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An inverted-U relationship between inequality and long-run growth

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Abstract

The relationship between income distribution and long-run economic growth has been a popular topic in recent economic research. Existing theoretical works find either a positive or a negative relationship, but not both. In this paper we propose an inverted-U relationship between initial income distribution and long-term economic growth, and estimate and test the relationship using cross-country data.

Keywords: Inverted-U; Income distribution; Gini; Economic growth

JEL classification: O4; O5

1. Introduction

The relation between income distribution and economic growth has been a popular topic of recent economic research. In particular, the contrasting experience in the post World War II era between Latin America which had high initial income inequality and low long-run economic growth and East Asia which had low initial inequality and high long-run growth, has fired up a popularity in documenting a negative relationship between income inequality and economic growth. Many empirical cross-country studies, led by Persson and Tabellini (1994) and Alesina and Rodrik (1994), have supported such a negative relationship. Yet, several other studies have recently obtained a positive relationship (e.g., Partridge, 1997; Li and Zou, 1998; Forbes, 2000).[1]

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[1] While most papers use cross-sectional data, Partridge (1997) uses both cross-state and panel data from the US. Li and Zou (1998) and Forbes (2000) use panel data sets. The results from panel data should be interpreted as a transitional relationship rather than a long-run steady-state relationship. This paper will focus on a long-run steady-state relationship.

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Although different kinds of data and estimation methods are used in these studies, these two monotonic relationships are not compatible and their implications are opposed to each other. While some theoretical works have posited a negative relationship between initial inequality and economic growth in the steady state, linked via the political redistribution process (e.g., Persson and Tabellini, 1994) or the imperfect credit markets (e.g., Banerjee and Newman, 1993), other works have obtained a positive relationship (e.g., Galor and Tsiddon, 1997).[2]

The purpose of this study is to revisit the empirical relationship between initial income inequality and long-run economic growth. We propose an inverted-U relationship, and estimate it using cross-country data.

Although no existing theoretical wisdom has proposed the coexistence of both a positive and a negative relationship, we think this is very likely. Intuitively, when income is very equally distributed, a redistribution tax program will be rarely called for so that the condition for an insufficient number of investors under the credit market imperfection proposed by Banerjee and Newman (1993) is unlikely to happen. A positive long-term relationship between income inequality and economic growth will naturally emerge under this situation, as an increase in income inequality from a very equal level encourages skilled workers to work harder and entrepreneurs to invest more. On the other hand, when income is already very unequally distributed, a large redistribution tax is easily called for which discourages incentives to work and invest, and furthermore, when credit markets are imperfect, there will be only a small number of investors capable of engaging in investment projects of a minimum size. As a result, a negative relationship between income inequality and long-term economic growth will arise. Given the above reasons, there is an inverted-U relationship: when income inequality is low, further income redistribution will hurt economic growth; and when income inequality is high, income redistribution will enhance economic growth.

2. Empirical model and data

Our empirical model follows Barro (1991) by proposing the following relationship:

$$\begin{cases} GR_i = f(INEQ_{i0}) + \beta_i X_i + \mu_i, \\ f(INEQ_{i0}) = \alpha_1 INEQ_{i0} + \alpha_2 (INEQ_{i0})^2, \end{cases} \tag{1}$$

where GR_i is long-run economic growth of country i, $INEQ_{i0}$ is initial income inequality, X_i is a vector of control variables, and μ_i is an independently and identically distributed error term. An innovation in the above model is the square income inequality. In order to obtain an inverted-U relationship between initial inequality and economic growth, it is necessary to restrict the parameters: $\alpha_1 > 0$, $\alpha_2 < 0$, and $|\alpha_1| < |\alpha_2|$.

We employ the Barro-type model as it is widely used in existing empirical works of inequality and economic growth across countries. Moreover, any difference between our study and previous works

[2] Two other channels proposed are the sociopolitical unrest and the savings rates. See Barro (2000) for a survey.

cannot be due to model specifications.[3] This work's major departure can be seen from two aspects. First, we use a more reliable data. Second, we propose a new relationship between initial income inequality and long-run economic growth. We are aware of the shortcomings when using such an estimation method, including, for example, the causal directions, the measurement problems across countries and over time, and the institutional and other factors. Bearing these in mind, we shall interpret the estimation results with caution.

Our empirical model does not identify the channels through which initial inequality affects long-run economic growth. Instead, we focus on their net relationship to shed light on existing empirical wisdom. This choice is based on the following reasons. First, existing theoretical relationship between inequality and economic growth is by and large derived under a steady state. Second, a body of previous empirical works between inequality and growth focuses on long-term relationship, so any discrepancy between this work and existing studies cannot result from differences in time period. Finally, the income inequality data as compiled in Deininger and Squire (1996) changes little over time.[4] Therefore, it is proper to look at the long-run consequence of different initial inequalities on economic growth.

Following existing long-run growth regressions, a linear functional form is assumed for control variables X_i. The vector of regressors X_i includes three sets of variables. The first is initial GDP (denoted as Y_0) and capital inputs (both physical capital *INV* and human capital H_0). The second set is institutional and policy's variables, including trade regimes (foreign exchange black market premium, *BMP*), macroeconomic policies (the share of government consumption in GDP, *GOV*, and the inflation rate, *INF*), and political regimes (the index of civil liberties, *ICL*). Finally, a set of regional dummies, *Latin*, *Africa* and *Asia*, is controlled, to capture the possibility of omitted variables pertaining to the regions. The above control variables are the most frequently used in cross-country growth regressions.

Few countries have collected data for income inequality on a regular basis. Measurement errors are always a concern for inequality. Moreover, the coverage of households under surveys is uneven and the definition of income is inconsistent across countries. Deininger and Squire (1996) have compiled more consistent and comprehensive income inequality data. They filtered out the 'high-quality' data on income inequality that satisfy three minimum standards of quality: (i) the data must be based on household surveys (not on income earners or tax payers); (ii) the population under surveys must be representative of the entire country; and finally, (iii) the measure of income (or expenditure) must include not only wages, but also all other kinds of non-wage and non-monetary income. Although the criteria for 'high-quality' data do not appear very stringent, a majority of inequality data used in some well-known articles does not satisfy the criteria. In this study, we only use the high-quality data to minimize the measurement errors. As Deininger and Squire collect more observations, the high-quality data cover more countries than previous data do.

[3]We do not use a fixed effect methodology. Measures of inequality vary very little and they are estimated with considerable errors. Under these circumstances, fixed effect techniques can produce results that are biased to zero. Likewise, the fixed effect methodology implies that all omitted variables are time invariant, which means that the only variables that vary over time are already accounted for. This is implausible over the 22-year period in our sample.

[4]The time series data change little over time for most countries. See Forbes (2000, Table 2) for Gini coefficients in a 5-year period between 1961 and 1990 across 45 countries.

The most popular Gini coefficient is used to measure income inequality, whose value ranges from 0 to 1: the higher the value, the larger the inequality. The initial Gini is utilized in estimation to minimize the endogeneity concerns, constructed in two ways. First, the initial year's data (i.e., 1970) is used, and if the data for 1970 is not available, then we follow Alesina and Rodrik (1994) by using the data in 1965–1975 that is closest to 1970 (denoted as $Gini_{70}$). Second, to avoid the sensitivity of relying on a single year, the average annual Gini in 1965–1975 is used (denoted as $Gini_{65-75}$). In Deininger and Squire (1996), 77 countries have the Gini data. Yet, many countries have data available only after the late 1970s. To reduce inconsistency resulting from the fact that some Gini's are based on income and others on expenditure, we follow Deininger and Squire's (1996) suggestion by adding 6.6 to those based on gross expenditure.[5] These procedures result in a sample covering 43 countries.

3. Empirical results

The estimated relationship between the initial income inequality and long-run economic growth is reported in Table 1.[6] Regressions (1)–(2) are the main results. While (1) employs the $Gini_{70}$ and (2) the $Gini_{65-75}$ as a measure of income inequality, the results are the same. Estimated coefficient α_1 for $Gini_{70}$ (and $Gini_{65-75}$) is positive and α_2 for $Gini_{70}{}^2$ (and $Gini_{65-75}{}^2$) is negative, both being statistically significant at the 1 or 5% level. On the bottom we perform a one-sided test to see whether $|\alpha_1| < |\alpha_2|$, and find they are statistically significant at the 1% level. These empirical results indicate the existence of an inverted-U relationship between initial income inequality and long-run economic growth. For other regressors, the estimated coefficients have expected signs. We note two points. First, even when H_0 is included as a regressor, the estimated coefficients of income inequality remain significant statistically. This result differs from that in Benhabib and Spiegal (1994).[7] Second, regional dummies (*Latin*, *Africa* and *Asia*) are mostly not related to long-run economic growth, as in Persson and Tabellini (1994). However, unlike Persson and Tabellini (1994), our estimated coefficients on income inequality do not lose the significance when regional dummies are added. Overall, these variables explain about 63% of long-term growth differentials across countries. For regressions (3)–(4), while (3) drops the three regional dummies, (4) removes further the four institutional and policies' variables.

Although their explanatory power reduces due to reductions in the number of regressors, a significant inverted-U relationship remains unchanged. We have also estimated other regressions by dropping different regressors, and using different initial Gini's. The inverted-U result remains the same.

There could be other control variables than the above three sets. When we include other control variables, for example, a rule-of-law and financial variables, an inverted-U relationship maintains, albeit some control variables lose significance. We have also separated East Asian countries and other Asian countries into two dummies. The results are the same. Some have argued that growth and an

[5] The same adjustment has been made by Li and Zou (1998) and Forbes (2000).

[6] For all estimations, we consider a possibility that observations are not identically distributed and might have different variances; that is heteroscedasticity. We account for it by the Huber–White variance correction.

[7] In Benhabib and Spiegal (1994), when the initial stock of human capital is added as a regressor, the effect of income inequality on economic growth becomes statistically insignificant.

Table 1
Regression results

	(1)	(2)	(3)	(4)	(5)
$Gini_{70}$	0.3164**	–	0.5002***	0.3490***	0.3464***
	(0.1384)		(0.1082)	(0.1049)	(0.1544)
$Gini^2_{70}$	−0.4250***	–	−0.6353***	−0.4467***	−0.4316***
	(0.1431)		(0.1111)	(0.1265)	(0.1838)
$Gini_{65-75}$	–	0.3650***	–	–	–
		(0.1315)			
$Gini^{\ 2}_{65-750}$	–	−0.4703***	–	–	–
		(0.1348)			
Y_0	−0.0037	−0.0051	−0.0079**	−0.0094**	−0.0042
	(0.0045)	(0.0043)	(0.0040)	(0.0038)	(0.0040)
INV	0.0762**	0.0738**	0.0754*	0.1136**	0.0010
	(0.0356)	(0.0350)	(0.0317)	(0.0426)	(0.0207)
H_0	0.0014	0.0017	0.0019	0.0023	0.0019
	(0.0014)	(0.0014)	(0.0014)	(0.0017)	(0.0044)
BMP	−0.0279***	−0.0273***	−0.0281**	–	−0.0248***
	(0.0086)	(0.0083)	(0.0104)		(0.0044)
GOV	−0.0934***	−0.0987***	−0.0899***	–	−0.1032***
	(0.0244)	(0.0238)	(0.0279)		(0.0390)
INF	−0.0087	−0.0093	−0.0119	–	−0.0001
	(0.0113)	(0.0113)	(0.0113)		(0.0104)
ICL	−0.0179***	−0.0182***	−0.0211***	–	−0.0080***
	(0.0049)	(0.0050)	(0.0053)		(0.0050)
Latin	0.0040	0.0019	–	–	−0.0052
	(0.0055)	(0.0055)			(0.0066)
Africa	0.0128	0.0107	–	–	−0.0090
	(0.0095)	(0.0092)			(0.0107)
Asia	0.0122*	0.0103	–	–	0.0144*
	(0.0070)	(0.0068)			(0.0075)
$\lvert\alpha_2\rvert - \lvert\alpha_1\rvert$	0.1086***,a	0.1053***,a	0.1352***,a	0.0977**,a	0.0852**,a
	(0.0355)	(0.0354)	(0.0315)	(0.04503)	(0.0485)
No. of countries	43	43	43	43	54
Adj-R^2	0.6313	0.6413	0.6281	0.2861	0.4936

The dependent variable is the average annual growth rate of real GDP per capita in 1970–1992 (*GR*). The intercept term is not reported. Notations ***, ** and * represent statistical significance at the 1, 5 and 10% level under two-sided tests (except those with *a* whose significance is for one-sided tests). The numbers in the parentheses are the Huber–White heteroscedasticity-adjusted standard deviation.

investment share may be simultaneously determined, so we have also conducted estimations with *INV* dropping from regressors. Although explanatory power decreases a lot, an inverted-U relationship remains unchanged.

Another inequality measure is the income share of the highest 40th to the 60th percentile (denoted as *MED*). While the Gini reflects the overall income distribution effects, the MED reflects the well-being of median voters. As the MED has been used in several existing works (e.g., Persson and Tabellini, 1994), we have also estimated our model using the MED. The *MED* also ranges from 0 to

1, but the larger the *MED*, the higher the *equality*. Two kinds of initial *MED* are constructed, as initial *Gini*. We estimate regressions under different combinations of control variables. An inverted-U relationship is obtained.

In order to increase the number of sampling countries, we augment the data by including the countries with Gini coefficients from 1960 to 1980. By doing so, we get 11 more countries, making the total number of countries 54. For a country with an initial Gini in 1960–1964, time period 1970–1992 and time 1970 are used for constructing long-term average variables and initial variables, respectively. For a country with an initial Gini in 1976–1980, time period 1980–1992 and time 1980 are used for constructing the corresponding variables. Gini's for an initial year and an average year are used, and the estimation results are similar. A statistically significant, inverted-U relationship is obtained for all regressions. See one of the results in Regression (5) (Table 1).

Finally, in order to demonstrate an estimated inverted-U relationship, we have plotted fitted regression (1) in Table 1 into Fig. 1 with axises ($Gini_{70}$, GR), with the control variables evaluated at their mean levels. We obtain a concave locus. With a concave shape, there is naturally an optimal Gini to attain maximal economic growth. Simple algebra indicates that the optimal value is 37.2% (the value is 39 and 40% for regressions (3) and (4), all on a 100 scale) which is about the average level of East Asia and West European regions. The result that the estimated optimal degree of income inequality is at the average level in the East Asian region is consistent with the argument proposed by Benabou (1996), who advocates that not only the initial first moment conditions, but also the initial second moment conditions, are important in explaining the East Asian growth miracles. However, he

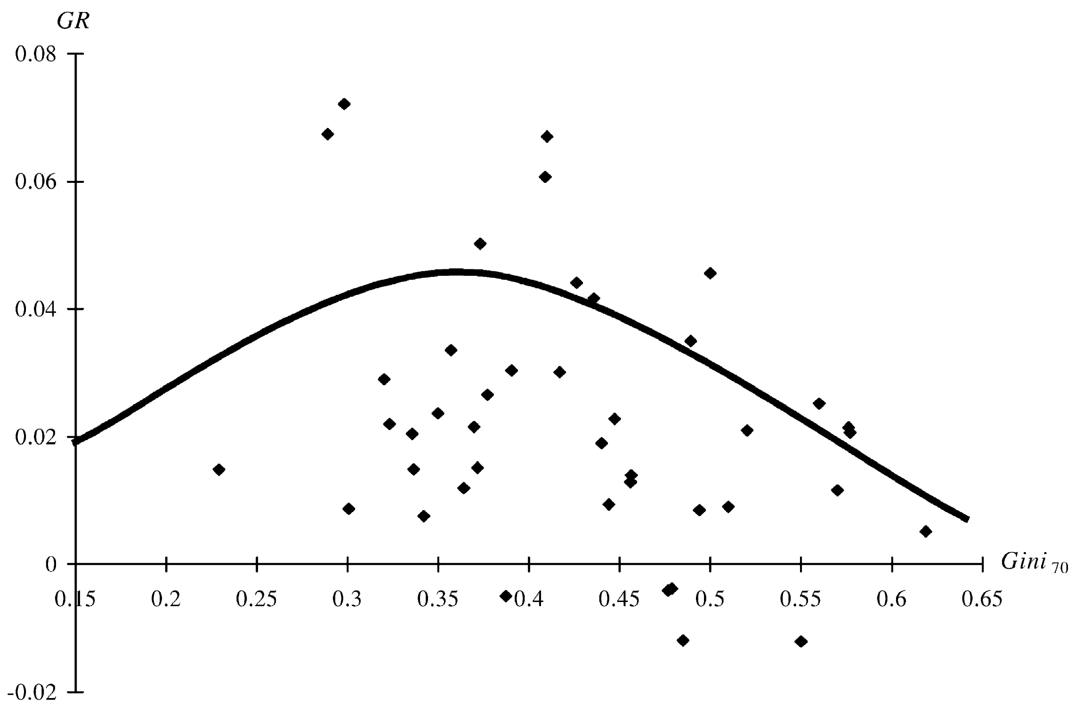

Fig. 1. A fitted relationship between Initial $Gini_{70}$ and Long-run Economic Growth.

does not notice the existence of an inverse-U relationship between the initial second moment conditions and long-run economic growth.

4. Concluding remarks

This paper has documented an inverted-U relationship between income distribution and long-run economic growth using cross-country data. If the long-run relationship means causality, our empirical results have implications, in that a country with a small initial income inequality can enhance economic growth by widening income inequality, and a country with a large income inequality can increase economic growth by reducing its income inequality, other things being equal. Since our model does not guarantee this causality, such an interpretation should be very careful.

Our empirical results are reminiscent of the Kuznets Curve (1966), according to which income inequality first increases and then decreases with the *level* of income. Our finding differs from the Kuznets Curve, in that the long-run income *growth rate* first rises and then declines with the initial income inequality. Therefore, our results do not conflict with the Kuznets Curve.

Is it possible that an inverted-U relationship also exists in a short run? When we follow Forbes's (2000) procedure to pool data in a 5-year period, the estimated results do not support such a relationship. Yet, this does not necessarily imply such a relationship does not exist in economic transitions. The main reasons lie in the data that income inequality changes very little for different periods, whereas economic growth rates vary much more. Nevertheless, we still believe such an inverted-U relationship appealing, as income distribution that is too equally distributed and one that is too unequally distributed would both kill incentives for working and investment. A deviation toward more inequality in the former case and toward more equality in the latter case would save such incentives. Documenting evidence using panel data is an avenue for further research.

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