RULES, STABILITY, AND GROWTH

Mark Gradstein

ABSTRACT

This paper examines two systems of fiscal redistribution in the context of a growing economy subject to unexpected shocks, rules and discretion. Under the former system, the tax system is in place and is known to households contemplating investment decisions. Under the second, redistribution is decided upon only after the investment decisions have been made. I find that rules always lead to faster capital accumulation and growth, but political support for them is only likely to occur in a stable economy. Income inequality adversely affects the likelihood of adopting rules, especially so in unstable economy.

Keywords: Fiscal rules, discretion, stability, economic growth

JEL classification: E62, O23, O40

1 Introduction

A great many studies have recently been conducted on the relationship between political and institutional structure on the one hand and economic performance on the other. The empirical strand of the literature has generated several very intriguing regularities that beg theoretical discussion. One set of results refutes, perhaps surprisingly, any significant relationship between democracy and growth. In particular, Barro, 1996, argues forcefully that democratization does not necessarily imply improved growth prospects in his cross-country study; see also Przeworski and Limongi, 1993, who reach a similar conclusion.

At the same time, a substantial body of evidence has emerged arguing the importance of institutions for growth. Specifically, Knack and Keefer, 1997, find that countries with a well-established rule of law grow faster than average. And while Easterly and Levine, 1997, find that ethnic conflict has been a crucial factor in explaining slow growth in Africa, Collier and Gunning, 1999, claim that good institutions can alleviate the problem. Rodrik, 1999, finds that existence of the rule of law enables the economy to handle more effectively adverse shocks thereby sustaining growth. Specifically, he points out the different growth paths after mid-1970s in many of the East Asian countries (such as South Korea) versus Latin American countries (such as Brazil). The argument is that, while both groups of countries were hit by shocks of about the same magnitude, the East Asian countries have apparently managed to handle these shocks much better than the Latin American countries, which enabled them to enhance economic growth. The mechanism through

which particular institutions contribute to growth remains unclear, however.

This paper is an attempt to formalize some of the above relationships. In the model economy below, voters consider two alternative systems of fiscal redistribution, referred to as rules versus discretion. Redistrib ution is associated with a deadweight loss whose magnitude is subject to a random shock. Rules prevail when the fiscal constitution specifying taxes and transfers is known in advance to households who consider their investment decisions.[1] In contrast, in the absence of rules, redistribution is arbitrary in the sense that it is determined ex post the individual investment decisions and is contingent on the realization of the shock. The volatility of the random shock is interpreted here as a lack of stability and implies a difficulty in making informed decisions on redistribution prior to the realization of shocks. In a stable economy, such volatility is minimal.

A comparison between the two fiscal policy systems reveals that when rules are employed, the levels of expected investment and growth are higher than under discretion; thus, rules are growth promoting. Their political support is, however, not guaranteed in general and hinges on the economy's stability and on the equality in the distribution of income. When the economy is unstable, the model predicts support for discretion rather than rules, with the subsequent reduction in investment as well as slower growth. The reason for this preference is that, under changing circumstances, the voters prefer to retain maximal flexibility in order to make better informed decisions. This is reinforced by income inequality, because the majority of voters prefer to determine redistribution ex post the investment decisions, which allows imposing higher taxes. Previous studies (e.g., Knack and Keefer, 1995) have detected that lack of appropriate institutions for enforcement of property rights may impede private investment; similarly, volatility has been

[1] Rules could be perceived as analogous to what Rodrik, 1999, calls a conflict-management institution.

identified as inhibiting private investment (see e.g., Aizenman, 1997, Aizenman and Marion, 1999).[2] Here we go one step further claiming that lack of institutions, which prevent redistributive tensions, along with volatility may also adversely affect investment-friendly *policies*.

The paper proceeds as follows. The next section lays out the framework. Analysis of the equilibrium outcomes under both rules and discretion is then presented in section 3. Section 4 compares the outcomes in terms of their redistribution and growth effects as well as in terms of the political support each system is likely to garner. Section 5 discusses the robustness of the assumptions and possible extensions, while section 6 contains concluding remarks.

2 Model

2.1 Economic environment

We stipulate a dynamic economy in which individuals live for two periods. There is a continuum of heterogeneous families in the economy, indexed by i, each comprising a parent and an offspring; the total population is constant over time. Initially, household i is endowed with total income y_{i0}; the initial distribution of income is skewed so that the mean income exceeds its median. In each period t, parent i allocates household income y_{it} between current consumption, c_{it} and investment, k_{it}. The budget constraint is thus:

$$y_{it} = c_{it} + k_{it} \tag{1}$$

Investment is subject to redistribution. We assume a very simple redistribution model of Meltzer and Richard, 1979, extended in Persson and Tabellini, 1994, which we supplement with an assumption of a deadweight loss associated with redistribution; for simplicity, a linear technology of production

[2] Alesina et al., 1996, and Alesina and Perotti, 1996, find that political instability reduces investment and growth.

is assumed which transforms a unit of net investment into one unit of output. Specifically, denoting q_t the value of the redistribution parameter we thus have:

$$y_{it+1} = (1 - q_t)\, k_{it} + (q_t - b(q_t; e_t))k_t \qquad (2)$$

where k_t is the average level of investment in period t; and $b(\,,\,)$ is the deadweight loss function, $b_q > 0$, $b_{qq} > 0$. Equation (2) implies that individual investment is taxed at the rate of q_t, and each individual household receives a lump sum transfer. The amount of these transfers is assumed, however, to be smaller than the tax proceeds to capture the distortive nature of redistribution. In particular, redistribution can adversely affect the incentives to engage in innovative activities thus reducing the productivity of investment in the official sector of the economy, or it can imply administrative burden associated with the need to monitor and inspect household's revenues. Note that a balanced budget in each period is assumed thus ruling out debt issuing as a way to smooth consumption over time – see Lucas and Stokey, 1983, for analysis which incorporates this possibility.

e_t represents a random shock, which becomes known only after the investment decisions have been made. It is related to the economy's stability: the smaller the volatility of the shocks the more stable is the economy in the sense of being able to better predict the deadweight loss stemming from redistribution policies. Under our interpretation of the excess burden function, for example, e_t can be viewed as an exogenous shock occurring to the relative productivity of investing in the official sector of the economy. e_t is assumed to be drawn in each period from a distribution function $H()$, which is twice differentiable with a positive support; e denotes the mean value of e_t. Whatever the origin of the shocks, purely economic or, instead, institutional-political, the existing institutional structure supposedly matters for the perceived magnitude of the shock effect.

Although not technically required, we find it useful for the sake of exposition to employ the following quadratic specification of the deadweight loss function also employed in Perotti, 1993,[3]

$$b(q_t; e_t) = e_t q_t^2 /2 \quad (3)$$

A larger value of e_t is then interpreted to be associated with a larger deadweight loss of redistribution.

Parents make all household decisions: the decision on the extent of redistribution in each period is taken by a majority vote, whereas the investment decisions are made by each household independently. Parents derive utility from current consumption and from their offspring's next-period income. Parent i's utility in period t, $U(c_{it}, y_{it+1})$, is assumed to satisfy the standard assumptions of monotonicity and concavity. Again, to simplify matters we assume away income effects by specifying quasilinear preferences and by suppressing discounting:

$$U(c_{it}, y_{it+1}) = V(c_{it}) + y_{it+1} \quad (4)$$

where $V'>0$, $V''<0$.[4]

In each period, parents act so as to maximize their expected utility,

$$E_e[U(c_{it}, y_{it+1})] = E_e[V(c_{it}) + y_{it+1}] \quad (5)$$

2.2 Decision making

Fiscal redistribution can take place either prior to the investment decisions, hence *a fortiori*, prior to the realization of the random shock, or after these events. We find it useful to apply Kydland and Prescott's, 1977, distinction between rules and discretion to these alternative decision making

[3] A crucial assumption here is that $b_{q\varepsilon} > 0$, so that the marginal burden of redistribution increases with ε

[4] The robustness of this assumption is discussed later.

sequences. Specifically, under the former, the households first vote on q_t and only then allocate their income between consumption and investment according to the budget constraint (1). In contrast, under discretion, a majority decides on redistribution *given* the stock of investment and after the realization of the random shock. Preceding these decisions there is a constitutional stage at which the households decide, in each period, whether fiscal redistribution should be governed by rules or by discretion. Our analysis precludes the possibility of complete contracts whereby the decision on the value of the redistribution parameter is made contingent on the realization of the random shock. The implication of allowing the possibility of complete contracts is discussed later on.

3 Analysis

3.1 Prevalence of rules

In this case in each period t, the households first vote on redistribution; then allocate their budget between consumption and investment; then realization of the random shock becomes known and future income is determined. The decision making process involves two stages, and the analysis proceeds backwards starting with the second stage whereby investment decisions are made.

Maximization of (5) subject to the constraints yields the following first-order condition at the interior optimum:[5]

$$V'(c_{it}) - (1-q_t) = 0 \qquad (6)$$

Combining with the budget constraint (1) this implies that

$$k_{it} = y_{it} - V'^{-1}(1-q_t) \quad \text{and} \quad k_t = y_t - V'^{-1}(1-q_t) \qquad (7)$$

where y_t denotes the average income in period t.

[5] The condition for the existence of such optimum is that the lower bound of income distribution is large enough.

Note that, as expected, a higher value of the redistribution parameter implies a lower level of investment. Further note that, since investment is a linear function of income and because future income is a convex combination of parental income and average income, it follows that for any chosen level of redistribution, skewness is intertemporally preserved, so that under all future income distributions the mean income exceeds the median one.

We then turn to the determination of the preferred value of redistribution in period t. Employing the envelope theorem, we obtain the following first-order condition with respect to q_t:

$$-k_{it} + (1 - eq_t)k_t + (q_t - eq_t^2/2)\, dk_t/dq_t = 0 \qquad (8)$$

where k_{it} and k_t are given from (7), and the second order condition for a maximum is assumed to hold. Totally differentiating (8) and employing the second order condition we then obtain that the richer a household the lower its preferred level of redistribution, implying that the preferences are single peaked and that the household with the median income is decisive in determining q_t. Letting subscript m denote the decisive household and recalling (7), the equilibrium value, q_t^*, is given as follows:

$$-(y_{mt} - y_t)/e - q_t^* [y_t - V'^{-1}(1-q_t^*)] - (q_t^*/e - q_t^{*2}/2)/(1-q_t^*)^2 = 0 \qquad (9)$$

It follows from (9) that q_t^* is positively related to the difference between the average and the median incomes and to the average income in the economy. This could be interpreted as a positive relationship between inequality and/or development on the one hand and redistribution on the other hand.

To sum up,

Proposition 1. When the rule of law prevails, there exists a political-economic equilibrium where

the median income household is decisive in determining the level of redistribution. Redistribution is higher the more developed the economy and the less equal the distribution of income.

3.2 Discretion prevails

Under discretion, the households first make their budget allocation decisions first. Then the random shock is realized; and, finally, redistribution takes place. Thus, at the redistributional stage the stock of capital is completely inelastic. Because of this, discretionary redistribution is similar to expropriation as studied in, for example, Benabou, 1996, Grossman, 1994, 1995, Tornell and Velasco, 1992, Tornell and Lane, 1999. The analysis proceeds backwards starting with the vote on redistribution given the investment decisions and knowing the realization of the random shock.

The preferred level of redistribution is given then by maximizing essentially the next-period income,

$$y_{it+1} = (1 - q_t)\, k_{it} + (q_t - e_t q_t^{\,2}/2) k_t \tag{10}$$

The first-order condition is:

$$- k_{it} + (1 - e_t q_t) k_t = 0 \tag{11}$$

It follows that the preferred level of redistribution is a monotonically decreasing function of household *i*'s investment implying in turn that the household with the median investment level, k_{mt}, is decisive. The equilibrium level of redistribution is then

$$- k_{mt} + (1 - e_t q_t^{**}) k_t = 0, \quad \text{or} \quad q_t^{**} = (1 - k_{mt}/k_t)/ e_t \tag{12}$$

In the first stage, households allocate their income between consumption and investment so as to maximize their expected utilities and anticipating redistribution as in (12). Thus, their objective is to maximize

$$V(c_{it}) + E_{e_t}[(1 - q_t^{**})k_{it} + (q_t^{**} - e_t q_t^{**2}/2)k_t] \quad (13)$$

subject to the budget constraint (1).

The first-order condition is:

$$-V'(y_{it} - k_{it}) + 1 - E_{e_t}(q_t^{**}) = 0 \quad (14)$$

The system of equations (12) and (14) determines the equilibrium solution consisting of the levels of investment and the level of redistribution. In particular, (14) implies that

$$k_{it} = y_{it} - V'^{-1}[1 - E_{e_t}(q_t^{**})] \quad (15)$$

so that (12) can be rewritten as follows:

$$-y_{mt} + V'^{-1}[1 - E_{e_t}(q_t^{**})] + (1 - e_t q_t^{**})\{y_t - V'^{-1}[1 - E_{e_t}(q_t^{**})]\} = 0 \quad (16)$$

or, after some simplifications,

$$-(y_{mt} - y_t) - e_t q_t^{**} y_t + e_t q_t^{**} V'^{-1}[1 - E_{e_t}(q_t^{**})] = 0 \quad (17)$$

The expected value of redistribution is, therefore, determined from

$$-(y_{mt} - y_t)E(1/e_t) - E_{e_t}(q_t^{**})\{y_t - V'^{-1}[1 - E_{e_t}(q_t^{**})]\} = 0 \quad (18)$$

As before, expected redistribution is positively related to the difference between the average and the median incomes and to the average income in the economy. Furthermore, note that convexity of $1/e_t$ implies that $E(1/e_t)$ increases when the distributions of the shocks becomes more dispersed. More precisely, consider a mean preserving spread in the distribution of the shocks, H. This is obtained by defining $e_t' = e_t + bz$, where b is a positive constant and z is a random variable distributed according to a cumulative distribution function $G(.)$ and has a zero mean; larger values of b correspond then to increases in volatility. Application of Rothschild-Stiglitz' (1970, 1971) analysis

tells us then that $E(1/e_t')$ increases as a result of this volatility increase. But this implies then that the expected equilibrium redistribution is positively related to the variability of the shocks: redistribution is expected to be higher in a more volatile economy. Furthermore, the two effects – larger inequality and larger volatility – reinforce each other in affecting redistribution, because the cross derivative of $(y_{mt} - y_t)E(1/(e_t + bz)$ with respect to $(y_{mt} - y_t)$ and to b is positive. In other words, the effect of increased volatility on making redistribution more aggressive is amplified in an unequal economy. Note that equation (2) implies that average future income is:

$$y_{t+1} = (1 - b(q_t; e_t))\, k_t \tag{19}$$

which clearly decreases in q_t, so that more redistribution implies less growth here.

We can, therefore, sum up:

Proposition 2. In the political-economic equilibrium under discretion, the expected value of redistribution in each period is higher and growth is slower the less equal and the more volatile the economy is. Furthermore, the adverse effect of volatility on growth is exacerbated by inequality.

This is supported by Rodrik's finding that economic growth in countries with a high level of redistributional tensions is less robust to exogenous shocks than in countries without such tensions.

4 Comparison of outcomes

In this section, we compare the outcome achieved when rules are employed to the situation when discretion prevails. We begin by comparing the implications of the two systems for redistribution

and growth, and then compare individual and majority preferences between the two.

4.1 Redistribution, investment, and growth

Proposition 2 suggests that expected redistribution is lower when the shocks are more predictable, that is when the distribution of shock shrinks in a mean preserving manner. In particular, it is lowest when shocks are fully predictable, that is, when e_t is replaced by its mean value, e. Furthermore, consider (18), when e_t is replaced by its mean value *e:*

$$-(y_{mt} - y_t)/e - q_t^{**}[y_t - V'^{-1}(1 - q_t^{**})] = 0 \qquad (18')$$

Comparing (18') with (9) we observe that the left-hand side in the latter exceeds that in the former. Since it decreases in the redistributive parameter, this implies that redistribution in the latter case is smaller, $q_t^* < q_t^{**}$, implying that even in the absence of shocks redistribution is higher under discretion. The reason for this is simple and has to do with time consistency of policies. When rules are employed, the median voter when deciding on redistribution takes into account its adverse effects on capital accumulation. In contrast, when redistribution takes place after investment decisions have been made, this consideration vanishes because the stock of capital is inelastic thus causing higher willingness to redistribute.

In both cases, growth is inversely related to redistribution, however. Thus, lower redistribution when rules are employed directly implies here faster growth.

To sum up,

Proposition 3. Rules cause less redistribution and foster faster economic growth than discretion.

4.2 Political support

Which system, rules or discretion, is likely to win the majority support? In addressing this question we add, in each period, a preliminary constitutional stage at which the voters decide which system they prefer to be in place, anticipating that under the chosen system events will evolve according to the preceding analysis. This analysis established that preference for redistribution is negatively related to income, so that the richer a household the lower its preferred value of the redistribution parameter. This implies that, *ceteris paribus*, preference for rules – which result in more limited redistribution – increases with income. Thus, for a given distribution of shocks, the richer a household the more likely is its support for the adoption of rules. The crucial issue, therefore, is the *ex ante* preference of the median voter, that is the household with the median income.

To approach this issue, we begin by assuming away random shocks for a moment. In such a case, the median income household prefers rules. The reason is that when rules prevail, that household is able to precommit itself to a desirable level of redistribution, whereas under discretion it cannot and redistribution ends up being too aggressive from the median voter's perspective *ex ante.*

How does the presence of random shocks affect the median voter's preferences? Specifically, suppose that the distribution of shocks undergoes a mean preserving spread. While this does not affect the median voter's utility when rules are employed, it should be clear that such mean preserving spread increases her utility under discretion: because the value of information (that allows tailoring optimal decisions to the shock realization) is positively related to uncertainty. Specifically, let

$$E_{e_t'} W(e_t', q_t^{**}(e_t')) = V(y_{mt} - k_{mt}^{**}) + E_{e_t'} [(1 - q_t^{**}) k_{mt}^{**} + (q_t^{**} - e_t' q_t^{**2}/2) k_t^{**}] \quad (20)$$

denote the median voter's expected utility level under discretion (and asterisks denote the equilibrium values as derived above). Differentiating (20) twice with respect to e_t' and employing the envelope theorem, it can be shown that (20) is convex. This is so because e_t' enters the utility function linearly and q_t**(e_t') is a convex function as was derived earlier. But then it follows from Rothschild-Stiglitz' (1970, 1971) results that a mean preserving spread increases (20). This, in turn, implies that the median voter's expected utility monotonically increases with the variability of the random shock; and if the spread of H is large enough, so that the economy is very unstable, then the median voter's expected utility under discretion can be higher than under rules.

Summing up,

Proposition 4. The majority support of rules hinges on the economy's stability. When the economy is stable, so that the random shocks are better predictable, then fiscal redistribution rules will enjoy the majority support. This is less likely, however, as the economy becomes less stable, in which case discretion may prevail.

The above proposition predicts a positive relationship between an economy's stability and the prevalence of rules. Very rich households tend to always support rules because rules limit future redistribution. Precisely the same factor causes very poor households to prefer discretion. Preferences of the middle-income households and in particular of the median income household are, therefore, decisive here. When the economy is stable, these households join the coalition of the rich to support rules. If the economy is unstable, however, then some of the middle class households, including the median voter, switch to support discretion rather than rules thus joining the coalition of poor households. To the extent that good institutions, such as the existence of an independent central bank, autonomous judiciary, reliable bureaucracy, breed stability, we can conclude that such institutions lead to the likelihood of adopting rules for fiscal redistribution. As we have seen earlier, this, in turn, ensures that investment and growth will be enhanced through a lower redistributive burden.

To relate our model to Rodrik's finding that existence of distributional conflict undermines a country's ability to absorb shocks. Based on this finding, we now ask whether the median voter's preference for discretion increases faster with volatility when his income is small relatively to the average income. Should this be the case, it would be an indication that an economy with a high level of income inequality is likely to adopt discretionary policies that slow down growth in response to volatility.

Technically, to address this issue, we need to establish the sign of the cross partial second derivative of the median voter's utility differential under discretion and under rules with respect to both his income and to the volatility parameter b. Since the expected utility under rules is not affected by volatility, the decisive factor is the sign of the derivative of (20). Taking the derivative, we obtain:

$$\partial^2 E_{e_t'} W(e_t', q_t^{**}(e_t'))/\partial y_{mt}\,\partial b = \partial E_z[-zk_t^{**}q_t^{**2}/2]/\partial y_{mt} \qquad (21)$$

Since $\partial q_t^{**}/\partial y_{mt} < 0$, (21) is positive implying that increased volatility tilts political balance towards discretionary policies in unequal societies. Thus, volatility and inequality complement each other in affecting preference of discretion as opposed to rules.

To sum up,

Proposition 5. Increased volatility increases the preference for discretionary policies in unequal economies to a greater extent than it does in egalitarian ones. In the light of the previous results, this implies that economies with a high level of inequality are prone to adopt growth retarding policies when volatility increases.

5 Discussion

Here we discuss the significance and robustness of the assumptions made above and some possible extensions.

5.1 Incompleteness of contracts

The above analysis ruled out the possibility of complete contracts. A contract is complete if the decision on redistribution could be made contingent on the realization of the random shock. When such a possibility does exist, the decisive majority clearly prefers rules to discretion: a commitment to a state contingent value of the redistributive parameter leads to a utility level for the decisive median voter that is higher than when there is no such commitment. In other words, when the adverse effects of a random shock are alleviated through complete contracting, the case for discretionary decision making disappears altogether. Thus, incompleteness of contracts is an essential feature of this model.

5.2. Political framework and constitutional rules

In the paper, we have assumed that the resource allocation outcome is shaped by voting. Alternatively, one could think about rent seeking, violent appropriation or open military conflict between different interest groups as determining the outcome. This is the approach pursued in Grossman, 1994, 1995, in a static context and in Benhabib and Rustichini, 1996, Tornell and Velasco, 1992, and Tornell and Lane, 1999, in a dynamic, growth-theoretic context. A comparison between rules and discretion in such framework would constitute a worthwhile extension of the present model. Such extension is particularly important in situations where the primary source of a distributional conflict are not income differences, but rather ethnic, religious or cultural cleavages – as many times is the case in less developed countries.

Also, the paper's analysis assumes that the political process is governed by a simple majority rule. Under discretion, however, the value of the redistributive parameter is excessively high in the eyes of the median voter. To reduce it, it may beneficial for the coalition of voters who

are richer than the median income voter to institute a supermajority rule in this case, see Gradstein, 1999, for a study of such incentives in a related context. In a different context, these alternative voting institutions have been recently considered by Aghion and Bolton, 1997. The optimal supermajority rule from the viewpoint of the current majority will involve a tradeoff between flexibility in the light of anticipated shocks and commitment to lower redistribution and is reminiscent of Rogoff, 1985.

5.3. Deadweight loss and multiple equilibria

The paper has assumed an intertemporally constant distribution function of the random shock associated with deadweight loss. In contrast, the deadweight loss itself could be construed as being a function of the redistribution system in place, so that, in particular, its volatility would be higher under discretion than under rules. This opens up the possibility of multiple equilibria: if the initial income inequality or volatility are high so that discretion prevails, volatility of the deadweight loss would increase over time reinforcing future public support for discretion; if, however, rules initially prevail, the resulting volatility will be small, thus rules will also likely be adopted in the future. In this case, depending on initial conditions, namely, income inequality and volatility, the economy will apply rules and be less volatile and high-growth, or it will adopt discretion, be volatile and grow slower.

Another extension concerns the exogeneity of the deadweight loss function. In a related paper Cukierman et al., 1992, the deadweight loss of a tax system is endogenously determined. Their setup differs in the policies being determined by a political party in power as opposed to the majority voting employed here. They show that, when the probability of an incumbent to get re-elected is low or when there is a high degree of political polarization, then the tax system will tend to

be inefficient. Dynamic inconsistency can be viewed as a common theme between Cukierman et al., 1992, and this paper. It might be interesting to merge the two approaches so as to endogenize the deadweight loss within the growth framework presented here.

5.4. Specification of preferences

The paper's analysis assumes that parental utility is linear in offspring's consumption. The main advantage of this assumption for our purposes is that it simplifies the study of the equilibrium effect of volatility. To check for the robustness of this assumption, we now briefly consider its modification. To this end, consider the following logarithmic utility specification:

$$U(c_{it}, y_{it+1}) = \log(c_{it}) + \delta \log(y_{it+1}),\ 0 < \delta < 1 \qquad (4')$$

so that the objective function is the expected utility,

$$E_e[\log(c_{it}) + \delta \log(y_{it+1})] \qquad (5')$$

The budget constraint, the redistribution function, and the specification of the deadweight loss remain unchanged.

Under rules, the first-order condition with respect to k_{it} is

$$-1/c_{it} + \delta(1-q_t)/y_{it+1} = 0 \qquad (6')$$

As in the above analysis, it can be shown from (6') that there exists a negative relationship between the redistribution parameter and the average amount of investment.

The first-order condition with respect to the redistribution parameter q_t is as in (8) and, in particular, it can be shown that preference for redistribution varies negatively with income, so that the median income individual determines redistribution. Similarly to the above, the equilibrium value of the redistribution parameter is higher when that income is small relative to the average income.

Thus, Proposition 1 is essentially preserved intact.

Under discretion, the equilibrium level of redistribution is determined in exactly the same way as in (12), $q_t^{**} = (1 - k_{mt}/k_t)/e_t$; in particular, it is an increasing function both of income inequality as measured by the ration between the median and the average investment levels, and of volatility. Thus, Proposition 2 also holds by and large. Anticipating this, the individuals make their investment decisions so as to maximize

$$log(c_{it}) + dE_{e_t} log[(1 - q_t^{**}) k_{it} + (q_t^{**} - e_t q_t^{**2}/2)k_t] \qquad (13')$$

subject to the budget constraint (1).

The first-order condition is:

$$-1/c_{it} + dE_{e_t} (1 - q_t^{**}) / [(1 - q_t^{**}) k_{it} + (q_t^{**} - e_t q_t^{**2}/2)k_t] = 0 \qquad (14')$$

Comparison between the outcomes leads to the conclusion of Proposition 3: dynamic inconsistency causes more aggressive redistribution under discretion than when rules are employed. Because utility is now concave in offspring's income, the expected utility under discretion is no longer, in general, a convex function of the random shock. Thus, Proposition 4 now may fail to hold. Similarly, Proposition 5 may not hold in general.

This discussion implies that some of our results can be easily generalized, while others may hold only under special circumstances. In particular, the conclusion that rules lead to faster capital accumulation and growth seems to be general. In contrast, the result that the political support for them can only occur in a stable environment may only hold when parental marginal utility from offspring's income is relatively small.

6 Concluding remarks

While it has been recognized for quite some time that stability is conducive for investment and growth, the importance of institutions for handling adverse random shocks has only recently been empirically illustrated, see Rodrik, 1999. This paper is an attempt to formalize the relationship between social polarization as it expresses itself through income inequality and the economy's ability to commit itself to growth promoting rules in the light of external volatility. Our major finding is that unequal economies are less likely to do so than economies with a more equal distribution of income. More specifically, it is shown that policies are more likely to be governed by rules the less volatile is the environment and the more equal is the distribution of income. This, in turn, should encourage private investment and lead to faster growth. These testable hypotheses naturally invite further empirical work on the relationship between measures of social polarization and countries' ability to handle shocks.

References

Aghion, P. and P. Bolton, 1997, "Incomplete social contracts," manuscript.

Aizenman, J., 1997, "Investment in new activities and the welfare cost of uncertainty," *Journal of Development Economics*, 52, 259-277.

Aizenman, J. and N. Marion, 1999, "Volatility and investment: Interpreting evidence from developing countries," *Economica*, 66, 157-79.

Alesina, A., Osler, S., Roubini, N., and P. Swagel, 1996, "Political instability and economic growth," *Journal of Economic Growth*, 2, 189-213.

Alesina, A. and R. Perotti, 1996, "Income distribution, political instability, and investment," *European Economic Review*, 40, 1202-1229.

Barro, R., 1996, "Democracy and growth," *Journal of Economic Growth*, 1, 1-28.

Benabou, R., 1996, "Inequality and growth," *NBER Macroeconomics Manual.*

Benhabib, J. and A. Rustichini, 1996, "Social conflict and growth," *Journal of Economic Growth*, 1, 125-142.

Collier, P. and J.W. Gunning, 1999, "Explaining African economic performance," *Journal of*

Economic Literature, 37, 64-111.

Cukierman, A., Edwards, S., and G. Tabellini, 1992, "Seignorage and political instability," *American Economic Review*, 82, 537-55.

Easterly, W. and R. Levine, 1997, "Africa's growth tragedy: Policies and ethnic divisions," *Quarterly Journal of Economics* 112: 1203-1250.

Gradstein, M., 1999, "Optimal taxation and fiscal constitution," *Journal of Public Economics*, 72, 471-485.

Grossman, H. I., 1994, "Production, appropriation and land reform," *American Economic Review*, 84, 705-712.

Grossman, H. I., 1995, "Robin Hood and the redistribution of income," *European Journal of Political Economy*, 11, 399-410.

Knack, S. and P. Keefer, 1995, "Institutions and economic performance: Cross-country tests using alternative institutional measures," *Economics and Politics*, 112, 207-228.

Knack, S. and P. Keefer, 1997, "Does social capital have an economic payoff? A cross-country investigation," *Quarterly Journal of Economics*, 112, 207-27.

Kydland, F.E. and E.J. Prescott, 1977, ""Rules rather than discretion: Inconsistency of optimal plan," *Journal of Political Economy*, 85, 473-491.

Lucas, R.E. and N. Stokey, 1983, "Optimal fiscal and monetary policy in an economy without capital," *Journal of Monetary Economics*, 12, 55-94.

Meltzer, A.H. and S.F. Richard, 1981, "A rational theory of the size of government," *Journal of Political Economy*, 89, 914-927.

Perotti, R., 1993, "Political equilibrium, income distribution, and growth," *Review of Economic Studies*, 60, 755-776.

Persson, T. and G. Tabellini, 1994, "Is inequality harmful for growth?" *American Economic Review*, 84, 600-621.

Przeworski, A. and F. Limongi, 1993, "Political regimes and economic growth," *Journal of Economic Perspectives*, 7, 51-69.

Rodrik, D., 1999, "Where did all the growth go? External shocks, social conflict, and growth collapses," *Journal of Economic Growth*, 4, 385-412.

Rogoff, K., 1985, "The optimal degree of commitment to an intermediate monetary target," *Quarterly Journal of Economics*, 100, 1169-1190.

Rothschild, M. and J. Stiglitz, 1970, "Increasing risk: I. A definition," *Journal of Economic Theory*, 2, 225-240.

Rothschild, M. and J. Stiglitz, 1971, "Increasing risk: II. Its economic consequences," *Journal of Economic Theory*, 3, 66-84.

Tornell, A. and A. Velasco, 1992, "The tragedy of the commons and economic growth: Why does capital flow from rich to poor countries?" *Journal of Political Economy*, 100, 1208-1231.

Tornell, A. and P. R. Lane, 1999, "The voracity effect," *American Economic Review*, 89, 22-46.