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Inequality and Growth in a Panel of Countries

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Evidence from a broad panel of countries shows little overall relation between income inequality and rates of growth and investment. For growth, higher inequality tends to retard growth in poor countries and encourage growth in richer places. The Kuznets curve—whereby inequality first increases and later decreases during the process of economic development—emerges as a clear empirical regularity. However, this relation does not explain the bulk of variations in inequality across countries or over time.

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JEL classification: O4, I3

A substantial literature analyzes the effects of income inequality on macroeconomic performance, as reflected in rates of economic growth and investment. Much of this analysis is empirical, using data on the performance of a broad group of countries. This article contributes to this literature by using a framework for the determinants of economic growth that I have developed and used in previous studies. To motivate the extension of this framework to income inequality, I begin by discussing recent theoretical analyses of the macroeconomic consequences of income inequality. Then I develop the applied framework and describe the new empirical findings.

1. Theoretical Effects of Inequality on Growth and Investment

Many theories have been constructed to assess the macroeconomic relations between inequality and economic growth.[1] These theories can be classed into four broad categories corresponding to the main feature stressed: credit-market imperfections, political economy, social unrest, and saving rates.

1.1. Credit-Market Imperfections

In models with imperfect credit markets, the limited ability to borrow means that rates of return on investment opportunities are not necessarily equated at the margin.[2] The credit-market imperfections typically reflect asymmetric information and limitations of legal institutions. For example, creditors may have difficulty in collecting on defaulted loans because law enforcement is imperfect. Collection may also be hampered by a bankruptcy law that protects the assets of debtors.

With limited access to credit, the exploitation of investment opportunities depends on individuals' levels of assets and incomes. Specifically, poor households tend to forego human-capital investments that offer relatively high rates of return. In this case, a distortion-free redistribution of assets and incomes from rich to poor tends to raise the quantity and average productivity of investment. Through this mechanism, a reduction in inequality raises the rate of economic growth, at least during a transition to the steady state.

An offsetting force arises if investments require setup costs—that is, if increasing returns to investment prevail over some range. For instance, formal education may be most useful when carried out beyond some minimal level. One possible manifestation of this effect is the strong role for secondary schooling, rather than primary schooling, in predicting economic growth (see Barro, 1997). Analogously, a business may be productive only if it goes beyond some threshold size. If these kinds of setup costs are large in relation to median income, then a reduction in inequality tends to reduce overall investment.[3] Hence, this element tends to generate a positive effect of inequality on economic growth.

If capital markets and legal institutions tend to improve as an economy develops, then the effects related to capital-market imperfections are more important in poor economies than in rich ones. Therefore, the predicted effects of inequality on economic growth (which were of uncertain sign) would be larger in magnitude for poor economies than for rich ones.

1.2. Political Economy

If the mean income in an economy exceeds the median income, then a system of majority voting tends to favor redistribution of resources from rich to poor.[4] These redistributions may involve explicit transfer payments but can also involve public-expenditure programs (such as education and child care) and regulatory policies.

A greater degree of inequality—measured, for example, by the ratio of mean to median income—motivates more redistribution through the political process. Typically, the transfer payments and the associated tax finance will distort economic decisions. For example, means-tested welfare payments and levies on labor income discourage work effort. In this case, a greater amount of redistribution creates more distortions and tends, therefore, to reduce investment. Economic growth declines accordingly, at least in the transition to the steady state. Since a greater amount of inequality (measured before transfers) induces more redistribution, it follows through this channel that inequality would reduce growth.

The data typically refer to ex-post inequality—that is, to incomes measured net of the effects from various government activities. These activities include expenditure programs, notably education and health, transfers, and nonproportional taxes. Some of the data refer to income net of taxes or to consumer expenditures, rather than to income gross of taxes. However, even the net-of-tax and expenditure numbers are ex post to the effects of various public-sector interventions, such as public education programs.

The relation of ex-post inequality to economic growth is complicated in the political-economy models. If countries differ only in their ex-ante distributions of income, then the redistributions that occur through the political process tend to be only partly offsetting.

That is, the places that are more unequal ex ante are also those that are more unequal ex post. In this case, the predicted negative relation between inequality and growth holds for ex-post, as well as ex-ante, income inequality.

The predicted relation between ex-post inequality and growth may change if countries differ by their tastes for redistribution. In this case, the countries that look more equal ex post tend to be those that have redistributed the most and, hence, caused the most distortions of economic decisions. In this case, ex-post inequality tends to be positively related to growth and investment.

The effects that involve transfers through the political process arise if the distribution of political power is uniform—as in a one-person/one-vote democracy—and the allocation of economic power is unequal. If more economic resources translate into correspondingly greater political influence, then the positive link between inequality and redistribution need not apply.[5] More generally, the predicted effect arises if the distribution of political power is more egalitarian than the distribution of economic power.

A negative effect of inequality on growth may arise in the political-economy models even if no transfers occur in equilibrium. The rich may prevent redistributive policies through lobbying and buying of votes of legislators. But then a higher level of economic inequality would require more of these actions to prevent redistribution of income through the political process. The lobbying activities would consume resources and promote official corruption and tend accordingly to hamper economic performance. Therefore, inequality can have a negative effect on growth through the political channel even if no redistribution of income takes place in equilibrium.

1.3. Sociopolitical Unrest

Inequality of wealth and income motivates the poor to engage in crime, riots, and other disruptive activities.[6] The stability of political institutions may even be threatened by revolution, so that laws and other rules have shorter expected duration and greater uncertainty. The participation of the poor in crime and other antisocial actions represents a direct waste of resources because the time and energy of the criminals are not devoted to productive efforts. Moreover, the threats to property rights deter investment. Through these various dimensions of sociopolitical unrest, more inequality tends to reduce the productivity of an economy. Economic growth declines accordingly at least in the transition to the steady state.

An offsetting force is that economic resources, including education, are required for the poor effectively to cause disruption and threaten the stability of the established regime. Hence, income-equalizing transfers promote political stability only to the extent that the first force—the incentive of the poor to steal and disrupt, rather than work—is the dominant factor.

Even in a dictatorship, self-interested leaders would favor income-equalizing transfers if the net effect were a decrease in the tendency for social unrest and political instability. Thus, these considerations predict some provision of a social safety net irrespective of the form of government. Moreover, the tendency for redistribution to reduce crimes and riots provides a mechanism whereby this redistribution—and the resulting greater income equality—would enhance economic growth.

1.4. *Saving Rates*

Some economists, perhaps influenced by Keynes's *General Theory*, believe that individual saving rates rise with the level of income. If true, then a redistribution of resources from rich to poor tends to lower the aggregate rate of saving in an economy. Through this channel, a rise in inequality tends to raise investment. (This effect arises if the economy is partly closed, so that domestic investment depends, to some extent, on desired national saving.) In this case, more inequality would enhance economic growth at least in a transitional sense.

The previous discussion of imperfect credit markets brought out a related mechanism by which inequality might promote economic growth. In that analysis, large setup costs for investment implied that concentration of asset ownership would be beneficial for the economy. The present discussion of aggregate saving rates provides a complementary reason for a positive effect of inequality on growth.

1.5. *Overview*

Many nice theories exist for assessing the effects of inequality on investment and economic growth. The problem is that these theories tend to have offsetting effects and that the net effects of inequality on investment and growth are ambiguous.

The theoretical ambiguities do, in a sense, accord with empirical findings, which tend not to be robust. Perotti (1996) reports an overall tendency for inequality to generate lower economic growth in cross-country regressions. Benabou (1996, Table 2) also summarizes these findings. However, some researchers, such as Li and Zou (1998) and Forbes (1997), have reported relationships with the opposite sign.[7]

My new results about the effects of inequality on growth and investment for a panel of countries are discussed in a later section. I report evidence that the negative effect of inequality on growth shows up for poor countries but that the relationship for rich countries is positive. However, the overall effects of inequality on growth and investment are weak.

2. The Evolution of Inequality

The main theoretical approach to assessing the determinants of inequality involves some version of the Kuznets (1955) curve. Kuznets's idea, developed further by Robinson (1976), focused on the movements of persons from agriculture to industry. In this model, the agricultural and rural sector initially constitutes the bulk of the economy. This sector features low per capita income and, perhaps, relatively little inequality within the sector. The industrial and urban sector starts out small, has higher per capita income and, possibly, a relatively high degree of inequality within the sector.

Economic development involves a shift of persons and resources from agriculture to industry. The persons who move experience a rise in per capita income, and this change raises the economy's overall degree of inequality. That is, the dominant effect initially is the expansion in size of the small and relatively rich group of persons in the industrial and urban sectors. Consequently, at early stages of development, the relation between the level of per capita product and the extent of inequality tends to be positive.

As the size of the agricultural sector diminishes, the main effect on inequality from the continuing urbanization is that more of the poor agricultural workers are enabled to join the relatively rich industrial sector. In addition, many workers who started out at the bottom rungs of the industrial sector tend to move up in relation to the richer workers within this sector. The decreasing size of the agricultural labor force tends, in addition, to drive up relative wages in that sector. These forces combine to reduce indexes of overall inequality. Hence, at later stages of development, the relation between the level of per capita product and the extent of inequality tends to be negative.

The full relationship between an indicator of inequality, such as a Gini coefficient, and the level of per capita product is described by an inverted-U, which is the curve named after Kuznets. Inequality first rises and later falls as an economy develops.

More recent models that feature a Kuznets curve generalize beyond the shift of persons and resources from agriculture to industry. The counterpart of the movement from rural agriculture to urban industry may be a shift from a financially unsophisticated environment to one of inclusion with the modern financial system (see Greenwood and Jovanovic, 1990).

In another approach, the poor sector may be the user of an old technology, whereas the rich sector is the one that employs more recent and advanced techniques (see Aghion and Howitt, 1997; Galor and Tsiddon, 1997; Helpman, 1997). Mobility from old to new requires a process of familiarization and reeducation. In this context, many technological innovations—such as the factory system, electrical power, computers, and the internet—tend initially to raise inequality. The dominant force here is that few persons get to share initially in the relatively high incomes of the technologically advanced sector. As more people move into this favored sector, inequality tends to rise along with expanding per capita product. But, subsequently, as more people take advantage of the superior techniques, inequality tends to fall. This equalization occurs because relatively few people remain behind eventually and because the newcomers to the more advanced sector tend to catch up to those who started ahead. The relative wage rate of those staying in the backward sector may also rise as the supply of factors to that sector diminishes.

In these theories, inequality would depend on how long ago a new technological innovation was introduced into the economy. Since the level of per capita GDP would not be closely related to this technological history, the conventional Kuznets curve would not fit very well. The curve would fit only to the extent that a high level of per capita GDP signaled that a country had introduced advanced technologies or modern production techniques relatively recently.

On an empirical level, the Kuznets curve was accepted through the 1970s as a strong empirical regularity (see especially Ahluwalia, 1976a, 1976b). Papanek and Kyn (1986) find that the Kuznets relation is statistically significant but explains little of the variations in inequality across countries or over time. Subsequent work suggested that the relation had weakened over time (see Anand and Kanbur, 1993). Li, Squire, and Zou (1998) argue that the Kuznets curve works better for a cross section of countries at a point in time than for the evolution of inequality over time within countries.

My new results on the Kuznets curve and other determinants of inequality are discussed in a later section. I find that the Kuznets curve shows up as a clear empirical regularity across countries and over time and that the relationship has not weakened over time. I find, however, consistent with some earlier researchers, that this curve explains relatively little of the variations in inequality across countries over time.

3. Framework for the Empirical Analysis of Growth and Investment

The empirical framework is the one based on conditional convergence, which I have used in several places, starting in Barro (1991) and updated in Barro (1997). I will include here only a brief description of the structure.

The framework, derived from an extended version of the neoclassical growth model, can be summarized by a simple equation:

$$Dy = F(y, y^*), \tag{1}$$

where Dy is the growth rate of per capita output, y is the current level of per capita output, and y^* is the long-run or target level of per capita output. In the neoclassical model, the diminishing returns to the accumulation of physical and human capital imply that an economy's growth rate, Dy, varies inversely with its level of development, as represented by y.[8] In the present framework, this property applies in a conditional sense, for a given value of y^*.

For a given value of y, the growth rate, Dy, rises with y^*. The value y^* depends, in turn, on government policies and institutions and on the character of the national population. For example, better enforcement of property rights and fewer market distortions tend to raise y^* and, hence, increase Dy for given y. Similarly, if people are willing to work and save more and have fewer children, then y^* increases, and Dy rises accordingly for given y.

In this model, a permanent improvement in some government policy initially raises the growth rate, Dy, and then raises the level of per capita output, y, gradually over time. As output rises, the workings of diminishing returns eventually restore the growth rate, Dy, to a value consistent with the long-run rate of technological progress (which is determined outside of the model in the standard neoclassical framework). Hence, in the very long run, the impact of improved policy is on the level of per capita output, not its growth rate. But since the transitions to the long run tend empirically to be lengthy, the growth effects from shifts in government policies persist for a long time.

The findings on economic growth reported in Barro (1997) provide estimates for the effects on economic growth and investment from a number of variables that measure government policies and other factors. That study applied to roughly 100 countries observed from 1960 to 1990. This sample has now been updated to 1995 and has been modified in other respects.

The framework includes countries at vastly different levels of economic development, and places are excluded only because of missing data. The attractive feature of this broad sample is that it encompasses great variation in the government policies and other variables that are to be evaluated. My view is that it is impossible to use the experience of one or a few countries to get an accurate empirical assessment of the long-term growth implications from factors such as legal institutions, size of government, monetary and fiscal policies, degree of income inequality, and so on.

One drawback of this kind of diverse sample is that it creates difficulties in measuring variables in a consistent and accurate way across countries and over time. In particular, less developed countries tend to have a lot of measurement error in national accounts and other data. The hope is that the strong signal from the diversity of the experience dominates the noise.

The other empirical issue, which is likely to be more important than measurement error, is the sorting out of directions of causation. The objective is to isolate the effects of government policies and other variables on long-term growth. In practice, however, much of the government and private-sector behavior—including monetary and fiscal policies, political stability, and rates of investment and fertility—are reactions to economic events. In most cases discussed in the following, the labeling of directions of causation depends on timing evidence, whereby earlier values of explanatory variables are thought to influence subsequent economic performance. However, this approach to determining causation is not always valid.

The empirical work considers average growth rates and average ratios of investment to GDP over three decades, 1965 to 1975, 1975 to 1985, and 1985 to 1995.[9] In one respect, this long-term context is forced by the data because many of the determining variables considered, such as school attainment and fertility, are measured at best over five-year intervals. Higher frequency observations would be mainly guesswork. The low-frequency context accords, in any event, with the underlying theories of growth, which do not attempt to explain short-run business fluctuations. In these theories, the short-run response—for example, of the rate of economic growth to a change in a public institution—is not as clearly specified as the medium- and long-run response. Therefore, the application of the theories to annual or other high-frequency observations would compound the measurement error in the data by emphasizing errors related to the timing of relationships.

Table 1 shows baseline panel regression estimates for the determination of the growth rate of real per capita GDP. Table 2 shows corresponding estimates for the ratio of investment to GDP.[10] The estimation is by three-stage least squares. Instruments are mainly lagged values of the regressors (see the notes to Table 1).

The framework includes different constant terms for each of the three time periods. Hence, the analysis does not explain changes over time in world averages of economic growth and investment ratios. The specification incorporates random effects, whereby the error terms are allowed to be correlated over time within countries. The framework does not include country fixed effects, which would eliminate the cross-sectional information in the data. Hence, the results reflect cross-sectional differences among countries, as well as variations over time within countries. In practice, the main information comes from the cross-sectional dimension (see Barro, 1997, pp. 36–42, for further discussion).

The effects of the starting level of real per capita GDP show up in the estimated coefficients on the level and square of the log of per capita GDP. The other regressors include an array of policy variables—the ratio of government consumption to GDP, a subjective index of the maintenance of the rule of law, a subjective index for democracy (electoral rights), and the rate of inflation. Also included are a measure of school attainment at the start of each

Table 1. Panel regressions for growth rate.

Independent Variable	Estimated Coefficient in Full Sample	Estimated Coefficient in Gini Sample
log(per capita GDP)	0.123 (0.027)	0.101 (0.030)
log(per capita GDP) squared	−0.0095 (0.0018)	−0.0081 (0.0019)
Government consumption/GDP	−0.149 (0.023)	−0.153 (0.027)
Rule-of-law index	0.0173 (0.0053)	0.0103 (0.0064)
Democracy index	0.053 (0.029)	0.041 (0.033)
Democracy index squared	−0.047 (0.026)	−0.036 (0.028)
Inflation rate	−0.037 (0.010)	−0.014 (0.009)
Years of schooling	0.0072 (0.0017)	0.0066 (0.0017)
log(total fertility rate)	−0.0250 (0.0047)	−0.0303 (0.0054)
Investment/GDP	0.059 (0.022)	0.062 (0.022)
Growth rate of terms of trade	0.164 (0.028)	0.122 (0.035)
Numbers of observations	79, 87, 84	39, 56, 51
R^2	0.67, 0.49, 0.41	0.73, 0.62, 0.60

Notes: The dependent variable is the growth rate of real per capita GDP. The growth rate is the average for each of the three periods 1965 to 1975, 1975 to 1985, and 1985 to 1995. The middle column has the full sample of observations with available data. The third column restricts to the observations for which the Gini coefficient, used in later regressions, is available.

Individual constants (not shown) are included in each panel for each period. The log of real per capita GDP and the average years of male secondary and higher schooling are measured at the beginning of each period. The ratios of government consumption (exclusive of spending on education and defense) and investment (private plus public) to GDP, the democracy index, the inflation rate, the total fertility rate, and the growth rate of the terms of trade (export over import prices) are period averages. The rule-of-law index is the earliest value available (for 1982 or 1985) in the first two equations and the period average for the third equation.

Estimation is by three-stage least squares. Instruments are the actual values of the schooling and terms-of-trade variables, lagged values of the other variables aside from inflation, and dummy variables for prior colonial status (which have substantial explanatory power for inflation). The earliest value available for the rule-of-law index (for 1982 or 1985) is included as an instrument for the first two equations, and the 1985 value is included for the third equation. Asymptotically valid standard errors are shown in parentheses. The R^2 values apply to each period separately.

period, the total fertility rate, the ratio of investment to GDP (in the growth regressions), and the growth rate of the terms of trade (export prices relative to import prices). The data, some of which were constructed in collaboration with Jong-Wha Lee, are available from the web sites of the World Bank and the National Bureau of Economic Research.

The results contained in Tables 1 and 2 are intended mainly to provide a context to assess the effects of income inequality on growth and investment. Briefly, the estimated effects on the growth rate of real per capita GDP from the explanatory variables shown in the first column of Table 1 are as follows.

The relations with the level and square of the log of per capita GDP imply a nonlinear, conditional convergence relation. The implied effect of log(GDP) on growth is negative for all but the poorest countries (with per capita GDP below $670 in 1985 U.S. dollars). For

Table 2. Panel regressions for investment ratio.

Independent Variable	Estimated Coefficient in Full Sample	Estimated Coefficient in Gini Sample
log(per capita GDP)	0.199 (0.083)	0.155 (0.119)
log(per capita GDP) squared	−0.0119 (0.0053)	−0.0099 (0.0071)
Government consumption/GDP	−0.282 (0.072)	−0.341 (0.105)
Rule-of-law index	0.063 (0.019)	0.063 (0.025)
Democracy index	0.100 (0.079)	0.093 (0.123)
Democracy index squared	−0.108 (0.068)	−0.096 (0.103)
Inflation rate	−0.058 (0.026)	−0.026 (0.028)
Years of schooling	−0.0005 (0.0058)	0.0050 (0.0066)
log(total fertility rate)	−0.0586 (0.0140)	−0.0679 (0.0189)
Growth rate of terms of trade	0.073 (0.067)	0.162 (0.113)
Numbers of observations	79, 87, 85	39, 56, 51
R^2	0.52, 0.59, 0.66	0.37, 0.64, 0.68

Notes: The dependent variable is the ratio of real investment (private plus public) to real GDP. The measure is the average of the annual observations on the ratio for each of the periods 1965 to 1975, 1975 to 1985, and 1985 to 1992. See the notes to Table 1 for other information.

richer places, growth declines at an increasing rate with rises in the level of per capita GDP. For the richest countries, the implied convergence rate is 5 to 6% per year.

For a given value of log(GDP), growth is negatively related to the ratio of government consumption to GDP, where this consumption is measured net of outlays on public education and national defense. Growth is positively related to a subjective index of the extent of maintenance of the rule of law. Growth is only weakly related to the extent of democracy, measured by a subjective indicator of electoral rights. (This variable appears linearly and as a square in the equations.) Growth is inversely related to the average rate of inflation, which is an indicator of macroeconomic stability. (Although not shown in Table 1, growth is insignificantly related to the ratio of public debt to GDP, measured at the start of each period.)

Growth is positively related to the stock of human capital, measured by the average years of attainment at the secondary and higher levels of adult males at the start of each period. (Growth turns out to be insignificantly related to secondary and higher attainment of females and to primary attainment of males and females.) Growth is inversely related to the fertility rate, measured as the number of prospective live births per woman over her lifetime.

Growth is positively related to the ratio of investment to GDP. For most variables, the use of instruments does not much affect the estimated coefficient. However, for the investment ratio, the use of lagged values as instruments reduces the estimated coefficient by about one-half relative to the value obtained if the contemporaneous ratio is included with the instruments. This result suggests that the reverse effect from growth to investment is also important. Finally, growth is positively related to the contemporaneous growth rate of the terms of trade.

The main results for the determination of the investment ratio, shown in column 1 of Table 2, are as follows. The relation with the log of per capita GDP is hump-shaped. The implied relation is positive for values of per capita GDP up to $5100 (1985 U.S. dollars) and then becomes negative.

Investment is negatively related to the ratio of government consumption to GDP, positively related to the rule-of-law indicator, insignificantly related to the democracy index, and negatively related to the inflation rate. The interesting results here are that a number of policy variables that affect economic growth directly (for a given ratio of investment to GDP) tend to affect the investment ratio in the same direction. This effect of policy variables on investment reinforces the direct effects on economic growth. Investment is insignificantly related to the level of the schooling variable, negatively related to the fertility rate, and insignificantly related to the growth rate of the terms of trade.

4. Measures of Income Inequality

Data on income inequality come from the extensive compilation for a large panel of countries in Deininger and Squire (1996). The data provided consist of Gini coefficients and quintile shares. The compilation indicates whether inequality is computed for income gross or net of taxes or for expenditures. Also indicated is whether the income concept applies to individuals or households. These features of the data are considered in the subsequent analysis.

The numbers for a particular country apply to a specified survey year. To use these data in the regressions for the growth rate or the investment ratio, I classed each observation on the inequality measure as 1960, 1970, 1980, or 1990, depending on which of these ten-year values was closest to the survey date.

Deininger and Squire denote a subset of their data as high quality. The grounds for exclusion from the high-quality set include the survey being of less than national coverage; the basing of information on estimates derived from national accounts, rather than from a direct survey of incomes; limitations of the sample to the income earning population; and derivation of results from nonrepresentative tax records. Data are also excluded from the high-quality set if there is no clear reference to the primary source.

A serious problem with the inequality data is that many fewer observations are available than for the full sample considered in Tables 1 and 2. As an attempt to expand the sample size—even at the expense of some reduction in accuracy of measurement—I added to the high-quality set a number of observations that appeared to be based on representative, national coverage. The main reason that these observations had been excluded was the failure to identify clearly a primary source.[11] In the end, considering also the availability of data for the variables included in Tables 1 and 2, the sample contains 84 countries with at least one observation on the Gini coefficient (of which 20 are in Sub-Saharan Africa). There are 68 countries with two or more observations (of which 9 are in Sub-Saharan Africa). Table 3 provides descriptive statistics on the Gini values.

Much of the analysis uses the Gini coefficient as the empirical measure of income inequality. One familiar interpretation of this coefficient comes from the Lorenz curve, which graphs cumulated income shares versus cumulated population shares, when the population is ordered from low to high per capita incomes. In this context, the Gini coefficient can be computed as twice the area between the 45-degree line that extends northeastward from

Table 3. Statistics for Gini coefficients.

	Gini 1960	Gini 1970	Gini 1980	Gini 1990
Number of observations	49	61	68	76
Mean	0.432	0.416	0.394	0.409
Maximum	0.640	0.619	0.632	0.623
Minimum	0.253	0.228	0.210	0.227
Standard deviation	0.100	0.094	0.092	0.101
Correlation with:				
Gini 1960	1.00	0.81	0.85	0.72
Gini 1970	0.81	1.00	0.93	0.87
Gini 1980	0.85	0.93	1.00	0.86
Gini 1990	0.72	0.87	0.86	1.00

Note: The table shows descriptive statistics for the Gini coefficients. The years shown are the closest 10-year value to the actual date of the survey on income distribution. Two observations have been omitted (Hungary in 1960 and Bahamas in 1970) because the corresponding data on GDP were unavailable.

the origin and the Lorenz curve. Theil (1967, pp. 121 ff.) shows that the Gini coefficient equals a weighted average of all absolute differences between per capita incomes (expressed relative to economywide per capita income), where the weights are the products of the corresponding population shares.

If the underlying data are quintile shares, and we pretend that all persons in each quintile have the same incomes, then the Gini coefficient can be expressed in two equivalent ways in relation to the quintile shares:

$$\begin{aligned} \text{Gini coefficient} &= 0.8^*(-1 + 2Q5 + 1.5Q4 + Q3 + 0.5Q2) \\ &= 0.8^*(1 - 2Q1 - 1.5Q2 - Q3 - 0.5Q4), \end{aligned} \tag{2}$$

where Qi is the share of income accruing to the ith quintile, with group 1 the poorest and group 5 the richest. The first form says that the Gini coefficient gives positive weights to each of the quintile shares from 2 to 5, where the largest weight (2) applies to the fifth quintile and the smallest weight (0.5) attaches to the second quintile. The second form says that the Gini coefficient can be viewed alternatively as giving negative weights to the quintile shares from 1 to 4, where the largest negative weight (2) applies to the first quintile and the smallest weight (0.5) attaches to the fourth quintile.

In the present sample, the Gini coefficient is highly correlated with the upper quintile share, $Q5$, and not as highly correlated with other quintile shares. The correlations of the Gini coefficients with $Q5$ are 0.89 for 1960, 0.92 for 1970, 0.95 for 1980, and 0.98 for 1990. In contrast, the correlations of the Gini coefficients with $Q1$ are smaller in magnitude: −0.76 in 1960, −0.85 in 1970, −0.83 in 1980, and −0.91 in 1990. Because of these patterns, the results that use Gini coefficients turn out to be similar to those that use $Q5$ but not so similar to those that use $Q1$ or other quintile measures. One reason that the correlations between the Gini coefficients and the $Q5$ values are so high is that the $Q5$ variables have much larger standard deviations than the other quintile shares.

Table 4. Effects of Gini coefficients on growth rates and investment ratios.

	Gini	Gini* log(GDP)	Gini (low GDP)	Gini (high GDP)	Wald Tests (p-values)
Growth rate regressions					
	0.000				
	(0.018)				
	−0.328	0.043			0.061
	(0.140)	(0.018)			
			−0.033	0.054	0.011,
			(0.021)	(0.025)	0.003*
Fertility variable omitted					
	−0.036				
	(0.017)				
	−0.364	0.043			0.014
	(0.155)	(0.020)			
			−0.059	−0.003	0.017,
			(0.021)	(0.026)	0.078*
Investment ratio regressions					
	0.050				
	(0.070)				
	0.49	−0.058			0.48
	(0.48)	(0.062)			
Fertility variable omitted					
	−0.049				
	(0.066)				
	0.46	−0.066			0.45
	(0.49)	(0.063)			

Notes: Gini coefficients were added to the systems shown in Tables 1 and 2. The Gini value around 1960 appears in the equations for growth from 1965 to 1975 and for investment from 1965 to 1974, the Gini value around 1970 appears in the equations for 1975 to 1985 and 1975 to 1984, and the Gini value around 1980 appears in the equations for 1985 to 1995 and 1985 to 1992. The variable Gini*log(GDP) is the product of the Gini coefficient and the log of per capita GDP. The system with Gini (low GDP) and Gini (high GDP) allows for two separate coefficients on the Gini variable. The first coefficient applies when log(GDP) is below the break point for a negative effect of the Gini coefficient on growth, as implied by the system that includes Gini and Gini*log(GDP). The second coefficient applies for higher values of log(GDP). Separate intercepts are also included for the two ranges of log(GDP). The variables that include the Gini coefficients are included in the lists of instrumental variables. The Wald tests are for the hypothesis that both coefficients equal zero. Values denoted by an asterisk are for the hypothesis that the two coefficients are equal (but not necessarily equal to zero). See the notes to Table 1 for additional information.

5. Effects of Inequality on Growth and Investment

The second columns of Tables 1 and 2 show how the baseline regressions are affected by the restriction of the samples to those for which data on the Gini coefficient are available. This restriction reduces the overall sample size for the growth-rate panel from 250 to 146 (and from 251 to 146 for the investment-ratio panel). This diminution in sample size does not affect the general nature of the coefficient estimates. The main effect is that the inflation rate is less important in the truncated sample.

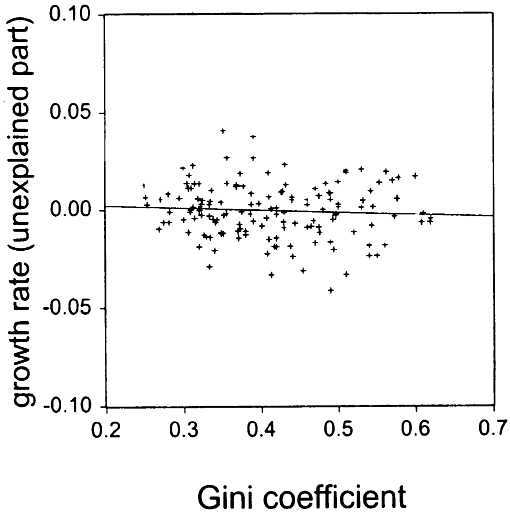

Figure 1. Growth rate versus Gini coefficient.

Table 4 shows the estimated coefficients on the Gini coefficient when this variable is added to the panel systems from Tables 1 and 2. In these results, the raw data on the Gini coefficient are entered directly. A reasonable alternative is to adjust these Gini values for differences in the method of measurement. The important differences are whether the data are for individuals or households and whether the inequality applies to income gross or net of taxes or to expenditures rather than incomes. Some of these features turn out to matter significantly for the measurement of inequality, as discussed in the next section. However, the adjustment of the inequality variables for these elements turns out to have little consequence for the estimated effects of inequality on growth and investment. Therefore, the results reported here consider only the unadjusted measures of inequality.

For the growth rate, the estimated coefficient on the Gini coefficient in Table 4 is essentially zero. Figure 1 shows the implied partial relation between the growth rate and the Gini coefficient.[12] This pattern looks consistent with a roughly zero relationship and does not suggest any obvious nonlinearities or outliers. Thus, overall, with the other explanatory variables considered in Table 1 held constant, differences in Gini coefficients for income inequality have no significant relation with subsequent economic growth. One possible interpretation is that the various theoretical effects of inequality on growth, as summarized before, are nearly fully offsetting.

It is possible to modify the present system to reproduce the finding from many studies that inequality is negatively related to economic growth. If the fertility-rate variable—which is positively correlated with inequality—is omitted from the system, then the estimated coefficient on the Gini variable becomes significantly negative. Table 4 shows that the estimated coefficient in this case is −0.037 (0.017). In this case, a one-standard-deviation reduction in the Gini coefficient (by 0.1, see Table 3) would be estimated to raise the growth rate on impact by 0.4 percent per year. Perotti (1996) reports effects of similar magnitude. However, this effect does not seem to operate once the fertility rate is held constant.

More interesting results emerge when the effect of the Gini coefficient on economic growth is allowed to depend on the level of economic development, measured by real per capita GDP. The Gini coefficient is now entered into the growth system linearly and also as a product with the log of per capita GDP. In this case, the estimated coefficients are jointly significant at usual critical levels (p-value of 0.059) and also individually significant: -0.33 (0.14) on the linear term and 0.043 (0.018) on the interaction term.

This estimated relation implies that the effect of inequality on growth is negative for values of per capita GDP below \$2070 (1985 U.S. dollars) and then becomes positive.[13] (The median value of GDP was \$1258 in 1960, \$1816 in 1970, and \$2758 in 1980.) Quantitatively, the estimated marginal impact of the Gini coefficient on growth ranges from a low of -0.09 for the poorest country in 1960 (a value that enters into the growth equation for 1965 to 1975) to 0.12 for the richest country in 1980 (which appears in the equation for 1985 to 1995). Since the standard deviation of the Gini coefficients in each period is about 0.1, the estimates imply that a one-standard-deviation increase in the Gini value would affect the typical country's growth rate on impact by a magnitude of around 0.5 percent per year (negatively for poor countries and positively for rich ones).

A possible interpretation of the results involves the idea that credit-market constraints would be more serious in poorer countries. In poor countries, the net effect of inequality on growth may be negative because of the severity of these credit-market problems. (As discussed before, this idea works if the net effect of credit-market restrictions is to create a negative linkage between inequality and growth.) In contrast, for rich countries, where credit constraints are less serious, the growth-promoting aspects of inequality may dominate.

The role of credit markets can be assessed more directly by using the ratio of a broad monetary aggregate, $M2$, to GDP as an indicator of the state of financial development. However, if the Gini coefficients are interacted with the $M2$ ratio, rather than per capita GDP, the estimated effects of the Gini variables on economic growth are individually and jointly insignificant.[14] This result could emerge because the $M2$ ratio is a poor measure—worse than per capita GDP—of the imperfection of credit markets.

As a check on the results, the growth system was reestimated with the Gini coefficient allowed to have two separate coefficients. One coefficient applies for values of per capita GDP below \$2070 (the break point estimated above) and the other for values of per capita GDP above \$2070. The results, shown in Table 4, are that the estimated coefficient of the Gini coefficient is -0.033 (0.021) in the low range of GDP and 0.054 (0.025) in the high range.[15] These estimated values are jointly significantly different from zero (p-value $= 0.011$) and also significantly different from each other (p-value $= 0.003$). Thus, this piecewise-linear form tells a similar story to that found in the representation that includes the interaction between the Gini and log(GDP).

Figure 2 shows the partial relations between the growth rate and the Gini coefficient for the low and high ranges of per capita GDP. In the left panel, where per capita GDP is below \$2070, the estimated relation is negative. In the right panel, where per capita GDP is above \$2070, the estimated relation is positive.

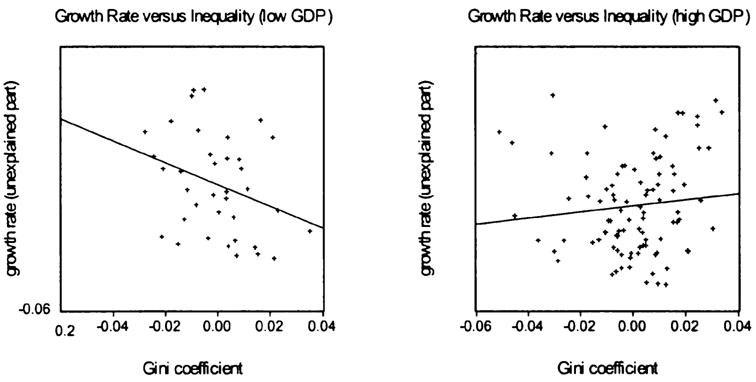

Figure 2. Growth rate versus inequality.

The bottom part of Table 4 shows how the Gini coefficient relates to the investment ratio. The basic finding, when the other explanatory variables shown in Table 2 are held constant, is that the investment ratio does not depend significantly on inequality, as measured by the Gini coefficient. This conclusion holds for the linear specification and also for the one that includes an interaction between the Gini value and log(GDP). (Results are also insignificant if separate coefficients on the Gini variable are estimated for low and high values of per capita GDP.) Thus, there is no evidence that the aggregate saving rate, which would tend to influence the investment ratio, depends on the degree of income inequality.[16]

The analysis in Table 4 considers direct effects of inequality on economic growth when the explanatory variables shown in Table 1 are held constant. Additional effects may involve the influence of inequality on the explanatory variables. One of these effects was already suggested for the case of the fertility rate because the estimated effect of inequality on growth becomes significantly negative when the fertility-rate variable is omitted. Direct consideration of a panel system in which the log of the fertility rate is the dependent variable verifies that greater inequality predicts significantly higher fertility. In this system, the fertility rate was observed at various dates, and the explanatory variables included prior values of the Gini coefficient, the log of real per capita GDP, and other factors. The fertility channel for an influence of inequality on growth is reasonable but was not among those sketched earlier in the discussion of various theories.

In many analyses, inequality affects growth indirectly by first influencing the economy-wide investment ratio. However, the analysis has already shown that the Gini coefficients lack explanatory power for the investment ratio. In other theories, inequality affects the accumulation of human capital and thereby affects growth. The empirical analysis of economic growth suggests that male schooling at the secondary and higher levels is a critical factor. Direct consideration of a panel system in which male school attainment at the secondary and higher levels is the dependent variable does not reveal a significant influence from the Gini coefficients.

Table 5. Effects of quintile-based inequality measures on growth rates.

	Quintile Measure	Quintile Measure* log(GDP)	Quintile Measure (low GDP)	Quintile Measure (high GDP)	Wald Tests (p-values)
Highest-quintile share					
	0.020				
	(0.020)				
	−0.44	0.060			0.005
	(0.15)	(0.019)			
			−0.056	0.058	0.003,
			(0.031)	(0.022)	0.001*
Middle-three-quintiles share	−0.020				
	(0.025)				
	−0.011	−0.002			0.66
	(0.163)	(0.021)			
			0.057	−0.057	0.022,
			(0.040)	(0.027)	0.010*
Lowest-quintile share					
	−0.044				
	(0.061)				
	0.19	−0.028			0.70
	(0.51)	(0.062)			
			0.37	−0.156	0.000,
			(0.12)	(0.062)	0.000*

Notes: The quintiles data on income distribution were used to form the share of the highest fifth, the share of the middle three quintiles, and the share of the lowest fifth. The quintile values around 1960 appear in the equations for growth from 1965 to 1975, the values around 1970 appear in the equations for 1975 to 1985, and the values around 1980 appear in the equations for 1985 to 1995. The interaction variable is the product of the quintile measure and the log of per capita GDP. The system with quintile share (low GDP) and quintile share (high GDP) allows for two separate coefficients on the quintile-share variable. The first coefficient applies when log(GDP) is below the break point for a change in sign of the effect of the highest-quintile-share variable on growth, as implied by the system that includes the highest quintile share and the interaction of this share with log(GDP). The second coefficient applies for higher values of log(GDP). Separate intercepts are also included for the two ranges of log(GDP). The variables that include the quintile-share variables are included in the lists of instrumental variables. The Wald tests are for the hypothesis that both coefficients equal zero. Values denoted by an asterisk are for the hypothesis that the two coefficients are equal (but not necessarily equal to zero). See the notes to Table 1 for additional information.

Table 5 shows the results for economic growth when the inequality measure is based on quintile-shares data, rather than Gini coefficients. One finding is that the highest-quintile share generates results that are similar to those for the Gini coefficient.[17] The estimated effect on growth is insignificant in the linear form. However, the effects are significant when an interaction with log(GDP) is included or when two separate coefficients on the highest-quintile-share variable are estimated, depending on the value of GDP. With the interaction variable included, the implied effect of more inequality (a greater share for the rich) on growth is negative when per capita GDP is less than $1473 and positive otherwise.

The similarity in results with those from the Gini coefficient arises because, as noted before, the highest-quintile share is highly correlated with the Gini values.

Table 5 also shows results for economic growth when other quintile-share measures are used to measure inequality—the share of the middle three quintiles and the share of the lowest fifth of the population. In these cases, the significant effects on economic growth arise only when separate coefficients are estimated on the shares variables, depending on the level of GDP.[18] The effects on growth are positive in the low range of GDP (with greater shares of the middle or lowest quintiles signifying less inequality) and negative in the high range.

6. Determinants of Inequality

The determinants of inequality are assessed first by considering a panel of Gini coefficients observed around 1960, 1970, 1980, and 1990. Figure 3 shows a scatter of these values against roughly contemporaneous values of the log of per capita GDP. A Kuznets curve would show up as an inverted-U relationship between the Gini value and log(GDP). This relationship is not obvious from the scatter plot, although one can discern such a curve after staring at the diagram for a long time. In any event, the relation between the Gini coefficient and a quadratic in log(GDP) does turn out to be statistically significant, as shown in the first column of Table 6. This column reports the results from a panel estimation, using the seemingly unrelated technique. In this specification, log(GDP) and its square are the only regressors, aside from a single constant term.

The estimated relation implies that the Gini value rises with GDP for values of GDP less than $1636 (1985 U.S. dollars) and declines thereafter. The fit of the relationship is not very good, as is clear from Figure 3. The R-squared values for the four periods range from 0.12 to 0.22. Thus, in line with the findings of Papanek and Kyn (1986), the level of economic development would not explain most of the variations in inequality across countries or over time.

The second column of Table 6 adds to the panel estimation a number of control variables, including some corrections for the manner in which the underlying inequality data are constructed. The first dummy variable equals one of the Gini coefficient is based on income net of taxes or on expenditures. The variable equals zero if the data refer to income gross of taxes. The estimated coefficient of this variable is significantly negative: the Gini value is lower by roughly 0.05 if the data refer to income net of taxes or expenditures, rather than income gross of taxes.[19] This result is reasonable because taxes tend to be equalizing and because expenditures would typically be less volatile than income. (There is no significant difference between the Gini values measured for income net of taxes versus those constructed for expenditures.)

The second dummy variable equals one if the data refer to individuals and zero if the data refer to households. The estimated coefficient of this variable is negative but not statistically significant. It was unclear, ex ante, what sign to anticipate for this variable.

The panel system also includes the average years of school attainment for adults aged 15 and over at three levels: primary, secondary, and higher. The results are that primary schooling is negatively and significantly related to inequality, secondary schooling is neg-

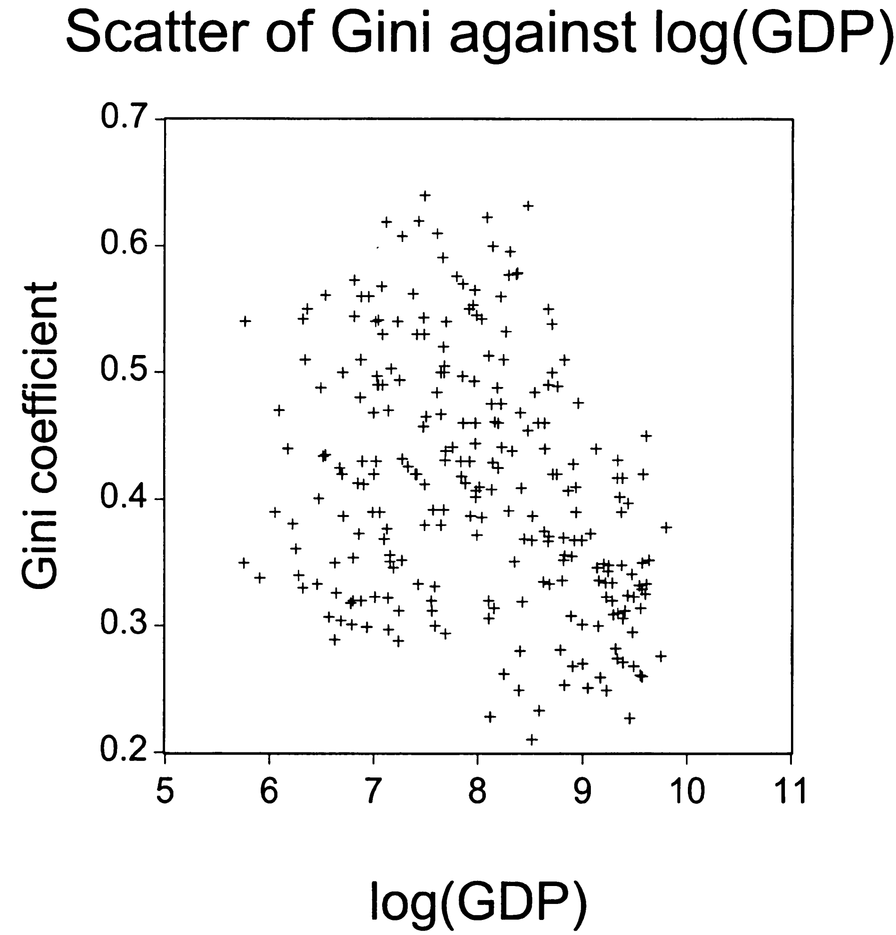

Figure 3. Scattor of Gini against log(GDP).

atively (but not significantly) related to inequality, and higher education is positively and significantly related to inequality.[20]

The dummy variables for Sub-Saharan Africa and Latin American are each positive, statistically significant, and large in magnitude. Since per capita GDP and schooling are already held constant, these effects are surprising. Some aspects of these areas that matter for inequality—not captured by per capita GDP and schooling—must be omitted from the system. Preliminary results indicate that the influence of the continent dummies is substantially weakened when one holds constant variables that relate to colonial heritage and religious affiliation.

Table 6. Determinants of inequality.

Part I: No Fixed Country Effects

Variable						
log(GDP)	0.407	0.407	0.437	0.415	0.443	0.401
	(0.090)	(0.081)	(0.078)	(0.084)	(0.074)	(0.073)
log(GDP) squared	−0.0275	−0.0251	−0.0264	−0.0254	−0.0280	−0.0253
	(0.0056)	(0.0051)	(0.0049)	(0.0053)	(0.0047)	(0.0046)
Dummy: net	—	−0.0493	−0.0480	−0.0496	−0.0515	−0.0517
income or spending		(0.0094)	(0.0087)	(0.0094)	(0.0090)	(0.0087)
Dummy: individual	—	−0.0134	−0.0143	−0.0119	−0.0146	−0.0146
vs. household data		(0.0086)	(0.0080)	(0.0087)	(0.0084)	(0.0082)
Primary schooling	—	−0.0147	−0.0152	−0.0161	−0.0065	−0.0094
		(0.0037)	(0.0036)	(0.0037)	(0.0039)	(0.0038)
Secondary schooling	—	−0.0108	−0.0061	−0.0109	−0.0176	−0.0174
		(0.0070)	(0.0070)	(0.0070)	(0.0067)	(0.0065)
Higher schooling	—	0.081	0.072	0.082	0.099	0.097
		(0.034)	(0.032)	(0.034)	(0.032)	(0.032)
Dummy: Africa	—	0.113	0.135	0.113	0.116	0.115
		(0.015)	(0.016)	(0.015)	(0.014)	(0.014)
Dummy: Latin America	—	0.094	0.089	0.092	0.095	0.095
		(0.012)	(0.012)	(0.012)	(0.012)	(0.011)
Rule-of-law index	—	—	−0.040	—	—	—
			(0.019)			
Democracy index	—	—	—	−0.003	—	—
				(0.015)		
Openness	—	—	—	—	0.050	0.422
					(0.013)	(0.113)
Openness*log(GDP)	—	—	—	—	—	−0.0445
						(0.0133)
Number of observations	49, 61	40, 59	40, 57	35, 59	38, 55	38, 55
	68, 76	61, 70	56, 67	61, 70	57, 64	57, 64
R-squared	0.12, 0.15	0.52, 0.59	0.50, 0.58	0.56, 0.59	0.61, 0.64	0.63, 0.63
	0.18, 0.22	0.67, 0.67	0.78, 0.72	0.67, 0.67	0.69, 0.72	0.74, 0.74

Notes: The dependent variables are the Gini coefficients observed around 1960, 1970, 1980, and 1990. See Table 3 for statistics on these variables. Estimation is by the seemingly-unrelated (SUR) technique. The first four columns include a single constant term, which does not vary over time or across countries. The last column includes a separate, time-invariant intercept for each country (and includes only countries with two or more observations on the Gini coefficient). GDP is real per capita GDP for 1960, 1970, 1980, and 1990. The first dummy variable equals one if the Gini coefficient is based on income net of taxes or on expenditures. It equals zero if the Gini is based on income gross of taxes. The second dummy equals one if the income-distribution data refer to individuals and zero if the data refer to households. The schooling variables are the average years of attainment of the adult population aged 15 and over for 1960, 1970, 1980, and 1990. The third and fourth dummy variables equal one if the country is in Sub-Saharan Africa or Latin America, respectively, and zero otherwise. The rule-of-law and democracy indexes are described in the notes to Table 1. The openness variable is the ratio of exports plus imports to GDP, filtered for the estimated effects on this ratio from the logs of population and land area. The numbers of observations and the R-squared values refer to each of the four periods 1960, 1970, 1980, and 1990.

I also considered measures of the heterogeneity of the population with respect to ethnicity and language and religious affiliation. The first variable, referred to as ethnolinguistic fractionalization, has been used in a number of previous studies.[21] This measure can be

Table 6. Continued. Determinants of inequality.

Part II: Fixed Country Effects

Variable		
log(GDP)	0.132 (0.013)	0.127 (0.013)
log(GDP) squared	−0.0083 (0.0014)	−0.0085 (0.0015)
Dummy: net income or spending	−0.0542 (0.0108)	−0.0479 (0.0111)
Dummy: individual vs. household data	−0.0026 (0.0078)	−0.0105 (0.0083)
Primary schooling	−0.0025 (0.0091)	0.0036 (0.0092)
Secondary schooling	−0.0173 (0.0099)	−0.0269 (0.0097)
Higher schooling	0.102 (0.030)	0.116 (0.033)
Openness	—	0.061 (0.025)
Number of observations	36, 56 57, 59	35, 54 53, 54

interpreted as (one minus) the probability of meeting someone of the same ethnolinguistic group in a random encounter. The second variable is a Herfendahl index of the fraction of the population affiliated with nine main religious groups.[22] This variable can be interpreted as the probability of meeting someone of the same religion in a chance encounter. My expectation was that more heterogeneity of ethnicity, language, and religion would be associated with greater income inequality. Moreover, unlike the schooling measures, the heterogeneity measures can be viewed as largely exogenous at least in a short- or medium-run context.

It turned out, surprisingly, that the two measures of population heterogeneity had roughly zero explanatory power for the Gini coefficients. These results are especially disappointing because the heterogeneity measures would otherwise have been good instruments to use for inequality in the growth regressions. In any event, the heterogeneity variables were excluded from the regression systems shown in Table 6.

The addition of the control variables in column 2 of Table 6 substantially improves the fits for the Gini coefficients; the R-squared values for the four periods now range from 0.52 to 0.67. However, this improvement in fit does not have a dramatic effect on the point estimates and statistical significance for the estimated coefficients of log(GDP) and its square. That is, a similar Kuznets curve still applies.

Figure 4 provides a graphical representation of this curve. The vertical axis shows the Gini coefficient after filtering out the estimated effects (from column 2 of Table 6) of the control variables other than log(GDP) and its square. These filtered values have been normalized

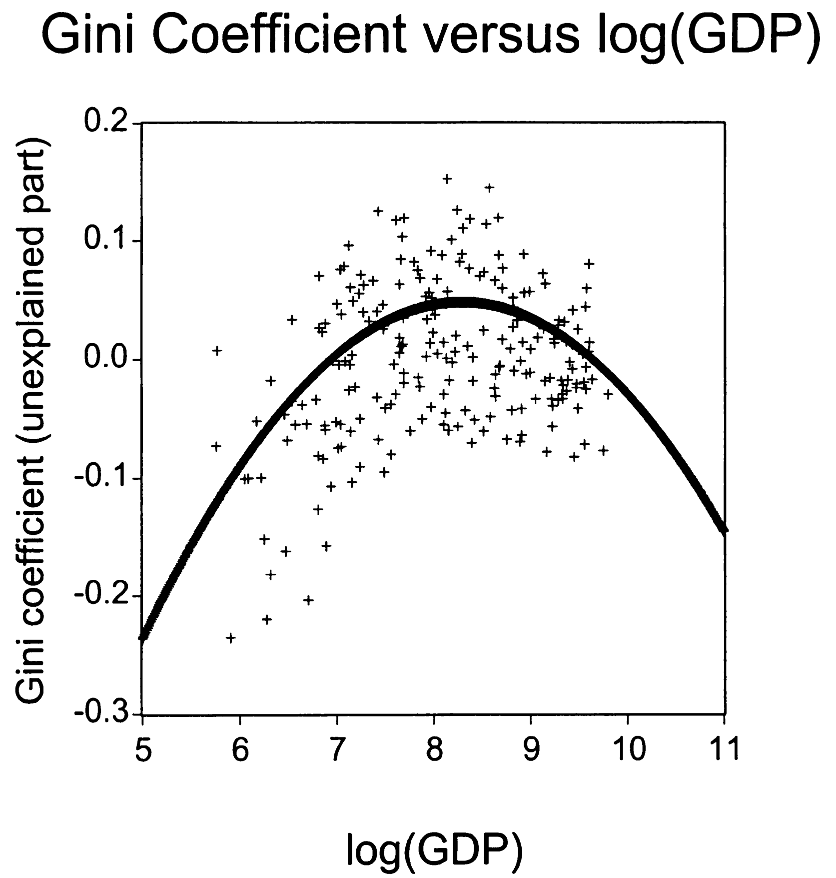

Figure 4. Gini coefficient versus log(GDP).

to make the mean equal zero. The horizontal axis plots the log of per capita GDP. The peak in the curve occurs at a value for GDP of $3320 (1985 U.S. dollars).

I have tested whether the Kuznets curve is stable—that is, whether the coefficients on log(GDP) and its square shift over time. The main result is that these coefficients are reasonably stable. The system shown in column 2 of Table 6 was extended to allow for different coefficients on the two GDP variables for each period. The estimated coefficients on the linear terms are 0.40 (0.09) in 1960, 0.38 (0,09) in 1970, 0.40 (0.09) in 1980, and 0.41 (0.09) in 1990. The corresponding estimated coefficients on the squared terms are −0.025 (0.006), −0.023 (0.006), −0.024 (0.006), and −0.025 (0.005). (In this system, the coefficients of the other explanatory variables were constrained to be the same for each period.) Given the close correspondence for the separately estimated coefficients of log(GDP) and its square, it is surprising that a Wald test rejects the hypothesis of equal coefficients over time with a p-value of 0.013.

The system shown in column 2 of Table 6 was also extended to allow for different coefficients over time on the schooling variables. In this revised system, three schooling coefficients were estimated for each period, but the coefficients of the other explanatory variables were constrained to be the same for all of the periods. The estimated coefficients for the different periods are as follows: primary schooling: −0.008 (0.005), −0.013 (0.005), −0.017 (0.011), and −0.010 (0.005); secondary schooling: −0.026 (0.023), −0.017 (0.011), −0.002 (0.010), and −0.010 (0.010); and higher schooling: 0.051 (0.127), 0.043 (0.072), 0.047 (0.053), and 0.055 (0.045). There is little indication of systematic variation over time, and a Wald test for all three sets of coefficients jointly is not significant (p-value of 0.17).

These results conflict with the idea that increases in income inequality in the 1980s and early 1990s in the United States and some other advanced countries reflected new kinds of technological developments that were particularly complementary with high skills. Under this view, the positive effect of higher education on the Gini coefficient should be larger in the 1980s and 1990s than in the 1960s and 1970s. The empirical results show, instead, that the estimated coefficients in the later periods are similar to those in the earlier periods.

The dummy variables for Sub-Saharan Africa and Latin America show instability over time. The estimated coefficients are, for Africa, 0.073 (0.032), 0.053 (0.023), 0.097 (0.023), and 0.152 (0.017); and for Latin America, 0.097 (0.023), 0.070 (0.016), 0.068 (0.015), and 0.121 (0.016). In this case, a Wald test for both sets of coefficients jointly rejects stability over time (p-value = 0.0001). This instability is probably a sign that the continent dummies are not fundamental determinants of inequality but are rather unstable proxies for other variables.

As mentioned before, the underlying data set expands beyond the Gini values designated as high quality by Deininger and Squire (1996). If a dummy variable for the high-quality designation is included in the panel system, then its estimated coefficient is essentially zero. The squared residuals from the panel system are, however, systematically related to the quality designation. The estimated coefficient in a least-squares regression of the squared residual on a dummy variable for quality (one if high quality, zero otherwise) is −0.0025 (0.0008). However, part of the tendency of low-quality observations to have greater residual variance relates to the tendency of these observations to come from low-income countries (which likely have poorer quality data in general). If the log of per capita GDP is also included in the system for the squared residuals, then the estimated coefficient on the high-quality dummy becomes −0.0018 (0.0008), whereas that on log(GDP) is −0.0012 (0.0003). Adjustments of the weighting scheme in the estimation to take account of this type of heteroscedasticity have little effect on the results.

Column 3 of Table 6 adds another control variable—the indicator for maintenance of the rule of law. The estimated coefficient is negative and marginally significant, −0.040 (0.019). Thus, there is an indication that better enforcement of laws goes along with less inequality of incomes.

Column 4 includes the index of democracy (electoral rights). The estimated coefficient of this variable differs insignificantly from zero. If the square of this variable is also entered, then this additional variable is statistically insignificant (as are the linear and squared terms jointly). The magnitude of the estimated coefficients on log(GDP) and its square fall only slightly from the values shown in column 2 of Table 6. Thus, the estimated Kuznets curve, expressed in terms of the log of per capita GDP, does not involve a proxying of GDP for democracy.

Columns 5 and 6 look for relationships between inequality and the extent of international openness. The variable used to measure openness is the ratio of exports plus imports to GDP, filtered for the usual relationship of this ratio to country size. This filtering was accomplished by estimating a panel system in which the dependent variable was the openness ratio in various periods. In this system, country size was represented by the logs of population and land area. The estimated coefficients of each of these variables was negative and statistically significant. The system also contained indicators of trade policy, including measures of tariff and non-tariff barriers and the black-market premium on the foreign-exchange rate. From the perspective of standard trade theory, the effect of an opening to international trade on income distribution depends on factor endowments. For countries that are relatively highly endowed in human and physical capital, an expansion of trade oppportunities would tend to depress the relative wages of unskilled workers and lead, thereby, to greater income inequality. The mechanism would involve increased imports of products intensive in unskilled labor and increased exports of products intensive in human and physical capital. In contrast, for countries that are relatively highly endowed in unskilled labor, greater openness to trade would tend to raise the relative wages of unskilled labor and lead, accordingly, to less income inequality. Hence, this theory suggests that greater international openness would raise inequality in rich countries and lower it in poor countries. One problem, however, with this standard analysis is that the predictions about the factor content of trade are hard to observe in the data, in line with the puzzle usually referred to as the "Leontief paradox."

The standard theory seems to conflict with the concerns expressed in the ongoing popular debate about globalization. The general notion is that an expansion of international openness—including access to foreign technology and culture—will benefit most the domestic residents who are already relatively well off. The idea seems to be that the relatively sophisticated and, hence, rich groups will be most able to take advantage of the opportunities offered by global commerce. Since this consideration would be especially important when the average level of income is low, the implication is that increased openness would be most likely to raise inequality in poor countries—the opposite to the prediction from the standard trade analysis. A reinforcing idea is that globalization reduces the abilities of governments to offset market determinants of income distribution.

Column 5 of Table 6 shows a positive and significant effect of the openness ratio on inequality. Thus, in line with the popular view, greater openness to trade goes along with more inequality.[23] I explored whether this positive relation was only temporary by adding lagged values of the openness ratio as determinants of inequality. However, in these systems, the estimated effects of the contemporaneous and lagged values were statistically indistinguishable. Basically, the data reveal a long-term positive association between the levels of openness and inequality.

Column 6 adds an interaction term between the openness ratio and the log of per capita GDP. The result is that the openness ratio is again significantly positive, whereas the interaction term is significantly negative. The implication, which supports popular arguments but conflicts with standard trade theory, is that the positive relation between openness and inequality is most pronounced in poor countries. The estimated relation weakens as countries get richer and reaches zero at a level of per capita GDP of around \$13,000 (1985 U.S. dollars). Hence, for the United States (with a per capita GDP of around \$19,000 in 1995) and the other major OECD countries, the implied relation between inequality and openness is negative.

Part II of Table 6 shows the results from fixed-effects estimation, where an individual constant is entered for each country. This estimation is still carried out as a panel for levels of the Gini coefficients, not as first differences. Countries are now included in the sample only if they have at least two observations on the Gini coefficient for the years 1960, 1970, 1980, or 1990. (The observations do not have to be adjacent in time.) This estimation drops the variables—the dummies for Sub-Saharan Africa and Latin America—that do not vary over time.

The first column of the second part of Table 6 shows that the estimated Kuznets-curve coefficients—0.132 (0.013) on log(GDP) and −0.0083 (0.0014) on the square—are still individually and jointly significantly different from zero.[24] However, the sizes of these coefficients are about one-third of those for the cases that exclude country fixed effects. With the country fixed effects present, the GDP variables pick up only time-series variations within countries. Moreover, this specification allows only for contemporaneous relations between the Gini values and GDP. Therefore, the estimates would pick up a relatively short-run link between inequality and GDP. With the country effects not present, the estimates also reflect cross-sectional variations, and the coefficients on the GDP variables pick up longer run aspects of the relationships with the Gini values. Further refinement of the dynamics of the relation between inequality and its determinants may achieve more uniformity between the panel and fixed-effects results.

The estimated effects of the schooling variables in the fixed-effects framework are similar to those reported before. However, the estimated coefficient on primary attainment is no longer statistically significant.

The second column in part II of Table 6 adds the openness ratio, again filtered for the effect of country size. The estimated coefficient is positive and statistically significant and similar to that found before. However, if an interaction with log(GDP) is also entered, the estimated coefficients on the two openness variables are individually insigificant. That is, in the fixed-effects framework, it is not possible to pin down the way that per capita GDP affects the influence of openness on inequality.

It is also possible to estimate Kuznets-curve relationships for the quintile-based measures of inequality. If the upper-quintile share is the dependent variable and the controls considered in column 2 of the first part of Table 6 are held constant, then the estimated coefficients turn out to be 0.353 (0.086) on log(GDP) and −0.0216 (0.0054) on the square. Thus, the share of the rich tends to rise initially with per capita GDP and subsequently decline (after per capita GDP reaches $3500).

For the share of the middle three quintiles, the corresponding coefficient estimates are −0.291 (0.070) on log(GDP) and 0.0181 (0.0044) on the square. Hence, the middle share falls initially with per capita GDP and subsequently rises (after per capita GDP reaches $3100). For the share of the lowest quintile, the coefficients are −0.080 (0.024) on log(GDP) and 0.0047 (0.0015) on the square. Therefore, this share also falls at first with per capita GDP and subsequently increases (when per capita GDP passes $5600).

7. Conclusions

Evidence from a broad panel of countries shows little overall relation between income inequality and rates of growth and investment. For growth, there is an indication that inequality retards growth in poor countries but encourages growth in richer places. Growth tends to fall with greater inequality when per capita GDP is below around $2000 (1985 U.S. dollars) and to rise with inequality when per capita GDP is above $2000.

The Kuznets curve—whereby inequality first increases and later decreases during the process of economic development—emerges as a clear empirical regularity. However, this relation does not explain the bulk of variations in inequality across countries or over time. The estimated relationship may reflect not just the influence of the level of per capita GDP but also a dynamic effect whereby the adoption of each type of new technology has a transitory, Kuznets-type effect on the distribution of income. This perspective explains not only the statistical significance of the standard Kuznets relation but also its relatively poor fit.

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Notes

1. Recent surveys of these theories include Benabou (1996) and Aghion, Caroli, and Garcia–Penalosa (1999).
2. For models of the macroeconomic effects of inequality with imperfect credit markets, see Galor and Zeira (1993) and Piketty (1997), among others.
3. Galor and Zeira (1993) stress this effect for investments in human capital. However, the same idea can apply under imperfect credit markets to investments in physical capital.
4. For these kinds of political-economy analyses, see Perotti (1993), Bertola (1993), Alesina and Rodrik (1994), Persson and Tabellini (1994), and Benabou (1996), among others.
5. For discussions, see Benabou (1996) and Rodriguez (1998).

6. For analyses in this area, see Hibbs (1973), Venieris and Gupta (1986), Gupta (1990), Alesina and Perotti (1996), and Benhabib and Rustichini (1996).
7. However, these results refer to fixed-effects estimates, which have relatively few observations and are particularly sensitive to measurement-error problems.
8. The starting level of per capita output, y, can be viewed more generally as referring to the starting levels of physical and human capital and other durable inputs to the production process. In some theories, the growth rate, Dy, falls with a higher starting level of overall capital per person but rises with the initial ratio of human to physical capital.
9. For the investment ratio, the periods are 1965 to 1974, 1975 to 1984, and 1985 to 1992.
10. The GDP figures in 1985 prices are the purchasing-power-parity adjusted chain-weighted values from the Summers-Heston data set, version 5.6. These data are available on the internet from the National Bureau of Economic Research. See Summers and Heston (1991) for a general description of their data. The figures provided through 1992 have been updated to 1995 using World Bank data. Real investment (private plus public) is also from the Summers-Heston data set.
11. The 48 observations added were for Benin 1960, Chad 1960, Congo 1960, Gabon 1960 and 1970, Ivory Coast 1960, Kenya 1960 and 1980, Liberia 1970, Madagascar 1960, Malawi 1970 and 1980, Morocco 1960, Niger 1960, Nigeria 1960 and 1980, Senegal 1960 and 1970, Sierra Leone 1980, Tanzania 1960 (and 1970 for quintile data only), Togo 1960, Uganda 1970, Zambia 1960 and 1970, Barbados 1970, El Salvador 1970, Argentina 1960 and 1970, Bolivia 1970, Colombia 1960, Ecuador 1970, Peru 1960, Suriname 1960, Uruguay 1970, Venezuela 1960, Burma 1960, Iraq 1960, Israel 1960, Austria 1990, Denmark 1960, Finland 1960, Germany 1990, Greece 1960, Netherlands 1960, Sweden 1960, Switzerland 1980, and Fiji 1970.
12. The variable plotted on the vertical axis is the growth rate (for any of the three time periods) net of the estimated effect of all explanatory variables aside from the Gini coefficient. The value plotted was also normalized to make its mean value zero. The line drawn through the points is a least-squares fit (and, therefore, does not correspond precisely to the estimated coefficient of the Gini coefficient in Table 4).
13. There is some indication that the coefficients on the Gini variables—and, hence, the breakpoints for the GDP values—shift over time. If the coefficients are allowed to differ by period, the results for the Gini term are −0.33 (0.15) for the first period, −0.33 (0.15) for the second, and −0.38 (0.14) for the third, and the corresponding estimates for the interaction term are 0.047 (0.020), 0.039 (0.019), and 0.043 (0.018). These values imply breakpoints for GDP of $1097, $5219, and $6568, respectively. Thus, the breakpoints are highly sensitive to small variations in the underlying two coefficients. A Wald test for stability of the two coefficients over time has a p-value of 0.088.
14. The effects of the Gini variables on economic growth are also individually and jointly insignificant if the Gini values are interacted with the democracy index, rather than per capita GDP. This specification was suggested by models in which the extent of democracy influences the sensitivity of income transfers to the degree of inequality.
15. This specification also includes different intercepts for the low and high ranges of GDP.
16. In this case, the Gini variables are insignificant even when the fertility-rate variable is excluded.
17. The sample size is somewhat smaller here because the quintile-share data are less abundant than the Gini values. The numbers of observations when the quintiles data are used are 33 for the first period, 40 for the second, and 43 for the third.
18. The breakpoint used, $1473, is the one implied by the system with the interaction term between the highest quintile share and log(GDP).
19. I have also estimated the system with the gross-of-tax observations separated from the net-of-tax ones for the coefficients of all of the explanatory variables. The hypothesis that all of these coefficients, except for the intercepts, are jointly the same for the two sets of observations is accepted with a p-value of 0.33.
20. If one adds the ratio to GDP of public outlays on schooling, then this variable is significantly positive. The estimated coefficients on the school-attainment values do not change greatly. One possibility is that the school-spending variable picks up a reverse effect from inequality to income redistribution (brought about through expenditures on education).
21. See, for example, Mauro (1995).

22. The underlying data are from Barrett (1982). The groupings are Catholic, Protestant, Muslim, Buddhist, Hindu, Jewish, miscellaneous eastern religions, nonreligious, and other religions. See Barro (1997) for further discussion.
23. The openness variable (filtered for country size) can also be added to the growth system from Table 1. If this variable is included in the instrument list, the estimated coefficient is positive and marginally significant: 0.0104 (0.0041). The results are similar if the openness variable is replaced in the instrument list by some arguably exogenous policy influences on trade volume: measures of tariff and non-tariff barriers, lagged values of the black-market premium on the foreign-exchange rate, and lagged dummy variables for whether a country imposes restrictions on capital-account and current-account flows. Thus, there is an indication that expanded international trade enhances economic growth.
24. These estimates are virtually the same—0.133 (0.012) on log(GDP) and −0.0090 (0.0013) on the square—if all other regressors aside from the country fixed effects are dropped from the system.

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