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 and uses data on the performance of a broad range of countries. This chapter 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.

**Theoretical Effects of Inequality on Growth and Investment**

Many theories have been constructed to assess the macroeconomic relations between inequality and economic growth. 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.

**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.\textsuperscript{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 to some extent on an individual's levels of assets and incomes. Specifically, poor people tend to forgo investments in human capital 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 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 a setup cost, that is, if increasing returns to investment prevail over some range. For instance, formal education may be useful only beyond some minimal level. One possible manifestation of this effect is the apparently strong role for secondary schooling, rather than primary schooling, in enhancing economic growth (see Barro 1997). Analogously, a business may be productive only if it goes beyond some threshold size. In the presence of credit-market imperfections, these considerations favor a concentration of assets. Hence this element tends to generate positive effects of inequality on investment and 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.

\textbf{Political Economy.} If the mean income in an economy exceeds the median income, then majority voting tends to favor the redistribution of resources from the rich to the poor.\textsuperscript{3} These redistributions may involve explicit transfer payments but can also appear as public-expenditure programs (such as programs for 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 more redistribution creates more distortions and therefore tends 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, inequality would reduce growth.

The data typically refer to ex post inequality, that is, to incomes measured net of the effects from various public interventions. These interventions include expenditure programs—notably, education and health—transfers, and nonproportional taxes. Some 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 data are ex post to the effects of various public-sector interventions.

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 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 such a 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 can change if countries differ by their tastes for redistribution. In this case the countries that seem more equal ex post tend to be those that have redistributed the most and hence have 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 literal 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 would not apply. More generally the predicted effect arises if the distribution of political power is more egalitarian than the distribution of economic power.

In addition, the predicted negative effect of inequality on growth can arise even if no transfers are observed in equilibrium. The rich may prevent redistributive policies through lobbying and buying votes of legislators. But then a higher level of economic inequality would require more of these activities to prevent the redistribution of income through the political process. The lobbying activities would consume resources and promote official corruption. Since these effects would be adverse for economic performance, inequality could have a negative effect on growth through the political process even if no redistribution of income occurs in equilibrium.

Sociopolitical Unrest. Inequality of wealth and income motivates the poor to engage in crime, riots, and other disruptive activities. 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. Defensive efforts by potential victims represent a further loss of resources. 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 are required for the poor to cause disruption and threaten the stability of the established regime effectively. 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 to work—is the dominant element.

Even in a dictatorship, self-interested leaders would favor some amount of 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 regardless 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.

**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 the rich to the poor tends to lower the aggregate rate of saving in an economy. Through this channel a rise in inequality tends to raise investment (if the economy is partly closed). 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 would promote economic growth. In that analysis setup costs for investment implied that the 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.

**Overview.** Many satisfactory theories can be used for assessing the effects of inequality on investment and economic growth. But these theories tend to have offsetting effects, and 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. But some researchers, such as Li and Zou (1998) and Forbes (1997), have reported relationships with the opposite sign.6

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.
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-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-urban sector starts out small and has higher per capita income and possibly a relatively high degree of inequality within the sector.

Economic development involves in part a shift of persons 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 of the small group of relatively rich persons in the industrial-urban sectors. Thus, at early stages of development, the relation between the level of per capita product and the extent of inequality is positive.

As the size of the agricultural sector diminishes, the dominant effect of continued mobility on inequality is the opportunity of more poor agricultural workers to join the relatively rich industrial sector. In addition, many workers who started on 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 is 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 the economy becomes more developed.

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 agricul-
ture to urban industry may be a shift from a financially unsophisticated position to one that involves inclusion with the modern financial system (see Greenwood and Jovanovic 1990).

In another approach the poor sector may use an old technology, whereas the rich sector may use more recent and advanced techniques (see Helpman 1997 and Aghion and Howitt 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—initially tend to raise inequality. The dominant factor here is the low number of persons who initially share 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 or may not 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 well. The curve would fit only to the extent that a high level of per capita GDP signaled a country’s relatively recent introduction of advanced technologies or modern production techniques.

On an empirical level the Kuznets curve was accepted through the 1970s as a strong empirical regularity (see especially Ahluwalia 1976a, b). 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 also find, however, that this curve explains relatively little of the variations in inequality across countries or over time.

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 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:

\[ Dy = F(y, y^*) \]

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 capital imply that an economy's growth rate, \( Dy \), is inversely related to its level of development, as represented by \( y \). 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 a given \( y \). Similarly, if people are willing to work harder, 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, $D_y$, to a value consistent with the long-run rate of technological progress (which is determined outside the model in the standard neoclassical framework). Hence, in the 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 elements. That study applied to roughly 100 countries observed from 1960 to 1990. That 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; places are excluded only because of missing data. The attractive feature of this broad sample is the great variation in the government policies and other variables to be evaluated. 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 concerns the difficulty in measuring variables in a consistent and accurate way across countries and over time. In particular, less-developed countries tend to have substantial 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. But in practice 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 in the following discussion, the labeling of directions of causation depends on timing evidence, whereby earlier values of explanatory variables are thought to influence subsequent economic performance. However, such an 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: 1965–1975, 1975–1985, and 1985–1995. 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. In any event the low-frequency context accords 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 1–1 shows baseline-panel regression estimates for the determination of the growth rate of real per capita GDP. Table 1–2 shows corresponding estimates for the ratio of investment to GDP. The estimation is by three-stage least squares. Instruments are mainly lagged values of the regressors (see the notes to table 1–1).

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 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 constructed in collaboration with Jong-Wha Lee—are available from the World Bank and NBER websites.

The results contained in tables 1–1 and 1–2 are intended mainly to provide a context to isolate 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 1–1 are as follows.
TABLE 1-1

PANEL REGRESSIONS FOR GROWTH RATE

<table>
<thead>
<tr>
<th>Independent Variable</th>
<th>Estimated Coefficient (In full sample)</th>
<th>Estimated Coefficient (In Gini sample)</th>
</tr>
</thead>
<tbody>
<tr>
<td>log(per capita GDP)</td>
<td>0.124 (0.027)</td>
<td>0.103 (0.030)</td>
</tr>
<tr>
<td>log(per capita GDP) squared</td>
<td>-0.0095 (0.0018)</td>
<td>-0.0082 (0.0019)</td>
</tr>
<tr>
<td>Government consumption/GDP</td>
<td>-0.149 (0.023)</td>
<td>-0.153 (0.027)</td>
</tr>
<tr>
<td>Rule-of-law index</td>
<td>0.0172 (0.0053)</td>
<td>0.0102 (0.0065)</td>
</tr>
<tr>
<td>Democracy index</td>
<td>0.054 (0.029)</td>
<td>0.043 (0.033)</td>
</tr>
<tr>
<td>Democracy index squared</td>
<td>-0.048 (0.026)</td>
<td>-0.038 (0.028)</td>
</tr>
<tr>
<td>Inflation rate</td>
<td>-0.037 (0.010)</td>
<td>-0.014 (0.009)</td>
</tr>
<tr>
<td>Years of schooling</td>
<td>0.0072 (0.0017)</td>
<td>0.0066 (0.0017)</td>
</tr>
<tr>
<td>log(total fertility rate)</td>
<td>-0.0251 (0.0047)</td>
<td>-0.0306 (0.0054)</td>
</tr>
<tr>
<td>Investment/GDP</td>
<td>0.059 (0.022)</td>
<td>0.062 (0.021)</td>
</tr>
<tr>
<td>Growth rate of terms of trade</td>
<td>0.165 (0.028)</td>
<td>0.124 (0.035)</td>
</tr>
<tr>
<td>Numbers of observations</td>
<td>79, 87, 84</td>
<td>39, 56, 51</td>
</tr>
<tr>
<td>(R^2)</td>
<td>0.67, 0.48, 0.42</td>
<td>0.73, 0.62, 0.60</td>
</tr>
</tbody>
</table>

Note: Dependent variables: The dependent variable is the growth rate of real per capita GDP over 1965–1975, 1975–1985, or 1985–1995. The first column has the full sample of observations with available data. The second panel is restricted to the observations for which the Gini coefficient, used in later regressions, is available.

Independent variables: 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.
## TABLE 1-2
### PANEL REGRESSIONS FOR INVESTMENT RATIO

<table>
<thead>
<tr>
<th>Independent Variable</th>
<th>Estimated Coefficient</th>
<th>In full sample</th>
<th>In Gini sample</th>
</tr>
</thead>
<tbody>
<tr>
<td>log(per capita GDP)</td>
<td>0.188 (0.083)</td>
<td></td>
<td>0.121 (0.111)</td>
</tr>
<tr>
<td>log(per capita GDP) squared</td>
<td>-0.0110 (0.0053)</td>
<td></td>
<td>-0.0077 (0.0070)</td>
</tr>
<tr>
<td>Government consumption/GDP</td>
<td>-0.271 (0.072)</td>
<td></td>
<td>-0.353 (0.104)</td>
</tr>
<tr>
<td>Rule-of-law index</td>
<td>0.064 (0.020)</td>
<td></td>
<td>0.070 (0.025)</td>
</tr>
<tr>
<td>Democracy index</td>
<td>0.072 (0.078)</td>
<td></td>
<td>0.047 (0.123)</td>
</tr>
<tr>
<td>Democracy index squared</td>
<td>-0.086 (0.068)</td>
<td></td>
<td>-0.057 (0.103)</td>
</tr>
<tr>
<td>Inflation rate</td>
<td>-0.058 (0.027)</td>
<td></td>
<td>-0.022 (0.028)</td>
</tr>
<tr>
<td>Years of schooling</td>
<td>-0.0013 (0.0058)</td>
<td></td>
<td>0.0045 (0.0065)</td>
</tr>
<tr>
<td>log(total fertility rate)</td>
<td>-0.0531 (0.0140)</td>
<td></td>
<td>-0.0592 (0.0187)</td>
</tr>
<tr>
<td>Growth rate of terms of trade</td>
<td>0.052 (0.067)</td>
<td></td>
<td>0.129 (0.114)</td>
</tr>
<tr>
<td>Numbers of observations</td>
<td>79, 87, 85</td>
<td></td>
<td>39, 56, 51</td>
</tr>
<tr>
<td>R²</td>
<td>0.52, 0.60, 0.65</td>
<td>0.35, 0.64, 0.69</td>
<td></td>
</tr>
</tbody>
</table>

**Note:** 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 over 1965–1975, 1975–1985, or 1985–1989. See the notes to table 1–1 for other information.

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 less than $670 in 1985 U.S. dollars). For 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 5–6 percent 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. (Though not shown in table 1–1, growth is insignificantly related to the ratio of public debt to GDP at the start of each period.)
Growth is positively related to the stock of human capital at the start of each period, as measured by the average years of attainment at the secondary and higher levels of adult males. (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 (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— as in the table— 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 1-2, 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 $5,100 (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 results imply that several policy variables that directly affect economic growth (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.

**Measures of Income Inequality**

Data on income inequality come from the extensive compilation for a large panel of countries in Deininger and Squire 1996 (henceforth denoted as D-S). 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, whether the income concept applies to individuals or households is indicated. 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 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’s 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 the availability of far fewer observations than for the full sample considered in tables 1–1 and 1–2. As an attempt to expand the sample size—even at the expense of some reduction in the accuracy of measurement—I added to the D-S high-quality set a number of observations that appeared to be based on representative, national coverage. D-S excluded these observations primarily because of the failure to identify a primary source clearly. In the end, considering also the data availability for the variables included in tables 1–1 and 1–2, I end up with eighty-four countries with at least one observation on the Gini coefficient (of which twenty are in sub-Saharan Africa). Sixty-eight countries offer two or more observations (nine of these are in sub-Saharan Africa). Table 1–3 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
TABLE 1-3
STATISTICS FOR GINI COEFFICIENTS

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of observations</td>
<td>49</td>
<td>61</td>
<td>68</td>
<td>76</td>
</tr>
<tr>
<td>Mean</td>
<td>0.432</td>
<td>0.416</td>
<td>0.394</td>
<td>0.409</td>
</tr>
<tr>
<td>Maximum</td>
<td>0.640</td>
<td>0.619</td>
<td>0.632</td>
<td>0.623</td>
</tr>
<tr>
<td>Minimum</td>
<td>0.253</td>
<td>0.228</td>
<td>0.210</td>
<td>0.227</td>
</tr>
<tr>
<td>Standard deviation</td>
<td>0.100</td>
<td>0.094</td>
<td>0.092</td>
<td>0.101</td>
</tr>
</tbody>
</table>

Correlation with

- Gini 1960: 1.00
- Gini 1970: 0.81
- Gini 1980: 0.85
- Gini 1990: 0.72

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

twice the area between the 45-degree line that extends northeastward from the origin and the Lorenz curve. Theil (1967, 121 ff.) shows that the Gini coefficient corresponds to 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:

\[
Gini\ coefficient = 0.8*(-1 + 2Q5 + 1.5Q4 + Q3 + 0.5Q2)
= 0.8*(1 - 2Q1 - 1.5Q2 - Q3 - 0.5Q4), \quad (1-2)
\]

where \(Qi\) is the share of income accruing to the \(i\)th 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.

The Gini coefficient turns out to be highly correlated with
the upper quintile share, Q5, and not as highly correlated with
the 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 mea-
sures. One reason that the correlation between the Gini coeffi-
cients and the Q5 values is so high is that the Q5 variables have
much larger standard deviations than the other quintile shares.

Effects of Inequality on Growth and Investment

The second columns of tables 1–1 and 1–2 show how the base-
line 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-
ration 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.

Table 1–4 shows the estimated coefficients on the Gini coef-
cient when this variable is added to the panel systems from
tables 1–1 and 1–2. In these results the raw data on the Gini
coefficient are entered directly. A reasonable alternative is to ad-
just these Gini values for differences in the method of measure-
ment, especially 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 do matter significantly for the measurement of
inequality, as discussed in the next section. However, the adjust-
ment of the inequality measures for these elements turns out to
have little consequence for the estimated effects of inequality on
growth and investment. Therefore, the results reported here con-
sider only the unadjusted measures of inequality.
For the growth rate, the estimated coefficient on the Gini coefficient in table 1–4 is essentially zero. Figure 1–1 shows the implied partial relation between the growth rate and the Gini coefficient.\textsuperscript{12} This pattern looks consistent with a roughly zero relationship and does not suggest any obvious nonlinearities. Thus, overall, with the other explanatory variables considered in table 1–1 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, one of the variables that are correlated with inequality, is omitted from the system, then the estimated coefficient on the Gini variable becomes significantly negative. Table 1–4 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 1–3) would be estimated to raise the growth rate on impact by 0.4 percent per year. Perotti (1996) reports effects of similar magnitude. However, it seems that this effect may represent merely a proxying for the correlated fertility rate.

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 less than $2,070 (1985 U.S. dollars) and then becomes positive.\textsuperscript{13} (The median value of GDP was $1,258 in 1960, $1,816 in 1970, and $2,758 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...
<table>
<thead>
<tr>
<th>Gini</th>
<th>Gini* log(GDP)</th>
<th>Gini, Low GDP</th>
<th>Gini, High GDP</th>
<th>Wald Tests (p-values)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Growth rate regressions</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.000</td>
<td></td>
<td></td>
<td></td>
<td>0.059</td>
</tr>
<tr>
<td>(0.018)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-0.331</td>
<td>0.043</td>
<td></td>
<td></td>
<td>0.011,</td>
</tr>
<tr>
<td>(0.141)</td>
<td>(0.018)</td>
<td></td>
<td></td>
<td>0.003^a</td>
</tr>
<tr>
<td>Fertility variable omitted</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-0.037</td>
<td></td>
<td></td>
<td></td>
<td>0.012</td>
</tr>
<tr>
<td>(0.017)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-0.367</td>
<td>0.043</td>
<td></td>
<td></td>
<td>0.085,</td>
</tr>
<tr>
<td>(0.156)</td>
<td>(0.020)</td>
<td></td>
<td></td>
<td>0.99^a</td>
</tr>
</tbody>
</table>
Investment ratio regressions

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0.060</td>
<td></td>
</tr>
<tr>
<td>(0.070)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.54</td>
<td>−0.062</td>
<td>0.39</td>
</tr>
<tr>
<td>(0.47)</td>
<td>(0.062)</td>
<td></td>
</tr>
</tbody>
</table>

Fertility variable omitted

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>−0.027</td>
<td></td>
</tr>
<tr>
<td>(0.066)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.50</td>
<td>−0.068</td>
<td>0.51</td>
</tr>
<tr>
<td>(0.48)</td>
<td>(0.062)</td>
<td></td>
</tr>
</tbody>
</table>

Note: Gini coefficients were added to the systems shown in tables 1–1 and 1–2. 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 1989. 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. See the notes to table 1–1 for additional information.

a. These values are for the hypothesis that the two coefficients are equal (but not necessarily equal to zero).
equation for 1965–1975) to 0.12 for the richest country in 1980 (which appears in the equation for 1985–1995). 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).

From a theoretical standpoint the effects may result because rising per capita income reduces the constraints of imperfect loan markets on investment. The positive effect of the Gini coefficient in the upper-income range may arise because the growth-promoting aspects of inequality dominate when credit-market problems are less severe.

Figure 1–2 shows the implied partial relation between economic growth and the Gini coefficient—in this case the explanatory variables held constant include the interaction term between the Gini coefficient and log(GDP). This partial relation is negative and corresponds to the significantly negative estimated coefficient on the linear term for the Gini variable in the panel system. Figure 1–3 shows the implied partial relation with
the Gini-log(GDP) interaction term (when the Gini coefficient and the other explanatory variables are held constant). The positive partial relation corresponds to the significantly positive estimated coefficient on the interaction term in the panel system.

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. 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 less than $2,070 (the break point estimated above) and the other
for values of per capita GDP greater than $2,070. The results, shown in table 1–4, 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. 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).

The bottom part of table 1–4 shows how the Gini coefficient relates to the investment ratio. The basic finding, when the other explanatory variables shown in table 1–2 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

Table 1–5 shows the results for economic growth when the inequality measure is based on quintile-shares data rather than Gini coefficients. 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 $1,473 and positive otherwise. The similarity in results with those from the Gini coefficient arises because, as noted, the highest-quintile share is particularly highly correlated with the Gini values.

Table 1–5 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.

**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 1–4 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 some 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 1–6. This column reports the results
<table>
<thead>
<tr>
<th>Quintile Measure</th>
<th>Quintile Measure* log(GDP)</th>
<th>Quintile Measure, Low GDP</th>
<th>Quintile Measure, High GDP</th>
<th>Wald Tests (p-values)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Highest-quintile share</td>
<td>0.019 (0.020)</td>
<td>-0.45 (0.15)</td>
<td>0.061 (0.019)</td>
<td>-0.056 (0.031)</td>
</tr>
<tr>
<td>Middle-three-quintiles share</td>
<td>-0.020 (0.025)</td>
<td>-0.017 (0.163)</td>
<td>-0.001 (0.021)</td>
<td>0.058 (0.039)</td>
</tr>
</tbody>
</table>
### Lowest-quintile share

\[
\begin{array}{ccc}
\text{Lowest-quintile share} & -0.044 & 0.71 \\
& (0.060) & \\
0.16 & -0.025 & 0.37 \\
(0.51) & (0.063) & (0.12) \\
& -0.155 & 0.000 \\
& (0.061) & \\
& & 0.000^a
\end{array}
\]

**Note:** 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. See the notes to table 1–1 for additional information.

a. These values are for the hypothesis that the two coefficients are equal (but not necessarily equal to zero).
from a panel estimation, using the seemingly-unrelated technique. In this first case 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 $1,636 (1985 U.S. dollars) and declines thereafter. The fit of the relationship is not good, as figure 1–4 clearly shows. 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 variation in inequality across countries and over time.

The second column of table 1–6 adds to the panel estimation a number of control variables, including some corrections for the manner in which the underlying distributional data are constructed. The first dummy variable equals 1 if the Gini coefficient is based on income net of taxes or on expenditures. The variable equals 0 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 for income net of taxes versus those for expenditures.)

The second dummy variable equals 1 if the data relate to individuals and 0 if the data relate 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 fifteen and older at three levels: primary, secondary, and higher. Primary schooling is negatively and significantly related to inequality, secondary schooling is negatively (but not significantly) related to inequality, and higher education is positively and significantly related to inequality.

The dummy variables for sub-Saharan Africa and Latin America 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.

I also considered measures of the heterogeneity of the population with respect to ethnicity and language and to religious affiliation. The first variable, referred to as ethnolinguistic fractionalization, has been used in a number of previous studies. This measure can be interpreted as (one minus) the probability of meeting someone of the same ethnolinguistic group in a random encounter. The second variable is a Herfindahl index of the fraction of the population affiliated with nine main religious groups. 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.
<table>
<thead>
<tr>
<th>Variable</th>
<th>No Fixed Effects</th>
<th>Fixed Effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>log(GDP)</td>
<td>0.407 (0.090)</td>
<td>0.415 (0.084)</td>
</tr>
<tr>
<td>log(GDP) squared</td>
<td>-0.0275 (0.0056)</td>
<td>-0.0254 (0.0053)</td>
</tr>
<tr>
<td>Dummy of net income or spending</td>
<td>-0.0493 (0.0094)</td>
<td>-0.0496 (0.0094)</td>
</tr>
<tr>
<td>Dummy of individual vs. household data</td>
<td>-0.0134 (0.0086)</td>
<td>-0.0119 (0.0087)</td>
</tr>
<tr>
<td>Primary schooling</td>
<td>-0.0147 (0.0037)</td>
<td>-0.0161 (0.0037)</td>
</tr>
<tr>
<td>Secondary schooling</td>
<td>-0.0108 (0.0070)</td>
<td>-0.0109 (0.0070)</td>
</tr>
<tr>
<td>Higher schooling</td>
<td>0.081 (0.034)</td>
<td>0.082 (0.034)</td>
</tr>
<tr>
<td>Dummy of Africa</td>
<td>0.113 (0.015)</td>
<td>—</td>
</tr>
<tr>
<td>Dummy of Latin America</td>
<td>0.094</td>
<td>0.089</td>
</tr>
<tr>
<td>-----------------------</td>
<td>-------</td>
<td>-------</td>
</tr>
<tr>
<td></td>
<td>(0.012)</td>
<td>(0.012)</td>
</tr>
<tr>
<td>Rule-of-law index</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Democracy index</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of observations</td>
<td>49, 61,</td>
<td>40, 59,</td>
</tr>
<tr>
<td></td>
<td>68, 76</td>
<td>61, 70</td>
</tr>
<tr>
<td>R²</td>
<td>0.12, 0.15</td>
<td>0.52, 0.59</td>
</tr>
<tr>
<td></td>
<td>0.18, 0.22</td>
<td>0.67, 0.67</td>
</tr>
</tbody>
</table>

Note: The dependent variables are the Gini coefficients observed around 1960, 1970, 1980, and 1990. See table 1–3 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 fifteen and older 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 1–1. The numbers of observations and the R-squared values refer to each of the four periods, 1960, 1970, 1980, and 1990.
Surprisingly 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 1–6.

The addition of the control variables in column 2 of table 1–6 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 1–5 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 1–6) of the control variables other than log(GDP) and its square. These filtered values have been normalized to make the mean equal 0. The horizontal axis plots the log of per capita GDP. The peak in the curve occurs at a value for GDP of $3,320 (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. If the system allows for different sets of coefficients on these variables for each period, then 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 are 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.

For the schooling variables, 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 $-0.010 (0.010)$; 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 1990s in the United States and 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 for Africa are $0.073 (0.032)$, $0.053 (0.023)$, $0.097 (0.023)$, 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 proxies for other variables.
As mentioned, 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 0. 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 (1 if high quality, 0 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 1–6 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 more equality of incomes.

Column 4 includes the index of democracy (electoral rights). The estimated coefficient of this variable differs insignificantly from 0. 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 1–6. Thus the estimated Kuznets curve, expressed in terms of the log of per capita GDP, does not involve a proxying of GDP for democracy.

The results described thus far are from a random-effects specification. That is, the panel estimation allows the error terms to be correlated over time for a given country. Column 5 shows the results of a 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 differ-

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cences. Countries are now included in the sample only if they have at least two observations on the Gini coefficient for 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 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 0. 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.

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 table 1–6 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 $3,500).

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 $3,100). 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 $5,600).
INEQUALITY, GROWTH, INVESTMENT

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 $2,000 (1985 U.S. dollars) and to rise with inequality when per capita GDP exceeds $2,000.

The results mean that income-equalizing policies might be justified on growth-promotion grounds in poor countries. For richer countries, active income redistribution appears to involve a tradeoff between the benefits of greater equality and a reduction in overall economic growth.

The Kuznets curve—whereby inequality first increases and later decreases in 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 the dynamic effect whereby the adoption of each new major technology has a Kuznets-type dynamic effect on the distribution of income.

Notes

1. Recent surveys of these theories include Benabou 1996 and Aghion, Caroli, and Garcia-Penalosa 1999.
2. For models of the economic effects of inequality with imperfect credit markets, see Galor and Zeira 1993 and Piketty 1997, among others.
4. For discussions, see Benabou 1996 and Rodriguez 1998.
6. However, these results refer to fixed-effects estimates, which have relatively few observations and are particularly sensitive to measurement error.
7. 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. 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 with World Bank data. Real investment (private plus public) is also from the Summers-Heston data set.


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 1–4).

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 $1,097, $5,219, and $6,568, respectively. 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 thirty-three for the first period, forty for the second, and forty-three for the third.
18. The breakpoint used, $1,473, 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 explanatory variables. The hypothesis that all 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. 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.

References


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Robert Barro’s chapter is a fair-minded, thorough, and unabashedly empirical examination of how income inequality is correlated with the level and growth rate of GDP per capita. Creating a hard job for a discussant, it neither makes poorly supported claims nor jumps to unwarranted conclusions.

**What Causes What?** Notice that the verb in the first sentence is “is correlated with,” not “affects.” It is abundantly clear, as Barro realizes, that a country’s degree of inequality and its level or growth rate of per capita income are endogenous variables, affected by many factors. Any claim that one variable causes the other must be heavily qualified and buttressed either by theory or by some other source of empirical evidence bearing on the question of causation. Barro appeals to the concept of Granger causality, that is, precedence in time, the idea that causes must precede effects. For example, the Gini ratio in 1980 is taken to be a determinant of income growth between 1985 and 1995. Income growth in 1985–1995 does not affect the 1980 Gini ratio.

This causal ordering is not unreasonable, but it is far from foolproof. For example, structural (and relatively unchanging) characteristics of countries may affect both inequality and growth and thus produce a correlation that implies no causation in either direction. Barro recognizes this problem, of course, and is appropriately modest in his claims, as he notes that “this approach to determining causation is not always valid.” To see that some third factors may be driving the correlation between inequality and GDP, we need only look at the right-hand column of table 1–6. There Barro adds country dummies (fixed effects) to the statistical model explaining income inequality and finds that the estimated Kuznets curve changes dramatically.
I will return to the idea that the correlation between inequality and growth (or between inequality and GDP) may stem from other factors. But first I want to mention two technical points.

**Two Technical Points.** First, cross-country data on Gini ratios clearly contain an unusually large amount of measurement error. As Barro notes, there are substantial cross-country differences in the income concept, in population coverage and, I assume, in the method of calculating the Gini ratio. So any regression that uses the Gini ratio on the right-hand side must be afflicted by a large dose of classical measurement error, which biases the coefficients toward zero.

The second technical point is that the Gini ratio may not be a sensible measure of inequality. When two Lorenz curves cross as surely happens often in Barro’s panel data, there is no real answer to the seemingly straightforward question, Which income distribution is more unequal? Nonetheless the Gini ratio always gives an answer. Here is a simple example to illustrate the point.

Consider two income distributions with quintile shares as shown in table 1–1C. Distribution A is the actual income distribution among U.S. households in 1997 with the Gini ratio calculated with the same approximation formula that Barro uses. Distribution B was created by shifting 3 percent of total income from the poorest quintile to the second quintile in a clearly dis-equalizing change and by shifting another 3 percent of total in-
come from the top quintile to the fourth quintile in a clearly equalizing change. Which distribution has more inequality? That answer is unclear. It all depends on the relative importance attached to inequality at the bottom compared with inequality at the top. My own value judgments lead me to conclude that the change from A to B is disequalizing, but another observer might call the change equalizing. And the Gini ratio stubbornly insists that inequality has not changed at all. (Slight perturbations in the numbers could have made the Gini ratio rise or fall.)

**Theory.** Barro offers a good summary of various theories of how inequality might affect either the level or the growth rate of GDP per capita. I do not comment on this because he reaches the indubitably correct conclusion: theory is of little help. Some theories predict that greater inequality will increase growth, while others imply just the opposite. As so often the case, a priori theorizing undisciplined by empirical evidence can lead to any conclusion.

Regarding theories of how the level of per capita GDP might impact the Gini ratio, Barro seems partial to the Kuznets model (or some of its modern reincarnations), which posits that economic development first raises and then reduces inequality. But all this theory elides the bigger question: Which variable causes which? As I have suggested, both inequality and growth must be caused by some other exogenous factors or shocks. It is not meaningful to say that inequality causes growth or that growth causes inequality. As a contemporary example, consider the much-discussed phenomenon of skill-biased technological change. Many economists believe that such technology shocks underlie the trend toward rising wage inequality in the United States since the late 1970s. Have these technological developments also raised the growth rate of per capita GDP? “New economy” advocates say yes.

**Barro’s Main Findings.** With theory providing such scant help, Barro sensibly concentrates on reading the messages in the data. What does he find?

Looking first at inequality (measured by the Gini ratio, henceforth $G$) as a potential determinant of economic growth (henceforth $dy$, where $y$ is the log of per capita GDP), Barro finds
a zero linear relationship. There does, however, appear to be a significant nonlinear relationship. The estimated derivative,

$$\frac{d(dy)}{dG} = -0.331 + 0.043 y,$$

varies with \(y\). At low-income levels it is negative and indicates that more inequality hurts growth. But at high-income levels greater inequality seems to raise the growth rate. With a different functional form, however, Barro finds that the relationship disappears. The inference appears a bit less fragile, at least qualitatively, when assessing how the level of GDP affects inequality. Barro detects a fairly consistent Kuznets curve relationship: inequality first rises with \(y\) and then falls. However, as he notes, the correlation does not explain much of the variance of \(G\). In addition, as mentioned, the quantitative dimensions of the estimated Kuznets curve change dramatically when fixed effects are allowed into the regression.

**The Big Unanswered Question.** Although Barro declined—perhaps wisely—to relate inequality to tax policy, I will take a stab at it. Government tax-transfer policies are clearly one of the prominent “other factors” that might account for any observed relationship between \(G\) and \(dy\) (or \(y\)). Unfortunately, but unsurprisingly, it is easy to think of examples in which equalizing policies have either a positive or a negative impact on growth.

First consider instituting a punitively progressive income tax of the sort once used in both the United States and the United Kingdom, with top marginal tax rates in excess of 90 percent. The Gini ratio would almost certainly fall, and either GDP or its growth rate would probably decline as well. (However, the U.S. economy grew very nicely in the early postwar period, when the top marginal tax rate was 90 percent.) A “policy shock” such as that should therefore induce a positive covariance between \(G\) and \(dy\) (or \(y\)).

Consider next redistributive policies that in poor countries ward off malnutrition or in rich countries enable low-income households to make high-return investments in human capital. Such policy actions would likely reduce the Gini ratio while raising GDP or its growth rate and would thereby induce a negative covariance between \(G\) and \(y\) (or \(dy\)). Now think about combining...
a variety of such policy shocks in a panel study of many countries at different stages of development and imagine that these shocks are the only third factor driving the correlation between growth and inequality. (I am plainly not being realistic here.) You might well find, as Barro did, that there is no linear relationship between $G$ and $dy$. But if the shocks just used as examples are representative, you might also find a nonlinear relationship like the one Barro found: equalizing policies speed up growth in poor countries but slow it in rich ones.

Is this behind the empirical correlations that Barro discovers? I do not claim to know, and neither does Barro. But it is certainly a good question.