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Did Growth Become Less Pro-Poor in the 1990s?

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Abstract

This note analyzes the stability of the empirical relationship between growth and changes in inequality over time. It concludes that while during the 1970s and 1980s the growth process was not accompanied by increases in inequality, during the 1990s a positive and significant correlation appears in the data. For this decade, we estimate that a one percent growth rate would be associated with an increase in the gini coefficient of between .3 to .5 percent. This positive correlation is hidden when one estimates the model without allowing for changes in the relationship over the different decades. The finding is robust to a number of departures from the basic specification including: (i) the use of alternative specifications to isolate decadal shifts; (ii) the use of robust estimation techniques that address the potential influence of outliers; (iii) restricting the sample to a balanced panel for the 1980s and 1990s to control for changes in the composition of the sample related to the unbalanced nature of the panel; and (iv) considering the possibility of fixed effects in the data. The paper also explores the impact of this structural change in the rate of poverty reduction and concludes that it is far from negligible.

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I. Introduction

The relationship between income inequality and economic growth has received significant attention in the empirical literature over the past few years. The results of most of the studies focusing on the impact of growth on inequality[1] suggest that there is no general tendency for inequality to move in any particular direction with growth.[2] Growth would therefore benefit everybody in society in a similar fashion.

This note adds to the existing literature by analyzing the stability of this relationship over time. Using data from the Dollar and Kraay (2002) database (DKD) the note concludes that the growth inequality relationship is far from stable. In particular, during the 1990s the data show a positive correlation that is not only statistically significant but also economically: a 1 percent growth rate would be associated with an increase in the gini coefficient of between .3 to .5 percent (i.e. growth has become less pro-poor in recent times). This finding, which is hidden both when one imposes a common slope over time and when one uses decadal dummies that do not take into account the unbalanced nature of the panel, survives a number of robustness checks including: (i) using alternative econometric specifications to isolate the decadal shifts; (ii) using estimation techniques that are robust to the presence of outliers; (iii) controlling for the potential impact of changes in the composition of the sample over time due to the unbalanced nature of the panel; and (iv) considering the possibility of fixed effects in the data. The rest of the note is organized as follows. Section II describes the basic empirical strategy. Section III presents the empirical results. Section IV explores how this structural change has affected the rate of poverty reduction. Finally, Section V closes.

II. Data and methods

Our empirical strategy relies on the estimation of models based on variations of the following basic specification:

$$\Delta_T g_{it} / T_{it} = \alpha + \beta \Delta_T y_{it} / T_{it} + u_{it}, \qquad (1)$$

where g is the log of the gini coefficient, y is the log of per capita income, Δ_T is the T-th difference operator so that $\Delta_T g_{it} = g_{it} - g_{it-T}$, and T_{it} is the length of the spell for country i and time t, which as indicated by the subscript it, will vary with the spell. u is an error term.

Panel (a) of figure 1 plots the scatter of changes in the gini coefficient (in logs) against growth for the 1970-2000 period. The inequality data are from the DKD and the growth data is derived from the PWT6.1. Inspection of this figure suggests no apparent relationship between growth and changes in inequality. This is confirmed by column (1) of table 1 which reports the results of estimating equation (1) for the 1970-2000 period.

[1] There is different strand on the literature that has focused on the impact of inequality on growth. Among others, see Forbes (2000) and Banerjee and Duflo (2003).

[2] See among others Deininger and Squire (1996), Chen and Ravallion (1997) and Dollar and Kraay (2002).

These results indicate that the null hypothesis of no correlation between growth and changes in inequality does not come close to rejection. The OLS estimate for the slope β is 0.07 and it has an associated p-value of .27.[3]

A similar conclusion is reached when the changes in inequality are regressed on interactions of the explanatory variable with decadal dummies for the 1970s, 1980s and 1990s; that is, when we estimate the following model

$$\Delta_T g_{it} / T_{it} = \alpha + (\beta_{70} d_{70t} + \beta_{80} d_{80t} + \beta_{90} d_{90t}) \Delta_T y_{it} / T_{it} + u_{it}, \qquad (2)$$

where d_{xxt}=1 if t falls in the 19xxs and 0 otherwise. The results for this model and a restricted version with $\beta_{70} = \beta_{80}$ are presented in columns (2) and (3) of table 1. To a large extent they are consistent with those reported in Dollar and Kraay (2002) (see table 4 of their paper), and could be interpreted as evidence in support of the view that the growth inequality relation has not changed significantly over time. [4]

It must be noted, however, that when interest centers on assessing the stability of the growth-inequality correlation, inference based on equation (2) can be misleading. Given the unbalanced nature of the panel, 35 of the 64 observations with final year of the spell in the 1970s would capture changes in inequality over the 1960s and 1970s; 46 of the 94 observations with final year of the spell in the 1980s would capture changes in inequality over the two previous decades. Finally, 57 of the 78 observations with final year of the spell in the 1990s would have the initial observation of the spell well before 1990. Thus, the estimates of the decadal shifts obtained from equation (2) will be contaminated by spells that span two and even three decades and will likely fail to isolate potential changes in the correlation over a particular period of time.

Just to give an idea of the magnitude of the problem, the 78 spells with final year in the 1990s would span 580 country year observations whereas the 21 spells with initial and final year in the 1990s would span 113 country years. This implies that less than 20 percent of the total country year observations spanned by the spells with final year in the 1990s are from the 1990s. Similarly for the 1980s and 1970s, where only 40 and 33 percent of the country year observations spanned by the spells with final year in the 1980s and 1970s respectively, belong to the decade in question.

Panels (b) to (d) of figure 1 plot the data by decade (1970s, 1980s and 1990s) after having eliminated those spells that have initial and final dates in different decades. Inspection of these panels indicates that while it is difficult to argue that growth and changes in inequality were related before 1990, during the 1990s there is a clear positive correlation. Next we explore whether alternative econometric specifications that take into

[3] Given the potential for reverse causality from inequality to growth, something that we do not address here, it is worth stressing that the estimates presented in this note should be understood as mere correlation coefficients and that no attempt should be made to make causal inference.

[4] The p-value of standard F tests for the null hypothesis $\beta_{70} = \beta_{80} = \beta_{90} = 0$ is .49 for the model in column (2) and .29 for the model in column (3).

account the problems associated to spells spanning more than one decade capture this change in pattern

II.1 Alternative specifications

We now consider two alternative empirical strategies that allow to test for changes in the growth-inequality correlation over time and that are not affected by the unbalanced nature of the panel. First, one can re-define the dummy variables used in equation (2) to eliminate all those spells that have initial and final dates in different decades, so that all the observations used in the regression fall within a given decade. More formally, the regression model used in this case would be

$$\Delta_T g_{it} / T_{it} = \alpha + (\beta_{70} d_{70it} + \beta_{80} d_{80it} + \beta_{90} d_{90it}) \Delta_T y_{it} / T_{it} + u_{it}, \quad (3)$$

where d_{xxit}=1 if both t and t-T_{it} fall in the 19xxs and 0 otherwise. This strategy has the additional benefit of producing a more homogenous database with all the spells spanning between 5 and 10 years (against between 5 and 37 years in the original database). On a less positive note, the sample size is reduced to 98 observations (29 in the 1970s, 48 in the 1980s and 21 in the 1990s).

A second alternative would not discard any of the existing data and instead would bring new information on inter-decadal growth. To see this more clearly, assume that at each period of time t changes in g and growth are given by

$$\Delta g_{it} = \beta_t \cdot \Delta y_{it} + e_{it}, \quad (4)$$

where the slope coefficient is allowed to vary by year. It then follows that

$$\Delta_T g_{it} = \sum_{j=0}^{Tit-1} \beta_{t-j} \cdot \Delta y_{it-j} + u_{it}, \quad (5)$$

where $u_{it} = \sum_{j=0}^{Tit-1} e_{t-j}$. A simplified version of equation (5) that can be used to test for decadal changes in the growth-inequality relationship without discarding any spell could be obtained by assuming $\beta_t = \beta_{xx}$ if t falls in the 19xxs (that is, by assuming that β is a step function of time by decade rather than an arbitrary function of time). In such a case (5) can be expressed as:

$$\Delta_T g_{it} = \alpha + \beta_{70} \Delta y_{70it} + \beta_{80} \Delta y_{80it} + \beta_{90} \Delta y_{90it} + u_{it}, \quad (6)$$

where $\Delta_{xxit} y_{it}$ denotes the observed growth rate corresponding to the spell $\Delta_T y_{it}$ that takes place during the 19xxs. Clearly, if both t and t-T_{it} fall in a single decade, say for example the 1990s, then $\Delta_{70it} y_{it} = \Delta_{80it} y_{it}$ =0. On the other hand, if t-T_{it} falls in the 1970s and t in the 1990s one would expect to find non-zero values in the thee explanatory

variables. Thus empirical implementation of (6) requires additional information on the temporal pattern of growth within the spell.

III. Results for the alternative specifications and sensitivity analysis

Column (4) of table 1 reports the results of estimating equation (3). These results now indicate that while we cannot reject the null that growth and changes in inequality were not related in the 1970s and 1980s, we do reject the same null for the 1990s. The point estimate for β_{90} suggests that during the 1990s a 1 percent increase in per capita income was associated with an increase in the gini coefficient of .42 percent (p-value of .03). Column (5) reports very similar results based on a model that imposes $\beta_{70} = \beta_{80}$ but allows β_{90} to vary freely. Therefore, according to the specification based on the elimination of spells spanning more than decade growth during the 1990s would have been less pro-poor than in the previous decades.

This finding is confirmed by the results reported in columns (6) and (7) of table 1, which are based on equation (6). Column (6) reports results allowing the slopes to vary freely by decade whereas column (7) restricts the change to the 1990s. The results for these two specifications also indicate that the null that growth and changes inequality were not related during 1990s is also rejected. The point estimates suggest a positive growth-inequality correlation during the 1990s, with an estimated value for β_{90} of .37 (p-value of .01) in both cases. As before, we do not find evidence of correlation between growth and inequality before 1990.

III.1 Sensitivity to the presence of outliers

The previous findings may be affected by a number of factors. In particular, it would be possible that these results are driven by the presence of outliers. In fact, panel (d) of figure 1 indicates that there a number of observations that may be particularly influential for the results of the 1990s. For example, in the south-east quadrant the spell corresponding to Yemen would indicate that between 1992-1998 the gini coefficient was declining at an annual rate of 10 percent per year while growth was close to 0. Similarly, in the north-east quadrant the observation corresponding to Poland indicates that between 1991 and 1996 the country's annual per capita growth was about 5 percent while the gini coefficient was increasing at 9 percent per year. Also in the north-east quadrant one can find China with an annual growth rate between 1990 and 1995 of about 9 percent and increases in the gini of about 6 percent per year.

To explore the possibility that the findings of table 1 are driven by the presence of these somewhat extreme observations, table 2 replicates the previous exercises but now using estimation techniques that are robust to the presence of outliers.[5] Inspection of table 2 indicates that there is no evidence suggesting that the results in table 1 are driven by outliers. The results corresponding to equations (1) and (2) continue to indicate that we

[5] Specifically the results in table 2 are based on robust regression techniques using Huber and Tukey biweights (see Huber, 1964 and Beaton and Tukey, 1974).

cannot reject the null hypothesis of no correlation between growth and inequality, but the estimates corresponding to equations (4) and (6), reported in columns 4 and 5, and 6 and 7 respectively would still reject the null hypothesis of no correlation during the 1990s, with point estimates for the slope coefficient β_{90} taking values of around .35.

III.2 Sensitivity to sample composition effects

Having ruled out that the results above are driven by the presence of outliers, we next move to explore whether we may be capturing the impact of a change in the composition of the sample rather than a change in the growth inequality relationship. That is, given the unbalanced nature of the panel, the apparent change in the observed slope may be the result of working with a sample that has different countries in different decades rather than of a time effect (i.e. the 1990s are different).

Columns (1) to (4) of table 3 report the results of estimating equations (1), (2), (3) and (6) using a reduced sample of countries for which we have at least one observation in both the 1980s and the 1990s.[6] Inspection of this exercise indicates that the results are very similar to those of the unbalanced sample, confirming the previous findings and rejecting the possibility that they are driven by a sample composition issue.

III.3 Sensitivity to country effects

An additional factor that may bias the results is the existence of fixed effects in the data, something ignored by the estimators above. To explore whether the previous findings are robust to this possibility, columns (5) to (8) of table 3 report the results of the fixed effects estimator corresponding to equations (1), (2), (3) and (6). Once again these results are suggestive of a change in the growth inequality correlation during the 1990s.

IV. How relevant is this for poverty reduction?

As noted above, the finding that during the 1990s per capita growth may have been accompanied by increases in income inequality implies that growth has become less pro-poor. In this section, we explore the order of magnitude of the decline in the pro-poorness of growth. To this end, we rely on work by Lopez and Serven (2006) who conclude that the lognormal density function provides an excellent approximation to the empirical distribution of household income. This is important because under the assumption that per capita income follows a lognormal distribution, we can easily simulate the poverty impact of different growth scenarios (i.e. distribution neutral growth, growth associated to increases in inequality, etc), which as noted by Lopez and Serven (2006) will depend on the country's levels of per capita income, income inequality as measured by the gini coefficient, and the poverty line used in the measurement of poverty.

[6] Robust regression estimates produce virtually unchanged results.

To be a more specific, assume that per capita income ν can be well approximated by a lognormal density function. Then, it is possible to write:

$$P_\alpha = P_\alpha(z/\nu, G), \tag{7}$$

where P is any of the poverty measures of the Foster-Greer-Thorbecke (1984) class (i.e. headcount poverty -P_0-, poverty gap -P_1-, or squared poverty gap -P_2-), z is the poverty line and G is the gini coefficient. From (7) its follows immediately

$$\frac{dP_\alpha}{P_\alpha} = \eta_\nu^\alpha \frac{d\nu}{\nu} + \eta_G^\alpha \frac{dG}{G}. \tag{8}$$

Here η_ν^α and η_G^α are respectively the elasticities of P_α with respect to growth and inequality, which are derived in Lopez and Serven (2006) for values of the gini coefficient running from .3 to .6 and a per capita income to poverty line ratio ν/z running from 1 to 6.

Having numerical values for η_ν^α and η_G^α at hand, equation (8) can be the basis to simulate differences in the impact of different growth scenarios (say scenario 2 and scenario 1) as:

$$\left.\frac{dP_\alpha}{P_\alpha}\right|_2 - \left.\frac{dP_\alpha}{P_\alpha}\right|_1 = \eta_\nu^\alpha\left(\left.\frac{d\nu}{\nu}\right|_2 - \left.\frac{d\nu}{\nu}\right|_1\right) + \eta_G^\alpha\left(\left.\frac{dG}{G}\right|_2 - \left.\frac{dG}{G}\right|_1\right). \tag{9}$$

Table 4 reports the results of using equation (9) to simulate the differences in the poverty impact of a 1 percent growth rate when growth is distribution neutral (i.e. the situation before 1990) and when growth is accompanied by an increase in inequality of .4 percent, which roughly speaking is the average estimate of our analysis for the post-1990 period. Therefore, negative values in the table can be interpreted as a decline in the pro-poorness of growth after 1990.

Inspection of table 4 indicates that indeed the decline in the pro-poorness of growth associated to the observed increases in inequality in the post 1990 period is quite significant. For example, for a country with a gini coefficient of .4 and a per capita income to poverty line ratio -ν/z- of 2,[7] the reported results indicate that during the 1990s for every 1 percent growth rate, the poverty headcount would have fallen almost .7 percent less than in the pre-1990 period.

Similarly, for a country with a gini coefficient of .5 (a typical value in Latin America) and a per capita income to poverty line ratio -ν/z- of 3:[8] here our estimates

[7] If the poverty line is $2 per person per day, this would imply an annual per capita income level of about $1460.

[8] If the poverty line is $2 per person per day, this would imply an annual per capita income level of about $2190.

indicate that in the after 1990 period the impact of growth on headcount poverty would have declined by almost a full 1 percent for every 1 percentage point of per capita growth. In turn, this would imply that in the after 1990 period one would have needed 3.7 times the growth rate observed in the pre 1990 period to achieve the very same rate of poverty reduction. In other words, from a poverty perspective the observed structural change can be extremely important.

It is worth noting that the estimated differences between the scenarios in the pre- and post-1990 periods tend to increase (in absolute value) as per capita income levels increase (i.e. as v/z increases). Intuitively, in countries with per capita income levels close to the poverty line, changes in inequality will have a low impact on poverty reduction since there is no much to distribute. Thus, from a poverty perspective, the estimated structural change in the growth inequality relationship should have been felt more on middle income countries than in low income countries.

These differences are amplified as we move from the headcount poverty to the poverty gap to the square poverty gap. That is, the differences are amplified as the poverty measure becomes more bottom-sensitive. A reason for this can be found in Kraay (2005) who notices that more bottom-sensitive poverty measures place relatively more weight on changes in relative incomes (i.e. they are relatively more sensitive to changed in inequality). For example, looking at the poverty gap (P_1) panel and continue to focus on a country with a gini coefficient of .5 and a per capita income to poverty line ratio -v/z- of 3, we find that the rate of poverty reduction would have decline after 1990 by about 1.5 percent. Instead, looking at the squared poverty gap (P_2) panel we find a reduction of the poverty rate of about 1.6 percent.

V. Conclusions

In this paper we have explored the stability of the growth inequality relationship over time. The paper concludes that while during the 1970s and 1980s the growth process was not accompanied by increases in inequality, during the 1990s a positive and significant correlation between growth and changes in inequality appears in the data. The estimates presented in the paper indicate that a 1 percent growth rates would be associated with increases in the gini coefficient in the .3-.5 percent range. This positive correlation would be hidden when one estimates the correlations without allowing for decadal changes.

When we assess the impact of this structural change on poverty reduction, we find that the associated decline in the pro-poorness of growth is not negligible. For example, our estimates indicate that for a country with a gini coefficient of .5 and a per capita income of about $2200, in the post-1990 period a growth rate of 3.7 percent would have the same poverty impact than a 1 percent in the pre-1990 period.

Clearly, identifying the potential forces at work that may have led to this structural break during the 1990s (e.g. trade liberalization, technological change, crises, etc) should be high on the research and policy agenda.

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Table 1. Growth and Inequality. OLS estimates

	(1)	(2)	(3)	(4)		(5)		(6)		(7)	
β	0.07										
s.e.	0.06										
$\beta_{70\text{-}80}$			0.01			-0.03				-0.03	
s.e.			0.07			0.09				0.06	
β_{70}		0.02		-0.06				-0.02			
s.e.		0.09		0.11				0.08			
β_{80}		0.01		0.02				-0.05			
s.e.		0.07		0.12				0.07			
β_{90}		0.16	0.16	0.42	*	0.41	*	0.37	*	0.37	*
s.e.		0.1	0.1	0.19		0.19		0.14		0.14	
N	236	236	236	98		98		236		236	

Note: The table reports OLS estimates for a regression of the changes in the logged gini coefficient on growth. Robust standard errors under the estimates. Column (1) corresponds to equation 1 in the text, while columns (2) and (3), (4) and (5), and (6) and (7) correspond to equations 2, 3, and 6 respectively. * Significant at the 5 % level. ** Significant at the 10 % level.

Table 2. Growth and Inequality. Robust Regression estimates

	(1)	(2)	(3)	(4)		(5)		(6)		(7)	
β	-0.002										
s.e.	0.05										
$\beta_{70\text{-}80}$			-0.05			-0.09				-0.05	
s.e.			0.05			0.09				0.06	
β_{70}		-0.06		-0.11				-0.06			
s.e.		0.07		0.11				0.08			
β_{80}		-0.04		-0.07				-0.05			
s.e.		0.08		0.12				0.07			
β_{90}		0.1	0.1	0.34	*	0.33	*	0.36	*	0.36	*
s.e.		0.07	0.07	0.14		0.14		0.09		0.09	
N	236	236	236	98		98		236		236	

Note: The table reports robust regression estimates using Huber and Tukey biweights for a regression of the changes in the logged gini coefficient on growth. Column (1) corresponds to equation 1 in the text, while columns (2) and (3), (4) and (5), and (6) and (7) correspond to equations 2, 3, and 6 respectively. * Significant at the 5 % level. ** Significant at the 10 % level.

Table 3. Growth and Inequality. Sensitivity analysis

	OLS-balanced sample				Fixed effects			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
β	0.12				0.13			
s.e.	0.07				0.09			
β_{70}		0.07	0.03	0.08		0.09	0.2	-0.01
s.e.		0.11	0.11	0.09		0.11	0.2	0.12
β_{80}		0.08	0.07	0.02		0.05	0.28	0.01
s.e.		0.08	0.12	0.08		0.12	0.25	0.12
β_{90}		0.2	0.53 *	0.39 *		0.22 **	0.6 *	0.36 *
s.e.		0.12	0.2	0.17		0.11	0.27	0.14
p-Zero fixed effects					0.82	0.83	0.26	0.98
N	177	177	75	177	236	236	98	236

Note: The table reports robust estimates for a regression of the changes in the logged gini coefficient on growth. Columns (1) and (5), (2) and (6), (3) and (7), and (4) and (8) correspond to equations 1,2, 3, and 6 respectively. The results of columns 1 to 4 are based on a balanced sample of countries. The results of columnd 5 to 6 report fixed effects estimates. * Significant at the 5 % level. ** Significant at the 10 % level.

Table 4. Poverty and growth patterns: 1990s vs. 1980s

$\mathbf{P_0}$	*Gini Coefficient*			
ν/z	**0.30**	**0.40**	**0.50**	**0.60**
6	-4.94	-2.95	-2.04	-1.56
3	-2.07	-1.31	-0.97	-0.79
2	-0.99	-0.68	-0.54	-0.47
1.5	-0.48	-0.37	-0.32	-0.31
1	-0.07	-0.10	-0.12	-0.14
$\mathbf{P_1}$	*Gini Coefficient*			
ν/z	**0.30**	**0.40**	**0.50**	**0.60**
6	-5.63	-3.60	-2.66	-2.15
3	-2.68	-1.88	-1.49	-1.29
2	-1.53	-1.17	-1.00	-0.91
1.5	-0.94	-0.79	-0.72	-0.69
1	-0.41	-0.42	-0.43	-0.45
$\mathbf{P_2}$	*Gini Coefficient*			
ν/z	**0.30**	**0.40**	**0.50**	**0.60**
6	-6.45	-3.59	-2.22	-1.44
3	-4.45	-2.57	-1.64	-1.09
2	-3.37	-2.02	-1.32	-0.90
1.5	-2.68	-1.67	-1.12	-0.77
1	-1.83	-1.23	-0.86	-0.62

Note: The table reports the difference in the poverty impact of a 1 percent growth rate when it is neutral from an inequality point of view and when it is accompanied by an increase in the gini of .4 percent. P0, P1, and P2 are the FGT poverty measures.

Figure 1. Growth and Inequality