change in the Gini coefficient. Indeed, the Gini coefficient is a relevant inequality index, but it is well known that it does not provide any information about the shape of the Lorenz curve. And, it follows from the observations quoted above that a likely result of instability is a change in the shape of the Lorenz curve (as illustrated by Figure A.1 in the Appendix): as instability affects the poor and the almost poor more than the rich, instability swells the left part of the Lorenz curve.

Subsequently, in order to explain how instability affects poverty reduction due to its impact on income distribution, we need to consider both the effects of income instability channelled by a change in the Gini coefficient as well as the effects channelled by a change in income distribution not reflected by the Gini coefficient.

In summary, macroeconomic instability can increase poverty in two ways: by reducing the average income growth and by making it more unequal. Moreover, such a rising inequality is not necessarily reflected in the change of the Gini coefficient.

## 3 Modelling the impact of income instability on poverty change

### 3.1 Sources of poverty data

Cross-country comparisons of poverty changes have been made possible by the work done at the World Bank, especially by Chen and Ravallion (2004, 2008). The data used in their paper are those collected through PovcalNet.[2] They come from 675

[2] We used PovcalNet data available in February 2009 at: www.iresearch.worldbank.org/PovcalNet/jsp/index.jsp.

socioeconomic sample surveys spanning 116 countries. An assessment is made from these surveys on how aggregate consumption or income is distributed across the population in each country at the date of each survey. Then the proportion of people who have not reached any given 'poverty line' is drawn from this theoretical distribution.

Since the surveys were not performed in the same years, they give the evolution of poverty over time periods that are neither of the same length nor related to the same years. Indeed, if income instability has an impact on poverty change, this impact is likely to depend on the length of the time period during which it occurs. Then poverty data are to be used on identical time periods, which leads to use data interpolated to non-survey years. The interpolation is done by the World Bank's research group: using national accounts data and census-based estimates of the population, they calculate, for each country and at each date, the total number of people living below various international poverty lines, as well as other poverty and inequality measures.[3,4] Here the poverty line is taken as US$1.25 a day in 2005 international prices.

One sample has been built from these data, and is composed by four six-year spells of poverty change: 1981-87, 1987-93, 1993-99 and 1999-2005. This sample of 85 countries and 337 observations allows a panel econometric study. The instability measure takes into account all shocks occurring during the six-year spells.

## 3.2 Income instability

The instability of a variable is always relative to a reference value. It is often measured by the standard deviation of the growth rate or preferably by the deviation from a trend.[5] The latter leads to the calculation of the trend value: insofar as the series may be neither purely deterministic, nor purely stochastic, the reference value is estimated from a mixed adjustment, combining at the same time a deterministic element and a stochastic element.[6] The indicator selected here is the average of the quadratic deviation relative to this mixed trend:[7]

$$\mathrm{Ins}_{\mathrm{quadra}} = 100\sqrt{\frac{1}{n+1}\sum_{t=0}^{n}\left(\frac{Y_t - \hat{Y}_t}{\hat{Y}_t}\right)^2}$$

where n = number of years during the period on which instability is calculated:

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3 See Chen and Ravallion (2004, 2008) for the details on the data sources and methods.

4 This may lead to underestimate the impact of instability which does not go through the change in the shape of the Lorenz curve.

5 The standard deviation is relative to the average growth rate, whereas the instabilities calculated here are relative to the trend.

6 This method is used in various works of the CERDI and has been chosen by the Committee for Development Policy, United Nations, for the measurement of the instability components of the Economic Vulnerability Index (UN 2005, 2008, Guillaumont 2009).

7 In this paper, income instability is calculated from a 'global trend', i.e., estimated using all the available observations from 1960 to 2006. An alternative instability measure is calculated from a 'smoothing 30-year trend', i.e., calculated from the observations of the thirty preceding years.

$$\hat{Y}_t = \exp\left(\dot{\ddot{\ln}}(\dot{Y})\right) \text{ and } \dot{\ddot{\ln}}(\dot{Y}_t) = \hat{a} + \hat{b}.\ln(Y_{t-1}) + \hat{c}.t$$

Y = GDP per capita, constant US dollars (Source: WDI 2008)

### 3.3 Basic factors determining the 'income elasticity of poverty': a parsimonious model

The incidence of poverty basically depends on the average level of income per capita and on the degree of income inequality. The latter is most often measured by the Gini coefficient. Thus the standard model of poverty change is a function of the respective changes of income per capita and Gini coefficient (Adams 2004). However the income elasticity of poverty (often named 'growth-elasticity of poverty') is arithmetically determined by the initial levels of income per capita and Gini coefficient: 'both a lesser level of development and a higher level of inequality reduce the growth-elasticity of poverty' (Bourguignon 2003).

Consequently, for given values of these initial levels, there is an expected level of the income elasticity of poverty. This expected elasticity is found to explain to a large extent the poverty change for a given growth of income per capita. Therefore, the model of poverty change must include the initial level of income and the initial Gini coefficient each multiplied both by the growth of income and the change in Gini coefficient. The model is then the following:

$$\frac{\Delta Pov}{Pov} = \alpha_0 + \beta_1.\frac{\Delta Y}{Y} + \beta_2.\frac{\Delta Y}{Y}.\frac{1}{Y_0} + \beta_3.\frac{\Delta Y}{Y}.G_0 + \gamma_1.\frac{\Delta G}{G} + \gamma_2.\frac{\Delta G}{G}.\frac{1}{Y_0} + \gamma_3.\frac{\Delta G}{G}.G_0 + \varepsilon \qquad (1)$$

where Pov represents the poverty headcount ratio, $\frac{\Delta Pov}{Pov}$ its relative variation,

Y the per capita income, $\frac{\Delta Y}{Y}$ the per capita income growth,

G the Gini coefficient, $\frac{\Delta G}{G}$ the Gini coefficient relative variation,

$Y_0$ the initial income per capita in log, $G_0$ the initial Gini coefficient.

Expected results: $\beta_1<0$, $\beta_2$ *and* $\beta_3>0$; $\gamma_1>0$, $\gamma_2$ *and* $\gamma_3<0$.

The reaction of poverty both to income and Gini changes is conditional to initial income (in log) and initial Gini coefficient. The absolute value of the income elasticity of poverty is higher the higher the initial income per capita and the lower the initial Gini coefficient. In the same way, the Gini elasticity of poverty is the higher the higher the initial income per capita and the lower the initial Gini coefficient are.

Since a low initial income per capita and a high Gini coefficient are the main factors of a high level of poverty, it is convenient in a more parsimonious model to replace these two variables by one single variable, the initial level of poverty (which then is multiplied by the rate of income growth and by the change in Gini coefficient). It also allows for a greater degree of freedom:

$$\frac{\Delta Pov}{Pov} = \alpha_0 + \chi_1.\frac{\Delta Y}{Y} + \chi_2.\frac{\Delta Y}{Y}.Pov_0 + \varphi_1.\frac{\Delta G}{G} + \varphi_2.\frac{\Delta G}{G}.Pov_0 + \eta \qquad (2)$$

$$\frac{\Delta \text{Pov}}{\text{Pov}} = \alpha_0 + (\chi_1 + \chi_2.\text{Pov}_0).\frac{\Delta \text{Y}}{\text{Y}} + (\varphi_1 + \varphi_2.\text{Pov}_0).\frac{\Delta \text{G}}{\text{G}} + \eta \quad (2')$$

where $\text{Pov}_0$ is the initial poverty headcount ratio.

Expected results: $\chi_1$<0, $\chi_2$>0; $\varphi_1$ >0, $\varphi_2$<0.

It simply means that the level of the per capita income elasticity of poverty depends on the initial level of poverty: its absolute level is expected to be the higher the lower is the initial level of poverty. In the same way the inequality elasticity of poverty is expected to be the higher the lower the initial level of poverty is.

### 3.4 An augmented model of poverty change

The advantage offered by an econometric estimation, in comparison to the arithmetic calculation of the expected elasticity, is that it allows us to capture the impact of variables or relationships not adequately reflected in the arithmetic model. Possible changes in income distribution not translated into a variation of the Gini coefficient are relationships to be considered. Income instability may lead to such changes, and this is the variable of which we want to estimate the impact.

Accordingly, in order to identify the effect of instability on poverty, we proceed in three steps. The first step focuses on the 'purely redistributional effect of instability' (the effect that acts neither through Gini change nor through income growth). The second looks at the way instability affects poverty through its overall effect on distribution: therein the impact of instability on the Gini coefficient is taken into account. The last step analyses the global effect of instability, taking into account the impact of instability on both Gini coefficient and per capita income growth.

#### *3.4.1 Purely redistributional effect of instability*

Two ways in which instability may affect income distribution are identified: one is the change in the Gini coefficient, the other one is a 'residual variable' likely to represent the effect of instability on income distribution which is not reflected by a change in the Gini coefficient. Indeed, income instability may weaken the assumption of log-normality of the income distribution: poor and 'almost poor' people may fall into the poverty trap while rich people may be well insured and stay rich. In order to assess the effect of instability on poverty through this latter effect on income distribution, income instability is introduced in the poverty model. It can be expected that this 'direct' effect of instability on poverty is itself dependent on the initial level of poverty, as is the reaction of poverty to the change in the Gini coefficient.[8] The model to estimate is then the following:

$$\frac{\Delta \text{Pov}}{\text{Pov}} = \alpha_0 + (\chi_1 + \chi_2.\text{Pov}_0).\frac{\Delta \text{Y}}{\text{Y}} + (\varphi_1 + \varphi_2.\text{Pov}_0).\frac{\Delta \text{G}}{\text{G}} + (\lambda_1 + \lambda_2.\text{Pov}_0).\text{INSY} + \upsilon \quad (3)$$

where INSY represents income instability during the spell.

Expected results: $\chi_1$<0, $\chi_2$>0; $\varphi_1$ >0, $\varphi_2$<0; $\lambda_1$ >0, $\lambda_2$<0.

[8] The higher the initial poverty level, the less the income instability is expected to increase poverty. On the contrary, if the initial poverty level is medium, then there is a more important part of 'almost poor' people, and therefore the part of people likely to fall in the poverty trap is greater.

*3.4.2 Overall distributional effect of instability*

Next, we estimate the total effect of instability on poverty change *via* its overall effect on income distribution. Following previous findings in the literature, the change in Gini coefficient is assumed to be influenced by instability:

$$\frac{\Delta G}{G} = \delta_0 + \delta_1.\text{INSY} + \text{net}\left(\frac{\Delta G}{G}\right) \tag{4}$$

Here, $\text{net}\left(\frac{\Delta G}{G}\right)$ is the residual of the equation. It represents the Gini change which does not result from instability. Then (4) is introduced in (3):

$$\begin{aligned}\frac{\Delta \text{Pov}}{\text{Pov}} &= \alpha_0 + (\chi_1 + \chi_2.\text{Pov}_0).\frac{\Delta Y}{Y} \\ &+ (\varphi_1 + \varphi_2.\text{Pov}_0).\left[\delta_0 + \delta_1.\text{INSY} + \text{net}\left(\frac{\Delta G}{G}\right)\right] \\ &+ (\lambda_1 + \lambda_2.\text{Pov}_0).\text{INSY} + \upsilon\end{aligned} \tag{5}$$

That gives the model to estimate:

$$\begin{aligned}\frac{\Delta \text{Pov}}{\text{Pov}} &= (\alpha_0 + \varphi_1.\delta_0) + \varphi_2.\delta_0.\text{Pov}_0 \\ &+ (\chi_1 + \chi_2.\text{Pov}_0).\frac{\Delta Y}{Y} \\ &+ (\varphi_1 + \varphi_2.\text{Pov}_0).\text{net}\left(\frac{\Delta G}{G}\right) \\ &+ ((\lambda_1 + \varphi_1.\delta_1) + (\lambda_2 + \varphi_2.\delta_1).\text{Pov}_0).\text{INSY} + \upsilon\end{aligned} \tag{6}$$

$$\frac{\Delta \text{Pov}}{\text{Pov}} = \psi_0 + \psi_1.\text{Pov}_0 + (\psi_2 + \psi_3.\text{Pov}_0).\frac{\Delta Y}{Y} + (\psi_4 + \psi_5.\text{Pov}_0).\text{net}\left(\frac{\Delta G}{G}\right) + (\psi_6 + \psi_7.\text{Pov}_0).\text{INSY} + \upsilon \tag{6′}$$

Note that compared to (3) the coefficient of the Gini change is not modified. But the coefficient of instability is increased since it now captures the total distributional impact of instability and not only that which is channelled through the Gini change.[9]

*3.4.3 Global effect including both distributional and growth effect of instability*

The last model estimates the global effect of instability on poverty change, considering its impact on both Gini change and income growth. Remembering the negative effect of instability on income growth, we write:

$$\frac{\Delta Y}{Y} = \kappa_0 + \kappa_1.\text{INSY} + \text{net}\left(\frac{\Delta Y}{Y}\right) \tag{7}$$

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[9] Another way to underline the distributional effects of income instability could be to estimate the effects of income instability on revenue quartiles, as already done by Breen and Garcìa-Peñalosa (2005). However, since poverty lines do not correspond, depending on the country, to the same quartiles, there would still be uncertainty regarding the distributional effects of instability on poverty.

Here, $\text{net}\left(\frac{\Delta Y}{Y}\right)$ is the residual of the equation and also represents the income growth net effect of instability.[10] Equation (7) being introduced in (6), the model to estimate is:

$$\begin{aligned}\frac{\Delta \text{Pov}}{\text{Pov}} = & \left(\alpha_0 + \varphi_1.\delta_0 + \chi_1.\kappa_0\right) + \left(\varphi_2.\delta_0 + \chi_2.\kappa_0\right).\text{Pov}_0 \\ & + \left(\chi_1 + \chi_2.\text{Pov}_0\right).\text{net}\left(\frac{\Delta Y}{Y}\right) \\ & + \left(\varphi_1 + \varphi_2.\text{Pov}_0\right).\text{net}\left(\frac{\Delta G}{G}\right) \\ & + \left(\left(\lambda_1 + \varphi_1.\delta_1 + \chi_1.\kappa_1\right) + \left(\lambda_2 + \varphi_2.\delta_1 + \chi_2.\kappa_1\right).\text{Pov}_0\right).\text{INSY} + \upsilon\end{aligned} \quad (8)$$

$$\frac{\Delta \text{Pov}}{\text{Pov}} = \zeta_0 + \zeta_1.\text{Pov}_0 + \left(\zeta_2 + \zeta_3.\text{Pov}_0\right).\text{net}\left(\frac{\Delta Y}{Y}\right) + \left(\zeta_4 + \zeta_5.\text{Pov}_0\right).\text{net}\left(\frac{\Delta G}{G}\right) + \left(\zeta_6 + \zeta_7.\text{Pov}_0\right).\text{INSY} + \upsilon \quad (8')$$

# 4 Econometric results

## 4.1 Descriptive statistics

As mentioned before, the poverty data used are collected from PovcalNet (World Bank). A sample of four six-year spells is built, between 1981 and 2005; this panel is not balanced.

Appendix Table A.1 gives the statistical description of the variables in the sample. Some heterogeneity can be noted. For instance, looking at the poverty headcount: about 90 per cent of the population lives on less than US$1.25 (in PPP) in Guinea whereas the same applies for less than 2 per cent in Peru (both before 1990). It also shows a large heterogeneity in poverty relative change: one can see that the mean of this variable is near 0 (-10 per cent), but that the maximum is +211 per cent (Peru, 1987-1993) and the minimum -166 per cent (Jamaica, 1999-2005).

Heterogeneity is also observed in levels of income instability. The mean level of *INSY* is around 4 per cent in the two samples. The maxima observed correspond to the Liberia conflict and to the Rwanda genocide and, respectively, attaining 37 per cent and 18 per cent during the period 1993-99. Appendix Table A.2 also lists the countries in a two twelve-year spells sample, sorted according to their level of income instability.

## 4.2 Traditional factors of poverty change

This part corresponds to the estimates of the standard model of poverty[11] and of a ‘parsimonious’ model which takes Bourguignon (2003) specification into account (model (2)). Appendix Table A.3 gives the estimates of these models, with two different estimators (*WITHIN* and *GMM-System*) which allow to control for unobservable fixed effects over time. The *GMM-System* estimator also allows treating the potential

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[10] Model (7) is an oversimplified model estimating the effects of instability on growth, and more complete models could be considered; however, its introduction just aims at remembering that instability does affect poverty also through economic growth, and that its impact on poverty reduction is more important when considering all channels of transmission.

[11] The standard model of poverty is assumed to be: $\frac{\Delta \text{Pov}}{\text{Pov}} = \alpha_0 + \alpha_1.\frac{\Delta Y}{Y} + \alpha_2.\frac{\Delta G}{G} + \eta$

endogeneity of variables and then completes the main analysis. The results are quite similar comparing the estimators, and the main estimates are:

For the standard model:

- Income elasticity of poverty = -0.7 to -1.2
- Gini elasticity of poverty = 0 to +1.1

For the 'parsimonious augmented' model (model (2)), which takes into account the initial level of poverty): using the *GMM-System* estimator,

- income elasticity of poverty is -3.2 for an initial poverty level of 10 per cent, and -1.3 for an initial level of 50 per cent.
- Gini elasticity of poverty is 4.8 for an initial poverty level of 10 per cent, and 1.6 for an initial level of 50 per cent.

In summary, income growth and Gini change have a non-linear effect on poverty change, which significantly depends on the initial poverty level. In what follows, in order to take this effect into account we always refer to the augmented version of the standard model as expressed in model (2).

### 4.3 The effect of instability on poverty change

The following estimates (Tables A.4 and A.6) add, as an explaining variable, income instability (additively and multiplied by the initial poverty level in order to take the non linear effect of instability on poverty change into account). Coefficients and significances of the standard variables (income growth and Gini change) are not affected by this introduction.

#### *4.3.1 The purely redistributional effect of instability*

Appendix Table A.4 estimates model (3) with the *WITHIN* and *GMM-System* estimators. Income instability is positive in both cases, and significant only with the *GMM-System* estimator, at 10 per cent. Table 1 gives the marginal effects of income instability according to the different estimates: according to the *GMM-System* estimates, one percentage point of income instability increases the poverty change by 5.9 percentage points, *i.e.* increases the poverty level by 5.9 per cent. To be recalled, in this model the change of the Gini coefficient is a significant control variable, although it is likely to be affected by instability. It captures the impact of all factors affecting poverty through the change in Gini coefficient which includes the likely effects of instability.

#### *4.3.2 The overall distributional effect of instability*

To assess all the distributional effects of instability, Appendix Table A.6 gives the estimates of model (6) where the change of the Gini coefficient is introduced net of the effect of income instability.[12] The coefficient of income instability then represents the effect of income instability on poverty change *via* its overall effect on inequality.

[12] Appendix Table A.5 gives the estimates of the effect on income instability on Gini change. It shows that income instability has a positive and significant effect on Gini change with the GMM-System estimator. The residuals of the OLS estimates are then introduced in model (6) as "Gini change net of instability'.

Stronger effects of instability appear. According to the *WITHIN* estimator, if income instability increases by one percentage point during a six-year period, then poverty change increases by 3.7 percentage points on average over the same period (Table 1). This is more than double the result when the *GMM-System* estimator is considered, which is better as it controls for potential endogeneity: in this case, poverty change increases by 8.6 percentage points on average, i.e., the poverty level increases by 8.6 per cent because of the distributional effects of instability. This effect is non-linear since the coefficient of the 'instability x poverty' multiplicative variable is significant: the effect is all the weaker the higher the initial level of poverty is. Table 2 gives the effect of instability on the poverty level for different initial levels of poverty. According to the *GMM-system* estimates, if the initial poverty level is 10 per cent, the overall distributional effect is such that an additional percentage point of instability increases the poverty level by about 0.9 percentage point (i.e., the poverty level grows from 10 per cent to 10.9 per cent); if the initial poverty level is 30 per cent, instability makes the poverty level higher by about 2.6 percentage points; if the initial poverty level is 50 per cent, instability makes the poverty level higher by about 4.3 percentage points.

### *4.3.3 The global effect of instability, including both distributional and growth effects*

Finally, to take into account the total effect of instability, i.e., the effect resulting from both changes in the distribution and a lower growth, Appendix Table A.6 also estimates model (8): Gini change and income growth variables are both net of the effects of income instability.[13] Therefore, the coefficient of income instability represents the global effect of income instability on poverty change through both its effect on inequalities and on income. As expected the effect of income instability appears much more important: it is positive and significant with the two estimators.

Moreover, the interactive variable is always negative and significant and, as in the previous model, the lower the initial poverty level, the greater is the effect of income instability on poverty change (Tables A.6 and 2). Considering the *GMM-System* estimates, the total effect of one percentage point of instability increases the poverty level by about 1.2 percentage points for an initial 10 per cent poverty level. For an initial level of 30 per cent, instability raises the poverty level by about 2.7 percentage points, and for an initial level of 50 per cent, it raises the poverty level by only 2.9 percentage points.

Table 1
Marginal effect of one % point increase of income instability
on the six-year rate of poverty change, for an average initial poverty level

| Estimator | Purely redistributional effect of instability | Overall distributional effect of instability | Global effect of instability |
|---|---|---|---|
| *WITHIN* | 0.00 | 3.65 | 4.37 |
| *GMM-System* | 5.87 | 8.62 | 7.48 |

Notes: Calculations made from results available in Appendix Tables A.4 and A.6, using the average initial poverty level of the sample. Tips for reading. Example of 1st line, 2d column: If instability increases by one percentage point, the poverty change increases by 3.65 percentage points (through its effect on distribution).

[13] Appendix Table A.5 also gives the estimates of the effect on income instability on income growth. It shows that income instability has a negative and significant effect on income growth. This is observed with the two samples used. We use the OLS estimates to calculate "Income growth net of instability' and then to introduce it in model (8).

Table 2
Effect of one % point increase of income instability
on the poverty level (in % points)

| Initial poverty level | Estimator | Purely redistributional effect of instability | Overall distributional effect of instability | Global effect of instability |
|---|---|---|---|---|
| 10% | *WITHIN* | 0.00 | 0.37 | 0.67 |
| | *GMM-System* | 0.59 | 0.86 | 1.20 |
| 30% | *WITHIN* | 0.00 | 1.10 | 1.54 |
| | *GMM-System* | 1.76 | 2.59 | 2.67 |
| 50% | *WITHIN* | 0.00 | 1.83 | 1.76 |
| | *GMM-System* | 2.94 | 4.31 | 2.94 |

### *4.3.4 Robustness check: alternative measures of instability*

Appendix Table A.7 gives the estimates of models (6) and (8) using different measures of instability: one is calculated from a 30-year rolling trend (whereas instability in the main estimates is calculated from a global trend, cf. sub-section 0 and footnote 5), the second one is measured by the standard deviation of income growth. The given results come from *GMM-System* estimates, but the *WITHIN* estimator gives comparable results. All in all, the results are similar with these two different measures of income instability: instability leads to higher poverty whatever the initial level of poverty, although this effect still decreases with the initial level.

### *4.3.5 Distributional effect versus growth effect*

A way in which the income growth effect can be roughly compared with the distributional effect of instability is to apply the method already used by Mo (2001) which gives an order of magnitude of the relative effects of variables. It consists of measuring the respective impact by multiplying the regression coefficients of instability on the intermediate variables (Gini change and income growth) by the regression coefficients of these intermediate variables on poverty. According to the *GMM-system* estimates (Table 3), the distributional effect of instability on poverty change accounts for 63 per cent of the total effect of income instability (of which only 15 per cent correspond to a change in the Gini coefficient), whereas the ‘income growth’ effect of instability accounts for 37 per cent.[14]

Mo’s method (2001) might be weakened by autocorrelation errors. In order to consolidate previous findings, models (3), (4) and (7) are simultaneously estimated with a *SUR* estimator (Appendix Table A.8). The global effect of income instability on poverty change is lower than with the other estimates: the effect through income growth is divided by three and there is no effect of income instability on the Gini change. However, the distributional effect still accounts for a large share, as a similar ‘purely redistributional effect’ of income instability is found compared to previous estimates: the shares attributed to the growth effect and to the distributional effect are about 50 per cent-50 per cent (Appendix Table A.8).

[14] We can also calculate these effects from the *SUR* estimates (Tables A.8): most of time, the shares attributed to the income growth effect and to the distributional effect are 50 per cent-50 per cent.

Table 3
Relative contributions of the growth effect and the distributional effect of income instability on poverty change

<table>
<tr><th>Effects of INSY</th><th>X</th><th>Effect of INSY on X<br>β</th><th>Effect of X on Pov. chge<br>α</th><th>Total effect<br>α*β</th><th>Share</th><th></th><th></th></tr>
<tr><td>Indirect effect through:</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td></td><td>-Income growth</td><td>-3.11</td><td>-1.47</td><td>4.56</td><td>37%</td><td>37%</td><td>Income growth effect of INSY</td></tr>
<tr><td></td><td>-Gini rel. change</td><td>0.66</td><td>2.84</td><td>1.87</td><td>15%</td><td rowspan="2">63%</td><td rowspan="2">Distributional effect of INSY</td></tr>
<tr><td>Purely redistributional effect</td><td></td><td></td><td></td><td>5.87</td><td>48%</td></tr>
<tr><td>Global effect</td><td></td><td></td><td></td><td>12.31</td><td>100%</td><td>100%</td><td>Global effect of INSY</td></tr>
</table>

Notes: *INSY* represents income instability. All calculations are based on the estimates of Equations (3), (4) and (7) (cf. *GMM-System* estimates in Appendix Tables A.4 and A.5). They are calculated at the average initial poverty level observed in the sample.

To sum up, the hypothesis that income instability contributes to increased poverty by increasing inequalities as well as by lowering income growth is not rejected. Second, the distributional effect of instability on poverty is not fully captured by the effect on the Gini coefficient.

### *4.3.6 LICs versus MICs*

As is suggested by these estimates, income instability has a greater distributional incidence on poverty change when the initial poverty level is lower. Indeed, in this case, the portion of the 'almost poor' people is greater than in high poverty countries where more people are already below the poverty line. It follows that income instability has a greater distributional effect on poverty in middle-income countries (MICs) than in low-income countries (LICs). Appendix Table A.9 suggests that the impact of income instability on poverty change tends to be more important in MICs than in LICs. In low income countries, where the initial level of poverty is high, the effect of instability on poverty is probably channelled mainly through a lower growth.

## 5 Conclusion, implications for aid effectiveness and further research

We have argued that income instability is likely to affect poverty change beyond its acknowledged effect on income growth. It does so by affecting income distribution, because of asymmetrical responses of the poor and the almost poor to negative and positive average income shocks.

As the almost poor are more likely to suffer from the ups and downs in income than richer people, income instability may involve stronger inequalities, which are a factor of increasing poverty. The econometric analysis gives significant results evidencing the relation between income instability and poverty change, reinforcing other findings about the effects of income instability on under-five mortality (Guillaumont, Korachais and Subervie 2008, 2010).

Income instability slows down poverty reduction not only because it affects income growth, but because it has a major effect through income distribution. Moreover, this distributional effect does not only occur through the Gini coefficient change: it has an additional and purely redistributional effect on poverty change not captured by the Gini coefficient. The poverty effect of income instability is thus greater when looking at the overall income distribution effect.

It has to be kept in mind that instability has also a significant impact on the average rate of growth, which is the main determinant of poverty reduction. The econometric analysis consistently shows a larger global impact of instability on poverty change when both the distributional and the growth effects are taken into account.

Finally the effect of instability on the change of poverty headcount index has been found to be less important in low-income countries than in middle-income countries. Indeed, the effect of instability on poverty change depends on the initial poverty level, since in LICs the part of people living below the poverty line (who cannot fall below the line) is higher. In contrast, MICs have a higher share of people above the poverty line and subsequently the probability of observing people sliding into the poverty trap is higher. On the other hand, income instability may have a negative impact on the already poor people, which could be captured with the poverty gap.

The present findings have a major implication for aid effectiveness. In other papers, it has been established that aid is more effective in countries vulnerable to exogenous shocks, because it dampens their negative effect on growth: the stabilizing impact of aid is a main factor of its effectiveness for growth (Chauvet and Guillaumont 2004, 2009; Guillaumont and Chauvet 2001). According to the argument developed in this paper, if aid has a stabilizing impact on growth, it may lead not only to enhancing the average rate of growth, but also to making the growth more pro-poor. Through these two channels, it can contribute to poverty reduction, a hypothesis not rejected by preliminary tests not included in this paper.

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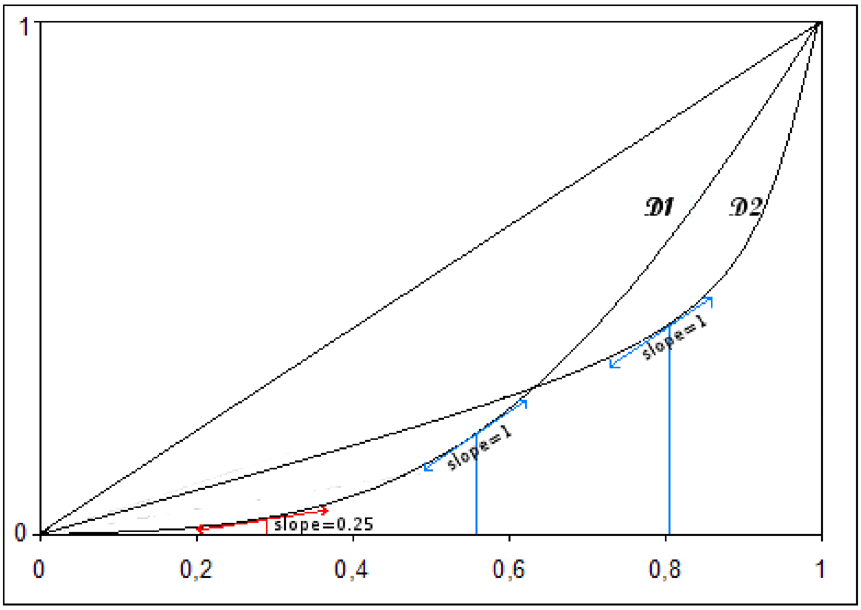
## Appendix I: For a given Gini coefficient, income instability may result in a move of the Lorenz curve

Appendix Figure A.1
For a given Gini coefficient,
income instability may result in a move of the Lorenz curve




Let us consider a country, with a given average income per capita and a given Gini coefficient. This country can evidence different income distributions, according to its income instability. Lorenz curves D1 and D2 are two of these possible distributions. We suppose that D1 corresponds to high income instability, D2 to a lower instability.

Let us imagine that the poverty line is at about 25 per cent of the average income. We can observe from this graph that there is no 'poor' in D2 (the slope of the curve is never below 0.25), whereas, in D1, about 30 per cent of population exhibit an income which is under the poverty line. Therefore, for a given income per capita and Gini coefficient, we observe different proportions of poverty.

In this paper, we argue that income instability pushes the 'almost poor' people into a poverty trap. Graphically, income instability makes the income distribution passing from a D2 configuration to a D1 configuration—*ceteris paribus*.

## Appendix II: Empirical results: descriptive statistics and econometric analysis

Appendix Table A.1
Descriptive statistics

| | $\frac{\Delta Pov}{Pov}$ | *Pov* | $\frac{\Delta Y}{Y}$ | *Y* | $\frac{\Delta G}{G}$ | *G* |
|---|---|---|---|---|---|---|
| Mean | -10.52% | 39.45% | 5.65% | 103.74% | -0.02% | 46% |
| Std dev. | 43.93% | 27.08% | 22.76% | 77.48% | 8.34% | 10% |
| Min | -165.82% | 0.56% | -93.59% | 15.09% | -27.28% | 23% |
| | *Jamaica 1999-2005* | *Peru 1987-93* | *Honduras 1981-87* | *Guinea 1987-93* | *Kenya 1993-99* | *China 1981-87* |
| Max | 211.02% | 92.35% | 115.82% | 414.62% | 38.77% | 74% |
| | *Peru 1987-93* | *Guinea 1987-93* | *Guinea 1987-93* | *Chile 1999-2005* | *Liberia 1981-87* | *Namibia 1981-2005* |

| | *INSY* | *INSY2* | *INSY3* | *SSA* | *LICs* |
|---|---|---|---|---|---|
| Mean | 3.80% | 3.85% | 3.68% | 53% | 54% |
| Std dev. | 3.35% | 3.28% | 3.54% | 50% | 50% |
| Min | 0.33% | 0.73% | 0.26% | | |
| | *Swaziland 1993-99* | *Jamaica 1999-2005* | *Swaziland 1993-99* | | |
| Max | 36.82% | 43.54% | 39.10% | | |
| | *Liberia 1993-99* | *Liberia 1993-99* | *Liberia 1993-99* | | |

With:

*Pov* Poverty headcount (% of population);

*INSY* Income instability, as explained in the text, section 2.2;

*INSY2* Income instability measured from a 30-year smoothing trend to estimate the reference value;

*INSY3* Income instability measured as the standard deviation of income growth;

*Y* Average monthly per capita income/consumption expenditure in 1993 international prices;

*G* Gini coefficient (comprised between 0 and 100%);

*SSA* Sub-Saharan African countries (dummy equals 1 if the country is a sub-Saharan African country);

*LICs* Low-income countries (dummy equals 1 if the country is a low-income country);

$\frac{\Delta Pov}{Pov}$ Relative poverty change;

$\frac{\Delta Y}{Y}$ Relative income change (income growth rate);

$\frac{\Delta G}{G}$ Relative Gini change.

Appendix Table A.2
List of countries sorted by decreasing income instability level in a sample of twelve-year spells

| Country | Years | % | Country | Years | % | Country | Years | % |
|---|---|---|---|---|---|---|---|---|
| Liberia | 1993-05 | 29.2 | Burundi | 1993-05 | 4.2 | Cameroon | 1993-05 | 2.7 |
| Liberia | 1981-93 | 19.6 | Costa Rica | 1981-93 | 4.1 | Gambia, The | 1981-93 | 2.6 |
| Rwanda | 1993-05 | 13.0 | Morocco | 1981-93 | 4.0 | Uganda | 1981-93 | 2.6 |
| Chad | 1993-05 | 9.9 | Haiti | 1981-93 | 4.0 | Namibia | 1981-93 | 2.6 |
| Sierra Leone | 1993-05 | 9.5 | Dominican Rep | 1981-93 | 4.0 | Senegal | 1993-05 | 2.6 |
| Guinea-Bissau | 1993-05 | 9.3 | Botswana | 1981-93 | 3.9 | Mozambique | 1993-05 | 2.6 |
| Chad | 1981-93 | 9.0 | Jamaica | 1981-93 | 3.8 | Burkina Faso | 1993-05 | 2.5 |
| St. Lucia | 1981-93 | 9.0 | Madagascar | 1981-93 | 3.8 | Gambia, The | 1981-93 | 2.5 |
| Angola | 1981-93 | 8.7 | Benin | 1981-93 | 3.8 | Colombia | 1993-05 | 2.5 |
| Angola | 1993-05 | 8.7 | Congo, Rep. | 1993-05 | 3.7 | Comoros | 1993-05 | 2.5 |
| Iran | 1981-93 | 7.7 | Burkina Faso | 1981-93 | 3.7 | Chile | 1993-05 | 2.5 |
| Ethiopia | 1981-93 | 7.7 | Nicaragua | 1993-05 | 3.7 | Jamaica | 1993-05 | 2.4 |
| Mozambique | 1981-93 | 7.6 | Guyana | 1993-05 | 3.6 | Paraguay | 1993-05 | 2.4 |
| Peru | 1981-93 | 7.5 | Lesotho | 1993-05 | 3.6 | Cape Verde | 1993-05 | 2.3 |
| Congo, Rep. | 1981-93 | 7.3 | China | 1981-93 | 3.5 | Honduras | 1981-93 | 2.3 |
| Cameroon | 1981-93 | 7.0 | Niger | 1993-05 | 3.5 | Costa Rica | 1993-05 | 2.3 |
| Rwanda | 1981-93 | 6.8 | Thailand | 1981-93 | 3.5 | Kenya | 1981-93 | 2.2 |
| Gabon | 1981-93 | 6.8 | Iran | 1993-05 | 3.5 | Panama | 1993-05 | 2.2 |
| Togo | 1993-05 | 6.5 | Bolivia | 1981-93 | 3.5 | Honduras | 1993-05 | 2.2 |
| Venezuela | 1993-05 | 6.3 | Peru | 1993-05 | 3.4 | Namibia | 1993-05 | 2.1 |
| Sierra Leone | 1981-93 | 6.3 | Paraguay | 1981-93 | 3.4 | Egypt | 1981-93 | 2.1 |
| Congo, DR | 1981-93 | 6.1 | Cote d'Ivoire | 1981-93 | 3.4 | Yemen, Rep. | 1993-05 | 2.1 |
| Malawi | 1993-05 | 6.1 | Algeria | 1981-93 | 3.4 | India | 1981-93 | 1.9 |
| Suriname | 1981-93 | 6.1 | Gabon | 1993-05 | 3.3 | Philippines | 1993-05 | 1.9 |
| Togo | 1981-93 | 6.0 | Suriname | 1993-05 | 3.3 | South Africa | 1993-05 | 1.9 |
| Niger | 1981-93 | 6.0 | Mali | 1993-05 | 3.3 | El Salvador | 1993-05 | 1.8 |
| Mongolia | 1981-93 | 5.9 | Central Af. Rep | 1993-05 | 3.3 | Cambodia | 1993-05 | 1.8 |
| Guyana | 1981-93 | 5.9 | Mauritania | 1993-05 | 3.3 | Pakistan | 1993-05 | 1.8 |
| Mali | 1981-93 | 5.9 | Mexico | 1981-93 | 3.3 | Kenya | 1993-05 | 1.8 |
| Papua N.G. | 1981-93 | 5.8 | Haiti | 1993-05 | 3.3 | Tunisia | 1993-05 | 1.7 |
| Nigeria | 1981-93 | 5.8 | Ecuador | 1993-05 | 3.3 | Pakistan | 1981-93 | 1.7 |
| Panama | 1981-93 | 5.7 | Lesotho | 1981-93 | 3.2 | Uganda | 1993-05 | 1.7 |
| Congo, DR | 1993-05 | 5.7 | Zambia | 1981-93 | 3.2 | Nepal | 1993-05 | 1.7 |
| Papua N.G. | 1993-05 | 5.6 | Senegal | 1981-93 | 3.2 | Brazil | 1993-05 | 1.7 |
| Nicaragua | 1981-93 | 5.5 | Lao PDR | 1981-93 | 3.1 | China | 1993-05 | 1.7 |
| Chile | 1981-93 | 5.2 | Mexico | 1993-05 | 3.1 | India | 1993-05 | 1.6 |
| Indonesia | 1993-05 | 5.2 | Jordan | 1993-05 | 3.1 | Bhutan | 1993-05 | 1.6 |
| Ethiopia | 1993-05 | 4.9 | St. Lucia | 1993-05 | 3.1 | Sri Lanka | 1981-93 | 1.6 |
| Bhutan | 1981-93 | 4.9 | Côte d'Ivoire | 1993-05 | 3.1 | Colombia | 1981-93 | 1.5 |
| Thailand | 1993-05 | 4.9 | Ecuador | 1981-93 | 3. 0 | Djibouti | 1993-05 | 1.5 |
| Central Af. Rep | 1981-93 | 4.8 | Tunisia | 1981-93 | 3. 0 | Bolivia | 1993-05 | 1.5 |
| Madagascar | 1993-05 | 4.7 | Guatemala | 1981-93 | 3. 0 | Benin | 1993-05 | 1.3 |
| Malawi | 1981-93 | 4.6 | Malaysia | 1981-93 | 3. 0 | Guinea | 1981-93 | 1.2 |
| Venezuela, RB | 1981-93 | 4.6 | South Africa | 1981-93 | 2.9 | Vietnam | 1993-05 | 1.1 |
| El Salvador | 1981-93 | 4.6 | Algeria | 1993-05 | 2.9 | Tanzania | 1993-05 | 1.1 |
| Zambia | 1993-05 | 4.5 | Nigeria | 1993-05 | 2.9 | Bangladesh | 1981-93 | 1.1 |
| Guinea-Bissau | 1981-93 | 4.5 | Comoros | 1981-93 | 2.8 | Egypt | 1993-05 | 1.0 |
| Burundi | 1981-93 | 4.5 | Mongolia | 1993-05 | 2.8 | Sri Lanka | 1993-05 | 1.0 |
| Philippines | 1981-93 | 4.4 | Nepal | 1981-93 | 2.8 | Guinea | 1993-05 | 1.0 |
| Ghana | 1981-93 | 4.3 | Dominican Rep | 1993-05 | 2.8 | Guatemala | 1993-05 | 0.9 |
| Swaziland | 1981-93 | 4.3 | Cape Verde | 1981-93 | 2.7 | Vietnam | 1981-93 | 0.9 |
| Morocco | 1993-05 | 4.3 | Indonesia | 1981-93 | 2.7 | Lao PDR | 1993-05 | 0.8 |
| Malaysia | 1993-05 | 4.3 | Mauritania | 1981-93 | 2.7 | Ghana | 1993-05 | 0.8 |
| Brazil | 1981-93 | 4.3 | Botswana | 1993-05 | 2.7 | Swaziland | 1993-05 | 0.7 |
| | | | | | | Bangladesh | 1993-05 | 0.6 |

Appendix Table A.3
Parsimonious model of poverty change: standard and augmented versions

| Estimator | *WITHIN* | | *GMM-Sys* | |
|---|---|---|---|---|
| Column | 1 | 2 | 3 | 4 |
| Income growth | -1.20***<br>(10.17) | -2.44***<br>(10.51) | -0.65*<br>(1.86) | -3.65***<br>(3.50) |
| Income growth * $Pov_0$ | | 2.52***<br>(7.03) | | 4.63***<br>(2.80) |
| Relative Gini change | 1.14***<br>(3.24) | 3.80***<br>(6.03) | 3.20<br>(1.06) | 5.54**<br>(2.46) |
| Relative Gini change * $Pov_0$ | | -4.86***<br>(5.29) | | -7.84**<br>(2.23) |
| Constant | -0.03*<br>(1.83) | -0.05***<br>(3.89) | -0.07*<br>(1.80) | -0.06***<br>(2.97) |
| Observations | 337 | 337 | 337 | 337 |
| Countries | 85 | 85 | 85 | 85 |
| Adjusted $R^2$ | 31% | 61% | | |
| AR(1) | | | 0.076 | 0.004 |
| AR(2) | | | 0.200 | 0.921 |
| Sargan p-value | | | 0.048 | 0.413 |
| Hansen p-value | | | 0.073 | 0.425 |

Notes: Absolute robust t-stats or z-stats in parentheses. * significant at 10%; ** 5%; *** 1%;
Dependent variable: Poverty relative change. $Pov_0$ is the initial poverty headcount;
Random effects estimates have also been done: they give similar results to *OLS* estimates.

Appendix Table A.4
A model of poverty change including income instability

| Estimator | *WITHIN* | *GMM-Sys* |
|---|---|---|
| Column | 1 | 2 |
| Income growth | -2.38***<br>(9.54) | -3.55***<br>(3.63) |
| Income growth * $Pov_0$ | 2.46***<br>(6.44) | 5.28***<br>(3.22) |
| Relative Gini change | 3.82***<br>(5.93) | 6.07***<br>(3.84) |
| Relative Gini change * $Pov_0$ | -4.86***<br>(5.20) | -8.19***<br>(3.53) |
| *INSY* | 3.07<br>(1.49) | 5.87*<br>(1.73) |
| *INSY* * $Pov_0$ | -3.14<br>(1.19) | -5.48<br>(1.49) |
| Constant | -0.12***<br>(3.01) | -0.22**<br>(2.40) |
| Observations | 323 | 323 |
| Countries | 84 | 84 |
| Adjusted $R^2$ | 59% | |
| AR(1) | | 0.011 |
| AR(2) | | 0.991 |
| Sargan p-value | | 0.714 |
| Hansen p-value | | 0.361 |

Notes: Absolute robust t-stats or z-stats in parentheses. * significant at 10%; ** 5%; *** 1%.
Dependent variable: Poverty relative change. $Pov_0$ is the initial poverty headcount.

Appendix Table A.5
Calculations of Gini change and of income change 'net of instability effect'

| Dependent variable | Gini change | | Income change | |
|---|---|---|---|---|
| Estimator | *OLS* | *GMM-Sys* | *OLS* | *GMM-Sys* |
| Column | 1 | 2 | 3 | 4 |
| *INSY* | 0.08<br>(0.64) | 0.66*<br>(1.74) | -1.63***<br>(3.12) | -3.11*<br>(1.79) |
| Constant | 0.01<br>(0.75) | -0.02<br>(1.07) | 0.12***<br>(5.26) | 0.18***<br>(2.58) |
| Observations | 397 | 397 | 397 | 397 |
| Adjusted $R^2$ | 0% | | 4% | |
| AR(1) | | 0.000 | | 0.000 |
| AR(2) | | 0.701 | | 0.011 |
| Sargan p-value | | 0.166 | | 0.000 |
| Hansen p-value | | 0.394 | | 0.043 |
| Instruments | | Time dummies,<br>One lag | | Time dummies,<br>Two lags |

Notes: Absolute robust t-stats or z-stats in parentheses. * significant at 10%; ** 5%; *** 1%; Bootstrap shows a stable significance of instability.

Appendix Table A.6
Effect of instability on poverty change (a) through its effect on income distribution and (b) through both its effects on income distribution and on income growth

| | Distributional effect of *INSY* | | Global effect of *INSY* | |
|---|---|---|---|---|
| Estimator | *WITHIN* | *GMM-Sys* | *WITHIN* | *GMM-Sys* |
| Column. | 1 | 2 | 3 | 4 |
| Income growth | -2.40***<br>(9.64) | -3.11***<br>(2.92) | | |
| Income growth net of *INSY* | | | -2.40***<br>*9.64* | -2.43***<br>*3.1* |
| Income growth * $Pov_0$ | 2.42***<br>(6.35) | 4.45**<br>(2.46) | | |
| Income growth net of *INSY* * $Pov_0$ | | | 2.42***<br>*6.35* | 2.84**<br>*2.11* |
| Relative Gini change net of *INSY* | 3.87***<br>(5.99) | 5.87***<br>(4.18) | 3.87***<br>*5.99* | 5.85***<br>*4.19* |
| Relative Gini change net of *INSY* * $Pov_0$ | -4.93***<br>(5.25) | -8.02***<br>(3.89) | -4.93***<br>*5.25* | -8.16***<br>*4.1* |
| *INSY* | 3.65*<br>(1.74) | 8.62*<br>(1.70) | 7.54***<br>*3.64* | 13.48**<br>*2.48* |
| *INSY* * $Pov_0$ | -4.10<br>(1.51) | -9.00<br>(1.51) | -8.03***<br>*2.96* | -15.22**<br>*2.27* |
| $Pov_0$ | 0.17<br>(1.16) | 0.10<br>(0.47) | 0.45***<br>*3.05* | 0.61***<br>*2.86* |
| Constant | -0.17**<br>(2.25) | -0.28<br>(1.59) | -0.45***<br>*5.81* | -0.63***<br>*3.43* |
| Observations | 323 | 323 | 323 | 323 |
| Countries | 84 | 84 | 84 | 84 |
| Adjusted $R^2$ | 59% | | 0.59 | |
| AR(1) | | 0.004 | | 0.00 |
| AR(2) | | 0.992 | | 0.69 |
| Sargan p-value | | 0.465 | | 0.27 |
| Hansen p-value | | 0.195 | | 0.14 |
| Instruments | | Time dummies,<br>initial poverty, | | Time dummies,<br>initial poverty, |

| | two lags | | | two lags |
|---|---|---|---|---|

Appendix Table A.7

Robustness check of the effect of income instability on poverty change: other measures of instability

| Estimator | *GMM-System* | | | |
|---|---|---|---|---|
| Instability | *INSY2* | | *INSY3* | |
| Column | 1 | 2 | 3 | 4 |
| Income growth | -3.03***<br>(3.32) | | -3.10***<br>(2.60) | |
| Income growth net of *INSY* | | -2.82***<br>(3.51) | | -2.63***<br>(3.31) |
| Income growth * $Pov_0$ | 4.09**<br>(2.53) | | 4.00**<br>(2.10) | |
| Income growth net of *INSY* * $Pov_0$ | | 4.09***<br>(2.74) | | 3.03**<br>(2.23) |
| Relative Gini change net of *INSY* | 5.94***<br>(4.46) | 6.09***<br>(4.35) | 5.22***<br>(3.22) | 4.99***<br>(3.65) |
| Relative Gini change net of *INSY* * $Pov_0$ | -8.22***<br>(3.99) | -8.01***<br>(4.25) | -7.55***<br>(3.00) | -7.37***<br>(3.39) |
| *INSY* | 10.43*<br>(1.64) | 14.83**<br>(2.24) | 6.58<br>(1.35) | 11.19***<br>(2.92) |
| *INSY* * $Pov_0$ | -11.85<br>(1.59) | -17.56**<br>(2.22) | -6.76<br>(1.22) | -12.52***<br>(2.76) |
| $Pov_0$ | 0.34<br>(1.22) | 0.72**<br>(2.50) | 0.10<br>(0.55) | 0.52***<br>(3.35) |
| Constant | -0.40*<br>(1.72) | -0.71***<br>(3.04) | -0.22<br>(1.36) | -0.54***<br>(4.19) |
| Observations | 306 | 306 | 324 | 324 |
| Countries | 84 | 84 | 85 | 85 |
| Adjusted $R^2$ | | | | |
| AR(1) | 0.001 | 0.002 | 0.002 | 0.002 |
| AR(2) | 0.634 | 0.436 | 0.494 | 0.540 |
| Sargan p-value | 0.435 | 0.732 | 0.405 | 0.415 |
| Hansen p-value | 0.455 | 0.689 | 0.279 | 0.258 |
| Instruments | Time dummies, initial poverty, two lags | | | |

Notes: Absolute robust t-stats or z-stats in parentheses. * significant at 10%; ** 5%; *** 1%;
Bootstrap shows a stable significance of instability;
Dependent variable: Poverty relative change. $Pov_0$ is the initial poverty headcount.

Appendix Table A.8
Seemingly unrelated regression estimates

| | Simultaneous estimates (1) | | | Simultaneous estimates (2) | | | Simultaneous estimates (3) | | |
|---|---|---|---|---|---|---|---|---|---|
| Measure of instability | *INSY* | | | *INSY2* | | | *INSY3* | | |
| Dependent variable | Relative pov. headcount change | Relative Gini change | Income growth | Relative pov. headcount change | Relative Gini change | Income growth | Relative pov. headcount change | Relative Gini change | Income growth |
| Column | 1a | 1b | 1c | 2a | 2b | 2c | 3a | 3b | 3c |
| Income growth | -2.57*** (24.12) | | | -2.55*** (23.34) | | | -2.59*** (24.34) | | |
| Income growth * $Pov_0$ | 2.63*** (12.91) | | | 2.57*** (12.16) | | | 2.66*** (13.05) | | |
| Relative Gini change | 4.38*** (14.84) | | | 4.46*** (14.66) | | | 4.33*** (14.60) | | |
| Relative Gini change* $Pov_0$ | -5.84*** (11.14) | | | -5.99*** (11.17) | | | -5.78*** (10.97) | | |
| *INSY* | 2.91*** (2.76) | -0.02 (0.17) | -1.07*** (2.91) | 3.77*** (3.31) | -0.09 (0.66) | -0.88** (2.28) | 1.49 (1.56) | -0.05 (0.42) | -0.85** (2.44) |
| *INSY* * $Pov_0$ | -3.49** (2.37) | | | -4.43*** (2.92) | | | -1.70 (1.23) | | |
| Initial dependent variable ($Pov_0$, $Gini_0$ or $Income_0$) | 0.20*** (2.70) | -0.26*** (5.73) | -0.00*** (3.69) | 0.27*** (3.33) | -0.28*** (5.84) | -0.00*** (3.68) | 0.14* (1.92) | -0.26*** (5.71) | -0.00*** (3.67) |
| Constant | -0.18*** (4.26) | 0.12*** (5.64) | 0.16*** (6.15) | -0.23*** (4.76) | 0.13*** (5.81) | 0.16*** (5.96) | -0.13*** (3.37) | 0.12*** (5.66) | 0.15*** (5.93) |
| Observations/countries | | 323 / 84 | | | 306 / 84 | | | 324 / 85 | |

Estimator: *SURE*. Absolute Z-stats in parentheses. * significant at 10%; ** 5%; *** 1%. *INSY*: income instability, measured from a unique trend value for each country. *INSY2*: income instability, measured from a 30-year rolling trend. *INSY3*: income instability, measured as the standard deviation of income growth.

Appendix Table A.9: LICs versus Non LICs

| Estimator | *WITHIN* | | | | *GMM-System* | | | |
|---|---|---|---|---|---|---|---|---|
| Income growth net of *INSY?* | No | | Yes | | No | | Yes | |
| Column | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| Income growth | -2.91*** | -2.39*** | -2.91*** | -2.39*** | -3.30*** | -2.28*** | -3.16*** | -1.72** |
| | (8.13) | (9.55) | (8.13) | (9.55) | (4.54) | (2.76) | (4.72) | (2.15) |
| Income growth * LICs | 1.07*** | | 1.07*** | | 1.38 | | 1.20 | |
| | (2.74) | | (2.74) | | (1.60) | | (1.53) | |
| Income growth * $Pov_0$ | 4.65*** | 2.38*** | 4.65*** | 2.38*** | 3.51 | 2.80* | 3.47 | 1.33 |
| | (4.61) | (6.34) | (4.61) | (6.34) | (1.30) | (1.81) | (1.33) | (0.93) |
| Income growth * $Pov_0$ * LICS | -3.01*** | | -3.01*** | | -1.49 | | -1.51 | |
| | (2.93) | | (2.93) | | (0.52) | | (0.54) | |
| Relative Gini change net of *INSY* | 5.16*** | 3.87*** | 5.16*** | 3.87*** | 6.79*** | 5.30*** | 6.84*** | 5.34*** |
| | (6.15) | (5.94) | (6.15) | (5.94) | (5.76) | (3.65) | (5.63) | (3.25) |
| Relative Gini change net of *INSY* * LICs | -3.05*** | | -3.05*** | | -5.77*** | | -6.60*** | |
| | (3.14) | | (3.14) | | (3.71) | | (4.16) | |
| Relative Gini change net of *INSY* * $Pov_0$ | -12.04*** | -4.93*** | -12.04*** | -4.93*** | -14.27*** | -7.27*** | -14.65*** | -7.37*** |
| | (3.95) | (5.21) | (3.95) | (5.21) | (3.45) | (3.32) | (3.36) | (3.09) |
| Relative Gini change net of *INSY* * $Pov_0$ * LICs | 9.61*** | | 9.61*** | | 12.60*** | | 14.04*** | |
| | (3.08) | | (3.08) | | (3.07) | | (3.17) | |
| *INSY* | 4.53 | 5.32* | 9.27*** | 9.20*** | 11.21* | 13.85** | 17.70*** | 15.61** |
| | (1.47) | (1.78) | (3.14) | (3.12) | (1.74) | (2.12) | (3.01) | (2.46) |
| *INSY* * LICs | -5.15 | -5.59* | -6.89** | -5.59* | -13.13* | -10.02 | -18.05*** | -9.21 |
| | (1.55) | (1.75) | (2.17) | (1.75) | (1.68) | (1.33) | (2.72) | (1.17) |
| *INSY* * $Pov_0$ | -1.58 | -7.63 | -9.13 | -11.50* | -14.06 | -24.33 | -22.40 | -24.75 |
| | (0.17) | (1.25) | (1.07) | (1.89) | (0.93) | (1.50) | (1.60) | (1.49) |
| *INSY* * $Pov_0$ * LICs | 2.84 | 8.50 | 7.74 | 8.50 | 16.60 | 20.35 | 23.70* | 18.39 |
| | (0.31) | (1.38) | (0.90) | (1.38) | (1.02) | (1.37) | (1.66) | (1.14) |
| | -0.06 | 0.12 | 0.48 | 0.40*** | 0.34 | 0.45 | 0.88* | 0.73** |
| $Pov_0$ | (0.13) | (0.81) | (1.15) | (2.62) | (0.51) | (1.34) | (1.89) | (2.32) |
| | -0.02 | | -0.37 | | -0.39 | | -0.88° | |
| $Pov_0$ * LICs | (0.05) | | (0.85) | | (0.42) | | (1.59) | |
| | | | | | 0.39 | | 0.75** | |
| LICs | | | | | (0.82) | | (2.46) | |
| Constant | -0.08 | -0.15** | -0.35*** | -0.43*** | -0.37 | -0.41** | -0.82*** | -0.62*** |
| | (1.14) | (2.00) | (5.35) | (5.72) | (1.43) | (2.00) | (3.80) | (3.32) |
| Observations/countries | 323 / 84 | 323 / 84 | 323 / 84 | 323 / 84 | 323 / 84 | 323 / 84 | 323 / 84 | 323 / 84 |
| Adjusted $R^2$ | 63% | 59% | 63% | 59% | | | | |
| AR(1) | | | | | 0.002 | 0.005 | 0.001 | 0.060 |
| AR(2) | | | | | 0.849 | 0.632 | 0.969 | 0.276 |
| Sargan p-value | | | | | 0.887 | 0.311 | 0.739 | 0.341 |
| Hansen p-value | | | | | 0.694 | 0.295 | 0.836 | 0.412 |
| Instruments | | | | | Time dummies, initial poverty, two lags | | | |