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Roland Bénabou

NEW YORK UNIVERSITY, DEPARTMENT OF ECONOMICS AND NBER

Inequality and Growth

1. Introduction

1.1 KOREA AND THE PHILIPPINES, CIRCA 1960: NOT SO SIMILAR AFTER ALL

To introduce the theme of this paper I shall revisit the puzzle raised by Lucas (1993) at the beginning of his article. In the early 1960s, South Korea and the Philippines were similar with respect to all major economic aggregates: GDP per capita, population, urbanization, primary and secondary school enrollment. The Philippines had a somewhat higher share of GDP in manufacturing, but in exports both countries had the same proportions of primary commodities and manufactures. Given nearly identical starting points, how can it be that over the next quarter century Korea experienced “miraculous” growth averaging about 6% per annum, while the Philippines stagnated at about 2%?

If one looks beyond first moments, however, initial conditions were in fact quite different. As shown by Table 1, the distribution of income was considerably more unequal in the Philippines, whose Lorentz curve lay everywhere below that of Korea.¹ The Gini coefficient was 17 percentage points higher, about 1.8 standard deviations in the world distribution of

I am indebted to Jess Benhabib, Jordi Gali, and Julio Rotemberg for helpful conversations at early stages in this project. I am also grateful for their detailed comments to my discussants, Roberto Perotti and José-Víctor Ríos-Rull, as well as to Alberto Alesina, Abhijit Banerjee, Andrew Bernard, Giuseppe Bertola, Patrick Bolton, Raquel Fernandez, Herschel Grossman, Andrew Newman, Torsten Persson, and Thomas Piketty. I also wish to thank Klaus Deininger and Lynn Squire for providing me with their data set, and Tim Smeeding for providing me with specific series from the Luxembourg Income Study. Financial support from the National Science Foundation (SBR-9601319) and the C.V. Starr Center is gratefully acknowledged.

1. The data are from Deininger and Squire (1995a); Q_i denotes the share of the i th quintile.

The year 1965 is the earliest one for which figures for both countries are available. Moreover these figures were based on the same survey method (gross household income), making them comparable. The 1988 Philippine number is for gross personal income, but very close to the 1985 figure, which still used household income.

Table 1 KOREA AND THE PHILIPPINES

Country	Gini (%)	Q ₁	Q ₂	Q ₃	Q ₄	Q ₅	Q ₃ +Q ₄	Q ₅ /Q ₁	Q ₅ /(Q ₁ +Q ₂)
1965									
Korea	34.34	5.80	13.54	15.53	23.32	41.81	38.85	7.21	2.16
Philippines	51.32	3.50	12.50	8.00	20.00	56.00	20.50	16.00	3.50
1988									
Korea	33.64	7.39	12.29	16.27	21.81	42.24	38.08	5.72	2.15
Philippines	45.73	5.20	9.10	13.30	19.90	52.50	33.20	10.10	3.67

Ginis, or 2.5 among East Asian countries. Most strikingly, the ratio of the income share of the top 20% to the bottom 20%, or even to the bottom 40%, was about twice as large in the Philippines. Similar disparities characterized land ownership: the Gini coefficient for farmland was 38.7 for Korea and 53.4 for the Philippines in 1961 and 1960 respectively.² This greater concentration of income and wealth, which persists to this day, cannot be blamed on the “kleptocratic” nature of the Marcos regime. Ferdinand Marcos was first elected president in 1965, and declared a state of emergency only in 1972. Preceding him in power at the end of the U.S.-assisted reconstruction period were two presidents whose main policies are described in the U.S. State Department’s background notes as seeking to “expand Philippine ties to its Asian neighbors, implement domestic reform programs, and develop and diversify the economy.”

Of course Table 1 does not constitute proof that greater initial equality was the reason—certainly not the sole reason—why the “miracle” occurred in one country and not the other. But the facts which it documents do suggest that the answer to the puzzle may lie outside the representative-agent framework.

2. The source for land Ginis is Taylor and Hudson (1972). The twelve-point gap corresponds to about one standard deviation. While it is common knowledge that Korea implemented a land reform following World War II, it may be worth mentioning that the Philippines also had its own around the end of World War I, during the American occupation period. Following the disestablishment of the Catholic Church, a large part of its land holdings were purchased and redistributed. The relatively high land Gini for 1960 suggests that either land reform was not as egalitarian as in Korea, where individual holdings were limited to 3 hectares, or that land ownership became reconcentrated during the following forty years.

1.2 EMPIRICAL REGULARITIES

South Korea and the other East Asian “dragons” are usually contrasted not to the nearby Philippines, but to Latin American countries. It has long been part of development economists’ conventional wisdom that the very equal distribution of income and land in the first group played a significant role in their takeoff, whereas the high levels of wealth concentration in the latter were a serious impediment to growth. In recent years the literature has moved from anecdotal to formal empirical evidence, spurred by the findings of Alesina and Rodrik (1994) and Persson and Tabellini (1994) of a negative effect of inequality in cross-country growth regressions, and by Perotti’s (1992, 1994, 1996) methodical testing of the main theories.

Table 2 summarizes the main results from 23 recent studies of the links from inequality to growth or investment. I shall refer to it throughout the paper. Column (1) corresponds to the basic, reduced-form regression, where the average growth rate of per capita GDP over some long period (twenty years or so) is regressed on initial inequality and several controls. These typically include: (a) initial income, whose coefficient is always negative and significant; (b) the initial stock of human capital, or proxies in the form of initial school enrollment ratios [as shown by column (8), this effect is systematically positive³]; (c) regional dummies. These regressions, run over a variety of data sets and periods with many different measures of income distribution, deliver a consistent message: initial inequality is detrimental to long-run growth. The magnitude of this effect is consistent across most studies: a one-standard-deviation decrease in inequality raises the annual growth rate of GDP per capita by 0.5 to 0.8 percentage points. Whether this is large or small may be in the eye of the beholder. On one hand, it amounts to between 30% and 45% of the standard deviation of growth rates found in most samples. It also implies an income gap of about 25% after 30 years, which is far from inconsequential. On the other hand, this does not come close to accounting for the growth differential observed between Korea and the Philippines, or East Asia and Latin America. However, several models in the literature predict a nonlinear effect, possibly leading to a multiplicity of equilibria. In that case small differences in initial inequality can have marginal effects well in excess of the average slope estimated by linear regressions, and significantly influence long-run outcomes.

3. With the exception of the puzzling result that when male and female stock are distinguished, the latter appears to contribute negatively (e.g., Barro, 1996, who also discusses possible explanations).

Table 2 EFFECTS OF INEQUALITY ON GROWTH OR INVESTMENT AND SOME OF THEIR DETERMINANTS

No.	Reference	(1) INEQ	(2) DEM	(3) DEM × INEQ	(4) INEQ	(5) REDIST	(6) HUMCAP	(7) CRED	(8) CRED × INEQ	(9) INEQ	(10) INSTAB
		on GR, INV	on GR, INV	on GR, INV	on REDIST TRAN, EDEXP TAX	on GR, INV	on GR, INV	on GR, INV	on GR, INV	on INSTAB	on GR, INV
1	Alesina-Rodrik (94)	⊖	0	0			⊕				
2	Alesina-Perotti (96)						⊕			⊕	-
3	Alesina <i>et al.</i> (96)		0				⊕			⊕	⊖
4	Barro (96)		↗			+	M=⊕	F=⊖			⊖
5	Benhabib-Spiegel (96)	(-)					⊕				(-)
6	Bourguignon (94)	⊖					⊕				
7	Brandolini-Rossi (95)	0		0			⊕				
8	Clarke (92)	⊖		+			+				
9	Deininger-Squire (95)	-	(±)								
10	Devarajan <i>et al.</i> (93)				+	(-)					
11	Easterly-Rebello (93)	⊖	(-)	(±)	+	(-)	⊕			⊕	(±)
12	Keefer-Knack (95)						⊕				
13	Levine-Renelt (92)						⊕				
14	Lindert (96)				⊖	(±)	⊕				
15	McCallum-Biais (87)				⊖	(-)	⊕				

16	Perotti (92)	⊖	(-)	(±)	+	+	⊕	⊖
17	Perotti (94)	⊖	(-)	(+)	(+)	0	⊖	⊖
18	Perotti (96)	⊖	(+)	(+)	⊕	M=⊕ F=⊖	⊖	⊕
19	Persson-Tabellini (92)	⊖	0	(-)	⊖	⊕	⊕	⊖
20	Persson-Tabellini (94)	⊖	-	(+)	⊖	(-)	⊕	⊖
21	Sala-i-Martin (92)				⊕			⊖
22	Svensson (93)						⊕	⊖
23	Venieris-Gupta (86)	⊖					+	⊖

Symbols: ⊕, ⊖: consistent sign and generally significant; +, -: consistent sign, sometimes significant; (+), (-): consistent sign but generally not significant; (±): inconsistent sign with significant coefficients; 0: inconsistent sign or close to zero, and not significant; ∩: inverse U-shaped, significant.

INEQ: Measures of inequality; 1 uses income and land Gini; 5, 16, and 23 use $-Q_3$; 6 uses $-Q_1$, $-(Q_1+Q_2)$, and Q_5 ; 7, 9 use income and land Gini; 8 and 11 use income Gini, Theil, coefficient of variation, and $Q_5/(Q_1+Q_2)$; 12 uses Gini, land Gini, and $-Q_3$; 14 uses $\ln(Q_2/Q_3) + \ln(Q_2/Q_1)$; 17 uses $-Q_3$ and $-(Q_1+Q_2)$; 18 uses $-(Q_3+Q_4)$; 19 uses $-Q_3$ and land Gini; 20 uses Q_5 and $-Q_3$; 22 uses $-(Q_1+Q_2)/Q_5$.

DEM: Measures of political rights and degree of democracy: see each study.

REDIST: Measures of redistribution: EDEXP is the share of education expenditures in GDP; TRAN and TAX are various transfers and tax rates, as detailed below. 10 uses current government expenditure/GDP (⊕), health and education (±); 11 uses twelve different average and marginal tax rates, only one has a significant effect; 12 uses shares in GDP of social security, welfare, government transfers, tax revenues, government expenditures, and government consumption, as well as the share of employment in the state sector; 14 uses the shares in GDP of payments for social security, welfare, unemployment, health (as well as the sum of these four transfers), and education; 16, 17, and 20 use total transfers/GDP; 18 uses GDP shares of: social security, health plus housing, and education; also the labor tax rate and average and marginal income tax rates; 15 and 21 use GDP share of social security.

CRED: Credit-market imperfections, measured in 16 by (minus) the loan-to-value ratio for mortgages.

HUMCAP: 4, 5, 9, and 15 use the initial stock of human capital (primary and/or secondary education); M=males, F=females; all others proxy for the stock with enrollment ratios.

INSTAB: 1, 2, 3, 5, 13, 16, and 18 focus on sociopolitical instability, measured by various combinations of protests, strikes, government turnover, political violence, coups, revolutions, etc. 4, 12, and 22 focus on the security of property rights, measured by indicators of country risk (default, expropriation, nationalization), contract enforceability, corruption, etc.

The inclusion of controls (b) and especially (c) typically reduces the coefficient on inequality. Sometimes it becomes insignificant, as in Benhabib and Spiegel (1994) when the stock of human capital is included, or in Deininger and Squire (1995b) where dummies for Latin America and sub-Saharan Africa drive out income Ginis—but not land Ginis. In most other studies inequality remains significant even in the presence of these controls. In any case, enrollments in and stocks of secondary education have a substantial negative correlation with inequality, and in some of the theories discussed below the link between income distribution and growth arises precisely through human-capital investment. Note finally that a large part of the cross-country variation in inequality comes from the high levels observed in Africa and, particularly, Latin America. These persistent interregional differences need to be explained, and in fact point in the direction of the models with multiple long-run distributions mentioned above.

1.3 OVERVIEW

This paper presents and extends the main theories linking income distribution and growth, as well as the evidence on their relevance. This is done through two unifying models, a survey of the empirical literature, and an econometric exercise. The first model integrates the political-economy and imperfect-capital-markets theories. The second one deals with social conflict and the security of property rights. The empirical section asks whether countries are converging to the same level of inequality. The paper focuses primarily on mechanisms by which income distribution (whether exogenous or endogenous) can affect output growth, rather than on reverse effects from the level of development to inequality. It thus barely touches on the Kuznets (1955) hypothesis.⁴

I start in Section 2 with theories where asset markets are complete and distributional effects arise solely through the balance of power in the political system (Bertola, 1993; Alesina and Rodrik, 1994; Persson and Tabellini 1994). The idea is that by lowering the income of the median voter or pivotal middle class relative to the national average, greater inequality increases the pressure for redistribution. This, in turn, discourages investment. The model developed here, which combines features of Persson and Tabellini (1994) and Bénabou (1995), displays this mechanism but also formalizes departures from the “one person, one vote” ideal. Whether or not there is a role for productive public invest-

4. See Fields and Jakubson (1994) for a recent review as well as some new evidence, which does not support the Kuznets curve hypothesis.

ment, growth in this class of models always increases with the degree of pro-wealth bias in the political system. I also provide new results, together with a general caveat, on the issue of whether inequality affects democracies and nondemocracies differentially. Compared to a perfect democracy, income disparities are shown to have a lesser impact on redistribution and growth only in right-wing or wealth-biased regimes, and a greater impact in left-wing or populist ones.

In Section 3 I turn to another set of theories, where the distribution of wealth has macroeconomic implications due to imperfections in asset markets. I use the very same model as before but simply “turn off” the loan market. Indeed, the main idea in this literature, which starts with Loury (1981), is that credit constraints prevent the poor from undertaking the efficient amount of investment. With decreasing returns their marginal product is higher, so that redistributions can increase total output or growth. My model embodies the trade-off between these growth benefits of land reform, public schooling, or other progressive transfers, and their traditional costs due to depressed incentives for savings or labor supply. The other central issue in the literature is intergenerational mobility, for which uninsurable shocks are of the essence. Some papers focus on the decentralized equilibrium (Galor and Zeira, 1993; Banerjee and Newman, 1993; Bénabou, 1996a; Aghion and Bolton, 1997; Piketty, 1997), while others combine market incompleteness with the politics of redistribution (Perotti, 1993; Saint-Paul and Verdier, 1993; Verdier and Ades, 1993; Saint-Paul, 1994; Bénabou, 1995). In a related class of models the macroeconomic effects of distribution arise from, or are magnified by, the endogenous sorting of agents into homogeneous communities or other “clubs” (Bénabou, 1993, 1996b; Durlauf, 1996a, 1996b; Fernandez and Rogerson, 1996, 1994; Kremer and Maskin, 1994). The results obtained in this paper are representative of this entire literature, and include a number of new propositions as well. I explain for instance why maximizing growth requires some (interior) degree of democracy, in contrast to the complete-markets case. I also demonstrate how the combination of credit constraints and a less than perfectly democratic political system can lead to multiple long-run equilibria, differing both in growth rates and in levels of inequality. I then use this example to explain the common principle by which multiple steady-state distributions arise, through a variety of general equilibrium feedbacks, in several of the models mentioned above.

Section 4 turns to theories based on the idea that sociopolitical conflict reduces the security of property rights, thereby discouraging accumulation. In particular, when the gap between rich and poor widens, the latter may have a greater temptation to engage in rent-seeking or preda-

tory activities at the expense of the former. The security of property rights is the main focus of Grossman (1991, 1994), Acemoglu (1995), Tornell and Velasco (1992), Tornell (1993), Grossman and Kim (1996), and Benhabib and Rustichini (1996). Only the last two papers, however, explicitly link inequality and growth. I propose here a simple growth version of the prisoner's dilemma which captures the essence of this class of models. The economy's maximum sustainable growth rate is shown to be negatively related to interest groups' rent-seeking abilities, as well as to income disparities between them. It may then be in the interest of the rich to collectively transfer wealth to the poor through land reform, education subsidies, a minimum wage, or trade protection. More generally, the analysis reveals that what really matters is not income inequality per se but inequality in the relative distribution of earning and political power. I also point out that actual instability or uncertainty is not part of the story told by most of these models, contrary to common interpretation. As in the case of taxation, growth is reduced through a decline in the expected return on investment, due to a higher threat of expropriation.

Finally, the possibility of multiple long-run distributions and history dependence discussed earlier leads me to raise in Section 5 a new empirical question: are countries converging to the same level of inequality, or are there permanent differences? Equivalently, is there convergence not only in the first moment of their income distributions—GDP per capita—but also in the second one (and higher), as would be predicted by most versions of the neoclassical model once it is enriched with uninsurable idiosyncratic shocks? Using a new data set put together by Deininger and Squire (1995a), I make a first pass at this issue of convergence in distribution. Although it is insufficient to resolve the issue, this exercise uncovers some interesting puzzles, including some evidence of mean reversion in Ginis.⁵

The general strategy adopted in this paper is one of simplification and unification. The models are thus stripped of many elements which contribute to the richness and realism of the literature, but are not essential to conveying the main ideas. These are briefly discussed in the concluding section, before turning to directions for further research. All proofs are gathered in the Appendix.

5. The paucity and sometimes poor quality of international data on income distribution remain binding constraints here, as in all empirical work on these issues; see Deininger and Squire (1995a), Perotti (1996) and OECD (1996) for discussions of data quality. Another general problem is the lack of almost any data on the distribution of wealth (land is sometimes used as an imperfect proxy), even though in most theories it is this distribution rather than that of income which is determinant.

2. Political Economy with Complete Markets

The model to be developed here and in the next section will bring together the political-economy and imperfect-capital-markets theories. There is a continuum of nonaltruistic overlapping-generation families, indexed by $i \in [0, 1]$. The utility of a member i in generation t is

$$U_t^i = \ln c_t^i + \rho \ln d_t^i, \tag{1}$$

where c_t^i and d_t^i denote consumption when young and old respectively. This person is born endowed with resources w_t^i , distributed independently across agents with mean $w_t \equiv E[w_t^i]$. Agents can invest in human or physical capital according to the technology

$$y_t^i = r(k_t^i)^\beta (w_t^i)^{1-\beta}, \tag{2}$$

where r is constant and $0 < \beta \leq 1$; k_t^i is the amount invested and y_t^i is the second-period pretax income. Note that individuals face decreasing returns but the aggregate technology is linear. One can interpret w_t^i as agent i 's basic level of skill or human capital, which can be supplemented through investment. The higher the general level of basic skills w_t , the easier it is to develop or acquire new knowledge. I shall focus for a while on what happens within a given generation, in which case time subscripts can be omitted.

2.1 SAVINGS AND INTRAGENERATIONAL GROWTH

There is a frictionless credit market where agents in each generation borrow from and lend to each other, at some endogenous interest rate \tilde{r} . The amount borrowed by i is denoted $b^i \geq 0$. Finally, there is a government which redistributes second-period income. I depart here from the standard case of linear taxes and focus instead on a simple log-linear scheme which will yield explicit solutions with both perfect and missing capital markets.⁶ Let income after taxes and transfers be

$$\tilde{y}^i = (y^i)^{1-\tau} (\tilde{y})^\tau, \tag{3}$$

where the break even income level \tilde{y} is defined by the balanced-budget constraint

6. This scheme was introduced in Bénabou (1995) in a context of dynastically altruistic families facing missing credit and insurance markets. Applied here to complete markets, it yields the same results as would be obtained from the standard scheme of linear taxes and lump-sum transfers.

$$\int_0^1 (y^i)^{1-\tau} (\bar{y})^\tau di = \int_0^1 y^i di \equiv y. \quad (4)$$

Note that the scheme is *progressive* (e.g., $\bar{y} > y$) when $0 < \tau \leq 1$, and *regressive* when $\tau < 0$; the maximum rate compatible with free disposal is $\tau = 1$. I allow $\tau < 0$, which will be relevant when studying imperfectly democratic regimes, but for technical reasons I restrict it to $\tau \geq -\sqrt{1+1/\rho\beta} \equiv \underline{\tau}$. Given an expected redistribution rate τ , agent i 's maximization problem is

$$\max_{b^i, k^i} (\ln(w^i + b^i - k^i) + \rho \ln\{[r(k^i)^\beta w^{1-\beta}]^{1-\tau} (\bar{y})^\tau - \bar{r}b_i\}), \quad (5)$$

and the first-order conditions are $d^i/c^i = \rho\bar{r} = \rho\beta(1-\tau)(\hat{y}^i/k^i)$. Together with (2) and (3), the second one implies that everyone invests the same amount, $k^i = k$; hence $\hat{y}^i = y^i = rk^\beta w^{1-\beta} = y = \bar{y}$ and $\bar{r} = r\beta(1-\tau)(w/k)^{1-\beta}$. The first Euler equation then becomes

$$rk^\beta w^{1-\beta} - \bar{r}b^i = \rho r\beta(1-\tau)(w/k)^{1-\beta}(w^i + b^i - k).$$

Summing over agents and using the loan-market-clearing condition $\int_0^1 b^i di = 0$ yields

$$k = \frac{\rho\beta(1-\tau)w}{1 + \rho\beta(1-\tau)} \equiv s(\tau)w. \quad (6)$$

Each individual thus invests the same fraction $s = s(\tau)$ of *aggregate* resources. Consequently everyone has the same second-period income, so no actual transfers take place in equilibrium. The critical feature of redistribution under complete markets is the *threat* of expropriation of part of the return to investment, as opposed to actual transfers of wealth.⁷ In particular, the growth rate of aggregate income within each generation,

$$g(\tau) \equiv \ln(y/w) = \ln r + \beta \ln s(\tau), \quad (7)$$

declines as the tax rate τ rises.

7. One could easily introduce some multiplicative form of ability into the investment function (2), perhaps correlated with w^i . Optimal investment levels would then differ across individuals and equilibrium transfers would be positive, but none of the essential results would change.

2.2 INTERGENERATIONAL LINKAGES

To extend this result to long-run growth rates it remains to specify the dynamic linkages between generations. The simplest kind is an aggregate spillover (as in Persson and Tabellini, 1994) through which the productivity achieved by generation t becomes embodied into the basic human capital endowment of generation $t + 1$:

$$w_{t+1}^i = \epsilon_{t+1}^i y_t \tag{8}$$

where ϵ_t^i is an i.i.d. shock with mean normalized to 1, representing for instance innate ability. Equivalently, let altruistic parents devote some of their second-period resources to children's education (say, primary schooling), which is provided as a public good. Specifically, let parents care about old-age consumption, now denoted c_t^i , and about the human-capital endowment of their child:

$$U_t^i = \ln c_t^i + \rho \gamma \ln c_t^i + \rho(1 - \gamma) E_t[\ln w_{t+1}^i]. \tag{1'}$$

The latter is a combination of ability and public expenditures on schooling,

$$w_{t+1}^i = \kappa \epsilon_{t+1}^i e_t \tag{8'}$$

with the latter financed through a proportional tax on second-period income. With logarithmic preferences the unanimously preferred tax rate is $1 - \gamma$, so that $c_t^i = \gamma d_t^i$ and $e_t = (1 - \gamma) d_t = (1 - \gamma) y_t$. Nothing else in parents' behavior or maximized utility is affected.⁸ Thus $w_{t+1}^i = \kappa(1 - \gamma) \epsilon_{t+1}^i y_t$, and normalizing the constant to one yields the same result as (8), namely that the intra- and intergenerational growth rates are equal:

$$g_t = \ln(y_t/y_{t-1}) = \ln(w_{t+1}/w_t) = \ln(y_t/w_t) = \ln r + \beta \ln s(\tau_t), \tag{9}$$

where τ_t is the tax rate chosen in generation t . Moreover, the distribution of relative incomes $w_t^i/w_t = \epsilon_t^i$ is stationary, which will result in a time-invariant equilibrium tax rate. In what follows I shall therefore omit time subscripts once again.

8. See Glomm and Ravikumar (1992) and Bénabou (1996a) for models of private, local, and public education with a similar specification. The former uses overlapping generations with a "warm-glow" bequest, as I do here; the latter has dynastic preferences.

2.3 INEQUALITY AND REDISTRIBUTION

I now examine the determination of taxes within each generation. Agent i 's optimal investment entails a net borrowing of

$$b^i = \frac{\rho}{1 + \rho} (w - w^i) \quad (10)$$

at the interest rate

$$\tilde{r} = r\beta(1 - \tau)^\beta [1 + \rho\beta(1 - \tau)]^{1-\beta}.$$

Redistribution through what is essentially a tax on capital income lowers this equilibrium return, thereby favoring borrowers and hurting lenders. It leaves unaffected the "representative" agent with resources equal to the per capita average w , as he does not make use of the loan market. Given optimal borrowing and investment decisions, the intertemporal utility of individual i is equal to

$$U^i(\tau) = V(\tau) + (1 + \rho)\ln \left[1 + \left(\frac{w^i}{w - 1} \right) \left(\frac{1 + \rho\beta(1 - \tau)}{1 + \rho} \right) \right], \quad (11)$$

where

$$V(\tau) \equiv (1 + \rho)\ln w + \ln[1 - s(\tau)] + \rho\ln[rs(\tau)^\beta] = \ln c + \rho\ln d, \quad (12)$$

with c and d representing aggregate consumption in the first and second periods. For an agent with the average endowment w the second term in (11) vanishes. His preferences thus coincide with those of a social planner concerned only with *intertemporal efficiency*, in the sense of being indifferent to the distribution of consumption across individuals. Since

$$V'(\tau) = - \frac{\rho\beta\tau}{(1 - \tau)[1 + \rho\beta(1 - \tau)]}, \quad (13)$$

the preferred tax rate of this representative individual or social planner is zero.⁹ Individuals poorer than average would like (progressive) taxes on

9. Note that $V(\tau)$ is different from the ex ante efficiency $E_{w^i}[U^i(\tau)]$. Because agents are risk-averse, maximizing this "behind-the-veil" criterion would always call for $\tau > 0$. By assuming that people vote only once they know their type, I am intentionally abstracting from the insurance value of redistribution, in order to highlight its effects on the path of output. See Loury (1981) or Bénabou (1996a, 1995) for dynamic models which incorporate this insurance value.

capital: it is easily seen that for all $w^i < w$, $U^i(\tau)$ is single-peaked and reaches its maximum at the solution τ^i to $U^{i'}(\tau) = 0$, or

$$\phi(\tau) \equiv \frac{\tau(1 + \rho)}{[1 + \rho(1 - \tau)][1 + \rho\beta(1 - \tau)]} = 1 - \frac{w^i}{w}. \quad (14)$$

This implies that agent i 's preferred tax rate τ^i is positive and declines as his relative income falls, as in Meltzer and Richards (1981). The problem is more complicated for agents who are richer than average, as ϕ is not monotonic over all negative values of τ . One can nonetheless show that $U^i(\tau)$ remains strictly concave on its domain $[\underline{\tau}, 1]$, where $\underline{\tau} < -1$ was defined earlier. Thus for $w^i/w < 1 - \phi(\underline{\tau})$ agent i 's preferred tax rate is still given by the first-order condition (14); for still richer individuals it is the corner solution, $\tau^i = \underline{\tau}$.

To abstract from time consistency issues, I follow Persson and Tabellini (1994) in assuming that τ is chosen irrevocably during the first sub-period. If the political process can be represented by majority voting over the single issue of taxation, the median voter is decisive, and his preferred policy is implemented. Hence the central implication of this class of models:¹⁰

PROPOSITION 1 *Let inequality be measured by, or correlated with, a lower ratio of median to mean pretax wealth. Then more inequality leads to more redistribution, slower growth, and reduced efficiency: τ rises, causing g and V to fall.*

These results on the personal distribution of wealth in a one-factor model can be extended to the functional distribution of income, say between capital and labor. Bertola (1993) and Alesina and Rodrik (1994) show more generally that a lower median-to-mean ratio in agents' relative endowments of accumulated and nonaccumulated factors reduces the growth rate. The mechanism is the same, namely increased taxation of capital, and so are the efficiency implications. The fact that these are models with infinite-lived agents also makes clear that the results are independent of the assumption of myopic preferences.¹¹ Note finally

10. The main difference between the present model and that of Persson and Tabellini (1994), apart from the fact that I allow $\beta < 1$ and make explicit the functioning of the loan market (b 's and \bar{r}), is the use of a geometric rather than linear redistribution scheme. While this modification will prove most convenient when incomplete credit markets are introduced, it is here inessential. All formulas derived above also obtain in the traditional, linear, case.
11. The quantitative magnitude of the effect, on the other hand, does depend on how far into the future agents look when making savings decisions and casting their ballots; see Krusell, Quadrini, and Ríos-Rull (1996).

that what is key in Proposition 1 is how inequality affects the desire for redistribution of whoever is the decisive agent in the political system. Because the latter is likely to depart from the “one person, one vote” abstraction, I will later on consider variations in political institutions.

2.4 EMPIRICAL EVIDENCE

I now turn to the evidence on the general idea that inequality increases redistribution, which in turn reduces growth. Column (4) of Table 2 reports the results of empirical studies which have examined the links between income inequality and a variety of measures of redistribution: share of transfers in GDP (either as a whole or decomposed into different categories such as welfare, unemployment, health, and social security), average and marginal tax rates, or education expenditures. Column (5) then reports the effects which these policies were found to have on the economy’s growth or investment rate. Some studies examine only one of these two relationships; others, most notably Perotti (1992, 1996), estimate a simultaneous system.

In column (4) the measure of inequality is generally taken to be the share of the third quintile, or the share of the third plus fourth quintiles. This reflects the emphasis placed by the models on the median voter and middle class. The results are rather disappointing: the effect of income distribution on transfers and taxes is rarely significant, and its sign varies from one study or even one specification to another. The same is true for education expenditures. Both Alesina and Rodrik (1994) and Persson and Tabellini (1994) raise an objection to interpreting such regressions as a test of the theory. They point out that redistribution can take many forms other than straight transfers: progressive income taxation, minimum-wage laws, trade and capital restrictions, the composition of government expenditure, patent legislation, regulation, and the protection of property rights. This is certainly true, but not entirely persuasive. First, the studies reported in Table 2 already include some of these variables such as tax rates, public employment, or education expenditures. Second, it is hard to see why the increased pressure for redistribution would manifest itself *only* through indirect channels and not through direct ones. Presumably the pivotal voter or class is equalizing the marginal costs and benefits of pressure along the different dimensions of redistribution. Finally, one would want to see at least some evidence that minimum-wage laws, trade and capital restrictions, and regulation are higher in more unequal countries. Such is not the case within the OECD: these indirect forms of redistribution are lowest in the United States, which has the greatest pretax inequality, and much more extensive in continental Europe (welfare state and labor legislation) or Japan (regulation and trade protection).

Column (5) provides even more surprising news. The coefficient in growth regressions of most of the transfers described above is positive, and frequently statistically significant. This is true not only for education expenditures, but also for social insurance and even pensions. These results stand in sharp contrast to those found for pure government consumption. Most of the studies which include this variable find it to be negatively related to growth, as in Barro (1990). Government consumption, however, is conceptually different from redistribution, at least on the expenditure side; I shall come back to this point later on. On the revenue side both are eventually financed through taxes, but even tax rates fail to have the predicted growth effect. Easterly and Rebello (1993) use twelve different average and marginal tax rates; the coefficients are always negative, but only one is significantly different from zero. Perotti (1996) finds that both average and marginal tax rates have a significantly positive effect on growth. One might be tempted to dismiss the whole set of results in column (5) as due to reverse causality, based on the plausible idea that the welfare state is a luxury good—a form of “Wagner’s law.” The fact that Perotti estimates simultaneous-equation systems which allow for the level and growth rate of GDP to affect transfers and tax rates precludes such an easy way out. Together, the results of columns (4) and (5) indicate that the median-voter, complete-markets model is missing some important factors which bear on both the causes and consequences of redistribution.

2.5 DEMOCRACIES AND OTHER REGIMES

Another dimension of the political-economy model which has generated substantial empirical effort concerns its differential implications across political regimes. Perhaps because some of these have not been formally modeled but simply argued on the basis of intuition, the literature manifests some disagreement as to what exactly these implications are and how they can be tested. I shall therefore explicitly formalize departures from the “one person, one vote” ideal, in a manner which is quite specific but allows me to demonstrate some more general points.

Instead of the voter at the 50th percentile of the wealth distribution being decisive, let it be the agent or pressure group located at the p th percentile. The case $p > \frac{1}{2}$ corresponds to a system biased against the poor due to a wealth-restricted voting franchise, unequal lobbying power, vote buying, or simply the fact that poor and less educated individuals have lower participation rates in elections, even in industrialized countries (e.g., Edsall, 1984, or Conway, 1991, for the United States). Conversely, $p < \frac{1}{2}$ corresponds to a populist bias reflecting either the ideology of a nondemocratic leftist regime (“dictatorship of the prole-

tariat”) or the bargaining power of powerful unions. To get simple expressions, assume moreover that the distribution of initial endowments in each generation is lognormal:

$$\ln w^i \sim \mathcal{N}(m, \Delta^2). \quad (15)$$

The pivotal voter or pressure group then corresponds to the wealth level w^* defined by $\Phi((w^* - m)/\Delta) = p$, where Φ is the c.d.f. of a standard normal. Equivalently, $w^* = m + \lambda\Delta$, where $\lambda \equiv \Phi^{-1}(p)$. Regimes with positive values of λ could be called “elitist,” those with negative values “populist.” But since even Western democracies exhibit departures from $\lambda = 0$, I will use a milder terminology and simply speak of positive or negative “wealth bias” in the political institutions.¹² Substituting $\ln(w^*/w) = \lambda\Delta - \Delta^2/2$ into (14) yields the following results:

PROPOSITION 2

1. *Growth is higher, the more biased against the poor is the political system: $\partial g/\partial \lambda > 0$.*
2. *Intertemporal efficiency is maximized when the individual setting the tax rate is the one with the average endowment w .*
3. *Achieving intertemporal efficiency requires more pro-wealth bias in a more unequal country: $w^* = w$ for $\lambda = \Delta/2$.*

The very stark nature of these results may lead one to think that they reflect special assumptions rather than general insights. They do not. These are in fact robust features of most political-economy capital taxation models with complete asset markets. This includes not only models where there is no useful role for the government (Persson and Tabellini, 1994) but also those where taxes or subsidies are required to correct an externality (Bertola, 1993) or to finance some productive public investment (Alesina and Rodrik, 1994). The underlying intuitions are indeed straightforward. With complete markets wealth heterogeneity has no efficiency consequences; if preferences are homothetic, it does not even affect aggregates. To equalize the social marginal costs and benefits of taxation one need therefore only look at averages, which means adopting the point of view of the individual with the “representative” en-

12. See Verdier and Ales (1993) for a dynamic model of political elites, and Bénabou (1995) for a discussion of alternative representations of the political system. I show there in particular that if political influence reflects absolute rather than relative wealth, with an elasticity λ , the pivotal agent has rank $\lambda\Delta$ and log wealth $m + \lambda\Delta^2$.

dowment.¹³ Complete markets also imply that aggregate consumption growth rises with the interest rate; in steady state, the same applies to output growth. Maximizing growth thus means maximizing the rate of return on capital, thereby adopting the perspective of the individual with highest wealth relative to other sources of income. This includes his valuation of any complementarities, public inputs, or regulations which might affect the private return.

The empirical literature seems to have somewhat shied away from the most direct testable implication, namely (1), focusing instead on a more indirect, second-order effect: the differential impact of inequality on redistribution and growth across political regimes. The claim, first made by Persson and Tabellini (1994) and taken up by Perotti (1992, 1996) and others, is that the negative effect of inequality discussed in Proposition 1 should be stronger in “democracies” than in “nondemocracies.” While it does relate to some valid intuitions, there are two problems with this argument.

1. I know of no formal proof or model. Upon reflection, this is probably no accident. Such claims concern the *cross partial second derivative* of the growth rate, with respect to income distribution and regime. Not only is it rare that cross partials can be signed unambiguously, but in this instance the growth rate (or equivalently, the tax rate) is determined by the first-order condition of the decisive agent—whether a dictator, landowning elite, or powerful union. Its cross partial thus inevitably involves the *third* derivative of that agent or group’s objective function, and therefore cannot be signed without restrictive functional assumptions.¹⁴
2. Whatever its sign, any differential effect of income distribution across political regimes must surely depend on the direction in which one moves away from pure democracy. A similar criticism was formulated by Alesina and Rodrik (1994), who pointed out that even dictators are subject to political pressure, whether through riots or bribes. What should matter is how inequality affects the desire for redistribution of their constituency.
13. This reasoning implicitly assumes linear taxation, as in all the literature under discussion. My model yields the same result even with progressive taxation, because in equilibrium everyone invests the same amount (all that matters is the threat of taxation).
14. Saint-Paul and Verdier (1993) and Persson and Tabellini in the working-paper version of their 1994 article show how restricting the political rights of different classes affects growth (an effect similar to $\partial g/\partial \lambda$ here). But neither paper provides results on how the political regime alters the effect of inequality on redistribution and growth ($\partial^2 \tau/\partial \lambda \partial \Delta$ and $\partial^2 g/\partial \lambda \partial \Delta$ in my model), which is the issue under discussion here.

Elaborating on these remarks, I shall now formally examine the cross-effects of political institutions and inequality, λ and Δ , on redistribution and growth. When voters or constituents located at the p th wealth percentile are decisive, the equilibrium tax rate is given by their first-order condition: $\ln[1 - \phi(\tau)] = \lambda\Delta - \Delta^2/2$, where ϕ was defined in (14). This implies

$$\frac{\partial \tau}{\partial \Delta} = (\Delta - \lambda) \left(\frac{1 - \phi(\tau)}{\phi'(\tau)} \right) \quad \text{and} \quad \frac{\partial \tau}{\partial \lambda} = -\Delta \left(\frac{1 - \phi(\tau)}{\phi'(\tau)} \right); \quad (16)$$

hence

$$\frac{\partial^2 \tau}{\partial \lambda \partial \Delta} = \frac{1 - \phi(\tau)}{\phi'(\tau)} \left[-1 + (\Delta - \lambda)\Delta \left(\frac{\phi'(\tau)^2 + \phi''(\tau)[1 - \phi(\tau)]}{\phi'(\tau)^2} \right) \right]. \quad (17)$$

The first term in the large square brackets is negative, but the second one depends on the curvature of $\ln(1 - \phi)$.¹⁵ This is a complicated expression, even for λ close to zero. One could of course evaluate it numerically. Alternatively, observe that when Δ is small, the second term is dominated by the first. Together with similar derivations for the growth rate, this allows me to prove an amended version of the “democracy and inequality” conjecture:

PROPOSITION 3 *As long as inequality is not too large, its positive effect on redistribution and negative effect on growth are weaker, the less favorable to the poor is the political system: $\partial^2 \tau / \partial \lambda \partial \Delta < 0$ and $\partial^2 g / \partial \lambda \partial \Delta > 0$.*

Compared to democracies, inequality should have *more* effect on redistribution and growth in left-wing, populist regimes, and less effect *only* in right-wing or wealth-biased systems.¹⁶ Note also from (16) that in this latter case taxes first decline, then rise with inequality: $\partial \tau / \partial \Delta \leq 0$ as $\Delta \leq \lambda$. Distributional conflict initially shifts policy to inefficiently low levels of taxation, but the growing skewness of the income distribution eventually tilts the balance of power back towards the poor. The regressive nature of taxes or capital subsidies in this range ($\tau < 0$ for $\Delta \leq 2\lambda$) need

15. The expression multiplying $(\Delta - \lambda)\Delta$ measures the concavity of the optimal tax rate with respect to the log income of the tax setter; it reflects the third derivative of preferences, as argued earlier. Note that by using the first-order condition to characterize the tax rate preferred by agents with $w^j/w = e^{\lambda\Delta - \Delta^2/2}$, I am implicitly assuming that it is always interior. A simple sufficient condition is $e^{\lambda^2/2} < 1 - \phi(x)$.

16. The earlier caveat about the inevitable reliance of *any* results concerning such cross derivatives upon specific functional and distributional assumptions naturally applies here as well.

not be taken literally, because one could incorporate some insurance value or public good which ensured that τ remained positive. What is important, given the lack of any empirical link between inequality and redistribution evident in Table 2, is the nonmonotonicity of τ with respect to Δ . The possibility of redistribution decreasing with inequality will play a still larger role once combined with imperfect capital markets in Section 3, and will therefore be discussed in more detail at that point.

Propositions 2 and 3 make clear that what matters for growth (both directly and through the impact of income distribution) is not just the degree to which the political system departs from perfect democracy, which corresponds to $|\lambda|$, but also whose political rights or influence are being curtailed. The empirical literature has nonetheless followed Persson and Tabellini (1994) in testing for differential effects of absolute democracy. Typically, countries are classified into “democracies” and “nondemocracies” on the basis of some composite index of political rights, freedom of expression and association, etc., such as those of Gastil (1982). The growth regression is then run separately for each subsample, or for the whole sample with a “democracy” dummy variable included—both by itself and interacted with income distribution. The results of these tests, summarized in columns (2) and (3) of Table 2, have generally been negative. First, there is no consistent direct effect of democracy on growth (recall that this class of models predicts $\partial g/\partial \lambda > 0$). The latest study, Barro (1996), finds a nonlinear effect which I shall revisit in the next section. Turning to column (3), most other studies have not reproduced Persson and Tabellini’s (1992, 1994) finding of a statistically significant differential impact of inequality across democracies and nondemocracies. Moreover, the sign of the estimates varies from one study to another. But since what is really measured in such regressions is the effect of $|\lambda|$ and $|\lambda| \Delta$ rather than λ and $\lambda \Delta$, I see these results as less damaging for the theory than those of the direct tests discussed in Section 2.4. It should be feasible in future work to provide more discriminating tests by distinguishing between left- and right-wing regimes, at least for some subset of countries.¹⁷

2.6 CONSUMPTION TAXES AND LABOR SUPPLY

One potential explanation for the fact that redistribution does not appear to depress investment or growth is the presence of credit constraints, as I will show later on. But even with complete markets this need not

17. One case which does not suffer from this problem is the historical sample of Persson and Tabellini (1994), where political institutions are represented by the fraction of the population which did not have access to an income-based or wealth-based voting franchise. This corresponds closely to λ itself, and is therefore a more appropriate regressor than any postwar democracy index. The resulting estimate of $\partial g/\partial \lambda$ is nonetheless negative, although not significant. The cross-effect is not estimated in this set of regressions.

happen: nothing in principle prevents progressive taxation, transfers, minimum wages, and the like from being combined with a consumption tax or investment subsidy to maintain accumulation at the appropriate level. Indeed, value-added and sales taxes account for a much higher share of government revenue in “welfare state” European countries than, say, in the United States or Japan.

Going back to the model, suppose that a proportional consumption tax is introduced and its revenue used to subsidize investment. First-period consumption is now $c^i = (1 - t)(w^i + b^i - k^i)$, investment $(1 + a)k^i$, and second-period pretax income $y^i = \{r[(1 + a)k^i]^\beta (w^i)^{1-\beta}\}^{1-\tau} (\bar{y})^\tau$. Balanced budgets require $t(w - k) = ak$, where letters without superscripts still denote aggregates. It is easily verified that, for any rate of redistribution τ :

1. Agents still save the same fraction $s(\tau)$ of their income, so that the investment rate is $s(\tau)(1 + a)$.
2. The consumption tax rate *unanimously* preferred by agents is $t^*(\tau) = \rho\beta\tau/(1 + \rho\beta\tau)$. Thus the more progressive the income tax, the greater the recourse to consumption taxes.
3. The resulting investment rate never departs from its *first best* level: $s(\tau)(1 + a) = \rho\beta/(1 + \rho\beta) = s(0)$.
4. Introducing elastic labor supply, by replacing the first-period income w^i with $w^i l^i$ and the preferences (1) with $U = \ln c - \delta l + \rho \ln d$, leaves these results unchanged. As to the growth rate, it becomes $g(\tau) = \ln r + \beta \ln s(0) + \ln l(\tau)$, where $l(\tau) = [1 + \rho\beta(1 - \tau)]/\delta$ is agents' common labor supply.¹⁸

This simple extension of the model makes clear that it is only when redistributive policy is restricted to capital taxation that increases in redistribution automatically translate into intertemporal distortions, thereby generating results like Proposition 1. A related conclusion emerges from Bertola's (1993) two-factor model, where labor supply is fixed. He shows that when redistribution takes the form of investment subsidies rather than factor taxation, wealthy agents want less of it than poor ones, as it depresses the value of the existing capital stock. Therefore the poorer the median voter relative to the mean, the *higher* the growth rate. Of course, when labor supply is elastic, redistribution depresses effort and this decline in $l(\tau)$ still lowers the growth rate. Note, however, that the magnitude of this effect is smaller than that of $s(\tau)$ —even with linear disutility of labor, which puts an upper bound on distortions to labor supply.

18. Similar results obtain when labor is less than infinitely elastic, but the formula for aggregate labor supply is now more complicated because agents choose different levels of effort $l^i(\tau)$.

2.7 WHAT OF LAND REFORM AND PUBLIC EDUCATION?

Formalizing the broad idea of a link between distributive conflict and growth is an important contribution of the pure political economy models discussed above (e.g., Bertola, 1993; Alesina and Rodrik, 1994; Persson and Tabellini 1994). The specific mechanism on which they focus, however, appears somewhat at odds with some of the motivating issues and evidence. For instance, when interpreting their empirical results, Alesina and Rodrik (1994) refer to the idea that land reform was an important factor in the growth performance of Japan, Korea, and other Asian countries, especially when compared to Latin America. Similar claims are often made concerning the role of public investment in primary and secondary education, which mostly benefits the poor and lower middle class. This means that if Latin American or African countries did not grow as fast as Asian ones it is—among other things—because they failed to redistribute, at least initially (land) and perhaps also along the way (education).¹⁹ Yet the *only* transfers allowed in this class of models are those detrimental to growth. Public schooling and any kind of redistribution affecting people's *ability to invest* simply have no place under complete asset markets. Land reform and similar reallocations of property rights which could reduce future distributional conflict are only envisioned as off-the-equilibrium-path events, in the form of one-time, unanticipated capital levies. But if one-time redistributions are so beneficial, they should occur systematically at high levels of inequality (Brazil and South Africa come to mind). To avoid this time inconsistency one needs to explain what is impeding such transfers, and perhaps why this constraint may be relaxed following a war or major crisis. More generally, countries face a tradeoff between the benefits of redistribution and its incentive or reputation costs; both aspects should be explicitly incorporated into the politico-economic game. This is the task to which I now turn.

For redistribution to potentially have any growth benefit, in addition to costs, it must of course take place before investment is completed. But altering the timing of transfers is not sufficient: the reader will easily verify that none of the earlier results change if the government redistributes investment expenditures (or capital itself but prior to production) according to the scheme

$$\hat{k}^i = (k^i)^{1-\tau}(\bar{k})^\tau, \quad (3')$$

19. In 1945 the adult literacy rate in South Korea was only 22%; thirty years later, it was over 90%.

where \bar{k} is defined by the budget constraint

$$\int_0^1 (k^i)^{1-\tau} (\bar{k})^\tau di = \int_0^1 k^i di \quad (4')$$

and second-period income is left untaxed: $\hat{y}^i = y^i = r(k^i)^\beta (w)^{1-\beta}$. This policy corresponds for instance to a land reform (redistributing plots of size k^i), but one which is anticipated by agents. Equivalently, one can think of redistributing education budgets across rich and poor school districts, as done implicitly in countries which have a national system of education finance, and explicitly in an increasing number of U.S. states in response to constitutional court mandates. Finally, if one thinks of physical capital, redistributing investment expenditures is equivalent to taxing large investments and subsidizing small ones: agents investing k^i face a price $p(k^i) = (k^i/\bar{k})^{\tau(1-\tau)}$.²⁰ But whatever the context may be, as long as agents are not liquidity-constrained, such redistributions—or the threat thereof—can only distort first-best investment decisions.

3. Growth and Political Economy with Imperfect Asset Markets

3.1 DIRECT EFFECTS OF INEQUALITY AND REDISTRIBUTION

Let me now consider the very same model as above, but with missing credit markets: agents have no possibility of borrowing from one another, for instance due to a severe moral hazard problem (there is no way to enforce repayment). Later on I shall relate the model to others which make credit frictions explicit. I naturally focus on the case where redistribution occurs in time to affect the resources available for investment, namely (3')–(4'). With no access to a loan market, agent i 's optimization problem is the same as (5) before, except that b^i is now constrained to zero:

$$\max_k (\ln(w^i - k^i) + \rho \ln\{r[(k^i)^{1-\tau} (\bar{k})^\tau]^\beta w^{1-\beta}\}). \quad (5')$$

The optimal investment is therefore

20. It might seem more natural to simply tax first-period wealth w^i . But since it is here exogenously determined for each generation, this would be equivalent to an unanticipated capital levy. Formalizing redistribution as affecting investment expenditures enables me to capture its disincentive effects while simultaneously allowing it to occur in time to affect potential liquidity constraints. Straightforward income taxation with dynastic or infinite-lived agents leads to very similar expressions (Bénabou, 1995).

$$k^i = \frac{\rho\beta(1 - \tau)w^i}{1 + \rho\beta(1 - \tau)} = s(\tau)w^i. \quad (18)$$

Whereas everyone previously invested a fraction s of *aggregate* income, they now invest that same fraction of their *own* income. The government's balanced-budget condition (4') then defines \tilde{k} to be $\tilde{k} = s\tilde{w}$, with

$$(\tilde{w}/w)^\tau \equiv w^{1-\tau} E[(w^i)^{1-\tau}]. \quad (19)$$

This yields the second-period income for agent i :

$$y^i = rs^\beta (w^i)^{\beta(1-\tau)} \tilde{w}^{\beta\tau} w^{1-\beta}. \quad (20)$$

Summing over all agents, the growth rate of aggregate income is given by

$$g(\tau) \equiv \ln \frac{y}{w} = \ln r + \beta \ln s(\tau) - \ln \frac{(E[(w^i)^{1-\tau}])^\beta}{E[(w^i)^{\beta(1-\tau)}]}, \quad (21)$$

where τ is the tax rate chosen by the current generation. With dynamic linkages still specified as in Section 2.2, this is also the intergenerational growth rate: $g(\tau) = \ln(w_{t+1}/w_t) = \ln(y_t/y_{t-1})$. The first two terms represent the growth rate with frictionless loan markets, derived in (9). The last term is negative for $\beta < 1$ due to Jensen's inequality, and vanishes for $\beta = 1$. A more unequal distribution of resources, in the usual sense of a mean-preserving spread in w^i , tends to increase this loss and thereby slow down growth. A particularly simple expression obtains when endowments are lognormally distributed, $\ln w^i \sim N(m, \Delta^2)$, which I will assume from now on:

$$g(\tau) = \ln r + \beta \ln s(\tau) - \beta(1 - \beta)(1 - \tau)^2 \Delta^2 / 2. \quad (22)$$

The intuition is straightforward. With $\beta < 1$ individuals face decreasing returns to investment. Reallocating funds from rich to poor relaxes the latter's credit constraints, allowing them to earn a higher return. Because the government is in no better position than potential financial intermediaries to monitor borrowers and ensure that they repay, this more efficient allocation of investment can only be achieved together with a net transfer to the poor. This in turn depresses savings incentives, as in the case of perfect capital markets. The same two effects are present when

evaluating intertemporal efficiency: the objective function of a planner with no distributional concern now equals

$$W(\tau) \equiv \text{Inc} + \rho \ln d = V(\tau) - \rho\beta(1 - \beta)(1 - \tau)^2 \Delta^2 / 2, \quad (23)$$

where $V(\tau)$ corresponds to the complete-markets case.

PROPOSITION 4

1. *Under any given policy τ , inequality reduces growth and intertemporal efficiency. This loss decreases with the extent of pre-investment redistribution.*
2. *Growth is hill-shaped with respect to redistribution, and the growth-maximizing tax rate increases with inequality.*

These results are related to those of Galor and Zeira (1993), Banerjee and Newman (1993), Perotti (1993), or Aghion and Bolton (1997) but with some differences. In those models the effects of inequality and redistribution on growth depend critically on the initial distribution of wealth. This is because investment involves a minimum project size, generating a threshold level of wealth below which agents do not invest, or do not leave enough to their offspring for them to invest. Increasing growth means maximizing the number of people above this threshold, and in the early stages of development this may require concentrating resources on a lucky few or on some emerging middle class. This nonconvexity was originally seen as a key ingredient in models with explicit credit rationing, especially in generating multiple long-run equilibria (poverty traps).²¹ To demonstrate that multiplicity can arise solely through the feedback from distribution to factor prices (see Section 3.6), Piketty (1997) does away with indivisibility by simply augmenting a standard Solow model with moral hazard. His neoclassical, concave technology again implies that inequality is always harmful and redistribution towards the poor beneficial—abstracting of course from incentive effects, which he does. Thus Piketty's model, incorporating the microfoundations underlying the rationing of credit, validates the similar result obtained by simply closing down the loans market, as I have done here following Loury (1981), Tamura (1991), and Bénabou (1996a).

21. Another potential appeal is its ability to generate Kuznets-type dynamics, as the range of increasing returns initially causes some measures of inequality to increase. Eventually, inequality decreases as aggregate growth pulls everyone out of the poverty trap through a decline in the scarcity of capital (Aghion and Bolton, 1997) or through positive spillovers from the better-educated segments of society (Galor and Tsiddon, 1993).

3.2 EMPIRICAL EVIDENCE

Because asset market incompleteness is difficult to measure, there has been very little direct testing of its implications for growth and distribution.²² Columns (7) and (8) in Table 2 show the results from Perotti (1994), who uses the loan-to-value ratio for mortgages as an indicator of credit availability and finds it to affect the investment rate positively and significantly. Moreover, this effect is stronger where the share of the bottom two quintiles is lower (that coefficient is significant only at the 10% level). Similarly, the negative effect of inequality on investment rises with credit frictions, as predicted by the model.

Evidence of a more indirect nature can also be considered. For instance, if liquidity constraints are impeding investment by the poor or lower middle class, *any* form of progressive transfer will contribute to relaxing them. By contrast, government consumption will not, except perhaps for civil servants. If anything, the taxes needed to finance it will aggravate wealth constraints. This differential effect is remarkably consistent with the empirical evidence discussed earlier: the estimated contribution of transfers to growth is generally positive, that of government consumption generally negative. The effects of public education expenditures also deserve attention. Column (5) of Table 2 shows that these generally promote growth. In the absence of credit constraints, increases in public spending on education would be offset by decreases in private spending (unless the two are complements), and therefore would not contribute to growth. To the extent that they require higher levels of distortionary taxation they would even have a negative effect, as in Becker and Tomes (1979).²³

The development literature also provides some valuable evidence, even if it does not directly relate to aggregate growth. First, it appears to

22. There is of course an empirical literature linking financial development and growth, but it does not directly connect to the personal or functional distribution of income and the consequences of redistributive policies, which represent our main concerns. More closely related is the literature devoted to credit constraints on the investment of small firms, e.g., Bernanke and Gertler (1989).
23. An interesting issue is the degree to which government transfers are actually progressive. Alesina (1995) shows that a significant fraction of health and especially education expenditures is often captured by the middle 40%, with even the top 20% appropriating a large share in some Latin American countries. The size of transfers is thus not as good an indicator of social equity as might appear. With respect to growth, however, these observations are not inconsistent with the idea that redistribution tends to relax wealth constraints on investment. First, even Alesina's data suggest that a significant amount of resources generally reaches the bottom 40%. Moreover, the key issue is what segment of the population has the highest marginal return on investment; in a poor country this could include parts of the middle class, as observed earlier when discussing the effects of fixed costs. Naturally, institutional reforms which could minimize transfers to the truly well off would always be beneficial.

be a robust finding that credit rationing and the lack of adequate insurance significantly constrain the investments of poor farmers away from profit-maximizing levels and compositions. See for instance Rosenzweig and Wolpin (1993), or the comprehensive surveys by Binswanger and Deininger (1995) and Binswanger and Rosenzweig (1995). Informal risk-sharing and consumption-smoothing arrangements play an important role but are only limited substitutes for well-functioning markets (Townsend, 1995). This literature also provides evidence of the decreasing returns which are central to the resulting inefficiency: whether in developing or developed countries, the family farm is usually the most efficient unit of production. Inadequate access by peasants to credit for buying land, agricultural inputs, or equipment is one of the main causes of concentration in land ownership; others are the favorable tax treatment of agricultural income and various subsidies which benefit wealthy farmers most. Diminishing returns also occur in education, according to empirical estimates of the private and social returns to primary, secondary, and tertiary schooling (e.g., Psacharopoulos, 1993).

3.3 POLITICAL ECONOMY WITH MISSING ASSET MARKETS

Let us now examine how inequality affects the efficient and equilibrium amounts of redistribution and the corresponding growth rates, by studying the interactions of political economy and imperfect asset markets. I continue to focus on the case where first-period endowments are lognormal and to omit time subscripts. Using (20), individual i 's welfare is equal to:

$$U^i(\tau) = V(\tau) - [1 + \rho\beta(1 - \tau)^2]\Delta^2/2 + [1 + \rho\beta(1 - \tau)](\ln w^i - m). \quad (24)$$

It can be shown that U^i is strictly concave over all $\tau \geq \underline{\tau}$, where $\underline{\tau} = -(1 + 1/\rho\beta)^{1/2} < -1$ was taken to be the most regressive tax feasible. Except for the richest individuals who prefer the corner solution ($\tau^i = \underline{\tau}$ for $\ln w^i - m > (\rho\beta)^{-1}V'(\underline{\tau}) + (1 - \underline{\tau})\Delta^2 > 2\Delta^2$), each agent's ideal tax rate τ^i is then given by the first-order condition $U^{i'}(\tau) = 0$; it decreases with own income $\ln w^i$ and increases with inequality Δ . Agents richer than $\ln w^i = m + \Delta^2 = \ln w + \Delta^2/2$ favor regressive taxes, while all others, including the individual with the average endowment w , desire progressivity. To compare these private optima with the social one, let us next rewrite:

$$U^i(\tau) = W(\tau) - \rho\beta^2(1 - \tau)^2\Delta^2/2 + [1 + \rho\beta(1 - \tau)](\ln w^i - m). \quad (25)$$

This leads to the following results.

PROPOSITION 5

1. A social planner concerned only with intertemporal efficiency W would set a positive tax rate $\tau^p(\Delta)$, increasing in Δ .
2. The preferred tax rate of the agent with median wealth is above this efficient level.
3. The preferred tax rate of the agent with average wealth is below the efficient level if $(1 - \beta)\Delta^2/4\beta > (2\beta - 1)/(2 + \rho)$, and above in the reverse case.

The first result is intuitive, given that redistribution now has not only efficiency costs through $s(\tau)$ but also efficiency benefits, proportional to Δ^2 . The second one has a familiar ring, although it should be noted that the median voter's preferred policy now maximizes ex ante or aggregate welfare, $E_w[U^i(\tau)]$. Most striking is the third result. In the previous class of models, the agent with average wealth always chose the efficient policy. Now there are two opposite forces which make him "unrepresentative." The first is the *progressivity* of the tax scheme, whereby for $\tau > 0$ all those below $\bar{w} > w$ gain at the expense of those above. Previously, redistribution was a threat which discouraged savings but did not materialize in equilibrium, as everyone invested the same amount. With liquidity constraints investments reflect wealth levels, allowing the average individual to join in "soaking" the very rich (differential productivities would yield a similar result). The opposite effect, which tends to make him choose too little redistribution, is his *failure to internalize* the social losses from liquidity constraints, which are proportional to $(1 - \beta)\Delta^2$. As seen in (10), the missing credit market does not affect him at all, because he does not want to borrow or lend. In this sense he is the *least representative* of all agents, as both richer and especially poorer ones are affected. When $(1 - \beta)\Delta^2$ is large enough or simply when $\beta < \frac{1}{2}$, this effect dominates the progressivity bias and the average agent chooses an inefficiently low tax rate, possibly even less efficient than that of the median voter.²⁴ Democracy has its virtues, after all.

To explore in more detail the effects of political institutions and inequality on redistribution, let the pivotal agent or group correspond once again to the p th percentile, with $p = \Phi(\lambda)$. Substituting $\ln w^i = m + \lambda\Delta$ into (24) and setting $U''(\tau) = 0$ leads to the following results:

PROPOSITION 6

1. Growth and intertemporal efficiency are hill-shaped with respect to the degree of wealth bias in the political system, λ . They are maximized at $\lambda_G > \lambda_W > 0$.
24. If $\beta < \frac{1}{4}$, this is always the case for Δ small enough; see the proof of Proposition 5.

2. *If the pivotal agent is at or below the median ($\lambda \leq 0$), taxes increase with inequality; such increases are always inefficient and reduce growth.*
3. *If the pivotal agent is of higher rank than the median ($\lambda > 0$), taxes are U-shaped with respect to inequality. Tax cuts induced by rising inequality are always inefficient and can also reduce growth if β is not too close to 1. Tax increases induced by rising inequality have the opposite effects up to some point, beyond which their contribution to intertemporal efficiency and growth becomes negative.*

The first result provides a potential explanation for Barro's (1996) finding that growth is maximized at some intermediate level of democracy, and more generally for the absence of any monotonic relationship between the two. See Table 2, column 2, with the usual caveat about measuring $|\lambda|$ rather than λ . Note that asset market incompleteness and tax distortions are both critical for this nonlinear effect of the political system on the growth rate. In models such as those of Alesina and Rodrik (1994) or Bertola (1993), the presence of public investment or spillovers does not change the fact that restricting the political rights of the poor always increases growth, as explained following Proposition 2. A polar opposite is Saint-Paul and Verdier's (1993) model where nondistortionary taxes are used to finance public education, supplementing wealth-constrained private expenditures. As a result, growth increases monotonically with redistribution, and therefore with $-\lambda$. The model presented here can be seen as combining both forces, resulting in an interior solution for the growth-maximizing political system.

As far as equilibrium taxes and welfare are concerned, results (2) and (3) also apply in the complete-markets case.²⁵ The difference is only one of degree: because the optimal level of τ now increases with Δ , inequality-induced tax increases are now less inefficient and tax decreases more inefficient. With respect to *growth*, however, the losses from credit constraints lead to a new and potentially important explanation for its negative correlation with inequality: Proposition 6 shows that more inequality can lead to *less* redistribution, which in turn leads to *less* growth (see also Bénabou, 1995).

3.4 DIRECT AND INDIRECT EFFECTS OF INEQUALITY

We saw earlier that for a given policy τ , inequality reduces growth and intertemporal efficiency. Does this remain true when policy responds

25. This can be shown directly using (13) and (14), or one can simply set $\beta = 1$ in (25), in which case credit constraints entail no efficiency loss. Both the complete and missing markets cases accord with the claim in Bénabou (1995) that it is when redistribution is ex ante efficient that the standard effect $\partial\tau/\partial\Delta > 0$ can be reversed. In that model such a reversal can occur with progressive taxes, $\tau > 0$.

endogenously? A straightforward application of the envelope theorem to (23) shows that such is the case when redistribution is determined by an efficient planner, i.e. $\tau = \tau^p(\Delta) \equiv \operatorname{argmax}\{W\}$. The more interesting case is when it arises through the political process. Let $\tau^*(\Delta, \lambda)$ denote this solution to the first-order condition $U''(\tau) = 0$ of the pivotal group:

$$(\rho\beta)^{-1}V'(\tau) + (1 - \tau)\Delta^2 - \lambda\Delta = 0. \tag{26}$$

We can write

$$\frac{dg}{d\Delta} = \frac{\partial g}{\partial \Delta} + \left(\frac{\partial g}{\partial \tau} \right)_{\tau=\tau^*} \left(\frac{\partial \tau^*}{\partial \Delta} \right),$$

and similarly for W . The first term in this expression, which holds policy fixed, is always negative, while the last two were analyzed in Proposition 6. In a pure democracy or a populist system ($\lambda \leq 0$) taxes increases with inequality; moreover, the equilibrium rate is always above τ^p and hence in the range where W and *a fortiori* g decline with redistribution. With positive wealth bias, on the other hand, taxes are U-shaped with respect to inequality. Lower taxes have a positive effect on savings incentives but a detrimental one on credit constraints. Whether growth rises or falls thus depends on the extent to which agents face decreasing returns and have unequal resources. The effects on W are similar, except that since it puts positive weight on first-period consumption, it does not “overvalue” low taxes as g does. In particular, Proposition 6 established that where rising inequality leads to tax cuts, these are never efficient.

PROPOSITION 7

1. If the pivotal agent is at or below the median ($\lambda \leq 0$), inequality reduces both growth and intertemporal efficiency.
2. If the pivotal agent is of higher rank than the median ($\lambda > 0$), inequality still lowers W as long as β is not too large. For β close to 1 inequality may increase intertemporal efficiency, but this can only occur through an increase in redistribution.
3. For $\lambda > 0$ inequality reduces growth if Δ is not too small and β not too close to 1. In the opposite case, inequality increases growth through a decline in tax rates.

While the direct effect of inequality on growth (through wealth constraints) often dominates, its interaction with the indirect one (policy response) can generate a fairly complex relationship between these vari-

ables. Sorting out the two channels through a structural model should nonetheless be possible, and even appears desirable. Particularly interesting is the third result, which calls attention to the fact that if political power is sufficiently correlated with financial or human wealth and if capital market imperfections are not too severe, greater inequality may actually increase growth through a decline in redistribution. A similar insight will arise from the model of social conflict discussed in Section 4: what matters for sociopolitical stability (which promotes growth) is not income inequality per se, but the inequality of income relative to the inequality of political power. Where institutions or the political technology are such that increases in the former translate into increases in the latter, instability (or here, taxation) need not rise, and may actually fall.

3.5 ENDOGENOUS INCOME DISTRIBUTIONS AND SOCIAL MOBILITY

Up to this point I have maintained a feature inherited from the complete-markets models discussed in Section 2: even though it plays a critical role, the pretax distribution of endowments is completely exogenous. In Persson and Tabellini (1994), as here, it simply reflects, period after period, the fixed distribution of agents' abilities. In Bertola (1993) and Alesina and Rodrik (1994) the distribution of wealth is indeterminate: the constancy of factor prices combines with the absence of idiosyncratic uncertainty to ensure that any initial distribution will reproduce itself from one period to the next. By contrast, the endogenous evolution of the wealth distribution is at the core of incomplete-markets models. This includes those which focus on the decentralized market outcome (Banerjee and Newman, 1993; Galor and Zeira, 1993; Aghion and Bolton, 1997; Piketty, 1997), those which analyze potential redistributive policies (Loury, 1981; Glomm and Ravikumar, 1992; Bénabou, 1996a; Fernandez and Rogerson, 1994), and those which endogenize redistribution as a political outcome (Perotti, 1993; Saint-Paul and Verdier, 1993; Verdier and Ades, 1993; Saint-Paul, 1994; Bénabou, 1995). Making these distributional dynamics explicit is also necessary to address the issue of *social mobility*, in the line of Becker and Tomes (1979). The intergenerational persistence of income and wealth disparities is at least as relevant a social concern as the level of inequality per se. The question of how policy affects persistence, both in theory and in practice, is therefore of considerable interest.

The model developed in this paper is easily amended to deal with these issues. Until now it was assumed that intergenerational linkages operated only at the aggregate level. Whether through an economy-wide spillover or through universal public education, they resulted in a transmission mechanism of the form $w_{i,t+1}^i = \epsilon_{i,t+1}^i y_t$. Let me now recognize that

the transmission of human capital operates largely within the family or at the level of small communities which are fairly homogenous in socio-economic status: school districts, neighborhoods, social networks, etc. Consider first the pure human-capital spillover interpretation, under which $w_{t+1}^i = \epsilon_{t+1}^i y_t^i$ is simply replaced by

$$w_{t+1}^i = \epsilon_{t+1}^i y_t^i. \tag{8''}$$

With perfect capital markets this changes nothing, because $y_t^i = r(s_i)^\beta w_t^i$ for all agents. Family income remains i.i.d., with variance $\Delta^2 = \text{Var}[\ln \epsilon] \equiv \sigma^2$. With imperfect capital markets, on the other hand, equation (20) now implies that family income follows the law of motion

$$\ln w_{t+1}^i = \ln \epsilon_{t+1}^i + \ln r + \beta \ln s(\tau_t) + \beta(1 - \tau_t) \ln w_t^i + \beta \tau_t \ln \bar{w}_t + (1 - \beta) \ln w_t^i, \tag{27}$$

where τ_t is the tax rate chosen in period t , and \bar{w}_t is given by (19). Income remains lognormally distributed, and its intergenerational persistence is given by $\beta(1 - \tau_t)$. As a result, inequality follows the autoregressive process

$$\Delta_{t+1}^2 = \sigma^2 + \beta^2(1 - \tau_t)^2 \Delta_t^2. \tag{28}$$

The alternative mechanism of intergenerational transmission is educational investment, now privately or locally funded. With the preferences (1'), agents all want to invest the same fraction $1 - \gamma$ of second-period resources in their child's human capital. Therefore $w_{t+1}^i = \epsilon_{t+1}^i d_t^i$, where the constant has again been normalized to one. In the absence of credit markets, $d_t^i = y_t^i$, so (27) and (28) remain unchanged. Complete markets lead to somewhat different individual dynamics, but these retain the property that redistribution reduces the persistence of w_t^i . From here on I shall focus on the first case, since it has implications for aggregate growth whereas the second one does not. Recall in particular that

$$g(\tau_t) = \ln r + \beta \ln s(\tau_t) - \beta(1 - \beta)(1 - \tau_t)^2 \Delta_t^2 / 2.$$

Together with (28) this makes clear that once the dynamics of income distribution are endogenized, an additional, *long-run* benefit of redistribution appears. A marginal rise in τ_t causes the same distortion $s'(\tau_t)$ as before, but now the growth losses due to the combination of wealth inequality and borrowing constraints are reduced not only in the current period [$(1 - \tau_t)^2 \Delta_t^2 / 2$ is lower], but also in all future periods: Δ_{t+k}^2 is lower

for all k . This homogenizing effect means that long-run growth is maximized at a higher level of redistribution than previously.²⁶ This, in turn, requires a lower degree of wealth bias λ in the political system, which must therefore be closer to pure democracy.

This brings me to the question of the long-run behavior of the economy and its income distribution, which I will discuss both theoretically and empirically. As before, let taxes be determined in each generation by the preferred policy of the pivotal group: $\tau_t = \tau^*(\Delta_t, \lambda)$, defined by (26). Together, τ_t and Δ_t then determine next period's distribution, according to (28). Recall now from Proposition 7 that when $\lambda \leq 0$, $\tau^*(\Delta_t, \lambda)$ is increasing in Δ_t , so that endogenous redistribution acts as a stabilizing feedback on inequality.

PROPOSITION 8 *If the median voter or some agent located at a lower percentile chooses the tax rate in every period ($\lambda \leq 0$), the economy converges to a unique steady-state growth path $(\tau_\infty, \Delta_\infty, g_\infty)$ where $\tau_\infty = \tau^*(\lambda, \Delta_\infty)$, $\Delta_\infty^2 = \sigma^2/[1 - \beta^2(1 - \tau_\infty)^2]$, and the growth rate is*

$$g_\infty = \ln r + \beta \ln(\tau_\infty) - \frac{\beta(1 - \beta)(1 - \tau_\infty)^2 \sigma^2 / 2}{1 - \beta^2(1 - \tau_\infty)^2}. \quad (29)$$

As one would expect, a stronger populist bias shifts this steady state towards greater redistribution and less inequality.

3.6 MULTIPLE LONG-RUN DISTRIBUTIONS

With any positive influence of wealth on the political process, on the other hand, taxes initially decrease with higher inequality Δ_t , before increasing again. By (28) this tends to increase Δ_{t+1} , hence also τ_{t+1} , and so on. The feedback from policy to intergenerational dynamics is now potentially destabilizing.

PROPOSITION 9 *If the pivotal agent is of higher rank than the median ($\lambda > 0$), there can be multiple steady states. In that case, intertemporal efficiency W increases as one moves from a less redistributive, more inegalitarian steady state to one where τ_∞ is higher and Δ_∞ lower. This is a fortiori true for ex ante welfare $E_w[U^i]$, and may also be true for the growth rate g_∞ .*

Proposition 9 and equation (27) on which it is based illustrate more generally the common principle through which multiple long-run distri-

26. Agents' myopic preferences (1) or (1') imply that they do not internalize this variance effect when setting the current tax rate, just as they do not internalize the mean effect of y_t on w_{t+1} . With forward-looking altruism or infinite lives, both are internalized to an extent which reflects the discount factor; see Bénabou (1996a).

butions arise in models with imperfect capital markets: a negative general equilibrium *feedback of inequality on mobility*, via a worsening of credit constraints.²⁷ In Banerjee and Newman (1993) this feedback operates through the real wage. A more unequal distribution of wealth means more people who do not have the collateral required to become either self-employed entrepreneurs or employers of labor. Instead they become workers, collectively depressing the wage and therefore the bequest which they leave to their children. Conversely, wealthy dynasties benefit from paying lower wages. This makes for low social mobility and persistently high inequality. Building on Aghion and Bolton (1996), Piketty (1996) generates a related form of “mobility trap” through the interest rate. When wealth is scarce and distributed very unequally, there are few lenders, many would-be borrowers, and interest rates are very high. High interest rates, in turn, aggravate poor agents’ borrowing constraints and make mobility more difficult. Thus both low total wealth and high dispersion persist into the next period. Across steady states, aggregate income and wealth vary negatively with the interest rate. In the present model, as in Saint-Paul (1994) and Bénabou (1995), the feedback is through policy; taxes and transfers or public funding of education serve as imperfect substitutes for the missing credit market. When greater inequality leads to lower redistribution, this again reduces mobility and makes disparities more persistent, by worsening the credit constraints of poor agents. This is why transfers and growth can be positively correlated across steady states in spite of savings distortions, as stated in Proposition 9. A related form of multiplicity occurs through segregation in models of endogenous community composition. In Durlauf (1996b), for instance, sufficient disparities in wealth and/or education cause well-off families to form small homogeneous communities rather than share the fixed costs with a larger, more heterogeneous population. Cut off from the tax base and positive local spillovers which richer, more educated neighbors would have provided, poor families again experience no or little upward mobility.²⁸

Are countries all headed towards the same long-run distribution of income, as in Proposition 8, or are there permanently different trajec-

27. Multiple equilibria can also arise from a nonconvexity at the level of individual families, as in Galor and Zeira (1993). With enough idiosyncratic uncertainty, however, a poor family escapes the poverty (no investment) threshold with positive probability; the wealth process is then ergodic and the long-run distribution unique.
28. See also Bénabou (1993, 1996b), Durlauf (1996a), and Fernandez and Rogerson (1996, 1994) for related sorting effects, as well as Kremer and Maskin (1994) on segregation by skills in the labor market. In the latter case, when segregation occurs it is always efficient. But if one combined this production model with credit-constrained accumulation of human capital, multiplicity could occur once again.

ries in terms of both level and inequality, as in Proposition 9? I shall argue in Section 5 that this issue of convergence in distribution is of even broader interest and merits to be investigated empirically, then take the first few steps in that direction. But first I turn to the last of the three main theories linking distribution and growth.

4. *Social Conflict and Property Rights*

In the median-voter model (at least when taken literally), expropriation occurs through an orderly process: votes are counted, then everyone submits to the majority rule. At the other extreme are models where agents or interest groups can simply grab part of someone else's wealth. It is generally presumed that this becomes more likely when the gap between rich and poor widens, and that the resulting decline in the security of property rights discourages investment, thereby impeding growth.

A number of related ideas have been formalized in the literature. Grossman (1991, 1994), Acemoglu (1995), and Grossman and Kim (1996) focus on the allocation of resources between productive, predatory, and defensive activities in the context of one-shot interactions between individuals or economic classes. Using "dynamic commons problem" games with either Markovian or trigger-type strategies, Tornell and Velasco (1992), Tornell (1993), and Benhabib and Rustichini (1996) study how growth is affected by distributional conflict between long-lasting interest groups or coalitions. The first two papers emphasize the role and sources of interest groups' ability to opportunistically extract rents from others; they do not directly deal with inequality. Benhabib and Rustichini (1996) show how the extent to which social conflict constrains growth may depend on the economy's level of development, as well as on a form of inequality which relates to equilibrium selection rather than initial conditions: among the continuum of subgame-perfect equilibria of their model, the one with fastest growth involves equal utility for all players.

I shall seek here to convey the essence of this literature and make some new points by means of a much simpler model, which relates the underlying structure of the problem to a familiar object: the prisoner's dilemma. The model has close links to that of Benhabib and Rustichini (1996) but also incorporates ingredients from several of the others.

4.1 A PRISONER'S DILEMMA WITH CAPITAL ACCUMULATION

Consider an economy constituted by two homogeneous groups of agents, labeled 1 and 2; allowing for n groups would be straightforward.

In period t each can choose to either moderate its claims to the economic pie (“cooperate”) or try and extract a disproportionate amount, at the expense of the other group (“deviate”). Formally, let k_t be the economy’s capital stock at the start of the period. The consumptions of groups 1 and 2 are given by the following shares of k_t :

$1 \setminus 2$	C	D
C	$\alpha_1(1 - s), \alpha_2(1 - s)$	$\alpha_1(1 - s) - (\beta_2 - \delta_2)s, \alpha_2(1 - s) + \beta_2s$
D	$\alpha_1(1 - s) + \beta_1s, \alpha_2(1 - s) - (\beta_1 - \delta_1)s$	γ_1, γ_2

When both sides cooperate, a total of $c_t = (1 - s)k_t$ is consumed, while sk_t is reinvested according to the linear technology:

$$k_{t+1} = r(k_t - c_t). \tag{30}$$

The parameters $\alpha_1 \leq \alpha_2 = 1 - \alpha_1$ capture the distribution of income in the nonconflictual outcome, which can be thought of as the market solution. They could for instance reflect the competitive shares of capital and labor. In the single-period game, however, (C, C) is never a Nash equilibrium: by deviating, group i can appropriate an extra share of the pie, equal to a fraction $0 < \beta_i \leq 1$ of the resources sk_t which would otherwise have been reinvested. Of this opportunistic gain, a fraction $0 < \delta_i \leq \beta_i$ comes from raiding the capital stock and $\beta_i - \delta_i$ is at the direct expense of the other group’s consumption. Following most of the literature, it is assumed that transfers or rents unilaterally extracted from the rest of society can only be consumed.²⁹ The underlying motivation is that otherwise they could be seized back by the opposite side. That consumption is less vulnerable to expropriation than investment does not mean that it is entirely safe, however. The possibility of indirect taxes and subsidies, import levies, or outright theft implies that not all of the deviator’s gain need come from investment, as is often assumed in the literature; β_i and

29. Or alternatively, reinvested in some asset with a lower return, such as deposits abroad; see Tornell and Velasco (1992). One could also introduce into the model direct or opportunity costs of engaging in expropriation, by making noncooperative payoffs sum to less than $(1 - s)k_t + \delta_i sk_t$. Thus deviator i ’s private gain (net of resources spent on expropriation) $\beta_i sk_t$, could be strictly less than the sum of the other side’s (net) consumption loss, say $\phi_i sk_t$, and the reduction in investment, $\delta_i sk_t$. For simplicity I shall not do so, thus imposing $\beta_i = \phi_i + \delta_i$. All costs and payoffs in the stage game are of course specified exogenously; to endogenize them would require modeling agents’ resource allocation problems between productive, offensive, and defensive activities, as in Grossman (1991, 1994) and Grossman and Kim (1996). Using these papers’ terminology, the β_i ’s reflect the private efficacy of the predation technology and the δ_i ’s (more generally, the δ_i ’s and the $\delta_i + \phi_i - \beta_i$ ’s) its social or aggregate “destructiveness.”

δ_i are conceptually distinct, and will be seen below to have different implications.

On net, a unilateral deviation by some group i reduces the capital stock by a factor $1 - \delta_i$. In a situation of open conflict where both groups try to appropriate resources from each other, they will be led to overconsume even more: for simplicity I assume that under (D, D) all capital is consumed, $\gamma_1 + \gamma_2 = 1$, but this is not essential for the nature of the results. The shares γ_i represent each side's strength in the political struggle, that is, its *power*. They could be related to the α_i 's and β_i 's, as discussed later on, but in general need not be.³⁰

Let me assume from here on that $\alpha_i(1 - s) - (\beta_{-i} - \delta_{-i})s < \gamma_i$ for all i , which implies that the unique equilibrium of the one-shot game is (D, D) . Consider, however, agents who are infinite-lived, with preferences

$$U_i^i = \sum_{s=0}^{\infty} \rho^s (c_{i+s}^i)^{1-a},$$

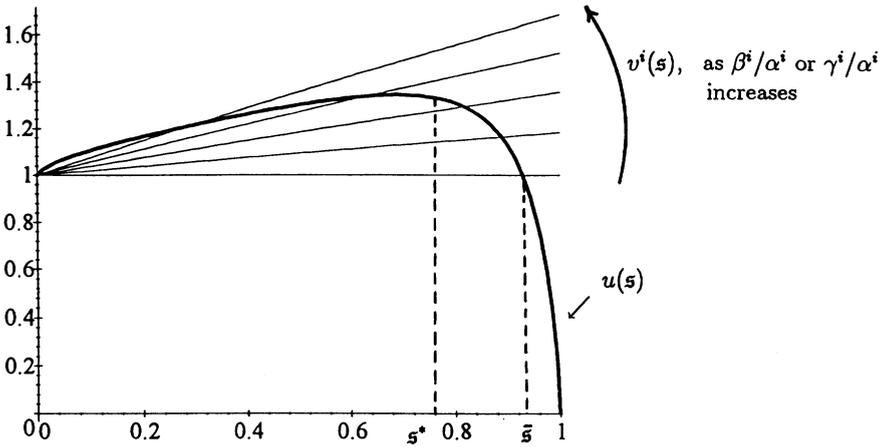
where $1/a > 1$ is the intertemporal elasticity of substitution and $\rho r^{1-a} < 1$. In each period they play the game described by the above payoffs. The capital stock k_t constitutes a state variable which makes this a dynamic game, rather than simply a repeated one. I begin by focusing on the "first-best" case where there is only one group, or equivalently a central planner who can carry out lump-sum transfers. Starting with $k_0 = k$, playing (C, C) in every period yields the intertemporal utility $U = u(s)k^{1-a}$, where

$$u(s) \equiv \frac{(1-s)^{1-a}}{1 - \rho(rs)^{1-a}}. \quad (31)$$

The resulting *growth rate* is constant and equal to rs . This strategy is preferable to (D, D) , where the entire capital stock is consumed immediately, if $u(s) > u(0) = 1$. As depicted on Figure 1 for the case $r = 3$, $\rho = 0.4$, $a = 0.25$, the function $u(\cdot)$ is strictly concave and maximized at $s^* \equiv \rho^{1/a} r^{1/a - 1}$. This is the value which the planner would choose if he could select the savings rate continuously. One could let $s = s^*$, but more generally I will simply require that s belong to the interval $(\bar{s}, 1)$ over which $u(s) > 1$, so that rs is indeed the better of the two growth rates achievable in our simple economy. The main question is whether it can be sustained as a subgame perfect equilibrium when groups have the

30. For instance, Benhabib and Rustichini (1996) impose a symmetry restriction similar to $\gamma_i = \frac{1}{2}$.

Figure 1 INCENTIVE CONSTRAINTS ON GROWTH



ability to behave opportunistically and extract more than their cooperative share from the common pool of resources.³¹

4.2 INCOME INEQUALITY, POWER INEQUALITY, AND GROWTH

Playing (D, D) in every period is always an equilibrium. This high-conflict, low-growth outcome will naturally serve as the punishment to which players revert whenever someone has deviated from cooperative behavior. These trigger strategies will sustain the first best if, for all i ,

$$(\alpha_i)^{1-a}u(s) \geq [\alpha_i(1 - s) + \beta_i s]^{1-a} + \rho[rs(1 - \delta_i)\gamma_i]^{1-a}.$$

The first term on the right-hand side is group i 's current consumption when it deviates and grabs extra resources equal to a fraction $\beta_i s$ of the capital stock. The second term measures its payoff in the following period where both groups play D , liquidating the capital stock. Rewriting this condition leads to:

PROPOSITION 10 *If the incentive compatibility constraint*

$$u(s) \geq \left(1 - s + \frac{\beta_i}{\alpha_i} s \right)^{1-a} + \rho \left(rs(1 - \delta_i) \frac{\gamma_i}{\alpha_i} \right)^{1-a} \equiv v_i(s) \tag{32}$$

31. Were agents also allowed to consume less than $\alpha_i(1 - s)$, such deviations could be shown to be unprofitable as long as s is not too far below the optimal savings rate s^* (specifically, $\alpha_i f(s) \leq 1$ where $f(s) \equiv (1 - s)(s/s^*)^a / (1 - s(s/s^*)^a)$ is a decreasing function with $f(s^*) = 1$).

is satisfied for both groups, continued cooperation and growth at the rate rs is sustainable as an equilibrium. If it is violated, the only equilibrium is the noncooperative one with no growth.

Several interesting results can now be obtained by examining condition (32), which is illustrated on Figure 1.

1. Incentive compatibility typically holds when s is sufficiently low, and is violated at high enough values.³² This means that there is a *maximum sustainable growth rate* which is constrained by conflict over the distribution of income, as in Benhabib and Rustichini (1996). This maximum growth rate rs_{\max} falls as $\max_i\{\beta_i/\alpha_i\}$ or $\max_i\{\gamma_i/\alpha_i\}$ rises.³³
2. Growth becomes harder to sustain when some (or both) group's ability to expropriate the other through unilateral, opportunistic deviations is *disproportionate* to its "normal" share of the economic pie: for any given s , (32) ceases to hold as β_i/α_i becomes large enough. Consequently, s_{\max} declines.
3. *Income inequality* also limits the economy's growth rate, for a given allocation of power and expropriating ability. For instance if $\beta_1 = \beta_2$ and $\gamma_i = \frac{1}{2}$, the incentive compatibility constraint is binding for the group with the smaller income share, $\alpha_1 < \alpha_2$. Deviations come from the poor, and are more likely the poorer they are. In this case it may be in the interest of the rich to voluntarily transfer wealth to the poor through land reform, education subsidies, a minimum wage, or trade protection: group 2 is better off if its own share α_2 can be permanently reduced to increase α_1 . This scenario, formalized by Grossman (1994, 1995) in a static context, arises here from the desirability of growth.
4. However, it could be the poor who are more vulnerable to expropriation or exploitation; one can think of small peasants versus large landowners. If $\gamma_1/\alpha_1 < \gamma_2/\alpha_2$ while $\beta_1/\alpha_1 = \beta_2/\alpha_2$, for instance, it is the rich's threat to deviate which reduces accumulation. The model thus makes clear that what matters is not inequality in the (equilibrium) distribution of income per se, as often claimed in the literature, but
 32. For instance as s tends to zero, $u(s) \approx 1 + \rho(rs)^{1-a} > 1 + \rho(rs(1 - \delta_i)(\gamma_i/\alpha_i))^{1-a} \approx v_i(s)$ as long as $(1 - \delta_i)(\gamma_i/\alpha_i) < 1$. Conversely, $u(1) = 0 < v_i(1)$ always and $u(\bar{s}) = 1 < v_i(\bar{s})$ whenever $\beta_i/\alpha_i > 1$.
 33. In the simple game described above there are only two sustainable growth rates, the cooperative one rs and zero. But suppose now that there is in fact a continuum of such games, indexed by s , which can be played; all other parameters are invariant. Among values of s for which cooperation can be sustained, both groups will prefer the one with the constrained-optimal growth rate, $s^{**} \equiv \min\{s^*, s_{\max}\}$. They will also be unanimous in preferring the s^{**} game to any other with a single, uncooperative equilibrium if $u(s^{**}) > \max_i\{(\gamma_i/\alpha_i)^{1-a}\}$. If this condition is not satisfied, the Pareto frontier includes both the s^{**} and the zero-growth outcomes.

inequality in the relative *distribution of earning and political power*: since $\alpha_1 + \alpha_2 = \gamma_1 + \gamma_2 = 1$, the minimal value of $\max_i \{\gamma_i / \alpha_i\}$, which maximizes growth, is 1.³⁴ Note also that the important role played by off-the-equilibrium-path payoffs is a potential problem for the empirical implementation of such game-theoretic models. I shall return to it below.

5. The more of the expropriation comes from capital, as opposed to other people's consumption, the easier it is to sustain cooperation: v_i is decreasing in δ_i .

4.3 EMPIRICAL EVIDENCE

The findings from most studies which have examined the links between inequality, conflict over property rights, and growth are summarized in columns (9) and (10) of Table 2. Two broad measures of "instability" or "insecurity" have been considered. The first consists of indices of sociopolitical instability constructed from various combinations of protests, strikes, government turnover, political violence, coups, revolutions, and the like (e.g., Venieris and Gupta, 1986; Londregan and Poole, 1990; Alesina and Perotti, 1996; Alesina et al., 1996; Perotti, 1996). Because of the potentially serious simultaneity problem, most studies estimate a joint model of growth and instability. The other form of "instability" is more directly linked to the issue of property rights. It is measured by various indicators of "country risk" sold by specialized firms to international investors, such as sovereign default risk, expropriation or nationalization risk, rule of law, enforceability of contracts, quality of the bureaucracy, corruption, etc.; see Keefer and Knack (1995), Svensson (1993), or Barro (1996). Column (9) shows that both types of security deteriorate as a result of increased income inequality. In turn, column (10) shows that both greater political turmoil and lower protection of property rights decrease investment and growth. The general idea that inequality exacerbates social conflict, which in turn makes property rights less secure and reduces growth, thus appears well supported by the evidence; indeed, it is eminently plausible. The specific channels through which this occurs, however, remain to be clearly identified. Svensson (1993) finds that when both political-instability and property-rights variables are included in investment regressions, only the latter are significant; on the other hand, greater political stability implies more secure property rights, as does a more equal income distribution. Keefer and Knack (1995) report that

34. Deviations by the rich also occur in Barbosa, Jovanovic and Spiegel (1996), but the context is different. Agents with stochastic endowments enter into an ex ante efficient income sharing agreement. Ex post, they may renege and fight over the appropriation of total resources. Their decisions are based on current payoffs only.

when one controls for initial GDP in the investment equation, political instability becomes insignificant.

I also wrote support for “the general idea” rather than “the models” because the link between the latter and intuitive or empirical notions of political instability is still somewhat incomplete. This can be seen from the representative model presented above. First, note that contrary to common interpretation, *uncertainty* or unpredictability is really *not* part of the story. The mechanism formalized here and in most of the literature is not one where greater inequality leads, through more acute political conflict, to a mean-preserving spread in the return to investment (and even this is known to have an ambiguous effect). It has no up side and thus leads, very much as in the voting models, to a lower mean return due to increased expropriation, or the threat thereof. Second, with perfect information about actions and payoffs, equilibrium is achieved without any “friction” or resource dissipation. Just as there is no reason for delay to occur in a bargaining model with symmetric information, there is no role in these models for strikes, riots, coups, assassinations, etc. Incorporating incomplete information, as for instance in Alesina and Drazen (1991), will generate delays and resource-dissipating struggles along the equilibrium path; but the extent to which these occur will reflect not so much the distribution of income (and power) as the extent of agents’ uncertainty over what this distribution is. Why the two should be related is not obvious. Given imperfect information, resources would be dissipated as well in standard political-economy models: the voter who turns out to be pivotal (say, median) will eventually have his way, but only after costly political campaigns, lobbying, and legislative maneuvers. This will make the two types of model a little more similar yet, as would the incorporation of strategic, dynamic concerns into the voting model: reputation of the pivotal class for fiscal restraint, trigger strategies on the part of the private sector, and so on.

5. *Convergence: On to Second Moments (and Higher)*

Are countries converging to the same level of inequality? This question may seem unusual, and indeed it has not been taken up by the empirical literature. Yet it is important, on several counts. First, ascertaining the facts is in itself of interest. It is common knowledge that Latin American countries tend to be more unequal than European ones, themselves less equal than East-Asian ones. Similarly, the specter of U.S.-style inequality is often used in Europe to justify high levels of

redistribution and minimum wages. But are all these gaps really permanent, or inexorably narrowing?³⁵

Second, it can shed light on the relevance of models with multiple steady states and history dependence of the income distribution. In particular, it provides an indirect test of the joint mechanisms of credit-market incompleteness and negative feedback from inequality to social mobility which underlie these theories, as explained in Section 3.6.

Third, there is now a vast empirical literature examining international convergence in per capita incomes. This variable is after all only the first moment of each country's income distribution. Once augmented with idiosyncratic shocks, most versions of the neoclassical growth model imply *convergence in distribution*: countries with the same fundamentals should tend towards the same invariant distribution of wealth and pretax income.³⁶ Barring unexplained differences in "tastes" for equity or in the distribution of innate abilities, persistent differences in the degree of inequality would conversely indicate the presence of some form of increasing return or complementarity in the economic or politico-economic structure.

Having raised the question of convergence in higher moments, I shall make here a first pass at trying to answer it. Ideally, one would apply to an international panel of inequality measures the same tests which are now standard in the literature on the convergence of first moments: regressing rates of change on initial values, examining whether cross-sectional dispersion falls over time (Barro, 1991; Barro and Sala-i-Martin, 1992), or the more complex tests of Quah (1993) and Durlauf and Johnson (1995). The binding constraint, however, is data: no such panel

35. Looking at the OECD countries in the 1980s, Gottschalk and Smeeding (1995) find no relation between initial levels of inequality and changes in inequality during that decade. If anything, there is some evidence of polarization at the extremes, of the type suggested by Proposition 9. The largest increases occurred in the United Kingdom and the United States, which had the highest initial levels, suggesting that these countries may be converging to a high-inequality steady state. The smallest increases occurred in Italy, France, Portugal, and Denmark; thus Denmark could be converging to a low-inequality steady state. While this exercise provides valuable information, it suffers from being based on a small number of countries, several of which are observed over a very short interval of time.
36. See for instance Banerjee and Newman (1991), Ayagari (1994), Bertola (1995), or the case without credit constraints in Piketty (1997) for examples of this ergodicity property. Some of these models even include credit rationing (agents can borrow less than what they could repay with probability one), but the feedback from the wealth distribution to credit constraints discussed in Section 3.6 is either absent, because the latter are specified exogenously, or else as the economy grows it becomes too weak to generate multiplicity (Aghion and Bolton, 1997). Departing from homothetic preferences by introducing a minimum consumption level as in Chatterjee (1994) could probably lead to history dependence, but the stochastic version of that model still remains to be studied.

Table 3 INEQUALITY ACROSS SEVEN MAIN REGIONS

<i>Decade</i>	<i>Gini (%)</i>	<i>Adj. Gini (%)</i>	<i>Bottom 20%</i>	<i>3rd + 4th Quintiles</i>	<i>Top 20%</i>	<i>(Top 20%)/(bottom 20%)</i>
<i>Mean</i>						
1960s	39.99	41.52	6.18	35.65	47.84	9.03
1970s	39.34	40.92	6.03	36.49	47.24	8.89
1980s	37.47	39.92	6.52	37.56	44.73	8.31
1990s	38.28	41.63	6.43	37.24	45.47	8.46
<i>Standard deviation</i>						
1960s	10.03	10.77	2.17	4.29	8.91	4.52
1970s	10.54	11.23	2.77	3.74	8.76	4.29
1980s	8.33	9.43	1.50	2.97	5.97	3.73
1990s	7.79	9.46	1.58	3.52	6.66	3.82

Regions: Latin America, Sub-Saharan Africa, Middle East and North Africa, East Asia / Pacific, South Asia, OECD and High Income, Eastern Europe.

Source: Computed from Deininger and Squire (1995a, Tables 5-7).

exists over a long enough period. The closest substitute is a new database recently put together by Deininger and Squire (1995a). It significantly expands the coverage of previous datasets, both over time and over countries, to the extent that one can think of it as a panel with (still many) missing cells. I shall also use data for a sample of OECD countries from the Luxembourg Income Study (LIS). It contains far fewer observations, but considerable effort has been devoted to making the numbers comparable across countries.

I start with a bird's-eye view of the issue, by comparing the seven main regions of the world for which Deininger and Squire (1995a) provide summary statistics on inequality: Latin America, Sub-Saharan Africa, Middle East and North Africa, East Asia/Pacific, South Asia, OECD and High Income, and Eastern Europe. For each region they constructed decadal means of various inequality measures, by averaging all available observations from the 1960s to the 1990s. From these numbers I computed both the world average and the cross-regional standard deviation of each inequality measure. These are reported in Table 3.

While these are somewhat crude statistics, they point to some interesting facts.³⁷ For the mean level of inequality in the world, the picture is

37. One would want to weight regions by population or income, for instance. The "adjusted Gini" in the second column of Table 3 refers to an adjustment made by Deininger and Squire (1995a) to observations based on expenditure rather than income surveys.

one of relative stability; some small and gradual improvement is visible until the 1980s, after which the situation starts to deteriorate. Cross-regional variations in inequality, on the other hand, show a clear decline. The coefficient of variation falls by 19% for the Gini coefficients, 30% for the shares of the bottom quintile, 22% for the shares of the third and fourth quintiles, and 37% for the share of the top quintile. Note also that almost all of this “convergence” occurred between the 1970s and 1980s.³⁸

I next went to the full sample and ran simple convergence tests for the Gini coefficients across individual countries, to the extent permitted by the data. I chose the Gini rather than particular shares or share ratios because it was available for more observations, and because it relates more directly to the transition equation (28) in the formal model.³⁹ In the first test I computed for each country the average yearly rate of change in the Gini coefficient between the first and last available observations. I then ran a regression of this variable on a constant and the initial value of the Gini. The results are reported in Table 4, for four samples.

The first sample consists of the 69 countries for which I was able to compute the rate of change.⁴⁰ The second one is perhaps the most reliable: it restricts attention to the 25 countries for which the data are most comparable, having been obtained from similar types of surveys (gross household income). The third one consists of the 19 OECD countries in the full sample. It is complemented by the LIS dataset, where I was able to perform the same regression on 16 countries; the typical time interval is much shorter, however. The results are consistent across the four columns: the negative and generally significant signs indicate mean reversion in inequality. To reduce the chance that these results were due to measurement error on the first observation (which biases the coefficient towards negative values), I ran the regression with the exact same right-hand-side variables but replacing the left-hand side by the average rate of change between the second and last available observations. For the

The former typically bias the Gini coefficient downward. The adjustment consists of adding to the Gini the average size of the bias, which Deininger and Squire compute to be about 6.6% in their dataset.

38. Given that there are only seven observations in each case, the differences in standard deviations or coefficients of variation documented in Table 3 are, unsurprisingly, not statistically significant. In my view this does not make them any less intriguing, especially in the light of the other evidence discussed below.
39. For a lognormal, the Gini is a monotonic function of the variance of logarithms, Δ_l^2 . I also ran many of the regressions with the logarithms of the Ginis instead of the levels. This led to similar results.
40. Restricting the sample to those countries where at least ten years separate the first and last observations leads to throwing out nine data points, with essentially unchanged results.

Table 4 CONVERGENCE TESTS USING GINIS' AVERAGE RATE OF CHANGE

Sample ^a	N	c ^b	Initial Gini ^b	R ²
1	69	0.641 (3.07)	-0.015 (-3.04)	0.061
2	25	0.755 (2.65)	-0.017 (-2.54)	0.262
3	19	1.22 (4.49)	-0.036 (-4.75)	0.480
4	16	2.56 (1.48)	-0.060 (-1.34)	0.050

^aSample 1: Deininger and Squire's dataset (1995a); sample 2: subset of countries using gross household income surveys; sample 3: subset of OECD countries; sample 4: LIS dataset.

^bHeteroskedasticity-consistent *t*-statistics in parenthesis.

first three subsamples the coefficient remained virtually unchanged and statistically significant (*t*-statistics ranged from 1.9 to 3.0). For the LIS dataset, it became positive and insignificant; however, that regression contained only 12 data points (with the trend often computed over dates separated by just a few years) as opposed to between 18 and 62 for Deininger and Squire's dataset.

One problem with this test is that inequality and its rate of change are computed over different periods for different countries. The incompleteness of the dataset does not permit one to run the standard cross-sectional regression over a fixed ten- or twenty-year period. To generate a usable panel it is necessary to interpolate some missing data. This is what I did, using neighboring observations when required to obtain Gini coefficients for 1970, 1980, and 1990. I was then able to run inequality convergence regressions for the periods 1970–1980 (Table 5a, 33 countries), 1980–1990 (Table 5b, 38 countries) and 1970–1990 (Table 5c, 25 countries). The first column presents the basic regression of the change in the Gini on the initial value and a constant. The coefficient is negative and significant at the 5% level for 1970–1980, similar in size but significant only at the 10% level for 1980–1990, and small and insignificant for 1970–1990. One source of concern is that the data from different countries may not be directly comparable. Some numbers come from expenditure surveys, others from income surveys; some pertain to household income, others to personal income; finally, most concern gross income, but some are for net (after tax) figures.⁴¹ I deal with this issue in three different ways, all of which lead to similar results. First, I include in the regression dummy variables for observations generated from expenditure data, personal-income data, and net-income data (*expdum*, *perdum*, and *netdum*); the results are reported in the second column of Table 5. Alternatively, I first regress both

41. Deininger and Squire (1995a) discuss these problems, of which the first one is the most serious.

Table 5 CONVERGENCE TESTS FOR GINIS^a

Variable	Sample 1 (N=33)		Sample 2 (N=24)		Sample 3 (N=18)		Sample 4 (N=9)	
	<i>dgini</i> 8070	<i>dginires</i> 8070						
<i>c</i>	9.02 (2.49)	0.98 (0.99)	7.66 (1.93)	17.36 (2.44)	1.39 (1.21)	18.65 (2.34)	18.42 (1.38)	-1.29 (-0.71)
<i>gini</i> 70	-0.231 (-2.69)	-0.347 (-3.19)	-0.190 (-1.98)	-0.364 (-2.59)	-0.337 (-2.63)	-0.411 (-2.37)	-0.496 (-1.39)	-0.743 (-1.93)
<i>expdum</i> 70	7.98 (2.49)		5.37 (2.47)					
<i>perdum</i> 70	4.10 (0.73)		2.26 (0.30)					
<i>perdum</i> 80	-4.68 (-0.93)		-5.80 (-0.77)					
<i>netdum</i> 70	2.65 (0.72)		6.72 (2.27)					
<i>netdum</i> 80	-9.56 (-2.28)		-13.28 (-2.91)					
\bar{R}^2	0.101	0.155	0.053	0.142	0.191	0.249	-0.020	0.247
<i>sdev</i> 70	10.23		10.18		8.09	8.45	5.45	6.67
<i>sdev</i> 80	9.98		10.20		8.27	7.34	8.28	7.09

Table 5 CONTINUED

Variable	Sample 1 (N=38)		Sample 2 (N=24)		Sample 3 (N=16)		Sample 4 (N=15)		
	<i>dgini</i> 9080	<i>dginires</i> 9080							
<i>c</i>	10.93 (2.14)	14.11 (2.13)	0.04 (0.04)	10.51 (1.64)	15.72 (1.35)	-0.13 (-0.09)	15.25 (1.41)	31.49 (3.73)	-1.94 (-1.10)
<i>gini</i> 80	-0.275 (-1.83)	-0.334 (-1.73)	-0.342 (-1.84)	-0.252 (-1.39)	-0.377 (-1.21)	-0.372 (-1.56)	-0.358 (-1.26)	-0.934 (-3.48)	-0.903 (-2.55)
<i>expdum</i> 80		-2.32 (-1.73)		-1.02 (-0.29)					
<i>perdum</i> 80		-2.32 (-0.65)		-2.26 (-0.41)					
<i>perdum</i> 90		4.23 (1.27)		5.05 (0.86)					
<i>netdum</i> 80		6.44 (2.11)		4.30 (0.81)					
<i>netdum</i> 90		-9.32 (-4.26)		-8.91 (-2.18)					
\bar{R}^2	0.120	0.175	0.144	0.070	-0.040	0.123	0.081	0.682	0.579
<i>sdev</i> 80	9.08		7.55	10.20		8.27	8.18	6.80	6.66
<i>sdev</i> 90	8.97		7.61	10.55		8.74	8.89	4.14	4.86

(c) 1970 to 1990

Variable	Sample 1 (N=25)		Sample 2 (N=24)		Sample 3 (N=14)		Sample 4 (N=7)		
	<i>dgini</i> 9070	<i>dginires</i> 9070							
<i>c</i>	2.72 (1.08)	7.32 (1.54)	1.39 (1.42)	2.38 (0.92)	7.02 (1.44)	1.38 (1.34)	3.50 (0.58)	19.01 (1.99)	-0.74 (-0.41)
<i>gini</i> 70	-0.039 (-0.64)	-0.141 (-1.37)	-0.214 (-1.60)	-0.028 (-0.44)	-0.130 (-1.20)	-0.216 (-1.53)	-0.460 (-0.37)	-0.542 (-1.87)	-0.576 (-2.64)
<i>expdum</i> 70	-0.54 (-0.29)				-0.62 (-0.32)				
<i>perdum</i> 70	-2.96 (-1.07)				-2.78 (-0.95)				
<i>perdum</i> 90	1.90 (0.88)				1.69 (0.74)				
<i>netdum</i> 70	1.63 (0.80)				1.56 (0.74)				
<i>netdum</i> 90	-3.23 (-1.42)				-3.13 (-1.36)				
\bar{R}^2	-0.030	-0.139	0.099	-0.039	-0.171	0.092	-0.069	0.024	0.243
<i>sdev</i> 70	10.37		9.17	10.18		9.09	9.08	4.26	6.30
<i>sdev</i> 90	10.60		8.74	10.55		8.73	9.38	5.20	5.45

Heteroskedasticity-consistent *t*-statistics in parenthesis.

Sample 1: all countries for which beginning- and end-of-period data were available or interpolated.

Sample 2: subset of countries for which 1970, 1980 and 1990 data were available or interpolated.

Sample 3: subset of countries using gross household income surveys.

Sample 4: available OECD countries

the initial and final Gini coefficients on these dummies (evaluated at the relevant years), then run the regression on the residuals ("dginires," third column of each table). Finally, I run the regression on the subset of countries which used gross family income for both dates. These results, given in the "Sample 3" column of each table, are very similar to the previous ones. Once again there is significant evidence of inequality convergence from 1970 to 1980, much less so from 1980 to 1990, and none at all for the whole period 1970 to 1990.

One problem which might explain the puzzling discrepancy between the first two results and the last one is that the data for each subperiod are for different subsets of countries. I therefore re-ran the regressions, with and without dummies, on yet another subsample consisting of the 24 countries for which 1970, 1980, and 1990 observations were available (either from the original data or by interpolation). The results are presented under the heading "Sample 2." Once again the estimates are all negative, with a drop in significance but not in magnitude from the first decade to the second, and a drop in both when moving to the full twenty-year period. A possible explanation would be for some countries to go from above to below the mean (say) during the first decade, then move back above during the second one. In the fourth, much smaller subsample of OECD countries, by contrast, the evidence of mean reversion seems stronger in terms of both magnitude and stability across periods. Overall, the regressions reported in Tables 5a to 5c consistently point to some mean reversion between 1970 and 1980, but the picture for the other periods is much less clear. It is interesting to recall that in Table 3, the dispersion of inequality across major regions of the world experienced most of its decline between the 1970s and the 1980s. Looking across individual countries, on the other hand, one sees no evidence of any narrowing in the range of Ginis. The standard deviation ("sdev"), reported in the last two lines of each table, shows virtually no change during any of the two decades under consideration.

The general picture which emerges at the end of this empirical exercise is thus a mixed one: general stability in the world distribution of Ginis, within which countries and regions seem to be experiencing some non-negligible amount of relative mobility. The question of whether there is actual convergence or whether countries oscillate around distinct long-run levels of inequality still awaits a definite answer. This is perhaps not surprising given the rather preliminary nature of the analysis and, above all, the limitations of the data.⁴² My main purpose, however, was to put for-

42. In particular, I have looked only at unconditional convergence. The potential effects of development on inequality (e.g., the Kuznets hypothesis) and the reverse links from

ward the issue of *convergence in distribution* as an important and essentially unexplored topic for empirical research. Hopefully, future studies with more sophisticated econometrics and better data (looking across states or regions as in Barro and Sala-i-Martin, 1992) will help resolve the issue.

Two related empirical questions also deserve serious investigation. One, motivated in particular by Proposition 9, is whether there is so to speak “convergence in redistribution.” Are countries, or even industrialized countries, converging to the same relative size of the welfare state, or are there permanent differences in the social contract? Evidence on OECD countries provided by Lindert (1996) suggests the latter, but more formal tests on larger samples are needed.⁴³ Another broad issue is whether educational, fiscal, or other forms of progressive redistribution actually increase mobility, as formalized in equation (27) and suggested by most models with imperfect capital markets. Recent work by Cooper (1996) studying the effect of state financing of education on the intergenerational mobility of families in poor communities suggests a positive answer. Mulligan (1995), on the other hand, finds only mixed evidence that borrowing constraints affect the transmission of inequality.

6. Conclusion

Non-representative-agent growth theory has developed so rapidly in recent years that this tour is necessarily incomplete. First, I focused only on the effects of income or wealth inequality on growth, rather than the reverse. The first model’s income distribution evolved endogenously in response to credit constraints and policy outcomes, but due to the homotheticity of preferences, technology, and tax schemes, it was not affected by the economy’s level of development. I thus entirely abstracted from the Kuznets (1955) hypothesis, except when discussing the role of fixed costs. This choice reflects both space constraints and waning interest in the Kuznets curve, arising from its lack of empirical support in most recent studies. Similar homogeneity properties in the second model precluded my examining whether sociopolitical conflict and extensive rent seeking are diseases more likely to afflict poor countries or rich ones (see Benhabib and Rustichini, 1996). Another level-dependent effect of income distribution arises in the “big push” theory formalized by Murphy, Shleifer, and Vishny (1989). If industrialization requires a sufficiently

inequality to growth studied in this paper suggest that the dynamics of mean income and income inequality should be examined jointly.

43. See Piketty (1995) and Bénabou (1995) for models which seek to explain such persistent differences.

large domestic market to make increasing-returns technologies profitable, excessive concentration of wealth may represent an obstacle to growth. The relevant constraint, however, is the absolute economic weight of the middle class, which in a large country like India is considerable even with very high inequality. Keefer and Knack (1995) test the “big push” mechanism by including in growth regressions measures of market size such as population, total GDP, and openness to trade, both by themselves and interacted with income distribution. They find no support for the theory in their data. An empirically more successful direction of research concerns the links between income distribution, fertility, and development. Perotti (1996) finds that a greater income share of the middle class has a strong negative effect on fertility, and this in turn has a significant positive effect on growth. I did not discuss this mechanism, due to space constraints and because there is yet no fully worked-out theory of distribution, fertility, and growth which can robustly generate these correlations. Among the models which have begun to formalize some of these links, moreover, the kind of wealth constraints on educational investment which were extensively considered in Section 3 often play a critical role (e.g., Galor and Zang, 1993).

Even for the three main theories which were examined in some depth, the analysis necessarily involved a number of simplifications. For concision I abstracted from inherited ability, dynastic altruism, occupational choice, and effort decisions of workers, entrepreneurs, or rent seekers, as well as from spillovers and nonconvexities of any kind. All these elements have been incorporated in the literature, and their role mentioned at various points in the paper.

Where do we go from here? The political-economy and imperfect-capital-market models are now well understood and have reached the quantitative stage.⁴⁴ While further developments (perhaps in relation to fertility or technology) will surely prove valuable, the gap between the scope of the theoretical literature and the scarcity of direct evidence makes further empirical work a high priority: signs of the adverse effects of redistribution on growth remain elusive (to put it mildly), and inferences about the role of credit constraints far too indirect. With respect to sociopolitical conflict, there remains room for theoretical and empirical work to move closer to one another. Existing models provide many valuable insights but few robust results about the effects of income inequality on

44. See for instance Krusell, Quadrini, and Ríos-Rull (1996, 1994) in the first case, Fernandez and Rogerson (1994) and Bénabou (1996c) in the second. There also are many quantitative models where liquidity constraints impede consumption smoothing but not investment (e.g., Ayagari, 1994; Bertola 1995). Their focus and properties are thus rather different.

conflict, whether conflict will be open or latent (off the equilibrium path), fully predictable or uncertain. On the empirical side, the *variances* of policy and property-rights variables should be included in the regressions, so as to determine whether it is instability or just the average level of extralegal redistribution that matters. Examining the interaction between economic inequality and inequality of political power in determining the occurrence of open conflict also seems desirable.

Coming full circle, it is tempting to conclude by asking: which of the theories linking distribution and growth considered in this paper best shed light on the experiences of South Korea and the Philippines? While this is not a substitute for detailed case studies [see for example Rodrik (1995) on Korea and Taiwan], one would expect the most relevant mechanisms to show up in basic indicators such as those compiled by Barro and Wolf (1989). Once again, the pure political-economy hypothesis of excessive redistributive pressure emanating from the poor, whether through the ballot box or the street, does not fare well. Public transfers in Korea were low, but still two and a half times higher than in the Philippines: 3.71% versus 1.46% of GDP on average between 1970 and 1980. Education expenditures show the same pattern, with shares of 5.13% and 1.97% respectively.⁴⁵ While the Philippines' government redistributed much less, it consumed a little more: 1.66% of GDP, versus 1.58% in South Korea. These numbers are broadly consistent with the credit-constrained human-capital accumulation hypothesis, and indeed Korea's educational investment skyrocketed past that of the Philippines: the enrollment rate in secondary education went from 42% in 1960 to 95% in 1985, as opposed to 50% to 65% for the Philippines. Similarly, for tertiary education Korea's 1965 enrollment rate of 6% was far behind the Philippines' 19%; by 1992 roles were reversed, with rates of 42% and 28% respectively. Another likely piece of the puzzle is the Philippines' much higher fertility rate (5.55% vs. 3.60% between 1965 and 1985), although the extent to which it reflects economic as opposed to cultural factors is unclear.

Turning now to theories of social conflict and property rights, political instability does not appear very relevant in this instance, as the two countries experienced similarly high levels of turmoil. The Philippines had more revolutions and political assassinations, Korea more riots, coups, government crises, and constitutional changes. Their indices of

45. Both the anecdotal evidence on the Philippines and the fact that 40% of health subsidies went to the richest 20% of the population (this number is cited by Alesina, 1995) suggest the type of path analyzed in Proposition 9, characterized by redistribution to the wealthy and low growth, or even Verdier and Ades' (1993) model of purely rent-seeking elites. Most of the Barro and Wolf (1989) data mentioned here are averages over 1960–1985; the figures given below for tertiary education are from the World Bank's 1986 and 1995 World Development Reports.

political rights and civil liberties were also very similar.⁴⁶ The more discriminating indicators of property-rights protection discussed earlier (rule of law, enforceability of contracts, expropriation risk, corruption, etc.), on the other hand, put Korea distinctly ahead.⁴⁷ This general security of property rights was probably instrumental not only in creating a favorable climate for business investment, but also in inducing Korean households to entrust much of their considerable savings to a state-controlled banking system, which in turn channelled credit towards the industries deemed strategic by the government, without excessive dissipation along the way.

Appendix

PROOF OF PROPOSITION 1 Let us first study the properties of the function $V(\tau)$ defined by (12). Clearly, (13) implies that it has a unique, global maximum at $\tau = 0$. Moreover,

$$-\frac{V''(\tau)}{\rho\beta} = \frac{1 + \rho\beta(1 - \tau^2)}{(1 - \tau)^2[1 + \rho\beta(1 - \tau)]^2} \quad (\text{A.1})$$

is positive if and only if $\tau^2 < 1 + 1/\rho\beta$. Thus V is strictly concave on the policy domain $(\underline{\tau}, 1)$, where $\underline{\tau} \equiv -\sqrt{1 + 1/\rho\beta}$. By (11), individual i 's utility function $U^i(\tau)$ is of the form $V(\tau) + (1 + \rho)\ln(A + B^i\tau)$ and therefore also strictly concave on $(\underline{\tau}, 1)$. The envelope theorem then yields the claims which follow equation (11), as well as Proposition 1.

PROOF OF PROPOSITION 3 The result for taxation was proved in the text. Next, note from (9) that

$$\frac{1}{\beta} \frac{\partial^2 (g - \ln r)}{\partial \lambda \partial \Delta} = \frac{s'(\tau)}{s(\tau)} \frac{\partial^2 \tau}{\partial \lambda \partial \Delta} + \frac{\partial}{\partial \tau} \left(\frac{s'(\tau)}{s(\tau)} \right) \frac{\partial \tau}{\partial \lambda} \frac{\partial \tau}{\partial \Delta}.$$

46. Barro and Wolf's (1989) data on the average numbers of these events per year for Korea and the Philippines are *Strike* = (0.00, 0.00), *Revol* = (0.31, 0.46), *Riot* = (2.12, 1.00), *Assass* = (0.12, 0.73), *Coup* = (0.09, 0.00), *Crisis* = (0.38, 0.08), *Constch* = (0.22, 0.09), *Polright* = (4.8, 4.7), *Civlib* = (5.0, 4.5).

47. The earliest available data are BERI's (Business Environmental Risk Intelligence) 1972 scores for bureaucratic delays, enforceability of contracts and nationalization potential. On a scale of 0 (worst) to 4 (best), Korea scored (2.1, 2.3, 2.6) and the Philippines (1.5, 1.9, 2.2). This pattern is confirmed by the additional data available for the last ten years. The averages of these three BERI scores computed by Keefer and Knack (1995) over 1986–1995 were 2.2 and 1.7 respectively. The average ICRG (International Country Risk Guide) scores over 1986–1995 were 36.7 and 20.3, on a scale of 0 to 50. See Keefer and Knack (1995) for sources and definitions.

For Δ small enough, $\partial^2\tau/\partial\lambda\partial\Delta$ was seen to be negative, and the fact that $\partial\tau/\partial\lambda$ is proportional to Δ makes the second term again dominated by the first; hence the result. Similar derivations apply to intertemporal efficiency V .

PROOF OF PROPOSITION 4 The first claim follows directly from (22). Differentiating this equation and using (6) also implies that

$$g'(\tau) \geq 0 \Leftrightarrow \frac{1}{(1-\tau)^2[1+\rho\beta(1-\tau)]} \leq (1-\beta)\Delta^2. \tag{A.2}$$

Since the left side is increasing in τ , g increases with τ up to some $\tau^g(\Delta) \in [\underline{\tau}, 1)$, then decreases. This maximum is interior (and increasing in Δ) if and only if

$$(1-\beta)\Delta^2 > \frac{1}{(1-\underline{\tau})^2[1+\rho\beta(1-\underline{\tau})]}. \tag{A.3}$$

As $\underline{\tau} < -1$, it suffices for instance that $(1-\beta)\Delta^2 > 1/(4+8\rho\beta)$. Finally, the growth-maximizing tax rate is positive if

$$\tau^g(\Delta) > 0 \Leftrightarrow (1-\beta)\Delta^2 > \frac{1}{1+\rho\beta}. \tag{A.4}$$

PROOF OF PROPOSITION 5 Because $W(\tau)$ is the sum of $V(\tau)$ and a concave, quadratic function of τ , it is strictly concave on $(\underline{\tau}, 1)$. The same statements hold for individual preferences $U^i(\tau)$, now given by (24). The social and (interior) private optima are thus respectively defined by $W'(\tau) = 0$ and $U^{ii}(\tau) = 0$. In the planner's case, (23) implies that $V'(\tau^p) = -\rho\beta(1-\beta)(1-\tau^p)\Delta^2$. The fact that V is strictly concave and maximized at zero then yields Claim 1, while Claim 2 follows from setting $\ln w^i = m$ in the first-order condition $U^{ii}(\tau) = 0$ derived from (25).

Next, let τ^a be the preferred tax of the agent with average wealth, $\ln w = m + \Delta^2/2$. Clearly, $\tau^a < \tau^p$ if and only if $U^a(\tau^p) < 0$, which by (25) is equivalent to $W'(\tau^p) + [\rho\beta^2(1-\tau^p) - \rho\beta/2]\Delta^2 < 0$, that is, to $\beta(1-\tau^p) < \frac{1}{2}$. Equivalently, $W'(1-(2\beta)^{-1}) > 0$, so by (23) and (13),

$$\begin{aligned} \tau^p > 1 - (2\beta)^{-1} &\Leftrightarrow \frac{(1-\beta)\Delta^2}{2\beta} > \frac{1 - (2\beta)^{-1}}{(2\beta)^{-1}(1 + \rho\beta(2\beta)^{-1})} \\ &\Leftrightarrow (1-\beta)\Delta^2 > \frac{4\beta(2\beta-1)}{2+\rho}; \end{aligned}$$

hence Claim 3.

Finally, let us show that when $\beta < \frac{1}{4}$ there exists an interval where the tax rate τ^m set by the median voter is less inefficient than that set by the average agent, τ^a . As Δ goes to zero the median converges to the mean, and both τ^m and τ^a converge to the planners' optimum, which is $\tau^p(0) = 0$. Therefore, from (25), $W'(\tau^a)/\rho\beta = [\frac{1}{2} - \beta(1 - \tau^a)]\Delta^2 = (\frac{1}{2} - \beta)\Delta^2 + o(\Delta^2)$ and $W'(\tau^m)/\rho\beta = -\beta(1 - \tau^m)\Delta^2 = -\beta\Delta^2 + o(\Delta^2)$. Thus if $\beta < \frac{1}{4}$ and Δ is small enough, $W'(\tau^a) > -W'(\tau^m)$, which implies (using Taylor expansions) that $\tau^p - \tau^a > \tau^m - \tau^p$ and therefore $W(\tau^a) < W(\tau^m)$.

PROOF OF PROPOSITION 6 Strict concavity of individual preferences $U^i(\tau)$ implies that the equilibrium tax rate is uniquely defined by the first-order condition (26), or

$$\Psi(\tau, \Delta, \lambda) \equiv (\rho\beta)^{-1}V'(\tau) + (1 - \tau)\Delta^2 - \lambda\Delta = 0, \quad (\text{A.5})$$

as long as there is an interior solution $\tau^*(\Delta, \lambda) > \underline{\tau}$. Since $\Psi_\lambda < 0 < -\Psi_\tau$ it is clear that τ^* is strictly increasing in λ . Proposition 5 showed that maximizing W requires $\lambda_w > 0$; conversely, $\lambda_w < \Delta$, because for $\lambda > \Delta$, $\Psi(0, \Delta, \lambda) < 0$ so τ^* is negative, implying $W'(\tau^*) > 0$ since $\tau^p(\Delta) > 0$. The fact that growth is maximized at $\lambda_G > \lambda_w$ is obvious; conversely, as λ increases towards the value which makes $\tau^*(\Delta, \lambda)$ equal to $\underline{\tau}$, $\tau^*(\Delta, \lambda)$ falls below $\tau^s(\Delta)$, implying $g'(\tau^*) > 0$. Therefore λ_G is interior, as long as (A.3) is satisfied. This concludes the proof of Claim 1, which concerns the effects of λ on equilibrium taxes $\tau^*(\Delta, \lambda)$.

I now turn to the effects of Δ on τ^* , and the resulting contributions to W and g . The solution to (A.5) is interior for all Δ if and only if $\max_\Delta [(\rho\beta)^{-1}V'(\underline{\tau}) + (1 - \underline{\tau})\Delta^2 - \lambda\Delta] > 0$, or

$$\frac{\lambda^2}{4} \leq \frac{-\underline{\tau}}{1 + \rho\beta(1 - \underline{\tau})}, \quad (\text{A.6})$$

which will be assumed from here on [since $\underline{\tau} < -1$, a sufficient condition is $\lambda^2 \leq 4/(1 + 2\rho\beta)$]. Equations (A.5) and (25) then imply

$$W'(\tau^*) = \rho\beta\Delta[\lambda - \beta(1 - \tau^*)\Delta], \quad (\text{A.7})$$

$$\frac{\partial \tau^*}{\partial \Delta} = \frac{2\Delta(1 - \tau^*) - \lambda}{-V''(\tau^*)/\rho\beta + \Delta^2}. \quad (\text{A.8})$$

Therefore, whenever rising inequality induces tax cuts, these are always inefficient:

$$\frac{\partial \tau^*}{\partial \Delta} \leq 0 \Rightarrow W'(\tau^*) > 0. \tag{A.9}$$

For $\lambda \leq 0$ equations (A.7) and (A.8) imply $\partial \tau^*/\partial \Delta > 0$ and $W'(\tau^*) < 0$; hence $g'(\tau^*) < 0$ *a fortiori*. This proves Claim 2. For $\lambda > 0$, $\partial \tau^*/\partial \Delta > 0$ if and only if $\tau^* \leq 1 - \lambda/2\Delta$, or equivalently $\Psi(1 - \lambda/2\Delta, \Delta, \lambda) < 0$. Substituting (13) into (A.5), this means

$$\frac{\lambda/2\Delta - 1}{(\lambda/2\Delta)(1 + \rho\beta\lambda/2\Delta)} + \frac{\lambda\Delta}{2} - \lambda\Delta < 0 \Leftrightarrow \Delta > \frac{\lambda}{2} \left(\frac{1 - \rho\beta\lambda^2/4}{1 + \lambda^2/4} \right) \equiv \tilde{\Delta}. \tag{A.10}$$

Note now that (A.6) implies that $\rho\beta\lambda^2/4 < 1$, hence $\tilde{\Delta} > 0$. Therefore τ^* is *U-shaped* with respect to Δ : it declines from $\tau^*(0, \lambda) = 0$ to a minimum $\tilde{\tau}^* < 0$ at $\tilde{\Delta}$, then rises again towards $\tau^*(\infty, \lambda) = 1$, cutting the $\tau = 0$ axis at $\Delta = \lambda$. Finally, (A.5) shows that as $\Delta \rightarrow +\infty$, τ^* tends to one with $1 - \tau^* \approx \theta/\Delta$, where

$$\begin{aligned} -\frac{1}{1 - \tau} + (1 - \tau)\Delta^2 - \lambda\Delta \approx 0 &\Rightarrow -\frac{\Delta}{\theta} + \Delta\theta - \lambda\Delta = 0 \\ &\Leftrightarrow \theta - 1/\theta = \lambda, \end{aligned} \tag{A.11}$$

which has a unique solution $\theta > 0$ for each λ . For further reference, note also that this limit is reached from below:

$$\forall (\Delta, \lambda) \in \mathbb{R}_+^2, \quad [1 - \tau^*(\Delta, \lambda)]\Delta < \theta. \tag{A.12}$$

Let us now turn to the efficiency consequences of these variations in τ^* . By (A.8), $W'(\tau^*) \geq 0$ if and only if $\tau^* \geq 1 - \lambda/\beta\Delta$. Equivalently, $\Psi(1 - \lambda/\beta\Delta, \Delta, \lambda) \geq 0$, or

$$\begin{aligned} \frac{\lambda\Delta^2}{\beta\Delta} - \lambda\Delta \geq \frac{1 - \lambda/\beta\Delta}{(\lambda/\beta\Delta)(1 + \rho\beta\lambda/\beta\Delta)} &\Leftrightarrow \lambda^2 \left(\frac{1}{\beta} - 1 \right) \geq \frac{\beta - \lambda/\Delta}{1 + \rho\lambda/\Delta} \\ &\Leftrightarrow \frac{\lambda}{\Delta} \geq \frac{\beta - \lambda^2(1/\beta - 1)}{1 + \rho\lambda^2(1/\beta - 1)}. \end{aligned}$$

Two cases are thus possible:

Case (i). If $\lambda^2 > \beta^2/(1 - \beta)$ then $W'(\tau^*) > 0$ for all Δ . Therefore, on the interval $[0, \tilde{\Delta}]$ where taxes decrease with rising inequality, these reduc-

tions in τ^* are always inefficient. On $[\bar{\Delta}, +\infty)$ taxes increase with inequality, although never sufficiently fast. One can also show that $\lim_{\Delta \rightarrow \infty} \Delta[1 - \tau^p(\Delta)] = (1 - \beta)^{-1/2}$, which is less than θ defined in (A.11) if and only if $\lambda^2 > \beta^2/(1 - \beta)$.

Case (ii). If $\lambda^2 < \beta^2/(1 - \beta)$ then $W'(\tau^*) > 0$ on $[0, \bar{\Delta})$ and $W'(\tau^*) < 0$ on $(\bar{\Delta}, +\infty)$, where

$$\bar{\Delta} \equiv \frac{\lambda[1 + \rho\lambda^2(1/\beta - 1)]}{\beta - \lambda^2(1/\beta - 1)}. \quad (\text{A.13})$$

Observe now that $\bar{\Delta} > \lambda > \bar{\Delta}$. This implies that $W'(\tau^*) > 0$ over the whole interval $[0, \bar{\Delta}]$ where τ^* decreases with higher inequality, and even over a strict superset of the interval $[0, \lambda]$ where capital is subsidized ($\tau^* < 0$). This is intuitive, as the planner always wants to set $\tau^p(\Delta) > 0$. Only once inequality has reached $\bar{\Delta}$ does it drive equilibrium taxes $\tau^*(\Delta, \lambda) > 0$ to excessively high levels.

This concludes the proof of Claim 3, as far as intertemporal efficiency is concerned.

It only remains to consider the growth effects of $\partial\tau^*/\partial\Delta$, that is, the sign of $g'(\tau^*)$. Using (A.2) and (A.5) one can write, as long as $\tau^* \neq 0$:

$$\begin{aligned} g'(\tau^*) > 0 &\Leftrightarrow \frac{(1 - \tau^*)\Delta^2 - \lambda\Delta}{\tau^*(1 - \tau^*)} < (1 - \beta)\Delta^2 \\ &\Leftrightarrow \tau^* \left(\frac{\lambda}{\Delta} - (1 - \tau^*)[1 - (1 - \beta)\tau^*] \right) > 0. \end{aligned} \quad (\text{A.14})$$

Note first that in the neighborhood of $\Delta = 0^+$, where $\tau \approx 0^-$, this condition is never satisfied. This is intuitive, since the losses from heterogeneity are of second order in Δ^2 , whereas the induced tax effects on savings are of first order.

Next, consider the condition in the neighborhood of $\bar{\Delta}$ defined by (A.10), where $\tau^* = 1 - \lambda/2\bar{\Delta} < 0$:

$$\begin{aligned} g'(\tau^*(\bar{\Delta}, \lambda)) > 0 &\Leftrightarrow 2 < 1 - (1 - \beta) \left(1 - \frac{\lambda}{2\bar{\Delta}} \right) \\ &\Leftrightarrow \frac{2 - \beta}{1 - \beta} < \frac{1 + \lambda^2/4}{1 - \rho\beta\lambda^2/4} \Leftrightarrow \frac{\lambda^2}{4} > \frac{1}{\rho\beta + (1 - \beta)(1 + \rho\beta)}. \end{aligned} \quad (\text{A.15})$$

It is easily shown that the right-hand side is smaller than that of (A.6) if and only if $(1 - \beta)|\underline{\tau}| > 1$, or equivalently $(1 - \beta)^2(1 + 1/\rho\beta) > 1$. This inequality holds if and only if β is not too close to one, in which case there exists a range of λ 's satisfying (A.6) such that $g'(\tau^*(\bar{\Delta}, \lambda)) > 0$. In this parameter configuration, tax cuts induced by rising inequality just below $\bar{\Delta}$ reduce growth, while tax increases which occur as Δ rises just above $\bar{\Delta}$ tend to improve it. To show that this last result is not specific to the region of regressive capital subsidies ($\tau^* < 0$), let us next examine $g'(\tau^*)$ at $\Delta = \lambda$. Since $\tau^*(\lambda, \lambda) = 0$, (A.2) shows that:

$$g'(\tau^*(\lambda, \lambda)) > 0 \Leftrightarrow \lambda^2 > \frac{1}{(1 - \beta)(1 + \rho\beta)}. \tag{A.16}$$

Again it can be shown that the right-hand side is greater than that of (A.6) as long as β is below some fixed upper bound. In that case there exists a range of λ 's such that increases in inequality in the neighborhood of $\Delta = \lambda^+$ generate tax increases to positive levels which still improve the growth rate.

Finally, let us consider (A.14) as $\Delta \rightarrow \infty$ and $1 - \tau^* \approx \theta/\Delta$. The condition becomes $\lambda \geq \beta\theta$, which by (A.11) is equivalent to $\lambda^2 \geq \beta^2/(1 - \beta)$. When this condition [which once more is compatible with (A.6) if and only if β is not too close to one] holds, $g'(\tau^*(\Delta, \lambda)) > 0$ even asymptotically: equilibrium taxes increase with inequality, but too slowly from the point of view of maximizing not only W but even g . When $\lambda^2 < \beta^2/(1 - \beta)$, on the other hand, taxes eventually increase too fast with rising inequality, again whether from the point of view of welfare or from that of growth.

PROOF OF PROPOSITION 7 Claim 1 immediately results from Propositions 4 and 6, or directly from (A.7)–(A.8). For $\lambda > 0$, let us write out

$$\begin{aligned} (\rho\beta\Delta)^{-1} \frac{dW}{d\Delta} \Big|_{\tau=\tau^*} &= -(1 - \beta)(1 - \tau^*)^2 \\ &+ \frac{[\lambda - \beta\Delta(1 - \tau^*)][2\Delta(1 - \tau^*) - \lambda]}{-V''(\tau^*)/\rho\beta + \Delta^2}. \end{aligned} \tag{A.17}$$

The numerator of the second term is a quadratic polynomial in λ whose maximal value is $[(2 - \beta)(1 - \tau^*)\Delta]^2/4$. Therefore, $(dW/d\Delta)_{\tau=\tau^*} < 0$ as long as

$$(1 - \beta) \left(1 - \frac{V''(\tau^*)}{\rho\beta\Delta^2} \right) > \frac{(2 - \beta)^2}{4}$$

$$\Leftrightarrow \frac{\beta^2}{4(1 - \beta)} < \frac{-V''(\tau^*)}{\rho\beta\Delta^2} = \frac{1 + \rho\beta(1 - \tau^{*2})}{\Delta^2(1 - \tau^*)^2[1 + \rho\beta(1 - \tau^*)]^2}, \quad (\text{A.18})$$

by (A.1). Now, recall from (A.12) that $\Delta(1 - \tau^*) < \theta$ for all (Δ, λ, β) , so the right-hand side is greater than $\theta^{-2}[1 + \rho\beta(1 - \tau)]^{-2}$. Provided β is below this value, $dW/d\Delta$ is therefore negative for all (Δ, λ) . For β close to 1, on the other hand, it is clear that the second term in (A.17) dominates. By (A.7) and (A.8) this second term is positive if and only if $\partial\tau^*/\partial\Delta > 0$ and $W'(\tau^*) > 0$, which occurs when $\Delta \in (\bar{\Delta}, \hat{\Delta})$, where these two bounds are defined by (A.10) and (A.13) (in which β can be set equal to 1). This concludes the proof of Claim 2.

Consider now growth. First, we showed earlier that if $\lambda^2 < \beta^2/(1 - \beta)$, then $g'(\tau^*)$ becomes negative as Δ becomes large enough. Since $\partial\tau^*/\partial\Delta > 0$ for $\Delta > \hat{\Delta}$ and $\partial g/\partial\Delta < 0$ always, this proves that $dg/d\Delta < 0$ for Δ large enough in this case. To obtain a result which is independent of λ and to make clear the role played by $\beta < 1$, let us use (A.2) and (A.5) to compute:

$$(\beta\Delta)^{-1} \frac{dg}{d\Delta} \Big|_{\tau=\tau^*} = \frac{[(1 - \beta)\tau^*(1 - \tau^*)\Delta - (1 - \tau^*)\Delta + \lambda][2\Delta(1 - \tau^*) - \lambda]}{\tau^*[-V''(\tau^*)/\rho\beta + \Delta^2]} - (1 - \beta)(1 - \tau^*)^2. \quad (\text{A.19})$$

Focus now on values $\Delta > \lambda$, for which $\tau^* > 0$. The numerator of the second term is a quadratic polynomial in λ whose maximal value is $(1 - \tau^*)^2[1 + (1 - \beta)\tau^*]^2\Delta^2/4$. Therefore, $(dg/d\Delta)_{\tau=\tau^*} < 0$ for $\Delta > \lambda$ as long as

$$(1 - \beta) \left(1 - \frac{V''(\tau^*)}{\rho\beta\Delta^2} \right) > \frac{[1 + (1 - \beta)\tau^*]^2}{4\tau^*}.$$

As Δ tends to infinity, $1 - \tau^* \approx \theta/\Delta$ and $-V''(\tau^*)/(\rho\beta\Delta^2) \approx \theta^{-2}$, so the condition becomes $1 + \theta^{-2} > (1 - \beta/2)^2/(1 - \beta)$. This holds if and only if β is below some critical value in $(0, 1)$; hence the first part of Claim 3. Conversely, one can show from (A.19) that $\lim_{\Delta \rightarrow 0} (dg/d\Delta)_{\tau=\tau^*} = \lambda^2\beta \lim_{\Delta \rightarrow 0} (-\Delta/\tau^*) > 0$. Indeed, as $\Delta \rightarrow 0$ (or also as $\beta \rightarrow 1$) the growth rate (22) reduces to the complete markets case, where $\partial g/\partial\tau < 0$.

PROOF OF PROPOSITION 8 The asymptotic variance $\Delta_\infty^2 = \sigma^2/[1 - \beta^2(1 - \tau)^2]$ associated to a constant tax rate τ decreases on the domain $(\underline{\tau}, 1)$; note in particular that $\beta(1 - \underline{\tau}) < 1$. Let $T(\Delta)$ denote the inverse, decreasing function, which maps $(\sigma^2, \sigma^2/[1 - \beta^2(1 - \underline{\tau})^2])$ into $(\underline{\tau}, 1)$. A steady state is an intersection of this decreasing curve with the equilibrium tax function $\tau^*(\Delta, \lambda)$ defined by (26) or (A.5). When $\lambda \leq 0$ this function is upward sloping, by Proposition 6; hence there can be at most one equilibrium. Moreover, $\tau^*(\sigma^2, \lambda) < \tau^*(\infty, \lambda) = 1 = T(\sigma^2)$ and $\tau^*(\sigma^2/(1 - \beta^2), \lambda) > \tau^*(0, \lambda) = 0 = T(\sigma^2/(1 - \beta^2))$, so there is a unique steady state, with $\tau_\infty \in (0, 1)$. Finally, a decrease in λ shifts up the $\tau^*(\Delta, \lambda)$ function, which then cuts $T(\Delta)$ at a higher τ and a lower Δ .

PROOF OF PROPOSITION 9 By Proposition 6, the equilibrium tax function $\tau^*(\Delta, \lambda)$ is now U-shaped in Δ : it decreases from $\tau^*(0, \lambda) = 0$ to a minimum at $\Delta = \bar{\Delta}$, then rises towards $\tau^*(\infty, \lambda) = 1$, cutting the $\tau = 0$ axis at $\Delta = \lambda$. The fact that $\tau^*(\Delta, \lambda)$ now has a decreasing segment implies that it can intersect $T(\Delta)$ at several points. Here I shall only characterize the set of equilibria, rather than derive sufficient conditions for multiplicity (this is done in Bénabou, 1995, for a closely related model). It is easy to see that such multiple intersections can only happen in the range $\Delta < \lambda$ where $\tau^*(\Delta, \lambda) < 0$, and that this scenario requires $\sigma^2/(1 - \beta^2) < \bar{\Delta}$. The number of intersections must then be odd, as $\tau^*(\sigma^2/(1 - \beta^2), \lambda) < 0 = T(\sigma^2/(1 - \beta^2))$ and $\tau^*(\sigma^2/[1 - \beta^2(1 - \underline{\tau})^2], \lambda) > \underline{\tau} = T^*(\sigma^2/[1 - \beta^2(1 - \underline{\tau})^2])$. Denote by $\{(\Delta_j, \tau_j)\}_{j=1}^n$ these intersections, with $\Delta_j < \Delta_{j+1}$ and $0 > \tau_j > \tau_{j+1}$, and let $W(\tau_j, \Delta_j)$ be the corresponding levels of intertemporal efficiency. By Proposition 5, each $W(\cdot, \Delta_j)$ is strictly concave and maximized at some $\tau^p(\Delta_j) > 0$. Since $W(\tau, \Delta_j)$ is decreasing in its second argument, this allows us to write

$$W(\tau_{j+1}, \Delta_{j+1}) < W(\tau_{j+1}, \Delta_j) < W(\tau_j, \Delta_j); \tag{A.20}$$

hence the result that intertemporal efficiency declines as one moves to a more regressive steady state. The same holds *a fortiori* for ex ante welfare, since the insurance motive makes it increasingly costly to reduce income sharing from τ_j to τ_{j+1} as the variability of income rises from Δ_j to Δ_{j+1} . A ranking similar to (A.20) obtains for growth rates as long as $\tau_j = \tau^*(\Delta_j, \lambda) < \tau^s(\Delta_j)$; such is the case in particular if the Δ_j 's satisfy (A.4), ensuring that $\tau^s(\Delta_j) > 0$. Since $\tau_j < 0$ for all j , implying $\Delta_j^2 > \sigma^2/(1 - \beta^2)$, it suffices that $\sigma^2 > (1 + \beta)(1 + \rho\beta)^{-1}$.

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Comment

ROBERTO PEROTTI
Columbia University

Roland Bénabou has written a very insightful and careful paper on a topic that has recently attracted considerable attention, both theoretically and empirically. The basic question the paper asks is: what can explain the observed negative reduced-form relationship between inequality and growth? One important contribution of the paper is to provide a unified and coherent analytical framework encompassing alternative theories of income distribution and growth. A second strength of the paper is its intellectual honesty: Bénabou is not interested in selling any particular model or approach (or, if he is, it does not show), but only in clarifying theories and confronting them with the available empirical evidence.

But the job of a discussant being what it is, I also have to voice some disagreement. My general point is that the paper does not say much on what, in my view, is becoming a more and more apparent feature of this literature: the growing gap between the virtually unlimited set of effects, results, nonlinearities, and complex interactions that we can model once we give up the representative-agent assumption, and what we will actually be able to even think of testing with a reasonable degree of confidence. A second, less important point is that the picture the paper paints of the empirical evidence is, in my view, missing a potentially important mechanism whereby income distribution affects growth.

Bénabou starts from the explanation offered by politico-economic models of income distribution and growth. The basic idea is simple: inequality hurts growth because a poorer median voter faces a lower tax price of government expenditure; hence, in equilibrium expenditure and therefore distortions are higher when the decisive voter is poorer.

Before addressing the empirical evidence on this approach, I want to point out the role of an important assumption of virtually all these models, a role that is not always adequately highlighted: the homotheticity of the utility function. This implies that all individuals have the same saving rate, given the return to investment they face. Because with perfect capital markets the equilibrium return *is* the same for all agents, it follows that the distribution of income never changes; in particular, the decisive agent is always the same individual, and his income is always the same fraction of the average income. Hence, the tax rate is constant. This is the reason why the tax rate would be time-consistent in an infinite-horizon version of the model, as in Alesina and Rodrik (1994). In the absence of this assumption, when voting for a given tax rate, an individual should calculate the effects of that tax rate on the future distribution of income, hence on the future tax rates, and so on. This is a problem that, to my knowledge, has not been solved in closed form.

Still, the basic message of these models is very clear, and quite independent of their technical details. In addition, this message has the advantage of being consistent with the reduced-form evidence. For it to be a candidate *explanation* for this evidence, however, one must find supporting empirical evidence on three components of these models. Bénabou discusses two, and he correctly points out that they do not seem to be supported by the data. I want to argue that the reason might well be that the third component of these models, which has always been taken as granted, is also probably not supported by the data.

The first component is the positive link between inequality and redistribution. It is true that redistribution can occur in many ways, as Bénabou and others have argued. But it is also true that, of all the *measurable* ways that have been studied empirically, not one seems to be robustly and/or significantly positively correlated with inequality. It is also interesting to note that, in a survey of a dozen careful studies of the overall incidence of taxation and government expenditure, Lecaillon *et al.* (1984) found one persistent pattern: the higher the pre-fisc Gini coefficient, the *lower* the percentage fall in the same coefficient that can be attributed to the redistributive effect of fiscal policy.

The second component of these models is the negative link between growth and redistribution. Here too the evidence seems to point strongly in the opposite direction. This is more surprising, because it runs counter to any reasonable view of the economy: if taken literally, it just means that there is no dynamic equity–efficiency trade-off. Several models have been advanced in recent years to explain the positive relationship between redistribution and growth. Bénabou himself correctly points out that in principle one can always think of a combination of redistribution and

subsidies that maintains growth at the rate the central planner would set. Yet, as *positive* models, these explanations are often far-fetched, and they are very difficult to test. For instance, when redistribution occurs through investment subsidies, growth and redistribution are positively linked: now it is poorer individuals who like growth-enhancing investment subsidies, while richer agents dislike them because they depress the value of existing capital. But I have yet to see a real-life entrepreneur who dislikes investment subsidies, or a real-life government that uses investment subsidies as a redistributive tool with any macroeconomic significance. In the end, I think that the simplest explanation is still the most plausible: reverse causation. Faster-growing countries can afford to redistribute more, and redistribution is a luxury good. Of course, with good instruments we should be able to disentangle this effect. But a good instrument is one of those things that life dispenses very sparingly.

The third component of the model that we need some evidence on is that fiscal policy more or less should redistribute from the rich to the poor, and in an approximately monotonic way. Bénabou addresses this link only briefly in footnote 23, and in the context of a model with imperfect capital markets; however, I believe it could be the key to understanding the empirical problems of many political-economy models of income distribution and growth. Redistribution through the overall fiscal system is notoriously a very difficult thing to measure, because of the almost unsurmountable difficulties in estimating the incidence of a number of tax and especially expenditure items. Nevertheless, two general conclusions seem to emerge from several studies on industrialized and developing countries (see e.g. Lecaillon *et al.*, 1984; Van der Walle, 1995). First, the very rich tend to be net losers from the fiscal system, while the very poor are often, but not always, net gainers; in between, say from the third or even the second to the eighth decile, there is considerable variation across countries. But if redistribution occurs, it is usually very limited; and in developing countries, it is often toward the middle class. If one looks only at taxation, there is also ample evidence that in several developing countries the average tax rate is U-shaped as a function of income. Second, two types of government expenditure seem to be genuinely redistributive: expenditure on primary education, and expenditure on health.

On the other hand, expenditure on tertiary education is well known to be extremely regressive. This is important, because in many developing countries expenditure on tertiary education has the lion's share. One only needs to go through the IMF's *Government Finance Statistics* to see the enormous prevalence of expenditure on tertiary education in certain African countries. Given the relative enrollments in primary and tertiary

education, and the household income of students at the two levels, the numbers imply a tremendous redistribution to the rich. Furthermore, for certain countries in the sample some variables that we use to measure redistribution in reality redistribute income to the middle class (see e.g. Alesina, 1995, for a forceful discussion of this fact); for instance, in many Latin American countries social security has long been reserved for relatively few workers in the formal sector and for government employees (see e.g. Mesa-Lago, 1985). Thus, it should not come entirely as a surprise that the income distribution–redistribution link does not perform very well empirically, particularly in developing countries.

A by-product of politico-economic models of income distribution and growth is a theory of the role of democratic institutions in the growth process. Bénabou argues that a widespread interpretation of these models—that they should be more relevant for democracies—is not easily defensible, for two basic reasons. First, it is essentially a statement on cross partial second derivatives, and as such difficult to test. Second, nondemocracies too are responsive to some constituency, so what matters is what type of nondemocracy we are dealing with. I disagree with the first reason and agree, with some reservations on its empirical implications, with the second.

Interactive terms and split samples are there to test for cross-partial-second-derivative effects. Several studies have interacted an income distribution variable with a democracy dummy variable in an otherwise standard growth regression. In most cases, the interactive term turns out to be insignificant. However, this approach forces all the other coefficients, like those of school enrollment and GDP per capita, to be the same in democracies and nondemocracies, even if they are not. In particular, in the pooled regression the coefficient of the school enrollment variables reflects heavily the coefficient in nondemocracies, which is much higher; because school enrollment and equality are positively correlated, this results in an insignificant interactive term. In my paper (Perotti, 1996) I show that if the other coefficients are not constrained to be equal, i.e. if one runs two separate regressions for democracies and nondemocracies, income distribution is indeed significant in democracies, and insignificant in nondemocracies.

Of course, the question then becomes: why should the coefficients of school enrollment be different in democracies and nondemocracies? It is hard to come up with reasons why they should. Yet, the answer might be very simple: the relevant difference is between rich and poor countries, rather than democracies and nondemocracies. In the sample of countries for which we have income distribution data, there are very few democracies with income below \$1500 in 1960, while the richest 25 coun-

tries are virtually all democracies. In fact, if one reruns the regressions splitting the sample into rich and poor countries, the results are virtually identical to those one obtains when the sample is split into democracies and nondemocracies: in poor countries, the coefficient of income distribution is insignificant, while in rich countries it is very significant.

So we might be down to yet another question: why should income distribution be more strongly related to growth in rich countries than in poor countries? I offer two tentative explanations. First, higher measurement error on income distribution in poorer countries. This is also consistent with the fact that virtually any relationship involving income distribution is weaker in developing countries, as I will show later. Second, the often perverse redistributive properties of fiscal systems in poorer countries, which I discussed earlier.

The practical implication of all this is very simple: the overlap between the existing datasets on income distribution and fiscal policy—combined with the scarcity of democratic regimes throughout the world—leaves very little hope of disentangling any meaningful relationship involving the notion of democracy and income distribution. This brings me to the second point that Bénabou makes on the issue: what matters is not so much if a country is a nondemocracy, but the nature of the government. It is hard to disagree with this point, but I think Bénabou is far too optimistic on its practical implications when he argues in Section 2.5 that “it should be feasible in future work to provide more discriminating tests by distinguishing between left- and right-wing nondemocracies, at least for some subset of countries.”

I doubt that this can actually be implemented. Under the most liberal selection criteria we have cross-sectional data on income distribution for about 70 countries. Of these 70 countries, we have data on fiscal variables over the 1970–1990 period for about 55 countries. Of these 55 countries, at most 25 or 30 are going to be nondemocracies, under any given definition of democracy. By the time we have classified these governments into left-wing, right-wing, center, and “don’t know,” we are left with desperately few observations to test any theory. Second, how do we classify nondemocracies? In many cases, it will be more or less explicitly through their actions: a left-wing democracy is, in part, defined by its treatment (at least in economic terms) of low-income individuals. If instead we try to characterize a nondemocracy using some *a priori* criterion, we very soon run into big problems: for instance, how do we classify the first Peron government, and many other populist governments?

The second class of theories Bénabou discusses is based on imperfect credit markets. Here too the basic idea is at the same time simple and powerful: when credit markets are imperfect, the distribution of wealth

determines how much an individual invests in physical and/or human capital and what the return to investment is. Bénabou's rendition of these ideas in this paper has two crucial ingredients: first, logarithmic utilities, which implies that the savings rate is independent of the individual's rate of return to investment; second, diminishing returns to an individual's investment. The two ingredients combined imply that richer individuals save more, in absolute amounts; hence, in more unequal societies more investment is done by individuals with lower return to investment.¹

As Bénabou points out, conceptually this approach has one key difference with the political-economy approach: although for a given total aggregate income the total savings and investment in the economy is the same as with perfect credit markets, now the "average" return to investment and therefore the second-period aggregate income is a function of the distribution of disposable income and therefore investment. In turn, the second-period aggregate income has a positive externality on each individual's income. In a positive model, this means that in general a voter will not internalize the effects of redistribution on the distribution of investment and therefore on the aggregate rate of growth of the economy. Hence, now some redistribution is good for growth, because it redistributes resources to agents with higher return; but a lot of redistribution is bad for growth, because of the usual disincentive effects of taxation. The relationship between growth and inequality is no longer monotonic.

Also, now it is not necessarily true that a richer decisive voter (as in a right-wing dictatorship) is necessarily good for growth. In particular, Proposition 7 has an interesting insight: an increase in inequality now can increase growth if the decisive voter is richer than the median and if inequality is not too high. The intuition is the following: because of the definition of wealth bias that Bénabou adopts, with positive wealth bias an increase in inequality is necessarily associated with a *richer* decisive voter, and therefore a lower tax rate. If inequality is not too high, this is good for growth because the growth-reducing disincentive effect of tax rates prevails over the growth-enhancing effect of redistribution. This is also the intuition for why what matters is the correlation between political power and economic wealth.

These, I believe, are interesting insights. I still have two comments. The first is on the theory: the relationship between political power and

1. It is worthwhile noting that in models of human capital investment and fertility, the standard assumption is that individuals in dynasties with higher human capital have a *higher* return to human capital investment, for any given amount invested. However, they still face diminishing returns to investment; since they save more in Bénabou's model, in equilibrium one might still obtain Bénabou's result.

economic power in Propositions 6 and 7 seems to me fairly specific to the definition of wealth bias adopted by Bénabou. Suppose that, given the average income, wealth bias is defined by the ratio of the *income* of the decisive voter to the average, rather than by the *percentile* he belongs to. This is a perfectly legitimate definition of wealth bias (recall that the average income is kept constant), which might apply to dictatorships just as well as the definition used by Bénabou. Then an increase in dispersion, like a mean-preserving spread, would always lead to less growth, because the equilibrium tax rate remains the same but the “average” return to investment decreases. More generally, Propositions 6 and 7 illustrate a general feature of many models in this literature: when one relaxes the representative-agent assumption, endogenizes fiscal policy, and lets it interact with imperfect credit markets, there is virtually no limit to the results and nonlinearities one can get. In Propositions 6 and 7, there are a remarkable number of cases, with often opposite implications, depending on the degree of wealth bias, on the degree of inequality, on the parameter of the production function, and other variables.

This leads me to the second comment, which is empirical. When we try to take these models and these insights to the data, once again we quickly realize how many effects we have modeled and how little we will be able to test them, at least with the macro-level data that we use in growth regressions. To start from the most basic component, for non-OECD countries and even for some OECD countries we essentially do not have reliable proxies for the degree of credit-market imperfections. An indirect piece of evidence is that primary- and especially, secondary-school enrollment ratios are strongly positively related to equality, after controlling for GDP per capita and the other usual suspects (see Perotti, 1996). The fact that the relationship is much stronger for secondary-school enrollment, which has higher direct and opportunity costs, than for primary-school enrollment seems to indicate that credit-market imperfections might play a role. One potential problem, however, is that this relationship is also much stronger in richer countries, while we probably expect credit-market imperfections to be a more important constraint on investment in human capital in poor countries. But yet again, higher measurement error in poorer countries is consistent with this finding.

The third class of models Bénabou studies is based, roughly speaking, on the notion that inequality fosters some form of social or political instability, or both. This type of idea can only be formalized in fairly specific and seemingly ad hoc models, and it is very difficult to test, for the obvious reason that the concept of sociopolitical instability is rather nebulous and does not have an immediately obvious and objective counterpart.

As Bénabou points out, existing models fail to capture the role of uncertainty, and do not have room for phenomena like riots, coups, and assassinations. However, both uncertainty and these phenomena figure prominently in the existing empirical studies of this link. I am much less disturbed by this than Bénabou is. The notion that inequality—especially extreme inequality—in the long run generates some type of sociopolitical instability, which in turn hurts investment and growth, seems to me very plausible. Empirically, I believe this explanation performs much better than the two others that we have seen so far. Measures of sociopolitical instability based on indicators like coups, political assassinations, violent protests, etc., are significantly positively correlated with inequality and negatively correlated with investment and growth. Moreover, these relationships tend to be quite robust. That existing models do not have a role for riots and assassinations is not surprising to me, and I doubt that any model ever will. Slightly more disturbing is the inability to distinguish between uncertainty effects and level effects on the return to investment. But again, I doubt that we will ever be able to disentangle the two effects, and I am not sure I would worry too much. Furthermore, I am not even sure that I would always want to think in terms of return to investment: after all, when people are busy killing each other it is pretty hard to grab investment opportunities, however high their rates of return might be. I do, however, have a suggestion regarding an area where some progress is, I believe, feasible: specifically, it might be interesting to go deeper into existing measures of instability, by distinguishing manifestations of social instability and social stress, like violent protests, from manifestations of political instability; and within the latter, *executive* instability from *legislative* instability.

I would like to conclude by discussing an empirical relationship that Bénabou mentions only briefly in the conclusions: the relationship between income distribution on one side and fertility and demographics on the other. This is not intended to be a criticism of the author, because Bénabou intentionally focuses on those ideas for which we have a theory, and admittedly, we have very few models on the subject of income distribution, fertility, and growth.² Yet, I think it is important to mention it because it is statistically so strong and eminently reasonable.

If one regresses growth on fertility and the latter on an index of inequality, the former coefficient is negative, and the latter is positive. Both are large in absolute value and highly significant (see Perotti, 1996). The latter coefficient remains large and significant even after controlling for proxies for cultural factors like regional dummies, for feedback from

2. The papers I am aware of are Galor and Zang (1993) and Dahan (1995).

growth, and for virtually any determinant of fertility one can think of. These estimates are perfectly consistent with a reasonable extension of a standard representative-agent model of human capital, fertility, and investment to an environment with human capital dispersion. Richer people have lower fertility and higher investment in human capital because they have a higher return to human-capital investment and a higher opportunity cost of rearing children. Hence, with reasonable elasticities, it is fairly straightforward that a redistribution of human capital to the poor should decrease fertility and increase investment in human capital. Note that this mechanism is consistent not only with the evidence on inequality and fertility, but also with the evidence on inequality and school enrollment ratios briefly discussed above.

Thus, in the end, the link between fertility, human-capital investment, and inequality might be one of the most promising areas of research in our search for an explanation of the inequality–growth nexus.

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Comment

JOSÉ-VÍCTOR RÍOS-RULL
Federal Reserve Bank of Minneapolis*

1. Introduction

Bénabou has written a very interesting paper about the connection between inequality and growth. He draws his conclusions from a review of

*The views expressed herein are those of the author and not necessarily those of the Federal Reserve Bank of Minneapolis or the Federal Reserve system.

the literature and an analysis of the data. In his review of the literature, he sorts previous work into two main groups: one group that includes models with perfect credit markets and another that includes models with imperfect credit markets. In his analysis of the data, he concludes that the data support a negative relation between inequality and growth.

The first strain of literature reviewed by Bénabou uses models that assume perfect credit markets. Here the mechanism linking inequality and growth is the endogenous selection of economic policies by voters. Bénabou argues against these models because the predicted link between inequality and growth through redistribution is absent in the data. This leads Bénabou to argue in favor of models in which credit markets are imperfect—in fact, agents cannot borrow at all—and redistribution towards the poor helps achieve a more efficient outcome. Bénabou illustrates these two strains of the literature by means of a very ingenious and simple model that encompasses the cases with perfect and imperfect credit markets. As a bonus, in this paper Bénabou does two more things: he analyzes the time-series data on inequality across countries in search of some evidence (or lack of it) for convergence of inequality, and he reviews a third strain of the literature on social conflict, inequality, and growth. In this last approach, various groups engage in either conflict (extraction of resources at the expense of other groups) or cooperation (which leads to growth). This strain represents an implementation of the idea that instances that can be characterized by “repeated prisoner’s-dilemma situations” are central in the formalization of social interaction.

In my discussion, I will concentrate on the following issues: Bénabou’s argumentation against political-economy models with perfect credit markets; his discussion of models where redistribution towards the poor increases efficiency by overcoming borrowing constraints; a small variation on the type of model proposed by Bénabou in models without credit markets that can lead to diverging conclusions; and the problems of the type of simple models that Bénabou considers. Finally, I will make a couple of comments on the last two topics discussed in this paper: the analysis of time-series data and the review of the literature that addresses the issue of conflict versus cooperation.

2. Political-Economy Models with Perfect Credit Markets

The first strain of the literature Bénabou discusses, starting with Persson and Tabellini (1994) and Alesina and Rodrik (1994), includes a collection of models in which agents differ in wealth, the median agent has wealth below the mean, and the political system is used to redistribute wealth from the rich to the poor. In these models, taxation, which basically

amounts to theft, discourages investment and hence reduces growth. These models make assumptions sufficient to guarantee that the median-wealth agent is, in fact, the politically decisive voter.

Bénabou constructs a simple model with a closed-form solution that captures some of the main qualitative features of these models: the more inequality, the more redistribution, the less growth. The model is of a two-period overlapping-generations economy with log utility. There is an initial endowment when young, w_i , that differs across agents, but no endowment when old. There are perfect credit markets. There is an individual investment technology with decreasing returns to scale, which yields output in the second period given by

$$y_i = r k_i^\beta w_i^{1-\beta},$$

where w is the aggregate endowment.

The existence of perfect credit markets allows individual investment to differ from individual savings. With linear budget constraints, savings in this model would be independent of the after-tax rate of return; however, there is a nonlinear tax schedule that makes first-period consumption (and hence savings) depend on the effective rate of return. The tax schedule gives after-tax output from the production technology by

$$\hat{y}_i = y_i^{1-\tau} \bar{y}^\tau,$$

where τ is a parameter that controls the size of taxes (in this model interest income is not taxed).

The tax system affects households not through redistribution (in equilibrium all agents pay the same taxes), but through the manipulation of the interest rate: borrowers want to lower it. The individual investment function depends only on the tax rate (negatively) and on the aggregate endowment (positively) and is given by

$$k_i = s(\tau)w,$$

where $s(\tau)$ is a decreasing function of τ .

Individual savings depend on the individual endowment. The difference between investment and savings is borrowing:

$$b_i = w_i - c_i - k_i.$$

In this model, voters do not have to worry about the effects of their policy choice on future policies, since nothing that can be done by younger generations affects them.

In a political system where the median voter chooses policy, more inequality leads to less growth, more redistribution, and less efficiency. If the political system is not a democracy (i.e., is biased in favor of or against wealth), then the more biased the system is against the poor, the higher the growth. Efficiency is maximized when the key household looks like the average household. Empirically, then, what matters is not just the absolute size of the deviation from democracy, but its direction. Thus Bénabou makes the important observation that studies that try to find a relation between absence of democracy and growth are likely to miss the point.

A key property of Bénabou's model is that the size of the distortions generated in the model do not show up in the amount of redistribution. Note that the redistributive schemes do not result in high volumes of transfers; in fact, they generate no transfers whatsoever. Redistribution works through the manipulation of the key relative price, the rate at which borrowing and lending is done.

Bénabou seems to be dissatisfied with this class of models as a means of connecting inequality and growth. This arises from the following observations on the data: (1) there seems to be a negative relation between inequality and growth; (2) there is no clear relation between redistribution and inequality; and (3) there is a positive relation between redistribution and output per capita (perhaps also between redistribution and growth). Bénabou points to this lack of evidence for an association between redistribution and output per capita (or growth) as an indication that these models are missing the mark.

I do not think that models of the link between inequality and growth with perfect credit markets can be dismissed solely on the grounds that there is no empirical relation between redistribution and output per capita (or growth). The reason is that, as Bénabou's own model exemplifies, the fight over the pie does not necessarily lead to higher transfers, just to higher distortions. There is some work (Coate and Morris, 1995; Holmes and Schmitz, 1995; Krusell and Ríos-Rull, 1996; Prescott, 1996) that points to the selection of barriers to technology or to inefficient policies as outcomes of the political process. This implies that unequal societies might choose policies that are detrimental to growth in complete-market settings without exhibiting a high volume of transfers.

Another reason I do not think that the evidence against complete-market models is very compelling is the reliance on cross-sectional data. Krusell and Ríos-Rull (1994) show that a key quantitative determinant for the amount of redistribution is the constitution of the country, especially the frequency of policy reassessment. In that model, inequality drives growth via the inefficient transfer mechanism, but a cross section

of country data from this model would give the impression, as do the real-world data, that this mechanism is not operative; the reason is that the differences in constitutions would be much more quantitatively important for transfers and growth than differences in initial inequality. In addition, recall that other cross-country differences can also be important (Bénabou points to the bias towards the key political agent, which he denotes by λ , as a key factor.).

An important property of Bénabou's model is that agents do not have to worry about the future consequences of their actions. This implies that extensions of this model that use shorter periods or in which there are more interactions between generations have to depart drastically from the type of approach with closed-form solutions that Bénabou uses, because of serious technical problems that arise when agents are truly forward-looking. The literature that Bénabou reviews has taken various routes to avoid this problem: for example, it has limited model dynamics to make future actions and policies irrelevant to current voters; however, this also limits the issues that can be addressed and leaves the two-period overlapping-generations model with irrelevant young agents as the only usable model [Persson and Tabellini (1994) and also the model constructed by Bénabou, have this property]. Another approach treats the political decision as a problem of determining in the initial period a policy that will remain constant forever (Alesina and Rodrik, 1994); this contradicts one of the features inherent in governments, the inability to commit to future policies. On some occasions, the literature has opted to limit the rationality available to agents, so that they are not fully aware of the effects of these policies. Krusell, Quadrini, and Ríos-Rull (1996) describe how these various approaches compare quantitatively with one that is fully dynamic and in which agents are completely rational.

Models of the type used by Bénabou, two-period overlapping-generations models with limited interaction between generations, are not very good for making quantitative predictions. In particular, this structure does not seem to be very appropriate for studying issues of capital accumulation, especially in the light of Kotlikoff and Summers' (1981) findings that the bulk of the wealth in the United States is related to bequests. It seems to me that infinite-lived-agent models are more appropriate.

3. Models with Imperfect Credit Markets

The second strain of the literature Bénabou discusses includes models with imperfect or nonexistent credit markets. In this setting, without transfers, the allocation is inefficient, as poor agents invest less than what they would if there were perfect credit markets. Redistributive

schemes now allow poor agents to overcome this friction and hence can foster growth.

Bénabou has a nice, simple implementation of these ideas that needs no basic changes in the setup of the model used for the case of perfect credit markets. Whereas the previous model has an investment function that depends only on aggregate assets, without credit markets the individual investment function is proportional not to aggregate assets, but to the individual's own assets, with the same constant of proportionality. Given decreasing returns to scale to individual investments, this feature yields inefficiency. In this model, individual savings equal individual investment and are given by

$$k_i = s(\tau)w_i.$$

In this model, inequality reduces growth, and there is actual redistribution. Note also that efficiency requires a positive tax rate. When a political economy mechanism is used to endogenize policy selection, we learn that the agent with median wealth prefers a higher tax rate than the efficient one and that the progressivity of the tax system leads the preferred tax rate of the mean wealth holder to depend on the variance.

Bénabou argues that this is a very promising type of model based on two pieces of evidence: that market imperfections affect growth and investment negatively, and that public education has a positive effect on growth. However, if it is market incompleteness that accounts for the comovements of growth and redistribution in the data, we should expect to see that transfers are tied to investment projects. It seems to me that the majority of transfers in developed countries are mainly designed to enhance the consumption possibilities of the recipients (social security, welfare) or to protect prices of certain goods (mostly in agriculture), and not to finance investment projects. Moreover, one of the components of government outlays that probably does assist individual investment is public education, which is not typically labelled a transfer.

4. Variant of Bénabou's Model Where the Specific Type of Redistribution Used Matters

A key property of transfers in Bénabou's model that yield higher growth is that appropriate recipients, which in his case are the poorest people, are chosen. To illustrate that this is not general, consider a variation of Bénabou's model in which the quality of the project varies across indi-

viduals. This can be easily formalized through an individual investment technology given by

$$y_i = r_i k_i^\beta w_i^{1-\beta}.$$

Note that this technology is identical to Bénabou's except that now the coefficient multiplying the return is r_i , individual-specific, rather than the common term r used in his model.

In a model with perfect credit markets, the individual level of investment is now an increasing function of r_i , while the individually desired tax rate is a function of both r_i and w_i . (For a given project quality r_i , the higher w_i is, the lower are the desired taxes as indexed by τ_i ; for a given level of wealth w_i , individuals might want a higher or lower tax rate depending on their r_i , since some might be lenders and some might be borrowers.) In this model, redistribution plays no role in improving efficiency. Moreover, taxation generates positive amounts of redistribution because projects come in different sizes. Here, the joint distribution of w_i and r_i will determine the mapping from inequality to economic performance and to volumes of redistribution, and it is not clear that more inequality would lead to more redistribution and to less growth. This mapping depends on the joint distribution of both variables.

In a world with imperfect credit markets, the special nature of the example used (two-period model with log utility and no second-period endowments) makes the individual investment rule the same as in Bénabou: i.e., a function that is independent of r_i . We also get an inefficient allocation without transfers. However, here efficiency can only be achieved if the transfers depend not only on wealth w_i , but also on the quality of the project, r_i . Depending on the joint distribution of r_i and w_i , transfers from the rich to the poor might increase or decrease the efficiency of the system. In fact, if we think of models in this vein in which periods are shorter than one generation, and hence where there might be persistence over time of the quality of the projects, it might very well be the case that subsidizing the previously successful entrepreneurs, the rich, is the policy that maximizes growth.

5. *Problems with Simple Models*

Whether, in the context of the model just outlined, the specific joint distribution of r_i and w_i is such that efficiency is increased with transfers from the rich to the poor or with transfers from the poor to the rich can only be resolved empirically. Here is where simple models with closed-form solutions and intuitive appeal start losing their usefulness, as they

are not capable of making tight quantitative predictions about issues such as the sources of inequality and how it persists over time. To give an idea of why models like the one presented are not so good for quantitative purposes, note that in these models there is no clear distinction between income and wealth. There is one variable (an endowment) that plays the role of both.

Tight quantitative predictions require a theory that simultaneously accounts for the joint distribution of income and wealth and for the intertemporal mobility of households. There is some quantitative work, based on general equilibrium models, that is starting to give us leads about the key determinants of inequality and its intertemporal transmission (Aiyagari, 1994; Huggett, 1995; Krusell and Smith, 1995; Castaneda, Díaz-Giménez, and Ríos-Rull, 1995; Imrohoroglu, Imrohoroglu, and Joines, 1994). Among their findings is that the absence of insurance markets for idiosyncratic uncertainty by itself, even when capable of accounting for the concentration of income seen in the data, cannot account for the observed concentration of wealth. This suggests some kind of increasing returns to individual asset accumulation. (In terms of the model just outlined, this can be modeled, for example, as relatively persistent disparities in the r_i .) Moreover, Quadrini (1996) seems to do a much better job in simultaneously accounting for the key features of the joint distribution of income and wealth by explicitly including entrepreneurial choice in a model of this type.

These findings indicate that even though it seems that imperfect credit markets are important in shaping the distribution of income and wealth, the implication for growth policy is not necessarily to subsidize the poor indiscriminately, but rather to engage in some form of encouragement of entrepreneurship.

6. *Other Issues*

In addition to reviewing the two main strains of the literature, Bénabou also tries to assess empirically whether the degree of inequality across countries is converging. The lack of sharp findings shows that it is still too early to make a call on this issue.

Finally, Bénabou reviews models where the relations between different social groups are modeled as either conflict or cooperation. These models are basically of the repeated-prisoner's-dilemma type. I agree with Bénabou that these models do not have a clear link to social conflicts unless issues of private information lead to periods of punishment (as for example in Zarazaga (1993), where groups fight over slices of the budget). Another interesting implementation of these ideas is Chang

(1995), in which workers and capitalists engage in centralized bargaining to set wages.

7. Conclusion

In this paper, Bénabou has looked at an important group of papers that study the relation between inequality and growth, as well as the cross-sectional evidence regarding this relation. Still there are some pertinent issues that Bénabou does not consider. All the evidence used comes from cross-sectional studies; there is no attempt to use, for example, U.S. time-series data. The United States has had large changes in its wealth concentration since the 1920s, with associated large changes in productivity growth.

Also, the types of models reviewed and used by Bénabou are chosen less for quantitative analysis than for analytical tractability. For example, the models used have the feature that one period means one generation, i.e., at least thirty years, and thus income and wealth are the same variable. Because of their lack of tight quantitative predictions, these models are not going to be very useful in helping us understand the mechanisms that determine inequality. In this respect, I think that the recent literature that attempts to make quantitative statements about the determinants of inequality (not reviewed by Bénabou) may ultimately be more useful for understanding the relationship between inequality and growth.

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Discussion

Per Krusell asked for a clarification about the empirical work: Was the author testing whether all countries converge to the same income distribution, or whether each country converges to a different distribution that depends on its characteristics and initial conditions? Bénabou acknowledged that the prediction depends on the model and the parameters; in particular, for some models and parameter configurations one can get multiple long-run distributions and countries converging to different distributions. His own test addresses only the issue of whether there is some tendency for Gini coefficients in different countries to become less dispersed over time.

Bob Barsky noted that in many dynastic models the asymptotic results are sensitive to parameter values, and that under certain conditions there may exist only degenerate limiting distributions. One simple example is when one agent has a low discount rate and thus gets all the wealth asymptotically. Another possible example is when parents invest more in their more able children. We don't observe these extreme distributions in reality, Barsky suggested, because governments typically intervene when inequality becomes too great.

Daron Acemoglu pointed out that the paper does not deal explicitly with labor-market dynamics, which may be an important omission. In particular, we have observed significant increases in wage inequality in OECD countries in recent years, which is likely to have a different set of causes than increased inequality in nonlabor income. Michael Klein ex-

pressed interest in what the paper has to say about the mobility of individuals between income groups. He suggested that empirical analysis of mobility might help differentiate among models of inequality.

Julio Rotemberg asked for a tighter connection of the analysis with the case of the East Asian "dragons." He agreed that, assuming the existence of credit constraints, the greater initial equality of incomes in East Asia could help to explain the rapid human-capital accumulation observed in those countries. But the idea that credit constraints affected physical investment didn't ring so true; in countries like Korea and Japan, much investment was by large companies with government support and substantial resources, not by individuals. He wondered whether the most benign effect of equality in East Asia might have been the enhancement of cooperation and social cohesion.

Bénabou, in his response, took issue with Roberto Perotti's contention that the models were becoming too complex and nonlinear to admit of useful empirical application. He suggested that one interesting direction would be to test for the existence of multiple equilibria. Another useful exercise, using the models as a guide, would be to try to separate out the effects of inequality on growth that are mediated by endogenous policy from those effects that operate through nonpolicy channels.