1 Growth, Distribution, and Politics

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A glaring fact of economic development is the difference in the growth rate across countries. Table 1.1 displays the average growth rate of real GDP per capita between 1960 and 1985—as well as other statistical indicators of growth—in about eighty developing countries, grouped by continent. Asian countries have, on average, grown twice as fast as Latin American countries and three times as fast as African countries, and the differences within each continent are much larger. Explaining this fact is still one of the most challenging questions in economics. In this paper we review some recent attempts at an answer that have focused on the interaction of economics and politics.

Consider the stylized aggregate production function: $Y = AF(K, N)$, where Y is GDP, A is a measure of technology, K is "capital," and N is population. Any theory of economic growth must then ultimately explain the variables appearing on the right hand side of the following equation:

$$g^y = g^A + RI - \alpha g^N. \tag{1}$$

In equation (1) g^y is the rate of growth of per capita GDP, g^A and g^N are the rates of exogenous technical progress and of population growth, R is the marginal product of capital, I is the investment rate (expressed as a percentage of GDP), and α is the income share of capital.

The early growth accounting literature ascribed a large share of growth to g^A. But the recent literature on endogenous growth has basically widened the definition of capital to include not only physical capital but also other cumulative factors such as human capital and productive knowledge. Under this view, I includes all such productive accumulation, while residual exogenous technical progress, g^A, becomes a negligible number. Suppose further that the population growth rate is primarily determined by non-economic factors, and the capital share of income (broadly defined) is fairly constant across countries.[1] We are then left with only two reasons for why

Table 1.1
Average growth rates

	Number of Countries	Growth 1960–1985	GDP 1960	S.E. Growth	Range Growth
Asia	23	3.08	1,434	2.28	−0.39, 7.44
Latin America	19	1.55	1,835	1.54	−1.61, 4.79
Africa	41	0.96	585	0.94	−2.83, 5.40

Source: Summers and Heston (1988). The country groupings are based on the IMF classification. GDP 1960 is average per capita income in 1960.

countries grow at different rates: either their investment rates differ or their marginal products differ. We now want to argue that economic policy, and in particular bad economic policy, plays a central role in explaining both differences.

Consider first the marginal product of capital, broadly defined. It is difficult to argue that in the slow-growth African and Latin American countries the *potential* marginal product is lower than in the rest of the world. These are the countries where cumulative factors are scarce. Any reasonable economic model would then suggest that investment would be very productive—if anything, more productive than elsewhere. So if marginal products are low, it must be because *realized* marginal products are low. This could happen for a variety of reasons, but most of them have to do with policy. First, investment could go to the wrong sector or firm or be the wrong kind of investment. Second, there may be indivisibilities that prevent investment on a sufficiently large scale. Third, high marginal product investment may be something like infrastructure, with a considerable public-goods component. And so on. But in all these cases, economic policy could either correct the distortions or else it is directly responsible for them. It seems plausible that a "benevolent dictator" in a poor African country would not face a lower physical marginal product of capital than elsewhere in the world. So if slow growth is due to a low marginal product, we must ask why economic policy preserves a gap between the potential and the realized marginal product of capital in some countries but not in others.

Consider next the investment rate. One reason why countries may invest little is that they cannot afford to save. Rebelo (1992) and Atkeson and Ogaki (1990) have recently shown how plausible forms of preferences lead to low savings rates at low levels of income. Taken literally, this argument says that poor countries *prefer* to grow slowly. More generally, it says that there may be a role for policy in attracting foreign direct investment.[2] A second reason why the investment rate differs across countries is more

directly related to policy. The marginal product of capital, R in equation (1), need not coincide with the rate of return that can be privately appropriated by investors. Any externality or any explicit or implicit tax on investment income would create a wedge between them. Two countries with the same marginal product will have different investment rates if investors face different appropriable returns. Therefore, policies that define the property rights of investors become a major determinant of growth.

The new research program on endogenous growth, in fact, stresses how economic policy can play a major role in explaining growth. Indeed, one reason why this research program is generating so much excitement is that it is making progress on analyzing the growth consequences of alternative economic policies with the powerful tools of modern economic theory.[3] However, the research on endogenous growth typically views cross-country differences in economic policy as exogenous to the analysis. Policy plays the role of a free parameter in a theoretical model or is an exogenous variable in cross-country regressions, as for instance in Fischer (1991) or in Easterly (1991). In a sense, the early development literature—with its emphasis on planning and government intervention—had a similar mechanistic view of policy: an exogenous set of instruments that could freely be set to achieve desired results.

But this view of policy is hard to swallow. Economic policy is not a random variable that varies freely across countries. Rather, policy is the result of deliberate and purposeful choices by individuals and groups, who have specific incentives and constraints, just like private economic agents. If we maintain that it is policy differences that explain growth differences, what we ultimately have to explain is why these deliberate and purposeful choices differ systematically across countries. To us, the most promising avenue toward such an explanation is to be found in the study of political incentives and political institutions. This is indeed the view of many modern development economists. For instance Kreuger (1990), in a recent paper on the state of development economics, sketches an ambitious research agenda entailing theoretical and empirical work on "the interaction between political and economic forces" and "the functioning of alternative institutions."

We very much agree with the agenda, and we believe that the right way to make progress is to borrow the insights from modern development economics and the tools from neoclassical economics. Operationally, this means that the theory of endogenous growth must be married with the theory of endogenous policy.[4] The next section describes a recent body of research—the first offspring of this marriage.

1.1 Property Rights and Economic Growth

This recent literature starts from the argument that the enforcement of property rights determines the incentive to invest in cumulative factors. To explain differences in growth rates, it attempts to explain why property rights are enforced differently across countries.

Benhabib and Rustichini (1991) address the question in a model without an explicit institutional structure or political mechanism. In their model, two groups of agents consume and invest. Property rights are not well defined, so at any point in time the two groups may also try to redistribute consumption toward themselves from the resources available in the economy. The paper shows how the quest for redistribution may impose binding incentive constraints on the two groups, which manifest themselves in low accumulation and growth. It also shows how the incentives to redistribute may reduce growth at low, as well as high, levels of income. An advantage of this framework is its generality. Because the analysis is highly abstract, the results do not depend on the specific assumptions about the policy instruments or the political environment. But the generality is not without costs. In particular, it becomes difficult to obtain precise testable implications.

Other papers on the topic are more explicit about the political mechanism and the policy formation process. A first group of papers studies conflict over the *size* distribution of income in a democratic society. The model of redistribution borrows from Meltzer and Richard (1981), where rational voters choose a linear income tax and the revenue is distributed lump sum. The outcome depends primarily on the degree of inequality among voters: with more inequality more voters favor redistribution, and the equilibrium tax rate is higher. Persson and Tabellini (1991a) embed such a political mechanism in an overlapping-generations model, where redistribution is harmful for growth, and obtain the testable prediction that more inquality brings about slower growth. Perotti (1990) obtains a similar result in a model that focuses on educational investment, with the qualification that in a poor society, where educational investment is indivisible, more inequality may lead to higher growth. Similarly, Saint-Paul and Verdier (1991) show that more inequality may lead to higher growth if it leads to more redistribution in the form of public education.[5]

A second group of papers focuses instead on conflict over the *functional* distribution of income. In Alesina and Rodrik (1991) and Bertola (1991) there are two kinds of factors: "capital," which is cumulative, and "labor," which is fixed. Different individuals own these factors in different proportions. The government taxes factor income directly, and a tax on the cumulative factor is bad for growth. Under democratic government, the equilibrium policy depends on how factor ownership is distributed among the voters. If wealthy voters have relatively more capital, these models again predict that income inequality is bad for growth because it leads to more capital taxation.

However, the same observable input typically contains a combination of both fixed and cumulative factors, and there is no way to tax them separately. For example, income from labor reflects a combination of human capital and a fixed input. And income from land reflects a combination of improvements to the quality and fertility of the soil and a fixed input. It is only to the extent that different observable variables contain different combinations of income from fixed and cumulative factors that economic policy can redistribute across factors. Persson and Tabellini (1991b) analyze a model of sectoral policy, where different sectors rely on different factors in different proportions. The government observes only the output produced in different sectors. A policy that redistributes away from the capital intensive sector is bad for growth. But conflict over the functional distribution of income still drives the results, since individuals differ in their factor ownership. The model predicts that growth is slower if the owners of the fixed factor have a strong influence over sectoral policy. A good example would be a country where land owners have the balance of power and manage to induce a policy that favors agriculture at the expense of manufacturing.

The next section illustrates some of these ideas in a common analytical framework.

1.2 A Simple Model

In this section we formulate a simple model that illustrates some of the results derived in the previously mentioned literature. The model branches out into two special cases, each one of which illustrates a different aspect of the interaction between growth and income distribution.

In the basic model all individuals live for two periods and have the following identical preferences:

$$U(c^i) + d^i + f^i. \tag{2}$$

A variable with an i superscript is specific to the i^{th} consumer and a variable without such a superscript denotes an average. In equation (2) c denotes

first-period consumption, while d and f denote second-period consumption of two goods, which are produced in different sectors. In period 1 there is no production, but individuals derive income from given initial endowments. In Period 2 good d is produced only with a cumulative factor, k, which we call capital, according to the linear technology: $d = k^d$. Good f is produced with capital and a fixed input l, which we call land, according to the concave constant-returns technology: $f = F(k^f, l)$. Since the two goods are perfect substitutes in consumption, their relative consumption price is fixed at unity. Consumers may differ in two dimensions. They may have different first-period income, and they may own different amounts of land. For simplicity, we assume that land cannot be traded, so land holdings only enter the consumer budget constraint in the second period. Finally, there is one-period-ahead commitment: policy is chosen in the first period but takes effect in the second period.

Income Taxes

Consider first a tax on all second-period income, used to finance a lump-sum transfer payment. Here sectoral differences are only of secondary importance, so we assume that all individuals own the same amount of land. Let e^i denote the first-period income of the i^{th} individual, and let θ denote the income tax. Then the consumer budget constraints are

$$e^i \geq k^{id} + k^{if} + c^i \tag{3a}$$

$$(1 - \theta)(k^{id} + k^{if} + F_l l) + g \geq d^i + f^i, \tag{3b}$$

where k^{ix} is individual i's holdings of capital in sector x, and where F_l is the partial of $F(k^f, l)$ with respect to l. We have also used the fact that equilibrium returns to capital in the two sectors are equalized: $(1 - \theta) = (1 - \theta)F_k(k^f, l)$. The government budget constraint is $g = \theta(k + F_l l)$, where $k = k^d + k^f$ is average capital.

Solving the consumer problem we find that individuals accumulate capital in direct proportion to their first-period income:

$$k^i \equiv k^{id} + k^{if} = e^i - U_c^{-1}(1 - \theta) \equiv e^i - C(\theta). \tag{4}$$

Using equations (3), (4), and the government budget constraint to substitute into the i^{th} consumer's utility function, we can then write the consumer's indirect utility, v^i, as a function of Policy θ.

$$v^i = v(\theta) + (1 - \theta)(e^i - e). \tag{5}$$

In equation (5), $v(\theta) \equiv U(C(\theta)) + e - C(\theta) + F_l l$ is the indirect utility of an individual with average first-period income e.[6] Since the tax distorts the savings decision and is purely redistributive, this average individual has nothing to gain from the tax. Hence, $v(\theta)$ is strictly decreasing in θ. Clearly then, individuals richer than the average are harmed by the tax, while individuals poorer than the average may gain from it since the tax redistributes in their favor.

Suppose now that tax policy is chosen democratically, under majority rule. It is easy to show that the voters' preferences are single peaked under a mild restriction on the form of $U(c)$. Then, the equilibrium tax is that preferred by the median voter, the voter with first period income given by e^m. From equations (4) and (5), the voter's optimum value of θ must satisfy the first-order condition

$$(E - e^m) - \theta C_\theta(\theta) = 0. \tag{6}$$

The lower is median income relative to average income, the more the median gains from redistributing, and the higher is the equilibrium tax. Since a higher tax discourages investment—that is, $C_\theta(\theta)$ is positive—we obtain the testable prediction that investment is lower in more unequal democracies.

Persson and Tabellini (1991a) use a similar framework embedded in an overlapping generations model, which permits endogenous growth because of an intertemporal (and intergenerational) externality. In such a model, predictions for investment translate into predictions for growth: the equilibrium growth rate thus becomes a decreasing function of income inequality.

Sectoral Taxes

We now slightly modify the model to allow for a sector-specific tax. Let the tax, τ, be a tax on the capital intensive sector, d. Again, the tax is chosen in period 1, enacted in period 2, and the proceeds are distributed lump sum to all individuals. Since aggregate income no longer plays a central role, let us assume that all individuals have the same first-period income, e. Given the preferences in equation (2), every consumer will then save the same amount, k. The second-period budget constraint can now be written as

$$(1 - \tau)k^d + F_k k^f + F_l l^i + g \geq d^i + j^i. \tag{7}$$

Consumers allocate capital optimally across time and across sectors, such that

$$F_k(k^f, l) = (1 - \tau) = U_c(e - k). \tag{8}$$

Because $F_{kk}(\cdot)$ and $U_{cc}(\cdot)$ are both negative, these conditions make k a decreasing function of τ and k^f an increasing function of τ. Hence, k^d becomes a decreasing function of τ. Since $F_{lk} > 0$, the returns to land are increasing in the tax rate: $Q(\tau) = F_l(k^f, l)$, with $Q_\tau > 0$. Intuitively, a tax on the capital intensive sector drives down the marginal return to capital, reducing aggregate investment. And since capital flows to the land-using sector, the return on land rises.

Imposing the government budget constraint, $g = \tau k^d$, we can again write the indirect utility of the i^{th} individual as a function of the policy and of his relative endowment. But here it is the relative endowment of land, not relative first-period income, that matters

$$v^i = v(\tau) + Q(\tau)(l^i - l). \tag{9}$$

The indirect utility of the average landowner $v(\tau)$ is decreasing in τ for two reasons, both revealed by equation (8): the tax distorts both the savings and the capital allocation decisions . Since $Q_\tau > 0$, we now obtain the result that individuals with less than average land are harmed by the tax, while individuals with more than average land may benefit from it, the more so the larger is their relative land endowment.

It is not very plausible to view a sector-specific policy as chosen under majority rule, even in a democracy. Unlike a general policy like a broad income tax, the benefits of a sectoral policy are highly concentrated among a possibly small subset of individuals, while its costs are broadly distributed among the population at large. It is more plausible to follow the tradition in the trade policy literature and view equilibrium policy as the outcome of lobbying or bargaining between different organized groups in society.[7] With this view, we should expect the individuals who have the most to gain from the policy to have the strongest incentives to organize themselves and take costly political action. These individuals will thus acquire the most power over the policy process.

In the context of our model, it is evident from equation (9) that the individuals with the most "intense" policy preferences are those with a large concentration of land. We thus predict that τ is higher and aggregate investment lower the more concentrated is the ownership of land. Persson and Tabellini (1991b) embed a similar framework in a dynamic model with altruistic overlapping generations and obtain the prediction that land concentration is harmful for growth.[8]

Discussion

To summarize, we have described a stylized model where equilibrium policy depends on conflicting interests over the distribution of income. The *size* distribution of income matters for the choice of a general income tax. The *functional* distribution of income—and particularly the distribution of the fixed factor—matters for the choice of a sectoral tax.

However, the way income distribution shapes policy depends critically on political institutions, because it is political institutions that aggregate conflicting interests into public policy. We argued that in a democracy a general income tax is likely to reflect the preferences of the majority of the population. For this reason, we expect the tax to be higher in more unequal democracies. But this prediction does not apply to nondemocracies, where there may not be any mapping at all from the income distribution of the population at large to the redistributive policy preferred by the decisive individual or group. We also argued that a sectoral tax is more likely to reflect the intensity of preferences of those who gain, rather than the number of gainers and losers in the population. So we expect policies that redistribute in favor of the sectors where factor ownership is more concentrated and organized. Moreover, since the political pressure is likely to operate through other forms of political participation than voting, there are strong reasons to believe that organized lobbies and pressure groups should be able to shape sectoral policies both in democracies and in dictatorial regimes.

We would also like to add that the tax policies in our simple model need not be taken literally. Taxation can be either explicit or implicit, and many other policies are similar, in that they affect the incentives for productive accumulation and entail a redistributive component. Most important among general policies—that is, policies that affect different sectors symmetrically—are probably some aspects of the regulatory system: patent legislation and enforcement of intellectual and general property rights. Most important among sectoral policies—that is, policies that affect different sectors asymmetrically—are probably trade, industrial, and regional policies, and sectoral regulation. Other policies of this type can be analyzed in a similar way and with similar conclusions.

The discussion in this section leaves us with a number of testable hypotheses regarding the effect of income distribution on economic growth. First, growth should be higher in more equal democracies, but it should not be related to the size distribution of income in nondemocratic countries.

Second, growth should be lower in countries where land ownership is highly concentrated, irrespective of the form of government. The next section asks if the available evidence is consistent with these hypotheses.

1.3 Some Evidence

As in our other work (Persson and Tabellini (1991a and b)), we estimate regressions of growth on income distribution and on other explanatory variables. Income distribution is measured at the start of the period over which we measure growth, so as to avoid reverse causation. Our sample includes both developing and industrial countries. The list of countries and the available data are shown in table 1.2. The dependent variable is the average growth rate of per capita real GDP between 1960 and 1985, drawn from the Summers and Heston (1988) data set.

The sample size is constrained by the availability of data on income distribution and land ownership. Paukert (1973) provides data on the pretax income distribution of households around 1960 in about fifty countries. Our measure of income *equality* is the fraction of income received by the third quintile of the distribution: MIDDLE. The third quintile includes median income, so MIDDLE measures the distance between median and mean income. We expect MIDDLE to have a positive effect on growth. Taylor and Hudson (1972) and Taylor and Jodice (1983) provide data on the concentration of land ownership in about seventy countries. Our measure of land concentration is the Gini coefficient for the distribution of land ownership: GINILA. We expect this variable to have a negative effect on growth. Combining these two sources, we are left with a sample of about forty countries for which we have both measures of distribution.[9]

The other variables in the regressions are the same as in Persson and Tabellini (1991a and b) and control for other features of the economy that contribute to explain growth differentials. They are: the percentage of the relevant age group enrolled in primary school, PSCHOOL, as a measure of human capital;[10] the initial level of real GDP per capita in 1960, GDP, as a measure of initial development; and the percentage of the labor force in the agricultural sector, AGRIL, as a measure of the structure of production as well as an additional measure of the relative political strength of the agricultural sector. All these variables are sampled at the start of the period.[11]

The results of the OLS estimation are shown in table 1.3. In column 1 we report the basic regression, where all the variables have been included. The fit of the regression is very good for a cross section, all the estimated

Table 1.2
List of variables

Country	Growth	GDP	PSCHOOL	AGRIL	MIDDLE	GINILA
United States	2.12	7380	118	7	17.6	71.0
United Kingdom	2.22	4970	92	4	16.6	72.3
Austria	3.31	3908	105	24	.	70.7
Denmark	2.74	5490	103	18	18.8	45.8
France	3.19	4473	144	22	14.0	52.5
Germany	2.88	5217	133	14	13.7	66.8
Italy	3.32	3233	111	31	14.6	73.2
Netherlands	2.65	4690	105	11	16.0	57.9
Norway	3.70	5001	100	20	18.5	67.6
Sweden	2.62	5149	96	14	17.4	50.6
Switzerland	1.77	6834	118	11	.	49.4
Canada	2.79	6069	107	13	.	55.8
Japan	5.76	2239	103	33	15.8	47.0
Finland	3.27	4073	97	36	15.4	35.1
Greece	4.43	1474	102	56	13.3	48.8
Ireland	2.86	2545	110	36	.	59.4
Australia	2.14	5182	103	11	17.8	88.2
New Zealand	1.45	5571	108	15	.	73.4
South Africa	1.57	2627	89	32	10.2	70.0
Argentina	0.48	3091	98	20	13.2	86.7
Bolivia	0.84	882	64	61	12.0	.
Brazil	4.79	991	95	52	10.2	84.5
Chile	0.69	2932	109	30	12.0	.
Colombia	2.64	1344	77	51	9.0	86.4
Costa Rica	1.86	1663	96	51	11.2	78.2
Ecuador	2.95	1143	83	57	16.1	86.4
El Salvador	0.48	1062	80	62	8.8	82.7
Guatemala	0.95	1268	45	67	.	86.0
Honduras	0.79	748	67	70	.	75.7
Mexico	2.45	2157	80	55	11.1	69.4
Nicaragua	0.90	1588	66	62	.	80.1
Panama	3.37	1255	96	51	13.8	73.5
Paraguay	2.80	991	98	56	.	.
Peru	0.82	1721	83	53	8.3	93.3
Venezuela	−1.61	5308	100	35	16.0	90.9
Jamaica	0.63	1472	92	39	10.8	77.0
Trinidad, Tobago	1.36	4904	88	22	14.6	69.1
Iran	3.03	1839	41	54	.	62.5
Iraq	0.43	2527	65	53	8.0	88.2
Israel	3.17	2838	98	14	18.6	.
Jordan	2.52	1124	77	44	.	.
Egypt	3.49	496	66	58	.	.
Bangladesh	1.51	444	47	87	.	.
Sri Lanka	1.83	974	95	56	13.8	.
Hong Kong	6.62	1737	87	8	.	.
India	1.37	533	61	74	16.0	64.0
Korea	5.95	690	94	66	18.0	38.7

Table 1.2 (continued)

Country	Growth	GDP	PSCHOOL	AGRIL	MIDDLE	GINILA
Malaysia	4.52	1103	96	63	15.7	47.3
Nepal	0.38	478	10	95	.	.
Pakistan	2.90	558	30	61	15.5	51.8
Philippines	1.77	874	95	61	12.0	53.4
Singapore	7.45	1528	111	8	.	.
Thailand	4.06	688	83	84	.	46.0
Burundi	−0.71	412	18	90	.	.
Cameroon	3.08	507	65	87	.	44.5
Central Africa	−0.44	485	32	94	.	37.2
Chad	−2.83	515	17	95	15.4	37.7
Congo, Peop	3.46	563	78	52	.	28.9
Benin	−0.46	595	27	55	.	.
Ethiopia	0.34	285	7	88	.	.
Ghana	−1.70	534	38	64	.	.
Cote d'Ivoire	0.85	743	46	89	12.0	42.2
Kenya	0.96	470	47	86	.	69.2
Madagascar	−1.13	659	52	93	11.3	.
Mauritania	1.14	414	8	91	.	.
Morocco	3.25	542	47	62	7.7	.
Niger	1.65	284	5	95	15.6	.
Nigeria	0.20	552	36	71	9.0	.
Zimbabwe	1.73	615	96	69	.	.
Rwanda	1.34	244	49	95	.	.
Senegal	−0.01	756	27	84	10.0	.
Sierra Leone	1.82	281	23	78	9.1	45.8
Somalia	−1.31	483	9	88	.	.
Sudan	−0.84	667	25	86	14.3	.
Tanzania	2.14	208	25	89	11.0	.
Togo	0.66	415	44	80	.	.
Tunisia	3.51	852	66	56	10.0	.
Uganda	0.30	322	49	89	.	.
Zambia	−0.95	740	42	79	11.1	75.7
Papua, New Guinea	1.24	1008	32	89	.	.

Note: Total number of countries: 80.

coefficients have the expected sign, and many of them are significantly different from zero. In particular, the coefficients on the two distributional measures have the right sign; GINILA is clearly significant, MIDDLE is not, strictly speaking, but still has a marginal significance level (p-value) of 0.145. Checking the residuals reveals that there is one outlier: Chad, with an average growth rate of −2.8 percent. Column 2 displays the same regression, once we drop Chad from the sample. The fit of the regression improves and all variables are now statistically significant. In the remaining regressions, we leave this outlier in the sample, even though the results continue to improve if we exclude it.

Table 1.3
Growth, investment, and distribution

Dependent variable	Growth				
	1	2	3	4	5
# OBS	36	35	36	48	50
CONSTANT	5.093	4.575	7.315	4.189	5.600
	(1.673)	(1.698)	(1.985)	(1.691)	(2.546)
GDP	−0.11E-2	−0.91E-3	−0.12E-2	−0.99E-3	−0.79E-3
	(−4.112)	(−3.885)	(−4.199)	(−4.102)	(−3.902)
PSCHOOL	0.038	0.029	0.034	0.024	0.029
	(3.187)	(2.727)	(2.081)	(1.862)	(2.494)
AGRIL	−0.061	−0.045	−0.063	−0.040	−0.048
	(−2.572)	(−2.109)	(−2.690)	(−1.895)	(−2.526)
MIDDLE	0.135	0.171	−0.067	−0.042	
	(1.466)	(2.076)	(−0.475)	(−0.343)	
GINILA	−0.039	−0.042	−0.028		−0.028
	(−2.595)	(−3.191)	(−1.076)		(−1.794)
MIDDLEDM			0.352	0.406	
			(1.814)	(2.484)	
GINILADM			−0.009		−0.027
			(−0.269)		(−1.193)
DEMOCRACY			−3.631	−4.750	2.014
			(−0.848)	(−2.298)	(1.204)
$\bar{R}^2$	0.540	0.556	0.563	0.427	0.481
SEE	1.258	1.111	1.225	1.376	1.232

Note: Method of estimation: OLS.

As we argued at the end of the previous section, the theory has more detailed predictions for the link between growth and income distribution in countries governed by different political systems. Specifically, we expect growth to be positively related to income equality in democracies but not in dictatorships. And we expect concentration of land ownership to have a negative effect on growth irrespective of the political regime. To test this more specific prediction, we add to the regressions a dummy variable, DEMOCRACY, taking a value of 1 for democratic countries and 0 otherwise. This variable is entered in the regressions by itself (to control for an independent effect of the political system on growth), and interactively with the two distributional variables: a DM suffix at the end of a variable indicates that it is interacted with DEMOCRACY. We expect to find MIDDLE to have a significant impact on growth only when interacted with DEMOCRACY, and we expect the opposite result for GINILA. The results, shown in column 3, are weakly supportive of the theory. The estimated

coefficients are of the sign predicted by the theory, and MIDDLE has a much stronger effect on growth when interacted with DEMOCRACY, while the opposite is true for GINILA, also as predicted by the theory. But the coefficients on the distributional variables are not statistically significant (even though MIDDLEDM has a t-statistic of 1.814, p-value 0.083).

The problem is probably that there are too few observations. Most of the countries in the sample with both distributional variables are democracies (we only have data for ten nondemocratic countries), so there is not enough variability in the political regime. To gain observations, we then run two separate regressions—one where only income equality is included and the other where only land concentration is included. Again, the income distribution variable is interacted with DEMOCRACY. The results, shown in columns 4 and 5, are now exactly as predicted by the theory. Equality of income is the right sign and significant only when interacted with DEMOCRACY, and land concentration has the same negative effect on growth in democracies and nondemocracies.[12]

As a further check on the robustness of our results, in table 1.4 we report the results of some sensitivity analysis. The first two columns add a second measure of human capital, the percentage of individuals enrolled in secondary school (SSCHOOL), to columns 4 and 5 of table 1.3. The new variable is almost significant and of the right sign in one of the two regressions, but the results of table 1.3 are otherwise confirmed. In particular, MIDDLEDM and GINILA are both significant and of the predicted sign. We also tried adding to the regression the percentage of the population living in urban areas, but it was generally insignificant and it did not change the other estimated coefficients.

The estimated residuals reveal a systematic pattern. They tend to be larger for the poor countries in the sample. As a possible correction for this heteroskedasticity, we reestimated the model by weighting observations with GDP. The results are shown in columns 3 and 4 of table 1.4. Again, they remain very similar to those of table 1.3. We obtained similar results for other specifications, not reported in the table.

Next, we ask if our results are robust to the possibility of measurement error and apply the techniques of Klepper and Leamer (1984). Following their approach, we estimate column 1 of table 1.3 minimizing in the direction of all the independent variables potentially measured with error. Klepper and Leamer (1984) show that if all the estimated coefficients thus obtained retain their signs from table 1.3, then the results are robust to measurement error. Furthermore, the two maximum likelihood coefficients lie in a known and bounded interval. In our case, the variables most likely

Table 1.4
Some sensitivity analysis

Dependent variable	Growth				Investment
	1	2	3	4	5
# OBS	46	49	48	50	31
CONSTANT	2.780	5.394	2.550	6.926	4.886
	(1.129)	(2.533)	(1.009)	(3.058)	(0.318)
GDP	−0.99E-3	−0.73E-3	−0.88E-3	−0.719E-3	−0.12E-2
	(−4.325)	(−3.808)	(−4.577)	(−4.386)	(−0.973)
PSCHOOL	0.024	0.024	0.032	0.0159	0.123
	(2.025)	(2.156)	(2.671)	(1.494)	(2.306)
SSCHOOL	0.033	0.016			
	(1.789)	(1.148)			
AGRIL	−0.023	−0.034	−0.278	−0.049	−0.078
	(−1.095)	(−1.825)	(−1.532)	(−2.969)	(−0.661)
MIDDLE	0.039		−0.066		0.747
	(−0.310)		(−0.418)		(1.743)
GINILA		−0.034		−0.037	0.038
		(−2.301)		(−1.750)	(0.505)
MIDDLEDM	0.325		0.396		
	(1.960)		(2.065)		
GINILADM		−0.016		−0.013	
		(−0.762)		(−0.525)	
DEMOCRACY	−4.174	1.111	−4.074	1.500	
	(−2.065)	(0.683)	(−1.697)	(0.785)	
$\bar{R}^2$	0.443	0.475	0.399	0.480	0.365
SEE	1.339	1.136	57.096	51.520	5.544

Note: Method of estimation: Columns 1, 2, 5: OLS. Columns 3, 4: weighted least squares, with GDP as weight.

to be measured with error are GDP, AGRIL, and the two measures of distribution, MIDDLE and GINILA. Hence we ran four "reverse regressions," in each of which we replaced the dependent variable by one of the incorrectly measured regressors. The estimated coefficients retain their sign only in three out of the four regressions. In particular, if we assume that one of the two distributional variables (it does not matter which one) is measured correctly, then we can compute consistent bounds for the coefficients of the remaining three variables. But if both MIDDLE and GINILA are measured with error, then we can argue that the results are robust (in the sense of retaining their sign) only if we are willing to assign specific priors to the percent size of measurement error in the regressors relative to the true R^2. We conclude that our results are somewhat sensitive to the

possibility of measurement error in the variables MIDDLE or GINILA, but not in the remaining variables.

As a further check on our measures of income distribution, we replaced the variable MIDDLE with other measures of income inequality, such as the percentage of income received by the top 5 percent of the population or the Gini coefficient obtained from the distribution of pretax income (the source is always Paukert (1973)). The results, not reported in the table, were essentially unchanged.

From these results taken together, we conclude that they are supportive of the theory: a more unequal size distribution of income is bad for growth in democracies, while more land concentration is bad for growth everywhere. These effects of distribution on growth are also quantitatively significant: a one-standard-deviation change in MIDDLE and in GINILA both affect average annual growth by at least half a percentage point (according to the point estimates in table 1.2).

Finally, the theory also has predictions for investment in cumulative factors. As explained in the previous section, distributional variables are important for growth because they affect the investment rate of different countries. In the last column of table 1.4 we change the dependent variable, replacing the average growth rate with the average physical investment rate between 1960 and 1985 (the source is still Summers and Heston (1988)).[13] The results are now less supportive of the theory. The size distribution of income enters with the correct sign and is almost significant. But land ownership is not significantly different from zero and has the wrong sign. In a sense this is not too surprising, since the measure of investment does not correspond with the implications of the theory. First, our measure of investment is the sum of public and private investment, while the theory only refers to private investment. Second, accumulation of human capital and of productive knowledge is not included in the measure of investment, while it should be according to the theory.

1.4 Conclusions

The main predictions of the simple theory outlined in the paper seem to be largely supported by the data. Income inequality and land concentration are bad for growth. In principle, these facts are consistent with other, nonpolitical reasons for why income distribution and the distribution of land ownership influence growth.[14] Our theory, however, also predicts that the distributional variables interact in a specific way with the form of government. This additional prediction is also consistent with the data and thus discriminates in favor of a political explanation of why distribution matters for growth.

The theory has predictions about the link between income distribution and policy and about the link between policy and growth. Future empirical research should try to identify both these links, rather than estimating reduced forms, as we have done in this chapter. We think this is going to be pretty hard work though. As we argued in section 1.2, "taxes" in the model can be interpreted in a variety of ways. These various general and sectoral policies are going to be hard to measure in a satisfactory way across countries.

The literature surveyed here has studied the link between income distribution at a point in time and policies affecting growth. But the evidence collected by development economists and economic historians suggests that the relationship between growth and income goes both ways: the literature on the Kuznets curve argues that income distribution is systematically related to the income level.[15] Future theoretical research should try to study the joint dynamics of growth, income distribution, and policy formation. A natural, but difficult, way to do this would be to extend earlier work on human capital and income distribution to incorporate endogenous policy formation.[16] Another challenging task involves building a bridge to the literature, surveyed by Aghion and Bolton (1991), on growth and income distribution under incomplete capital markets.

Notes

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1. However, there is a literature that studies optimizing fertility choice and thus makes population growth the object of economic analysis (see, for instance, the recent paper by Barro and Becker (1990)).

2. The contribution of foreign direct investment to GDP growth may be particularly important if there are indivisibilities or other nonconvexities that keep the marginal product of capital low when capital is scarce. The relationship between foreign direct investment, domestic policy, and growth has been recently studied by Cohen and Michel (1991).

3. See for instance Barro and Sala-i-Martin (1992) and Rebelo (1991).

4. The theory of endogenous economic policy has developed in two somewhat different traditions. One development—surveyed by Persson and Tabellini (1990)—is oriented toward macroeconomic policy and public finance. The other development—surveyed by Hillman (1989) and Magee, Brock, and Young (1989)—is oriented toward trade policy.

5. Glomm and Ravikumar (1991) study an overlapping-generations model with heterogenous agents where income taxes finance public education. They obtain the conclusion that more inequality produces less growth. But their assumptions are such that all agents prefer the same tax rate, so there is no distributional conflict in their model.

6. F_l, the return to land in the expression for v, is pinned down by the requirement that $F_k(k^f, l) = 1$ and thus does not depend on the tax.

7. See Hillman (1989) and Magee, Brock, and Young (1989).

8. A tax on the capital intensive sector here is bad for growth for two reasons. First, there is the disincentive to save, which was also present in the other model. Second, capital is driven out of the capital intensive sector, which is typically the sector driving growth. This sectoral distortion further reduces the growth rate (on this point see also Easterly (1991)).

9. For six countries, GINILA is observed in the early 1970s, but for all other countries it is observed in the early 1960s.

10. This is a flow measure of human capital. A stock measure, such as the literacy rate, would be more closely tied to the model, but it is measured with much bigger error than school enrollment.

11. The source for GDP is Summers and Heston (1988). The source for AGRIL and PSCHOOL is the World Development Report, 1988.

12. The correlation coefficient between MIDDLE and GINILA is -0.28. This is not very high, but under the null hypothesis that both variables should be included in the regression, excluding one of them may bias the estimates.

13. We leave the other independent variables in the equation. PSCHOOL may not seem to belong there, but it does—according to some versions of endogenous growth theory—since human capital may increase the return to physical investment (see Romer (1990)).

14. For example, Murphy, Shleifer, and Vishny (1989), building on earlier work in development economics, have suggested another, purely economic, reason why more equality may be good for growth: you may need a sufficiently large middle class to generate demand for manufacturing products that is sufficient for a growth takeoff.

15. Regarding the evidence on the Kuznets curve, see Williamson (1989) and Lindert and Williamson (1985) for an overview of the historical evidence, and Fields (1980) for an overview of the postwar evidence across developing countries.

16. The papers mentioned in section 1.1, by Perotti (1990), Saint-Paul and Verdier (1991), and Glomm and Ravikumar (1991), all take some steps in this direction but

are forced to make simplifying assumptions that rule out an interesting part of the problem.

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