Is Inequality Harmful for Growth?

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Is inequality harmful for growth? We suggest that it is. In a society where distributional conflict is important, political decisions produce economic policies that tax investment and growth-promoting activities in order to redistribute income. The paper formulates a theoretical model that captures this idea. The model's implications are supported by the evidence. Both historical panel data and postwar cross sections indicate a significant and large negative relation between inequality and growth. This relation is only present in democracies. (*JEL* D30, E62, H30, O40).

Why do different countries—or the same country in different periods—grow at such different rates? And what is the role of income distribution in the growth process? To answer these old questions, we believe one should explain why growth-promoting policies are or are not adopted. In this paper we try to do just that by combining insights from two recent strands of literature, namely, the theory of endogenous growth and the theory of endogenous policy. We can summarize our tentative conclusion in a simple aphorism: inequality is harmful for growth.

The arguments that lead us to this conclusion run as follows. Economic growth is largely determined by the accumulation of capital, human capital, and knowledge usable in production. The incentives for such productive accumulation hinge on the ability of individuals to appropriate privately the fruits of their efforts, which in turn crucially hinges on what tax policies and regulatory policies are adopted. In a society where distributional conflict is more important, political decisions are likely to result in policies that allow less private appropriation and therefore less accumulation and less growth. But the growth rate also depends on political institutions, for it is through the political process that conflicting interests ultimately are aggregated into public-policy decisions.

In the paper we first formulate a simple general-equilibrium model that formally captures this idea. It is an overlapping-generations model in which heterogeneous individuals are born in every period and act as economic agents and voters. The model's politico-economic equilibrium determines a sequence of growth rates as a function of parameters and initial conditions. The greater is income inequality, the lower is equilibrium growth.

Next, we confront the model's empirical implications with two sets of data. The first is an historical panel of nine currently developed countries: the United States and eight European countries. The second sample contains postwar evidence from a broad cross section of countries, both developed and less developed. The predictions of the

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model hold up in both samples. In particular, a strong negative relation betwen income inequality at the start of the period and growth in the subsequent period is present in both samples. To the best of our knowledge, this result is a genuinely new finding.[1] The evidence concerning political institutions is more mixed. In the historical sample, relevant data are available but exhibit little variation. In the postwar sample, relevant data are not available. However, the results in subsamples of democratic and nondemocratic countries are strikingly different, providing indirect support for our theory.

As we already mentioned, our work in this paper is related to both the theory of endogenous growth and the theory of endogenous policy. The work on endogenous growth has made clear the importance of policy for growth; but it has not yet made the link connecting distribution, politics, and policy.[2] Analogously, the literature on endogenous policy has made clear the importance of distribution for policy; but it has not yet made the link between policy and growth.[3] In complementary and independent work, Alberto Alesina and Dani Rodrik (1993) and Roberto Perotti (1993) have studied the determination of tax policy in the political equilibrium of an endogenous-growth model. Alesina and Rodrik also find a negative empirical link between inequality and growth.[4]

Obviously, our work is also related to the vast literature in economic history and economic development about the relation between development and income distribution. This work largely revolves around the so-called *Kuznets curve*: the hypothesis that income inequality first increases and then decreases with development.[5] The Kuznets curve remains a controversial concept both theoretically and empirically. The work on the Kuznets curve, however, deals with the question of how the *level* of income affects income distribution, while our work instead addresses the question of how income distribution affects the *change* in income. Our theory, as well as our empirical tests, remain valid both in the presence and in the absence of a Kuznets curve.

In Section I of the paper we formulate our theoretical model of politico-economic equilibrium growth. We use the model to derive an equilibrium sequence of growth rates and spell out its empirical implications. In Section II we describe our empirical results from the historical panel of countries. Section III presents our empirical work based on postwar evidence from a broad cross section of countries. Section IV discusses the interpretation of our results. Final remarks are contained in Section V.

[1]Some preliminary evidence that growth is inversely related to inequality in a small cross section of countries is also found by Andrew Berg and Jeffrey Sachs (1988).

[2]Paul Romer (1989) surveys the literature on endogenous growth. Sergio Rebelo (1991) and Robert Barro and Xavier Sala-i-Martin (1992) discuss the growth consequences of alternative (exogenous) policies. Romer (1990) spells out the income-distribution consequences of trade policies in an endogenous-growth model of a small open economy and discusses informally how these distribution consequences may block growth-promoting policies from being pursued. Marco Terrones (1990) models redistributive policy and growth endogenously, but in a representative-agent model that does not address issues of distribution and politics. Giuseppe Bertola (1991) studies the relationship between growth and the *functional* (rather than the size) distribution of income.

[3]In Persson and Tabellini (1990), we survey the literature on endogenous policy. The classic papers on how income distribution affects the choice of tax policy in a static voting model are Thomas Romer (1975), Kevin Roberts (1977), and Alan Meltzer and Scott Richard (1981).

[4]Subsequently, quite a few papers have been written on the interaction among income distribution, politics, and accumulation. In Persson and Tabellini (1992), we briefly survey this growing literature.

[5]As suggested by the name, the hypothesis is intimately associated with the writings of Simon Kuznets, notably Kuznets (1966). Peter Lindert and Jeffrey Williamson (1985) provide a recent evaluation of the theoretical as well as the empirical work on the Kuznets curve, while François Bourguignon and Christian Morrisson (1990) provide new cross-country evidence on the effects of economic development on income distribution.

I. Theory

A. *The Model*

We study an overlapping-generations model with constant population, where nonaltruistic individuals live for two periods.[6] Every individual has the same *preferences*. Let the utility of the ith individual born in period $t-1$, but indexed by t, be:

$$v_t^i = U(c_{t-1}^i, d_t^i). \quad (1)$$

In (1), c denotes the consumption when young, and d denotes the consumption when old. The utility function $U(\cdot)$ is concave, well-behaved, and homothetic or (without loss of generality) linearly homogeneous.

Different individuals have different incomes. The *budget constraints* of the ith individual are

$$c_{t-1}^i + k_t^i = y_{t-1}^i \quad (2a)$$

$$d_t^i = r\left[(1-\theta_t)k_t^i + \theta_t k_t\right] \quad (2b)$$

where y^i is the ith individual's income when young (to be defined below), k^i and k are the individual and average accumulation, respectively, of an asset, r is the exogenous rate of return on that asset, and θ is a policy variable (throughout the paper we use superscripts to denote individual-specific variables and no superscripts to denote average variables). Thus policy is purely redistributive: it takes from those who have invested more than the average and gives to those who have invested less than the average.

The income when young is defined as

$$y_{t-1}^i = (w + e^i)k_{t-1} \quad (3)$$

where w is an exogenous average endowment of "basic skills" and e^i is an exogenous individual-specific endowment of such skills with zero mean and nonpositive median. Thus the stock of k accumulated on average by the previous generation has a positive externality on the income of the newborn generation.

The most straightforward interpretation of this externality is to think of k as physical or human capital that has a "knowledge spillover" on the basic skills of the young, as in Kenneth Arrow (1962) or Romer (1986). With this interpretation, θ would be interpreted as a proportional capital income tax, the proceeds of which are used to finance equal lump-sum transfers to every old citizen.[7] But it may be more relevant to think of k as a measure of knowledge that is useful in promoting technical progress. In this case, the owners of k earn monopoly rents from their previous investment in the accumulation of knowledge. The policy variable θ would then represent regulatory policy such as "patent legislation" or "protection of property rights," so that θ becomes an index of how well an individual can privately appropriate the returns on his investment.[8] Since technical progress is largely embodied in new capital, the two interpretations are not mutually exclusive.

Summarizing, average national income is a linear function of the asset already accumulated, $(w+r)k$, where wk and rk represent the average wage to the young and profit to the old, respectively. The distribution of income between wages and profits is determined exogenously by the extent of the externality. The model focuses only on redistributive taxation across profits, and it

[6]The overlapping-generations structure enables us to disregard the effect of individual savings decisions on the wealth distribution of future generations, which considerably simplifies the analysis.

[7]In principle, one could think of more sophisticated, nonlinear, redistribution schemes. However, we could rule out such schemes as infeasible because of tax arbitrage, if we extended the model so as to make individual skills unobservable.

[8]Following the approach of Romer (1987), a previous version of the paper (Persson and Tabellini, 1991), showed that the second interpretation is formally consistent with our model.

rules out any intergenerational redistribution.[9]

Events unfold according to the following timing. At the start of period $t-1$ the eligible voters choose θ_t. Then investors choose k_t^i. Thus, we abstract from credibility problems and just assume that there is one-period-ahead commitment of policy. Since the old generation in period $t-1$ is not affected by the policy enacted in period t, we assume without loss of generality that only the young generation participates in the vote. We start by assuming that the distribution of e^i in the population is stationary. This assumption is relaxed later on.

A politico-economic equilibrium is defined as a policy and a set of private economic decisions such that:

(i) The economic decisions of all citizens are optimal, given the policy, and markets clear;
(ii) the policy cannot be defeated by any alternative in a majority vote among the citizens in the enfranchised section of the population.

(Below we analyze the effects of constitutional limits on political participation.)

B. *Economic Equilibrium*

With homothetic preferences, the ratio of consumption in the two periods is a function only of intertemporal prices and is independent of wealth: that is, for all i, $d_t^i/c_{t-1}^i = D(r,\theta_t)$, with $D_r > 0$ and $D_\theta < 0$. Equivalently, every individual has the same "savings rate" so that individuals with more skills accumulate more k. Using this fact and the budget constraints (2), we can write the amounts consumed by the ith individual as

$$(4) \quad d_t^i = \frac{rD(r,\theta_t)\left[(1-\theta_t)y_{t-1}^i + \theta_t k_t\right]}{D(r,\theta_t) + r(1-\theta_t)}$$

$$(5) \quad c_{t-1}^i = \frac{r\left[(1-\theta_t)y_{t-1}^i + \theta_t k_t\right]}{D(r,\theta_t) + r(1-\theta_t)}.$$

For the average individual, $k_t = y_{t-1} - c_{t-1}$. By repeated substitution and use of (2) and (3) we can therefore solve for the *growth rate* of k (and of national income, under our assumptions):

$$(6) \quad g_t = G(w,r,\theta_t) = k_t/k_{t-1} - 1$$
$$= wD(r,\theta_t)/\left[r + D(r,\theta_t)\right] - 1.$$

In (6) $G_w > 0$, $G_r \lessgtr 0$, and $G_\theta < 0$ (since $D_\theta < 0$). Thus, the higher are the average skills w, the higher is the growth rate of k. A higher gross of return may increase or decrease growth, depending on the usual balancing of substitution and income effects, but the more an individual can appropriate the fruits of his investment (i.e., the lower is θ), the higher is the growth rate (on average a change in θ has only a substitution effect, since the average individual receives a lump-sum transfer equal to the tax he pays).

C. *Political Equilibrium*

To characterize the political equilibrium we first study the ith individual's policy preferences. Simply differentiate his utility function $v_t^i = U(c_{t-1}^i, d_t^i)$ with respect to θ_t, subject to the budget constraints (2). Applying the envelope theorem and using (2b), we have

$$(7) \quad \frac{\partial v_t^i}{\partial \theta_t} = U_d(\cdot)\left[\left(k_t - k_t^i\right) + \theta_t \frac{\partial k_t}{\partial \theta_t}\right] r.$$

This expression reflects the trade-off facing the voters. On the one hand, an increase in

[9]The linearity of the production function in k and the presence of a (linear) externality of k on wages is what allows unbounded growth in this model. See Larry Jones and Rodolfo Manuelli (1991) for a more general discussion of endogenous growth in overlapping-generations economies. Finally, note that r here denotes the return on capital net of depreciation. Hence, given r, the depreciation rate of capital (or knowledge) does not enter the model.

θ redistributes income and welfare from individuals with $k^i > k$ to individuals with $k^i < k$. On the other hand, an increase in θ is costly in that it diminishes investment and the base for redistribution. The optimal policy from the point of view of the ith voter exactly balances these two effects, which happens when the right-hand side of (7) is equal to zero (provided the second-order conditions are satisfied).

By (2a), (3), and (5),

$$k_t - k_t^i = \frac{-D(\cdot)k_{t-1}}{D(\cdot)+r(1-\theta_t)}e_{t-1}^i \tag{8}$$

which says, very intuitively, that individuals born poorer ($e_{t-1}^i < 0$) or richer ($e_{t-1}^i > 0$) than average have respectively less or more capital than the average. Hence individual preferences for redistribution can be ranked by their idiosyncratic endowment, e^i. The political equilibrium policy is thus the value of θ preferred by the median voter, that is, the individual with median endowment, e^{m} (see Jean-Michel Grandmont, 1978). Combining (7) and (8) and computing the expression for $\partial k_t / \partial \theta_t$, the equilibrium policy θ^* is a function $\theta^*(w,r,e^{\mathrm{m}})$, defined implicitly by

$$-\frac{D(r,\theta)e^{\mathrm{m}}}{D(r,\theta)+r(1-\theta)} + \theta D_\theta(r,\theta)\frac{wr}{r+D(r,\theta)} = 0 \tag{9}$$

where the first term captures the marginal benefit of redistribution for the median voter and where the second term is the marginal cost of the tax distortions.

It is easy to verify from (9) that $\theta^* \gtrless 0$ as $e^{\mathrm{m}} \lessgtr 0$, $\theta_e^* < 0$, $\theta_w^* \lesseqgtr 0$ as $e^{\mathrm{m}} \lesseqgtr 0$, and $\theta_r^* \lesseqgtr 0$. Intuitively, if the median voter coincides with the average investor ($e^{\mathrm{m}} = 0$), he prefers a nonredistributive policy ($\theta^* = 0$) whereas he prefers a tax (a subsidy) on investment if he is poorer (richer) than the average. More generally, a median voter with higher individual skills e^{m} and therefore a higher k^{m} prefers more private appropriability (a lower θ). A higher average skill level w gives higher average accumulation and hence increases the cost of redistribution, so that the voter prefers a less interventionist policy (a lower tax or a smaller subsidy). A higher rate of return r may either increase or decrease the preferred level of θ.

Combining (9) and (6), the growth rate in politico-economic equilibrium is

$$g^* = G(w,r,\theta^*(w,r,e^{\mathrm{m}})). \tag{10}$$

From (10) and the properties of the $G(\cdot)$ and $\theta^*(\cdot)$ functions derived above, we obtain some clear-cut and testable ceteris paribus implications:

$$dg^*/de^{\mathrm{m}} = G_\theta \theta_e > 0 \tag{11}$$

(i.e., a more equal distribution of income increases growth); and

$$dg^*/dw = G_w + G_\theta \theta_w > 0 \qquad \text{if } e^{\mathrm{m}} < 0 \tag{12}$$

(i.e., a higher average level of basic skills increases growth). The predictions regarding the effects on growth of the rate of return r are inconclusive. However, that may not be such a loss, since r in the model measures the gross (pretax or inclusive-of-externalities) return on accumulating productive knowledge, a variable that is notoriously difficult to observe empirically.

D. *Dynamics of Growth*

So far we have assumed that the distribution of income and all relevant parameters were stationary. As a result, the equilibrium growth rate was also stationary. However, the model can easily be extended to allow for exogenous laws of motion of both income distribution and the key parameters. In this case, equilibrium growth can exhibit some interesting dynamics. A previous version of the paper, Persson and Tabellini (1991), discussed these extensions in detail. Here we only provide a brief sketch.

Consider first the distribution of income. Suppose that the idiosyncratic income of individual i born in period $t-1$, e^i_{t-1}, is distributed according to a given family of distribution functions, $F(e^i, k_{t-1})$. Suppose further that different levels of k_{t-1} induce a mean-preserving spread on $F(\cdot)$. Then, even though the model does not endogenously derive the properties of $F(\cdot)$, it may nevertheless be consistent with the dynamics of the Kuznets curve. Moreover, additional implications are obtained about the dynamics of equilibrium growth, depending on the specific assumptions about the function $F(\cdot)$.

Suppose for instance that the hypothesis underlying the Kuznets curve is valid, so that inequality increases with development at low levels of income but decreases at higher levels of income. In terms of the model, this means that median income e^{m} is now a function of k, first decreasing up to some point $\tilde{k}$ and then increasing. If initial capital, k_0, is below $\tilde{k}$, then by (10) the time path of equilibrium growth is nonmonotonic: it first falls until k reaches $\tilde{k}$ and then accelerates again at a higher level of development.

This nonmonotonicity implies that the equilibrium dynamics can exhibit path-dependence. If at the point of minimum growth and maximum inequality, $\tilde{k}$, equilibrium growth is nonpositive, then any country with $k_0 < \tilde{k}$ eventually falls in a "growth trap": income inequality is or becomes so pronounced that it discourages further accumulation and growth. In the growth trap, the only way the economy could take off again would be if the equilibrium growth path somehow, were shifted upward, so that minimum growth is always positive.

Next, consider the parameters w and r. Since the economic model is recursive, the expressions for equilibrium growth are unchanged even if w and r are allowed to vary over time. When going from the model to our empirical tests, however, relaxing this assumption matters. If w and r vary over time, the growth rate of k, no longer coincides with the growth rate of GDP, which is what we ultimately observe. A previous version of this paper (Persson and Tabellini, 1991) spelled out the specific assumptions that are needed to derive from the model a linear expression for per capita GDP growth that can be estimated.

E. *Taking the Model to the Data*

The remainder of the paper tests the two implications of (10) spelled out above, namely, that a more equal distribution of income and a higher average level of basic skills both increase growth. The theory also has predictions about the effect of inequality on economic policy, θ_t, and in turn about the link between policy and growth. The policy θ, however, can be interpreted in several ways: as a tax on human or physical capital, patent legislation, regulatory policy, or even more broadly as legal enforcement and general protection of property rights. These various policies are very difficult to measure, and focusing on only one of them could be misleading. For this reason, in the empirical analysis we consider mainly the reduced form of the equilibrium solution, focusing on the predictions (11) and (12) stated above. (See, however, the discussion in Section IV below.)

The model is formulated in terms of per capita growth and abstracts from population growth and from short-run fluctuations. Given that the time unit of the model is a generation, equation (10) is relevant only for growth rates over relatively long periods of time. Further, it applies to a given country with particular economic and political institutions. Because usable data on relevant variables do not go back further than to the mid-19th century, we cannot test these implications for a single country. In Section II we therefore pool historical data from a cross section of nine currently developed countries with similar economic and political histories. In Section III, we then look at postwar data from a broad cross section of countries, developed as well as developing.

II. Historical Evidence

A. *Data*

Our historical data cover nine countries: Austria, Denmark, Finland, Germany, the Netherlands, Norway, Sweden, the United

TABLE 1—SUMMARY STATISTICS FOR HISTORICAL SAMPLE

	Number of observations	Mean	SD	Minimum	Maximum
GROWTH	57	1.875	1.026	0.17	5.05
GDPGAP	57	0.684	0.188	0.362	1.00
INCSH	38	0.504	0.068	0.38	0.67
SCHOOL	52	0.140	0.081	0.017	0.362
NOFRAN	59	0.278	0.312	−0.01	0.89

Correlation Matrix:

	Variable			
Variable	GROWTH	GDPGAP	INCSH	SCHOOL
GDPGAP	−0.354			
INCSH	−0.445	−0.056		
SCHOOL	0.401	0.120	−0.713	
NOFRAN	−0.367	0.078	0.574	−0.620

Kingdom, and the United States. We divide the time period back to 1830 into subperiods of 20 years each, so that the first possible observation for each country comprises the years 1830–1850 and the last observation comprises the years 1970–1985 (the last observation is the only one that has 15 years rather than 20). For each country and variable, we go as far back as the data permit. Our rule for selecting the countries was that we could find data for all the variables below at least back to 1930. The data are put together from a variety of sources, which are detailed in the Appendix.

Per Capita Growth.—The dependent variable in all our regressions is the annual average growth rate of GDP per capita (continuously compounded and expressed as a percentage) for each country and each 20-year episode. We have a total of 57 observations for this variable, which we call GROWTH. The mean value in the sample is 1.88, and the range goes from 0.17 (Austria, 1910–1930) to 5.05 (Germany, 1950–1970). Summary statistics for this and other variables appear in Table 1.

For the independent variables, we try to find data that match our model as closely as possible. In each case, we also follow the model in trying to find an observation as close to the beginning of the time period as possible. Unless otherwise noted, the explanatory variables described below are measured at the *start* of each of the 20-year periods.

Income Distribution.—The best available data are based on personal income before tax. In the model, e^m is the distance between mean per capita national income and the median income of the eligible voters; but the data from the earlier part of the period at best only comprise the uppermost deciles in the distribution.[10] The variable we use in our regressions, INCSH, is therefore the share in personal income of the top 20 percent of the population. We have 38 observations for this variable. The mean value is 0.50, and the observations range from 0.38 (Sweden in 1970) to 0.67 (Finland in 1930). The expected sign of the coefficient of this variable in the regression is negative, since a higher value of INCSH means more inequality.

Political Participation.—The variable INCSH refers to the population at large. In the early part of the sample, however, only some citizens could vote in most countries.

[10]The reason for the incomplete coverage is that the data are based on income tax records, and only people at the top of the income distribution paid income taxes.

For this reason, we would also like to control for the effect of a limited franchise on the identity of the median voter. We do that by adding to the regressions the share of the enfranchised age and sex group in the population that is *not* in the electorate. This measure corrects for political discrimination of women and for different age limits for voting across countries, factors that do not seem directly relevant in our context. For this variable, NOFRAN, we have 59 observations, with a mean of 0.28 and a range from 0 (virtually all countries in the postwar period) to 0.89 (the United Kingdom in 1830 and the Netherlands in 1850 and 1870). Its expected sign is positive, since a more restrictive franchise (a higher value of NOFRAN) implies a richer median voter, given the distribution of income in the population at large.

Average Skills.—In the model, w measures the average basic skills of the young generation. The empirical counterpart of this variable clearly has to do with the general education level. To correct for possible differences in the classification of schools across countries and time and to take the quality of education into account, we constructed an index of schooling, SCHOOL. For each country and time period, we took a weighted average of the shares of the relevant age groups enrolled in primary school, lower secondary school, higher secondary school, and tertiary school, at the start of each period. The weights are increasing in the level of schooling. We have 52 observations for the index. Its mean is 0.14, and it ranges from 0.017 (England in 1850) to 0.362 (Finland in 1970). The expected sign of this variable is positive.

The Level of Development.—Our simple model does not predict any convergence, so that poor countries grow faster than rich countries, once we control for other factors. However, this implication is not likely to survive slight variations in the model. Moreover, the question of whether or not there is convergence, once we control for other variables identified by our model, is interesting in its own right. We therefore include as an explanatory variable the ratio between GDP per capita and the highest level of GDP per capita in our sample at the same point in time. We call this variable GDPGAP. We also use the level of GDP per capita when constructing fitted values to replace missing observations (see below). To make real GDP levels comparable across countries, we use Robert Summers and Alan Heston's (1988) measures of GDP at international prices in 1950 and 1970. For earlier periods, we use the 1950 observations as a benchmark and splice them with the real GDP series for each country. (This procedure effectively assumes constant international relative prices for earlier periods.) For this variable, we have 57 observations, which range from 0.362 (Sweden in 1870) to 1 (the United Kingdom up to 1890 and the United States from then on). Its expected sign in the regression is negative if there is convergence.

B. *Results*

Table 2 reports the parameter estimates from the first set of regressions for our historical sample, all estimated by ordinary least squares (OLS). Columns (i)–(ii) in the table are based on the sample of those 38 growth episodes, for which we have observations on all our variables. Columns (iii)–(iv) are based on a larger sample, in which we replaced missing values for INCSH (18 observations) and SCHOOL (three observations) by the fitted values obtained by regressions on the independent variables and on GDP per capita (see G. S. Maddala, 1977).

The most striking result is the effect of inequality on growth. The coefficient on INCSH is of the expected negative sign and almost always statistically significant. The exceptions are tied to multicollinearity: INCSH is relatively strongly correlated with both SCHOOL and NOFRAN. The coefficient is also economically significant: an increase of 0.07 (one standard deviation in the sample) in the income share of the top 20 percent lowers the average annual growth rate just below half a percentage point. Differences in distribution alone explain about a fifth of the variance in growth rates

TABLE 2—REGRESSIONS FOR GROWTH

Independent variable	Regression (i)	(ii)	(iii)	(iv)
Constant	5.263 (2.659)	7.206 (5.723)	6.256 (4.066)	6.465 (6.899)
INCSH	−3.481 (−1.017)	−6.911 (−3.074)	−6.107 (−2.234)	−6.409 (−3.963)
NOFRAN	−0.782 (−0.670)		−0.011 (−0.018)	
SCHOOL	2.931 (0.913)		0.316 (0.204)	
GDPGAP	−2.591 (−2.739)	−2.695 (−2.696)	−1.720 (−2.708)	−1.728 (−2.778)
Number of observations:	38	38	56	56
$\bar{R}^2$:	0.294	0.298	0.269	0.296
SEE:	0.931	0.929	0.882	0.866

Notes: The table reports ordinary least-squares regressions; *t* values are shown in parentheses. SEE = standard error of the estimate.

across countries and time. None of the other variables alone explains more than a tenth of the variance.

NOFRAN, our measure of political participation, is insignificant and has the wrong sign.[11] However, that may just reflect the lack of variation in this variable in a large part of the sample: all observations for 1930 and later are close to zero for all countries. To study the effect of a limited franchise, it is preferable to look at column (iii) where there are 18 more observations from earlier periods. In this equation, the coefficient on NOFRAN indeed drops considerably to around zero. This (weakly) suggests that with more observations from the 19th century, we could possibly find stronger evidence for the model (see also the discussion at the end of Subsection II-C).

SCHOOL, our index for average skills, has the expected sign, but is never statistically significant.[12] GDPGAP, the measure of income relative to the leading country, always has the correct (negative) sign and is significant. Its negative coefficient is likely to pick up specific effects tied to the two world wars.[13] But it also indicates some convergence in GDP levels over time. This finding is similar to the results found by Barro (1991), Gregory Mankiw et al. (1992), and others for postwar growth across a broad section of countries.

All these results hold almost identically for other specifications, reported in Persson and Tabellini (1991).

C. *Sensitivity Analysis*

In this subsection we discuss three possible problems with the regressions reported above. First, one may ask whether our results are distorted by *reverse causation* lead-

[11] We also tried to interact the measure of political participation with the income-inequality measure without much success.

[12] Running the regressions replacing the index with its separate components produces little difference in the results.

[13] For instance, the three countries in our sample on the losing side of World War II (Austria, Finland, and Germany) have the three highest growth rates in 1950–1970 (and in the sample, 4.62, 4.04 and 5.05) as well as the three lowest GDP levels in 1950 of all the nine countries.

TABLE 3—SENSITIVITY ANALYSIS

Independent variable	Regression (i)	(ii)	(iii)	(iv)
Constant	8.331	8.267	4.151	4.277
	(2.564)	(2.443)	(1.761)	(1.797)
INCSH	−11.859	−11.606	−3.737	−5.427
	(−2.766)	(−2.098)	(−0.831)	(−1.206)
NOFRAN		−0.171	0.422	0.617
		(−0.073)	(0.648)	(0.942)
SCHOOL			−0.502	
			(−0.389)	
GDPGAP	−0.391	−0.458	−1.039	
	(−0.142)	(−0.156)	−(1.833)	
Number of observations:	35	35	29	29
$\bar{R}^2$:	0.089	0.078	0.032	−0.019
SEE:	1.083	1.090	0.576	0.591

Notes: Columns (i) and (ii) report two-stage least-squares regressions; columns (iii) and (iv) report OLS regressions up to 1930 only. Numbers in parentheses are t values.

ing to simultaneity bias. In particular, would not a systematic relation between income inequality and development (such as the Kuznets curve) give rise to a simultaneity problem? Let us first note that direct reverse causation is ruled out, because INCSH is measured at the beginning of each 20-year period and so is statistically predetermined relative to GROWTH. However, a systematic relation between inequality and development would make our inequality measure correlated with lagged growth. Indeed, the theoretical discussion about growth dynamics in Subsection I-D relied precisely on such a relation. Hence, if the residual of the regression is serially correlated, then INCSH and GDPGAP are correlated with the error term, which could bias the estimated coefficients.

In Persson and Tabellini (1991), we found no direct evidence of serial correlation in the estimated residuals, nor did we find evidence of a systematic relation between lagged growth and inequality. However, the unbalanced panel with a small number of observations for each country and time period makes it difficult to conduct powerful tests. Further evidence is presented in Table 3. Columns (i) and (ii) show results from two-stage least-squares regressions. The instruments include a constant plus observations of GDP per capita, SCHOOL, GDPGAP, and NOFRAN, all lagged 20 years. (That is, we use observations dated in 1910, say, to instrument for the 1930 variables explaining growth between 1930 and 1950.) The parameter estimates suggest that our results on the negative effect of inequality on growth are not due to reverse causation. If anything, the results are stronger than in the previous OLS regressions.

The second possible econometric problem is *measurement error*, given that the data go back to the mid-19th century. In Persson and Tabellini (1991) we discussed this problem at some length, following the "reverse regression" approach of Stephen Klepper and Edward Leamer (1984) (see also Section III, below). We found the results to be robust to measurement error in INCSH and GDP. In particular, the coefficients on INCSH seem to coincide with the lower bound (in absolute value) for the true maximum-likelihood estimates. Hence, if anything, measurement error would seem to bias the coefficients of interest against our hypothesis. The instrumental-variables estimates reported in Table 3 provide additional evidence of the robustness to measurement error.

Finally, the third possible problem is *omitted variables* correlated with INCSH or other regressors. To investigate this problem, we ask whether the residuals show a particular pattern across countries or time. Consider first the variation across countries. When we add a set of country dummies to the regressions in Table 2, the coefficient on INCSH typically becomes more negative and stays significant. Also, the country dummies add little explanatory power. Here, there is clearly no indication of a potential omitted-variable problem.

Consider next the variation across time. When we add a set of period dummies to the same regressions, all coefficients in the regression turn insignificant, except the coefficient on GDPGAP. Furthermore, the time dummies add considerable explanatory power. The dummy for 1950–1970 is strongly significant and positive, and the dummy for 1970–1985 is marginally significant and positive. Thus, the significant coefficients on INCSH seem predominantly to pick up the time variation in the data. Put differently, our model ascribes the higher average growth rates in the postwar period to a more equal distribution of income. It is possible, however, that income inequality is negatively correlated with some other growth-promoting variable which is omitted in our model and in our regressions. For instance, World War II brought about a more equal distribution of income as well as a set of important technological innovations. Our finding that growth is higher in the 1950's than in the 1930's, and that income inequality is lower in 1950 than in 1930, could thus simply reflect the effect of the war, rather than a causal link from inequality to growth.

To shed further light on the importance of the observations after and immediately before World War II, we reestimated the model excluding all observations from the periods 1930–1950, 1950–1970, and 1970–1985. Results from these regressions are displayed in columns (iii) and (iv) of Table 3. Comparing the results for this early sample to the results in Table 2, the overall fit is clearly worse. The coefficients on INCSH stay negative and have the same order of magnitude as before, but they are not significantly different from zero. The coefficient on GDPGAP is still marginally significant. Finally, the coefficients on NOFRAN are now positive (in accordance with our model) but do not reach statistical significance. Nevertheless, the latter result gives mild support to our speculation in Subsection II-B that the effects of a restricted franchise on equilibrium policy may only be visible in 19th-century data.

All in all we conclude from this sensitivity analysis that the negative effect of inequality on growth is not due to reverse causation and is robust to measurement error. The possibility of an omitted-variable problem remains.

III. Postwar Evidence

A. *Data*

Our sample consists of 56 countries for which we could find reliable data on income distribution. Each observation corresponds to a country.

Per Capita Growth.—As in Section II, our dependent variable is the annual average growth rate of GDP per capita, which we again call GROWTH. The time period covered is 1960–1985, and the source is Summers and Heston (1988). The mean value of GROWTH is 2.10 and it ranges from -2.83 (for Chad) to 5.95 (for Korea). Summary statistics for this variable, as well as the other variables in the data set, appear in Table 4.

Income Distribution.—The source is Felix Paukert (1973), who in turn elaborated and aggregated data originally compiled by Irma Adelman and Cynthia Morris (1971). These date refer to pretax income of families or households and are probably among the most reliable data for international comparison of a broad sample of countries. The sampling date varies by country, and it ranges from 1956–1957 for India to 1971 for Tunisia. For most countries it is around

TABLE 4—SUMMARY STATISTICS FOR POSTWAR SAMPLE

Variable	Number of observations	Mean	SD	Minimum	Maximum
GROWTH	53	2.10	1.827	−2.827	5.953
GDP	53	2,155	1,832	208	7,380
MIDDLE	56	13.305	3.099	7	18.8
PSCHOOL	49	78.326	31.959	5	144

Correlation Matrix:

	Variable		
Variable	GROWTH	GDP	MIDDLE
GDP	0.076		
MIDDLE	0.203	0.532	
PSCHOOL	0.459	0.689	0.350

1965, close to the start of the sample period for GROWTH.

Alternative measures of income inequality can be constructed from these data. In line with our model, we use the measure that best approximates the relative position of the median income recipient. This is the income share accruing to the third quintile (the 41st to the 60th percentile of households), which includes the median. Since this variable measures the relative position of the middle quintile, we call it MIDDLE. Obviously, income equality is greater the greater is MIDDLE, so its expected sign in the regressions is positive. The variable MIDDLE is measured in percentage points. It has a mean of 13.31 and ranges from 7.0 (for Gabon) to 18.8 (for Denmark).[14]

Average Skills.—As for the historical data set, we proxy this variable with a measure of education: the share (percentage) of the relevant age group attending primary school, PSCHOOL. All observations are from 1960. This measure is available for 49 countries. It has a mean of 78.3 and ranges from 5 (for Niger) to 144 (for France).[15] Previous versions of the paper also used other measures, such as the share attending secondary school and a weighted education index, and obtained similar results. The expected sign is positive.

Political Participation.—Unlike in the historical sample, we have not been able to construct any measure of restricted franchise. Nevertheless, our model captures policy-making in a democracy. Therefore, what we do below is first to run our regressions for the whole cross section. Then we control for whether a country is democratic or not, to see if the nature of the regime makes a difference.

Initial GDP.—As for the historical sample, we also include the level of GDP per capita in 1960, to allow for differences in the stage of development and for the possibility of convergence.

A previous version of this paper also controlled for other observable differences in the economic structure (such as the percentage of national income originating in the industrial sector or the percentage of

[14]A previous version of the paper (Persson and Tabellini, 1991) also used other measures of income distribution: the Gini coefficient and the income share accruing to the top 5 percent of households. The empirical results were similar to those reported here.

[15]The measure can exceed 100 percent because actual school age—as well as the classification of different levels of schooling—varies across countries, whereas our World Bank source assumes that "primary-school age" is everywhere the same.

TABLE 5—REGRESSIONS FOR GROWTH

	(i) Whole sample	(ii) Democracies	(iii) Nondemocracies	(iv) Whole sample
Constant	−2.589 (2.359)	−5.159 (−3.363)	0.949 (0.526)	0.949 (0.572)
MIDDLE	0.189 (2.350)	0.326 (3.235)	−0.072 (−0.559)	−0.072 (−0.608)
GDP	-5.3×10^{-4} (−3.070)	-5.8×10^{-4} (−3.579)	-1.7×10^{-3} (−2.967)	-1.7×10^{-3} (−3.229)
PSCHOOL	0.041 (4.432)	0.049 (3.627)	0.057 (3.119)	0.057 (3.396)
DEMOCRACY				−6.108 (−2.624)
MIDDLEDM				0.398 (2.489)
GDPDM				0.001 (2.028)
PSCHOOLDM				−0.008 (−0.377)
Number of observations:	49	29	20	49
$\bar{R}^2$:	0.32	0.46	0.31	0.44
SEE:	1.483	1.265	1.466	1.347

Notes: The table reports ordinary least-squares regressions; *t* values are shown in parentheses. SEE = standard error of the estimate.

the population living in urban areas). The results were essentially the same. To summarize, the regressions we estimate look pretty much like those in Section II, with the exception of a variable (like NOFRAN) that captures political participation.

B. *Results*

The results of estimating the model on the whole sample by OLS are reported in column (i) of Table 5. They are surprisingly good, given the large variety of countries in the sample. All the variables have the expected sign, they are significant most of the time, and they explain about a third of the variance in growth.[16] In particular, MIDDLE always has a positive and highly significant coefficient, as predicted by our model. The effects of equality on growth are also quantitatively significant. A one-standard-deviation increase in equality increases growth by about half a percentage point. This is about the same number that we obtained in the historical sample of Section II. In Persson and Tabellini (1991), we estimated additional specifications and obtained very similar results.

As we already mentioned, many countries in this sample have nondemocratic political institutions. In these countries there may be little relationship between income inequality in the population *at large* and the redistributive preferences of the government. Our theory predicts that growth should be inversely related to inequality in a democracy, but not necessarily in a dictatorship. The nature of the political regime, on the other hand, should not matter too much for how growth relates to the other variables,

[16] Except for the results for the effects on growth of income inequality, these results are similar to those in Barro (1991), who does not include income inequality in his empirical study.

which mainly control for the features of the economy.

To test this implication, we first split the sample into two groups of countries: those that were democracies for at least 75 percent of the time between 1960 and 1985, and all the others. Our definition of democracy is based on the form of the constitution in place between 1960 and 1985, as detailed in Arthur Banks (1987). Thus, our sample of democracies consists of a large variety of political regimes, some more democratic than others, whereas the sample of nondemocracies is more homogeneous. (Reallocating borderline cases to one group or the other does not affect the results.) Democracies on average grow faster and have a higher initial level of per capita income, even though there are some very poor countries in this group. But the most striking difference between these two groups concerns the (partial) correlation coefficient of the variables GROWTH and MIDDLE. It is 0.401 for democracies and -0.309 for nondemocracies! Clearly, the association between inequality and growth is very different in the two samples. Except for this coefficient, the correlation matrix for democratic countries is remarkably similar to the correlation matrix for the whole sample in Table 4.

The results from reestimating the model separately for the two samples of countries are shown in columns (ii) and (iii) of Table 5. As predicted, the estimated coefficient on MIDDLE is positive and significant only for the democratic countries. The t statistics for the other (economic) variables are instead similar in the two samples.

Finally, we turn to a test of an even stricter hypothesis, namely, that *the only* difference between the two samples of countries is the effect of income inequality on growth. To test this, we reestimate the model on the whole sample of countries but add a dummy variable (called DEMOCRACY) which takes a value of 1 if the country is a democracy (as defined above), and 0 otherwise. This dummy variable is entered separately, and it is interacted with all the explanatory variables in the regression.

Ordinary least-squares estimates are shown in column (iv) of Table 5. The suffix -DM at the end of a variable indicates that it is interacted with the DEMOCRACY dummy. A previous version of this paper reported similar results for other, less parsimonious, specifications. The reported estimates, as well as those reported in the previous version, reject the strict hypothesis, though not overwhelmingly. The coefficient on income inequality is not the only difference between the two sample of countries; but it is almost the only difference. Specifically, as predicted by the theory, the coefficient on the variable MIDDLE is significantly different from zero and of the correct sign only when interacted with DEMOCRACY. The coefficients of the remaining variables always have the expected sign and are significantly different from zero when they are entered in isolation. When interacted with DEMOCRACY, these other coefficients are generally insignificant, except for GDPDM which is significant (and with a sign opposite to that of GDP). Thus, even though the differences between the two samples are not exclusively due to the effect of inequality on growth, there are few other systematic differences.

We can summarize our findings in this section as follows. First, income equality at the start of the period has a positive effect on subsequent growth. Second, this positive correlation is present only in democratic countries, irrespective of whether or not we control for other economic variables. Third, the nature of the political regime does not seem to be very important for how the other (economic) variables relate to growth. These last two findings are particularly important, because they suggest that the effect of equality on growth may indeed operate through a political mechanism. We will say more on this in the next subsection.

C. *Discussion*

We now analyze the robustness of these results.

(i) As in Section II, it is likely that several regressors, and particularly MIDDLE, are measured with error. We deal with this

TABLE 6—SENSITIVITY ANALYSIS

Independent variable	(i) Whole sample	(ii) Democracies	(iii) Non-democracies
Constant	−5.527	−9.923	−3.607
	(−2.806)	(−2.726)	(−0.774)
MIDDLE	0.513	0.771	0.349
	(2.843)	(2.473)	(0.848)
GDP	-8×10^{-4}	-9×10^{-4}	-1.6×10^{-3}
	(−3.372)	(−3.020)	(2.216)
PSCHOOL	0.032	0.042	0.054
	(2.786)	(2.246)	(2.150)
Number of observations:	46	29	17
$\bar{R}^2$:	0.28	0.31	0.18
SEE:	1.670	1.690	1.709

Notes: The table reports two-stage least-squares regressions; t values are shown in parentheses. SEE = standard error of the estimate.

problem in two ways. First, we reestimate the model with instrumental variables. Our instruments for MIDDLE are the percentage of the labor force in the agricultural sector in 1960, the male life-expectancy ratio in 1960, secondary-school enrollments in 1960, and the independent variables GDP and PSCHOOL. We believe these are pretty good instruments. They capture different aspects of the economic and social structure of a country and are likely to be correlated with income inequality. Since they are all measured in 1960 and some of them belong to the regressors in the GROWTH equation, they are unlikely to be correlated with the error term of that equation or with the measurement error in MIDDLE.

Table 6 reports the two-stage least-squares (2SLS) estimates, for the whole sample and for democratic and nondemocratic countries. The results are very similar to those reported in Table 5. In particular, MIDDLE is significant and has the right sign in the whole sample and in the sample of democratic countries, but not in the sample of dictatorships. The coefficients on the other variables, on the other hand, are quite stable across the three samples.

Second, we apply the techniques of Klepper and Leamer (1984) based on reverse regressions. Consider the whole sample and the sample of democratic countries: columns (i) and (ii), respectively, in Table 5. When we regress these equations in all directions, all the variables retain their signs. Thus, the true maximum-likelihood estimates lie in the convex hull of the estimates so obtained. In particular, the coefficients of MIDDLE lie in the following intervals: whole sample, [0.189, 1.727]; democracies, [0.242, 1.104].

Compared to the least-squares estimates, we see that, if anything, measurement error tends to bias MIDDLE toward zero and thus against our theory. We obtain similar results for the other specifications in Table 5.[17]

(ii) The residuals reveal a few outlying observations (Venezuela, Chad, and Morocco). Removing them makes no difference for the results, neither for the whole sample nor for the two samples of democratic and nondemocratic countries. However, the estimated residuals tend to be larger in absolute value for the countries with lower per capita income in 1960, indicating a potential heteroscedasticity problem. We therefore reestimated the model weighting each observation with GDP. The results, reported in a previous version of this paper (Persson and Tabellini, 1991) remain supportive of the theoretical model, as do alternative specifications controlling for heteroscedasticity.

(iii) Despite our attempts to control for institutional differences, our measures of income inequality may pick up the effect of some *omitted variable*. To check for this possibility, we added three continental dummies (for Asia, Africa, and Latin America) to the previous regressions. In the most basic specifications (which include only

[17] In a previous version of this paper (Persson and Tabellini, 1991) we also estimated the same regressions with data on income inequality obtained from other sources (primarily the United Nations) and for a slightly different sample of countries, and with other definitions of inequality. Even though these other data were less reliable and were generally dated in the mid-1970's, we obtained similar results.

MIDDLE, GDP, and PSCHOOL) estimated on the whole sample, the continental dummies are jointly (though not individually) significant and the estimated coefficient on MIDDLE becomes insignificant. However, when we estimate the equation on the two separate samples, or when we add the DEMOCRACY dummy, MIDDLE remains significant only when interacted with DEMOCRACY, or in the sample of democratic countries. Moreover, the continental dummies now become insignificant.

(iv) Generally (and in our sample) democratic countries have a much higher average GDP per capita than nondemocratic countries. Can we be sure that our results do not reflect genuinely different behavior in rich and poor countries, rather than in democracies and dictatorships? To check this, we split the sample into two halves according to 1960 GDP per capita, one made of rich countries, the other of poor countries. We then reestimated column (iv) in Table 5, with democracy dummies and interaction terms, in each subsample. The estimated coefficients on MIDDLE and MIDDLEDM are virtually identical to those in Table 5 in both samples; but the standard errors on MIDDLEDM are higher, such that we can no longer reject the hypothesis that this coefficient is zero at conventional significance levels: the p value is 0.176 in the rich sample and 0.178 in the poor sample. Still, these results suggest that there are considerable differences between democracies and dictatorships *within* the groups of rich and poor countries.

All this sensitivity analysis strongly indicates that our results are not due to measurement error, to particular features of our samples, to reverse causation, or to omitted variables.

IV. Discussion

Even though we believe that the empirical findings in Sections II and III are statistically robust, the possibility remains that these findings reflect mechanisms other than the political theory outlined in Section I. After all, these regressions only estimate the reduced form of the model, and not the two specific channels identified by the theory: from more equality to less policy-induced redistribution; and from less redistribution to more investment and faster growth. In this section we discuss the evidence concerning these separate channels of causation.

Consider first the link between investment and growth. According to the theory, inequality exerts its effect on growth by discouraging investment. The first two columns of Table 7 provide evidence on this link for the whole sample of countries. We estimate a growth regression by two-stage least squares, where MIDDLE is replaced by the share of investment over GDP on average between 1960 and 1985 (INVESTMENT), and the latter is regressed on the remaining independent variables including MIDDLE. As expected, MIDDLE has a positive and almost significant estimated coefficient on INVESTMENT (its p value is 0.06), while INVESTMENT has a positive (but not quite significant) effect on GROWTH. The remaining coefficients have the expected sign in the INVESTMENT equation, even though the schooling variable loses significance and has the wrong sign in the GROWTH equation.

According to the theory, the variable MIDDLE should have a positive effect on INVESTMENT only in democracies. This proposition is tested in columns (iii) and (iv) of Table 7, which split the sample into democracies and nondemocracies. The result is exactly as predicted. MIDDLE only affects INVESTMENT in the democratic countries.

Overall, thus, this decomposition further supports the theory. Equality affects growth by promoting investment, and this effect is present only in the democracies.

Next, let us turn to the other channel identified by the theory: from more equality to less redistribution, and from less redistribution to more growth and investment. As discussed in Section I, the reason for emphasizing the reduced-form implications of the theory, rather than the "structural" implications, is the difficulty in observing the relevant redistributive policies. A government can redistribute through explicit

TABLE 7—INVESTMENT AND GROWTH

	Whole sample		Democracies	Nondemocracies
Dependent variable	(i) GROWTH	(ii) INVESTMENT	(iii) INVESTMENT	(iv) INVESTMENT
Constant	−2.772 (−1.607)	0.962 (0.232)	−7.988 (−1.150)	2.637 (0.371)
INVESTMENT	0.312 (1.578)			
MIDDLE		0.581 (1.904)	1.024 (2.210)	0.481 (0.948)
GDP	-4.6×10^{-4} (−1.913)	-2×10^{-5} (−0.034)	-4.2×10^{-4} (−0.623)	0.002 (0.673)
PSCHOOL	−0.005 (−0.156)	0.143 (4.232)	0.173 (3.204)	0.117 (1.630)
Number of observations:	43	43	23	20
$\bar{R}^2$:	0.192	0.511	0.507	0.330
SEE:	1.992	5.291	5.006	5.770

Notes: Column (i) is estimated by 2SLS; the remaining columns are estimated by OLS. Numbers in parentheses are t values. SEE = standard error of the estimate.

transfers, but also more implicitly through regulation, lax law enforcement, patent protection, and so on. Reliable measures of these redistributive policies are not readily available.

Nevertheless, two recent studies of the OECD countries provide evidence in favor of the two separate theoretical hypotheses. Lorenzo Kristov et al. (1992) find that various measures of inequality explain the size of current transfers by OECD countries in the period 1960–1981;[18] and Håkan Nordström (1992) finds evidence that greater government transfers in proportion to GDP are negatively associated with average growth in the OECD countries between 1970 and 1985.

Postwar data on the OECD countries are particularly reliable compared to those on other countries or earlier time periods, both because transfers in these contries are an important form of government redistribution and because OECD data on transfers are comparable across countries. For this reason, we focus exclusively on OECD postwar data below and run separate regressions for the two channels identified by our model. Matching the available OECD data on government transfers with our data on income distribution, we are left with a sample of 13 countries. Column (i) of Table 8 reestimates our typical reduced-form equation for this smaller sample. The results are almost identical to those found in Section III for the larger sample of democracies. In particular the estimated coefficient on MIDDLE is remarkably stable: the coefficient in column (i) of Table 8 is very similar to that of the same variable in column (ii) of Table 5. This provides further evidence of the robustness of the reduced-form estimates.

Columns (ii)–(iv) of Table 8 estimate equations that correspond to the two separate theoretical hypotheses. We measure government-induced redistribution by current transfers as a fraction of GDP, on average between 1960 and 1981 (TRANSF).[19] In column (ii) this variable

[18]This paper argues, however, that the evidence is more consistent with a "pressure group" explanation than with the hypothesis of Meltzer and Richard (1981) about the size of transfers.

[19]This variable is taken from Organization for Economic Cooperation and Development (1985) and is the

TABLE 8—GROWTH AND TRANSFERS

Dependent variable	(i) GROWTH	(ii) GROWTH	(iii) GROWTH	(iv) TRANSF
Constant	−1.763 (−0.473)	4.874 (3.414)	4.786 (3.314)	0.203 (1.790)
MIDDLE	0.337 (1.951)			−0.011 (−1.286)
GDP	-8.5×10^{-4} (−4.527)	-5.2×10^{-4} (−3.873)	-5.0×10^{-4} (−3.687)	1.8×10^{-5} (1.756)
PSCHOOL	0.031 (1.786)	0.011 (0.763)	0.013 (0.900)	
TRANSF		−4.742 (−0.970)	−6.723 (−1.246)	
Number of observations:	13	13	13	13
$\bar{R}^2$:	0.679	0.657	0.663	0.089
SEE:	0.578	0.587	0.591	0.043

Notes: Columns (i), (ii), and (iv) report OLS regressions; column (iii) reports a 2SLS regression. Numbers in parentheses are t values.

replaces MIDDLE, our measure of equality, in the GROWTH regression. Its estimated coefficient is negative, as expected, but it is not statistically significant.

Column (ii) is estimated by OLS. It is possible, though, that some unobservable determinant of TRANSF is correlated with the residuals of the GROWTH regression. For this reason, column (iii) reports an instrumental-variables estimation of the same equation. The instruments for TRANSF are MIDDLE, PSCHOOL, GDP, and transfers as a fraction of GDP, also in 1960. Now the t statistic of TRANSF rises in absolute value to -1.246. Even though it is still insignificant at conventional significance levels, this coefficient provides some weak evidence of a negative effect from TRANSF on GROWTH.

Finally, the last column of Table 8 investigates the link between equality and redistribution. The variable MIDDLE has the expected negative coefficient, but its t statistic is again on the order of -1.2. Here too there is some (weak) evidence consistent with the theoretical hypothesis.

same one used by Kristov et al. (1992). It consists of social expenditures on pensions, unemployment compensation, and other social expenditures (other than health and education). It is only available up to 1981.

To summarize, OECD postwar data do not seem to be at odds with the two building blocks of our theory. Naturally, the degrees of freedom are so few that the results in Table 8 are very tentative. They do suggest, however, that it may be worthwhile to explore these issues further with better data and a larger sample.

V. Final Remarks

Drawing on the theories of endogenous economic growth and endogenous economic policy, we formulated a model that relates equilibrium growth to income inequality and political institutions. The main theoretical result is that income inequality is harmful for growth, because it leads to policies that do not protect property rights and do not allow full private appropriation of returns from investment. This implication is strongly supported by the historical evidence of a narrow cross section of countries and by the postwar evidence from a broad cross section of countries.

The paper may serve as a stepping stone for further theoretical and empirical work along similar lines. On the theoretical side, the most important issue for future research is perhaps to endogenize growth and income distribution in a dynamic political equilibrium. The model of this paper is recursive and takes the distribution of income as given or following a given law of motion. There is also a literature, surveyed by Philippe Aghion and Patrick Bolton (1992), which studies the endogenous evolution of income distribution in a growth model, abstracting from policy interventions. But, to date, how income distribution and economic growth are jointly determined in political equilibrium is not very well understood.

On the empirical side, the most important extension is to discriminate better between alternative explanations of our central finding, namely, that inequality is negatively correlated with subsequent growth.[20] We have provided two bits of evidence suggesting that this correlation is induced by government policies and by political forces. First, the correlation is only present under democratic institutions. Second, OECD postwar data weakly suport the two-way links identified by our theory: from inequality to government redistributive policies, and from these policies to economic growth. This transmission channel remains to be more extensively investigated, however, by paying more attention to the exact nature of government intervention.

Data Appendix

Sources for Historical Data

GROWTH: Average rate of growth of real GDP over 20-year periods, continuously compounded. Sources: Angus Maddison (1982) for the period 1830–1950 and Summers and Heston (1988) for the period 1950–1985.

GDP: Level of GDP per capita in the first year of each 20-year period. Sources: Maddison (1982) for the period 1830–1950 and Summers and Heston (1988) for the period 1950–1985. The 1950 indexes computed from Maddison were spliced with the 1950 values from Summers and Heston to get compatible series.

INCSH: Share of pretax income received by the top 20 percent of the population, computed from tax statistics and sometimes adjusted for incomplete coverage on the basis of census data. We only used sources with a wide original coverage, however. The income units and income concepts may vary across countries due to different tax laws. All observations except a few are close (within five years) to the beginning of the relevant 20-year period. Sources: For the United Kingdom 1870, 1890, and 1910, Lindert and Williamson (1985); for the Netherlands 1910, 1930, 1950, and 1970, Joop Hartog and J. G. Veenbergen (1978); for the United States 1930 and 1950, U.S. Department of Commerce (1975); for the United States 1970, Shail Jain (1975); for all other observations, Peter Flora et al. (1987 Ch. 6).

NOFRAN: Share of the enfranchised sex and age group not in the electorate at the year of the election closest to the beginning of the relevant time period, computed from data on electoral rules and from censuses. Sources: for the United States (presidential elections), Thomas Mackie and Robert Rose (1982) and U.S. Department of Commerce (1975); for all other countries (parliamentary elections), Flora (1983 Ch. 3).

SCHOOL: Index of Education computed as

$$0.1(\text{PSCHOOL})+0.2(\text{LSSCHOOL})+0.3(\text{HSSCHOOL})+0.4(\text{UNIV})$$

where each component of the index and the sources are described below.

PSCHOOL: Share of the 5–14 age group enrolled in primary school, computed from detailed data on different types of schools and population data from censuses. Sources: for the United States, U.S. Department of Commerce (1975); for all other countries, Flora (1983 Ch. 10).

LSSCHOOL: Share of 10–14 age group enrolled in post-primary school and lower secondary school, computed from detailed data on different types of schools and population data from censuses. Sources: for the United States, U.S. Department of Commerce (1975); for all other countries, Flora (1983 Ch. 10).

HSSCHOOL: Share of 15–19 age group enrolled in higher secondary school, computed from detailed data on different types of schools and population data from censuses. Sources: for the United States, Department

[20]Alternative, purely economic, reasons for why inequality might be harmful for growth have been analyzed by Kevin Murphy et al. (1989), who look at the composition of demand, and by Oded Galor and Joseph Zeira (1993), who look at imperfect credit markets. In the ambitious model of Jeremy Greenwood and Boyan Jovanovic (1990) income distribution and growth become correlated over time due to financial development.

of Commerce (1975); for all other countries, Flora (1983 Ch. 10).

UNIV: Share of 20–24 age group in universities and institutes for higher education, computed from detailed data on different types of schools and population data from censuses. Sources: for the United States, Department of Commerce (1975); for all other countries, Flora (1983 Ch. 10).

Sources for Postwar Data

GROWTH: Average rate of growth in real GDP per capita over 1960–1985, continuously compounded. Source: Summers and Heston (1988).

GDP: Real GDP per capita in 1960, expressed in "international $." Source: Summers and Heston (1988).

PSCHOOL: Percentage enrolled in primary school out of relevant age group in 1960. Source: World Bank (1984).

URB: Urban population as a percentage of total population in 1965. Source: World Bank (1984).

IND: Percentage of GDP originating in the industrial sector in 1960. Source: World Bank (1984).

DEMOCRACY: Dummy variable taking a value of 1 for a country that was a democracy for at least 75 percent of the time and 0 otherwise. Source: Banks (1987) and Charles Taylor and David Jodice (1983).

MIDDLE: Share of pretax income received by the 41st–60th percentile of the population. Source: Paukert (1973).

TRANSF: Pensions, unemployment compensations, and other social expenditures (other than health and education), scaled to GDP. Source: Organization for Economic Cooperation and Development (1985, 1992).

In the instrumental-variables regressions we also used the following variables taken from World Bank (1984): male life expectancy ratio in 1960, percentage of labor force in the agricultural sector in 1960, and percentage enrolled in secondary school out of the relevant age group in 1960.

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