# Institutional Traps and Economic Growth

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## ABSTRACT

This paper's point of departure is that low-quality institutions, concentration of political power, and underdevelopment are persistent over time. Its analytical model views an equal distribution of political power as a commitment device to enhance institutional quality thereby promoting growth. The politically powerful coalition contemplates relinquishing of its power, weighing this advantageous consequence against the limit on own appropriative ability that it entails. The possibility of two developmental paths is exhibited: with concentration of political and economic power, low-quality institutions, and slow growth; and a more equal distribution of political and economic resources, high-quality institutions, and faster growth.

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# 1. Introduction

Whereas the broad importance of institutions for economic development seems to have been firmly established in recent work, see Acemoglu et al., 2005, for a comprehensive account, much less is known about their determinants. In contrast, the reality of underdevelopment begs for enhancement of such understanding. In other words, what prevents societies from adopting superior institutions and why so many less developed countries seem to be stuck in a bad equilibrium with poor institutions and poor economic outcomes?

One observation is that the commitment to high-quality institutions should be real. In other words, it is important to distinguish between statutory, de jure, institutions and their in practice implementation; sustainability of good institutions hinges upon the latter. Many failed states have adopted decent, sometimes even exemplary, institutions de jure, and the wording of the constitutions generally little differs across countries, almost all emphasizing to various degrees universal values, such as equality, rights, justice etc.[1] Indeed, there are many appealing constitutions in developing countries, which were often inspired by advanced European and American constitutional theories and convey similar sentiments; yet, these countries often times represent examples of utter developmental failures associated with particularly poor institutions in practice and high levels of material and political inequalities.[2]

This suggests that merely a blueprint is not enough and that the de facto implementation may be of an even greater importance in the context of institutional

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[1] A cursory review of constitutions in a sample of countries reveals many common themes although some as in the US emphasize individual freedoms and rights, whereas many other countries – advanced as well as developing ones - putting additional emphasis on equality, in particular, with respect to access to public services; see http://www.oefre.unibe.ch/law/icl/ for a useful information source in this regard.

[2] One stark case is that of Liberia whose governance system was modeled after the one in the United States; another equally revealing one is that of Haiti, whose constitution borrows from the French one. Additionally, the Stalinist constitution of 1936 (in particular, its article 125) that supposedly formed the background for the Soviet Union's legal system until the country's extensively provides for individual rights as well as for the self determination of the federal sub-units. Likewise, in Iraq under Saddam Hussein: "Private ownership and

development. In other words, the understanding of the factors that provide incentives to societies to maintain high-quality institutions is the key. Some recent work has started addressing these issues. One line of research attempts to answer this set of questions by recognizing that institutions – in addition to their aggregate effects – entail redistributive consequences. This implies that growth enhancing institutions benefit some groups of individuals – but potentially at the expense of others. If the latter wield political influence, superior institutions may not be adopted despite their overall growth enhancing potential. According to this approach, the distribution of political power is an important determinant of institutional quality, see Acemoglu, 2005, for argumentation along these lines. Thus, democracy, with its relatively equal distribution of political power, often emerges in this line of thinking as a political system that is more amenable to better institutional quality than an oligarchy with its concentration of political power – see Acemoglu, 2003, and Gradstein, 2007.

This paper's point of departure is that economic factors as well as the concentration of political power, may play a role in determining institutional quality, hence have developmental consequences. To focus on these, we deliberately regard the concentration of political power to a large extent as endogenous and focus on the concentration of economic resources, specifically, income inequality. While decisions on institutional quality are political, only income inequality affects the outcome in this regard, whereby the rich are less interested in high-quality institutions than the poor. More importantly, we consider a rational political determination of institutional quality assuming that an ex ante commitment does not have much bite, hence, is ruled out. Instead, it is determined ex post individual economic decisions, which are made in correct anticipation of implemented institutional quality. Institutional quality has two principal effects. On the one hand, it induces higher overall

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economic individual liberty are guaranteed according to the law…" and "Equal opportunities are guaranteed to all citizens, according to the law." (Iraq's 1990 constitution, articles 16b and 19b respectively).

investment and faster income growth; on the other hand, by restricting the ability of the rich to engage in successful appropriation, it distributes the fruits of this growth more equally.

An exogenously given political bias in conjunction with income inequality determines the composition of the decisive political coalition. While this coalition is unable to directly precommit to institutional quality, it can democratize thereby creating an indirect commitment by tilting the balance of political power toward a coalition more favorable to institutions. In deciding whether or not to do so, it weighs the benefits of better institutional quality for aggregate investment versus a lesser share of the generated income it is able to appropriate. In our setting, if the political bias is substantial, income inequality and poor institutional quality may reinforce each other, potentially generating different developmental paths. Low level of inequality, high institutional quality, and rapid growth are the features of the good equilibrium, and high inequality, low institutional quality, and slow growth are obtained in the bad equilibrium. The existence of these developmental paths means that poor institutional quality and backward economic development can be persistent. Without creating favorable economic conditions – in this instance, through a reduction in income inequality – development is unlikely to emerge from the low equilibrium. This is consistent with the often failed attempts to import some constitutional features from advanced countries to developing ones, without introducing parallel changes in economic incentives to support these features, such as land reform or strong public education.

This paper is related to several literatures. Its motives are related to the literature on the political determinants of development, such as in Olson, 1993, Acemoglu, 2003, and Acemoglu, 2005.[3] More specifically related is Sonin, 2003, who offers a model where income inequality leads to the subversion of institutional quality; important historical work, summarized in Sokoloff and Engerman, 2000, brings forth similar ideas by contrasting the

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[3] A somewhat dissenting view, that economic development eventually leads to the adoption of superior institutions, is presented in Galor and Moav, 2006.

developmental patterns of New World's colonies. Jack and Lagunoff, 2006, and Cervellati et al., 2005, 2006, discuss democratization incentives, and Lagunoff, 2006a, 2006b, contain a general model introducing the stability of political institutions. Gonzalez and Neary, 2004, study the impact of rent seeking on the biased incidence of public spending in a growth model that shares some features with the one presented below. Neither of these papers, however, exhibits institutional and developmental traps whereby growth, income inequality, and political bias are all jointly determined.[4] In Gradstein, 2007, the possibility of such traps is presented in a related albeit somewhat narrower setting, but its relationship to the politico-economic conditions is not made fully transparent. Acemoglu and Robinson, 2006, in a related work, present a model of institutional traps carefully distinguishing between their political and economic determinants; but theirs is not an explicitly growth model. Finally, this paper shares with Rajan and Zingales, 2006, the emphasis on the primacy of the political and economic fundamentals over formal institutions, although its modeling details are different.

The rest of the paper proceeds as follows. The next section reviews some basic facts about development traps in their relation to institutions. Section 3 presents then the analytical framework, which is followed in Section 4 by the basic equilibrium analysis that takes the distribution of political power, represented by the political bias, as exogenously given. Section 5 endogenizes the determination of the political bias identifying conditions under which the ruling elite will be prepared to relegate political power to the masses as the means of committing to better institutions. Section 6 contains a dynamic analysis exhibiting the possibility of convergence to different steady states, Section 7 discusses the assumptions and the implications, and Section 8 concludes with brief remarks.

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[4] Although the work surveyed in Sokoloff and Engerman, 2000, informally suggests this possibility.

## 2. Motivation

To motivate the paper's argument, we now review some evidence on developmental traps in their relation to institutional quality. Economic development is often measured by outcomes such as income per capita or its growth, as well as associated attainment in the areas of health, education, infrastructure etc. Yet, these outcomes are known to be highly correlated with additional factors, in particular, measures of institutional quality. Thus, the correlations between income per capita across countries and measures of institutional quality range between 0.65-0.78. High income countries also seem to be more committed to a more egalitarian distribution of economic resources as can be judged by measures of income inequality: the correlations between income per capita and institutional quality on the one hand and measures of income inequality on the other hand are around -0.40, see Chong and Gradstein, 2006, for a more detailed account of the relationship between inequality and institutional quality. A great variety of institutional quality measures have been developed in recent years using somewhat different approaches. For example, Kaufmann et al., 2005, have constructed aggregate measures of governance for 209 countries and territories for five recent years, including voice and accountability; political instability and violence; government effectiveness; regulatory quality; rule of law; and control of corruption. The correlations between these measures are very high, typically exceeding 0.80; moreover, similarly high correlations are to be found between these measures and the ones generated by the ICRG risk rating system. All these measures are in turn also highly correlated with measures of democracy – either based on Freedom House (2005) or Gastil index, the respective correlations exceeding 0.60.

Further, there is a great deal of persistence in various development-associated

indicators. Incomes and growth rates have received the most attention in this regard.[5] But the persistence of income inequality has also been noticed in the literature. Thus, Li et al., 1998, show that inequality is fairly stable across time and most of its variation is due to cross-country differences. Expanding and updating their data, the author's calculations show that simple correlations in the Gini coefficients calculated over five year periods in, say, early 1970s and the end of 1990's exceed 0.60. Likewise, there exists a similar degree of persistence in institutional indicators. Thus, the ones based on the ICRG – the only source of a panel data – exhibit measures of persistence of the same order of magnitude, with correlations between 0.60-0.70. Moreover, intertemporal institutional quality tends to correlate with income inequality as argued more in detail in Chong and Gradstein, 2006.

All this suggests that underdevelopment is a multifaceted phenomenon that is manifested through many observable factors, which tend to persist over time. Important recent work has tried to disentangle the causality relationships between some of these factors. Notably, much effort went into showing that institutions have a causal effect on development, and some representative work in this vein is mentioned above. Inasmuch as this work is a significant step forward in its econometric sophistication, as revealed in Glaeser et al., 2004, it is still unable to fully separate the effect of institutions from other factors such as human capital. Additionally, there is the possibility of a reverse relationship as well, that development somehow leads to better institutions.[6] Thus, viewing underdevelopment as an institutional trap that is affected by the distribution of resources as is suggested below is consistent with the available evidence.

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[5] See Pritchett, 1997; however, Sala-i-Martin, 2005, presents a dissenting view.

## 3. The framework

*Economic environment.* Consider an economy populated by a measure one of households indexed by $i$, each consisting of a parent and child, operating in discrete time $t$. The initial level of household $i$'s income is exogenously given at $y_{i0}$, and the income level in period $t$, $y_{it}$, is determined endogenously. The initial income distribution is given, $F_0$, and the distributions in subsequent periods, $F_t$, are endogenously determined in a way specified more in detail below. In each period, the households' income is allocated between consumption, productive investment, and investment in appropriative activity or rent seeking. The role of the latter is to affect the distributional incidence of the publicly provided good.

Specifically, the individuals allocate resources between consumption, $c_{it}$, productive investment, $k_{it+1}$, and unproductive investment in lobbying or rent seeking, $r_{it+1}$; normalizing all prices to one, the budget constraint then is

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

Thus, the individuals are credit constrained, which will play a crucial role in the analysis below implying, in particular, that richer individuals expend more resources on rent seeking than poorer ones.

Investment is taxed, and the proceeds are used to produce a publicly provided good.[7] Letting $T_{t+1}$ denote the tax rate, $G_{t+1}$ the amount of the publicly provided good, and $K_{t+1}$ the aggregate amount of investment, the government's budget constraint is:

$$G_{t+1} = T_{t+1} K_{t+1} \tag{2}$$

The incorporation of publicly provided goods in growth models has been inspired by

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[6] See Galor and Moav, 2006, for interesting recent work in this regard.

Barro, 1990. It reflects the idea that productive publicly provided goods such as infrastructure and education are crucial for successful development, see World Bank Development Report, 1997, for an account. Unlike this earlier literature, it is assumed, however, that the incidence of the publicly provided good can be affected by individual households who expend resources on rent seeking to this end.[8] In this sense, the approach adopted here is similar to Gonzalez and Neary, 2004. Indeed, there is much evidence that the incidence of publicly provided goods, far from uniform, is skewed toward the rich. Le Grand, 1982, for example, documents this in many areas of public intervention in the UK, such as health, infrastructure, and education, and the World Bank Development Report, 2001, exhibits similar picture for developing countries. More recent research provides detailed evidence on the non-uniform incidence of public spending, see Olken, 2005, and Reinikka and Svensson, 2004. (The latter paper especially also notes that this unequal incidence is related to the differences in political influence across income groups.)

The extent to which an individual household can affect the incidence of public spending is given by the level of institutional quality, represented by the parameter $Q_{t+1}$, which is endogenously determined by collective decision making detailed below.[9] In particular, the accrued share to household $i$ share of extent of the publicly provided good is

$$g_{it+1} = \frac{r_{it+1}^{1-Q_{t+1}}}{\int_0^1 r_{jt+1}^{1-Q_{t+1}} dj} \; G_{t+1} \tag{3}$$

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[7] Assuming that taxes are levied on current income instead does not change anything in substance.

[8] Virtually identical results are obtained if rent seeking is done over an available resource such as a natural resource instead of a publicly provided good (Chong and Gradstein, 2006), or when rent seeking redistributes income as in Sonin, 2003; the specific modelling choice here was driven by the importance of publicly provided goods for growth as pointed out in Barro, 1990, along with their biased incidence as discussed above.

[9] Conceptual issues with defining institutions as opposed to policies are well known, see Glaeser et al., 2004. Here, the choice of institutional quality sets the rules of the game by implicitly determining the propensity to engage in wasteful rent seeking investment.

Larger values of $Q_{t+1}$, $0 \leq Q_{t+1} \leq 1$, make the allocation of the incidence benefits more equal by decreasing the marginal productivity of rent seeking, whereas smaller values make the distribution of the benefits more responsive to an individual rent seeking effort. An egalitarian access to publicly provided goods in many cases constitutes a part of a country's constitution; in other cases, the constitutionally guaranteed equality of opportunity can often be interpreted as such. The specification in (3) follows Sonin, 2003, and Chong and Gradstein, 2006. While very convenient, this single parameter specification of institutional quality is clearly a first approximation reduced form. Future work should address the complexity of conceptualization of institutional quality and its microeconomic determination much more in detail. Glaeser et al., 2003, is one interesting recent effort in this direction. It is shown there how large inequalities provide the rich with an opportunity to subvert the court system. Another potentially useful direction is given in Dal Bo and Di Tella, 2003 (see also references therein), where threats are used by organized interest groups to apply pressure on elected politicians; in equilibrium, this may lead to low quality political leaders being elected.

The after-tax portion of the investment along with the individually accrued benefits from the publicly provided good are used to generate next-period income, $y_{it+1}$. Specifically, the production function is

$$y_{it+1} = A\ \varepsilon_{it+1}\ [(1 - T_{t+1})k_{it+1}]^{\beta}\ g_{it+1},\ \ A > 0,\ 0 < \beta < 1 \tag{4}$$

where $\varepsilon_{it+1}$ are interpreted as individual specific shocks such as innate abilities. They are assumed to be i.i.d. and uncorrelated with initial income.

Each parent's preferences derive from current private consumption and from the child's income. Assuming for simplicity symmetric logarithmic preferences, we write the expected utility:

$$u(c_{it},\ y_{it+1}) = \ln(c_{it}) + \ln(y_{it+1}) \tag{5}$$

This assumption captures the "warm glow" motive for intergenerational transfers and has been often used in the related literature. It greatly simplifies the analysis by disregarding the potential for the parents to manipulate the political environment in the children generation.

The above assumptions, including the logarithmic specification, enable the derivation of closed form solutions below. As will be seen more clearly later, they, in particular, imply that individual decisions are independent of abilities. The main results, however, most crucially depend on the fact that rent seeking is a waste, which would be eliminated if the individuals were able to write complete allocation contracts.

***Political system.*** The political process guiding collective choices is assumed to be shaped by the households exerting influence on the outcome and is biased in favor of the rich. This is done through a weighting measure $w(y)$, $w : [0, \infty) \rightarrow [0, 1]$. For example, under the commonly used in earlier centuries voting franchise rule, $w$ assigns the value of zero to all individuals with income below $\underline{y}$ and the value of $1/[1-F(\underline{y})]$ to all individuals with income above $\underline{y}$. A weighted majority rule then specifies the political equilibrium as the Condorcet winner given the weighting scheme. As will be shown below, monotonicity of policy preferences with respect to incomes implies that a policy preferred by (weighted) median voter emerges as such equilibrium. A reduction in the political bias simply implies that a poorer individual becomes politically decisive.[10]

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[10] One possible formalization of this view is given by stipulating a weighting voting scheme, where the weights are positively related to incomes, see the appendix.

Note that this generalization enables us to treat democratization as encompassing a variety of channels of political influence, not just voting franchise.[11]  Its other advantage is related to the fact that the empirical literature typically uses proxies of democracies based on outcomes such as civil liberties and freedoms, not on procedures such as measures of the voting franchise - which likely reflects the skepticism as to the extent to which procedural details of voting rights are indeed related to democratic processes.  We will somewhat loosely interpret a reduction in the political bias – hence the increase in the political power of the poor - as democratization; subsequently, a more specific weighting scheme will be introduced to study the economy's dynamics.[12]

# 4. Equilibrium analysis: Policy commitment

We assume that, in each period, decisions on the tax rate and on the institutional quality are taken first, and then the individuals allocate their incomes.  The analysis proceeds backward starting with the allocation decisions for a given tax rate and institutional quality.

## 4.1. Rent seeking and investment

In each period for a given level of political inequality, investment decisions, and institutional constraints on rent seeking, the individual rent seeking levels are determined.  An individual household determines the allocation of resources so as to maximize the utility (5) and given the constraints (1)-(4).  The first order conditions with respect to $r_{it+1}$ and $k_{it+1}$ are

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[11] For some evidence linking incomes with political activism see Rosenstone and Hansen, 1993, and Verba et al., 1978.

[12] Acemoglu and Robinson, 2006, carefully distinguish between formal voting rights and informal political influence in determining the de facto distribution of political power.  We abstract here from these

$$-1/(y_{it} - k_{it+1} - r_{it+1}) + (1-Q_{t+1})/ r_{it+1} = 0 \tag{6}$$

and

$$-1/(y_{it} - k_{it+1} - r_{it+1}) + \beta/ k_{it+1} = 0 \tag{7}$$

Combining (1), (6) and (7) and aggregating we obtain the following equilibrium values:

$$k_{it+1} = \beta y_{it}/(2-Q_{t+1}+\beta), \ r_{it+1} = (1-Q_{t+1})y_{it}/(2-Q_{t+1}+\beta), \ c_{it} = y_{it}/(2-Q_{t+1}+\beta),$$

$$K_{t+1} = \beta Y_t/(2-Q_{t+1}+\beta) \tag{8}$$

where $Y_t$ denotes the average income in period $t$; note that $dK_{t+1}/dQ_{t+1} = \beta Y_t/(2-Q_{t+1}+\beta)^2 > 0$ –

higher institutional quality enhances investment.

This implies that the next-period level of the publicly provided good, its incidence,

and next-period income are respectively given as follows:

$$G_{t+1} = T_{t+1}\,\beta Y_t/(2-Q_{t+1}+\beta), \ g_{it+1} = [T_{t+1}\,\beta Y_t/(2-Q_{t+1}+\beta)]\, y_{it}^{1-Q_{t+1}}/\int_0^1 y_{jt}^{1-Q_{t+1}}dj$$

$$y_{it+1} = A\,\varepsilon_{it+1}\,(1-T_{t+1})^\beta[\beta y_{it}/(2-Q_{t+1}+\beta)]^\beta\,\{[T_{t+1}\beta Y_t/(2-Q_{t+1}+\beta)]\,y_{it}^{1-Q_{t+1}}/\int_0^1 y_{jt}^{1-Q_{t+1}}dj\ \} \tag{9}$$

Note that the level of the publicly provided good increases with the level of institutional

quality, $Q_{t+1}$. Additionally, future income is a concave function of the current income if $Q_{t+1}$

$> \beta$; is a convex function of the current income if $Q_{t+1} < \beta$; and is a linear function if $Q_{t+1} = \beta$.

A better institutional quality channels resources away from rent seeking and into productive

investment. By limiting the comparative advantage of the rich in rent seeking, it also implies

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microfoundations assuming that the distribution of political weights determined the de facto distribution of political power.

a more egalitarian distribution of the incidence of the publicly provided good.

Also note that the assumption on logarithmic preferences ensures that the preferred tax rate to finance this good is identical across the individuals both within and across generations, namely, $T_{t+1} = T = 1/(1+\beta)$.[13] Abstracting from a deeper analysis of the determination of the level of the publicly provided good facilitates focusing on institutional quality.[14]

It will be convenient at this point to make further assumptions on the distribution of income and of the random ability shock. In particular suppose that, initially, $\ln(y_{i0})$ has a normal distribution with the parameters $\mu_0$ and $\sigma_0^2$, and that $\ln(\varepsilon_{it})$ is in each period normally distributed with the mean of zero and the variance of $\phi^2$.[15] From (9), this implies that all subsequent distributions of income will also be lognormal, say, with the parameters $\mu_t$ and $\sigma_t^2$; so that

$$\ln(y_{it+1}) = \ln\{A\,(1-T)^{\beta}[\beta/(2-Q_{t+1}+\beta)]^{\beta}\,[T\beta Y_t/(2-Q_{t+1}+\beta)]\} + \ln(\varepsilon_{it+1}) +$$

$$(1+\beta-Q_{t+1})\ln(y_{it}) - \ln[\int_0^1 y_{jt}^{\,1-Q_{t+1}} dj\,] =$$

$$\ln\{A\,(1-T_t)^{\beta}[\beta/(2-Q_{t+1}+\beta)]^{\beta}\,[T\beta Y_t/(2-Q_{t+1}+\beta)]\} + \ln(\varepsilon_{it+1}) +$$

$$(1+\beta-Q_{t+1})\ln(y_{it}) - [(1-Q_{t+1})\,\mu_t + (1-Q_{t+1})^2\sigma_t^2/2] \tag{10}$$

with the recursively determined parameters

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[13] This is because, in general, two factors affect the demand for this good here. First, as poorer individuals benefit less from the publicly provided good, they demand less of it. On the other hand, poorer individuals tend to prefer a larger tax which has a redistributive nature: while poorer individuals pay lower taxes, they stand to benefit from the publicly provided good alongside with the richer individuals. Logarithmic preferences imply that these two countervailing factors cancel each other leading to identical demand for the publicly provided good.

[14] Consideration of the possibility where a fraction of tax revenues is used to provide a public good and another fraction is used for income redistribution would complicate the analysis significantly, but would be unlikely to qualitatively change the results. Intuitively, a larger inequality would cause an increase in direct redistribution and a decrease in public provision of the productive good, thus reinforcing the results.

[15] This restriction is, in fact, redundant for some of the results below.

$$\mu_{t+1} = \ln\{A\,(1-T)^{\beta}[\beta/(2-Q_{t+1}+\beta)]^{\beta}\,[T\beta Y_t/(2-Q_{t+1}+\beta)]\} +$$

$$(1+\beta-Q_{t+1})\,\mu_t - [(1-Q_{t+1})\,\mu_t + (1-Q_{t+1})^2\sigma_t^2/2] =$$

$$\ln\{A\,(1-T)^{\beta}[\beta/(2-Q_{t+1}+\beta)]^{\beta}\,[T\beta Y_t/(2-Q_{t+1}+\beta)]\} + \beta\mu_t - (1-Q_{t+1})^2\sigma_t^2/2 \qquad (11)$$

and

$$\sigma_{t+1}^2 = (1+\beta-Q_{t+1})^2\,\sigma_t^2 + \phi^2 \qquad (12)$$

Income variance increases over time when the level of institutional quality is sufficiently small, for example, when $Q_{t+1} < \beta$, and, depending on the variance in innate abilities, decreases over time when it is high enough. We will assume that $\phi^2$ is relatively large, so that, in particular, $\sigma_t^2 > (2+\beta)/(1+\beta)^2$.

Also, we define a measure of intergenerational income mobility as the complement to one of the intertemporal correlation in (logarithms of) incomes, $\gamma_{t+1} = 1 - Corr\,(\ln(y_{it+1}),$ $\ln(y_{it}))$. Simple yet cumbersome calculations establish then that $\gamma_{t+1}$ increases in $Q_{t+1}$, implying that institutional quality enhances intergenerational income mobility.[16] Moreover, next-period average income is

$$Y_{t+1} = A\,(\phi^2/2)\,T(1-T)^{\beta}[\beta/(2-Q_{t+1}+\beta)]^{1+\beta}\,Y_t\int_0^1 y_{jt}^{1+\beta-Q_{t+1}}\,dj/\int_0^1 y_{jt}^{1-Q_{t+1}}dj \qquad (13)$$

and the economy's growth rate is

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[16] Here is a brief sketch of the argument. Letting $Exp$ denote the aggregation operator over the households measure and recalling that abilities and incomes are uncorrelated, we obtain:

$\gamma_{t+1} = 1 - Corr\,(\ln(y_{it+1}), \ln(y_{it})) = 1 - Cov(\ln(y_{it+1}), \ln(y_{it}))/\sigma_{t+1}\,\sigma_t = 1 - Exp\,[(\ln y_{it+1} - \mu_{t+1})\,(\ln y_{it} - \mu_t)]/\sigma_{t+1}\,\sigma_t =$

$1 - Exp[\ln\varepsilon_{it+1}\,(\ln y_{it} - \mu_t)]/\sigma_{t+1}\,\sigma_t - (1+\beta-Q_{t+1})\,Exp\,(\ln y_{it} - \mu_t)^2/\sigma_{t+1}\,\sigma_t =$

$1 - Exp\,(\ln\varepsilon_{it+1})\,Exp\,(\ln y_{it} - \mu_t)]/\sigma_{t+1}\,\sigma_t - (1+\beta-Q_{t+1})\,\sigma_t^2/[(1+\beta-Q_{t+1})^2\,\sigma_t^2 + \phi^2]^{1/2}\,\sigma_t =$

$1 - 1/[1 + \phi^2/(1+\beta-Q_{t+1})^2\,\sigma_t^2]^{1/2}$, which increases in $Q_{t+1}$.

$$Y_{t+1} / Y_t = A \, (\phi^2/2) T (1-T)^{\beta} [\beta/(2-Q_{t+1}+\beta)]^{1+\beta} \int_0^1 y_{jt}^{\,1+\beta-Q_{t+1}} \, dj / \int_0^1 y_{jt}^{\,1-Q_{t+1}} dj \; =$$

$$A(\phi^2/2)T(1-T)^{\beta}[\beta/(2-Q_{t+1}+\beta)]^{1+\beta}[(1+\beta-Q_{t+1})\mu_t+(1+\beta-Q_{t+1})^2\sigma_t^2]/\,[(1-Q_{t+1})\mu_t+(1-Q_{t+1})^2\sigma_t^2] \quad (14)$$

and differentiation of (14) establishes that the economy's growth rate increases with institutional quality. Note that our assumptions imply neutrality of the growth rate with respect to exogenous allocations of the benefits from the publicly provided good across the individuals; this focuses attention on the waste inherent in rent seeking efforts to skew its incidence.[17]

Collecting the results, we obtain

**Proposition 1**. A higher level of institutional quality induces a larger amount of the publicly provided good, a larger level of investment, a larger degree of intergenerational income mobility, and faster income growth, as well as decreases income dispersion.[18]

In particular, note that a better institutional quality prevents diversion of resources away from investment thus increasing the rate of economic growth. This is consistent with the recent literature that finds a direct causal effect of institutional quality on growth (see Acemoglu et al., 2005, for a review). Further note that rent seeking here is a waste. Thus, it can be shown that for any given equilibrium, an alternative allocation can be devised whereby rent seeking is prohibited, and the publicly provided good is allocated such as to make all individuals better off; an implicit assumption, however, is that incomplete contracting renders such scenario impossible. Where rent seeking cannot be ex ante eliminated through an effective contract, it is ex post regulated through the political choice of the institutional quality

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[17] A more general formulation would consider interactions between individual abilities and the incidence allocation; but from our perspective, this would unduly complicate the analysis.

parameter, to whose determination we now proceed.

## *4.2. Institutional quality*

To determine the political outcome of voting on institutional quality, we first examine the individually optimal decisions in this regard. Utility maximization while employing the envelope theorem, yields the preferred level of institutional quality for an individual household, which is given by the following first order condition:

$$(2+\beta)/(2-Q_{t+1}+\beta) - \ln(y_{it}) + \int_0^1 y_{jt}^{1-Q_{t+1}} \ln(y_{jt})dj / \int_0^1 y_{jt}^{1-Q_{t+1}} dj =$$

$$(2+\beta)/(2-Q_{t+1}+\beta) - \ln(y_{it}) + \mu_t + (1- Q_{t+1})\sigma_t^2 = 0, \ \ 0 < Q_{t+1} < 1 \tag{15a}$$

$$1 - \ln(y_{it}) + \mu_t + \sigma_t^2 < 0, \ \ Q_{t+1} = 0 \tag{15b}$$

$$(2+\beta)/(1+\beta) - \ln(y_{it}) + \mu_t > 0, \ \ Q_{t+1} = 1 \tag{15c}$$

The derivative of the left-hand side in (15a), $(2+\beta)/(2-Q_{t+1}+\beta)^2 - \sigma_t^2$, increases in $Q_{t+1}$; and when $Q_{t+1}=1$, it equals $(2+\beta)/(1+\beta)^2 - \sigma_t^2$, which is negative by assumption. It then follows that the second condition holds, (15) admits a unique root, and the preferences are single peaked. Differentiation establishes then that the preferred level of institutional quality decreases with individual income; further, the political equilibrium – given, as recalled, by the weighted majority rule - exists and is determined by the preferences of the weighted majority voter, say $y_{dt}$, with $y_{dt}$ replacing $y_{it}$ in (15). Recalling our definition of the political bias, we then obtain that the larger is the political bias the higher is the decisive voter's income, hence the lower is the preferred level of institutional quality.[19]

 Summarizing,

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[18] In a related context, similar results are derived in Sonin, 2003.

**Proposition 2**. There is a negative relationship between the political bias and the preferred by the decisive voter level of institutional quality.

The key for the above result is the negative relationship between individual income and the preferred level of institutional quality. This follows because richer individuals have a comparative advantage in rent seeking, so that public enforcement limiting rent seeking acts against their interests.

Combining Proposition 1 and 2, it follows that a larger political bias has negative consequences for investment, income growth, and income inequality. In other words, when the decisive coalition consists of a narrow group of rich elite, they will tend to subvert institutions sacrificing overall growth to appropriate a larger share of the accumulated investment through rent seeking. This proposition, therefore, identifies the distribution of political power as an important determinant of institutional quality. We then proceed to study how this political power evolves over time.

## 5. Political power

Suppose now that the possibility of a direct commitment to institutional quality in each generation is ruled out. In other words, the individual allocations decisions in each period necessarily precede the determination of institutional quality. However, the existing politically decisive coalition, referred to the ruling elite, may relinquish its power and democratize. This constitutes the essence of the analysis that follows. Indeed, as emphasized in Olson, 1993, commitments to institutional quality, such as restraining from expropriation

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[19] For presentational simplicity, the ensuing analysis focuses on the case of internal solutions.

or law enforcement, should not be taken for granted, in particular, in the context of oligarchic regimes. It is, in fact, often argued that an important role of the political system is to restrict the ruler's capacity to make bad institutional choices, see North and Weingast, 1989.

Specifically, the assumed sequence of events is now as follows. The economy begins a period with a given distribution of income and with a given political bias. It will be now convenient to be more specific about the nature of the political bias. In particular, suppose that the political weight of an individual household is a properly normalized exponential function of its income; the exponent, $b_t$, $0 \leq b_t \leq 1$, represents the extent of the political bias, whereby the case of $b_t = 0$ corresponds to full democracy. It is not difficult to show that the identity of the decisive voter is then given by: $\ln(y_{dt}) = \mu_t + b_t \sigma_t^2$; for example, under full democracy, $b_t = 0$, the median income voter, $y_{mt}$, is decisive (see Benabou, 2000, for a more complete derivation in a related context).

First, the voters determine whether to democratize – in which case future decisions, on institutional quality, will be made through the one-man-one-vote system - or to leave the existing political bias in place. For simplicity, a marginal reduction of the political bias is ruled out here, which leads to the consideration of full democracy as the only alternative to the prevailing elite-ruled system.[20] After the level of the political bias has been determined, the households make their individual budget allocation choices, in particular, making productive investment decisions and laying rent seeking claims against accumulated investment. Finally, the level of institutional quality is determined by the political majority based on the first stage decision. This level determines the institutional effectiveness of rent

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[20] This assumption is discussed later; a very elegant general analysis of stability of political institutions is contained in Lagunoff, 2006a, 2006b, and requires far sightedness on behalf of the agents. The potential snowball effect of democratization has been widely articulated, c.f., *"Depend upon it, Sir, it is dangerous to open so fruitful a source of controversy and altercation as would be opened by attempting to alter the qualifications of voters; there will be no end of it. New claims will arise; women will demand the vote; lads from twelve to twenty-one will think their rights not enough attended to; and every man who has not a farthing, will demand an equal voice with any other, in all acts of state. It tends to confound and destroy all distinctions, and prostrate all ranks to one common level."* (John Adams, 1776).

seeking claims that have been laid before. Thus, a direct commitment to institutional quality is ruled out, and the individuals make individual decisions in anticipation of the political decision in regard to institutional quality. Note that, in each period, $b_t = 0$ in the case of democracy, or $b_t = b > 0$, in the case of oligarchy with a political bias; it is assumed that, initially, $b_0 = b$, so that the economy is elite-controlled.

The analysis begins with the last stage. The preferred level of institutional quality by a household is determined from:[21]

$$- \ln(r_{it+1}) + \int_0^1 r_{jt+1}^{1-Q_{t+1}} \ln(r_{jt+1}) dj / \int_0^1 r_{jt+1}^{1-Q_{t+1}} dj = 0 \qquad (16)$$

and differentiation reveals that it is a decreasing function of the individual level of rent seeking. The individually optimal allocation of resources has the same form as in the above analysis – correctly anticipating the level of $Q_{t+1}$. We can, therefore, write the first order condition determining the individually favored level of $Q_{t+1}$ after substituting from (10) as follows:

$$-\ln(y_{it}) + \int_0^1 y_{jt}^{1-Q_{t+1}} \ln(y_{jt}) dj / \int_0^1 y_{jt}^{1-Q_{t+1}} dj = - \ln(y_{it}) + \mu_t + (1- Q_{t+1})\sigma_t^2 = 0 \qquad (17)$$

Comparing (15) and (17) we observe that each voter prefers a higher level of institutional quality when the decision is made ex ante than when it is made ex post, see also Figure 1 illustrating this relationship.

**INSERT FIGURE 1 HERE**

Depending on the pre-determined level of the political bias, therefore, the institutional quality is determined from (17) with the appropriate $y_{dt}$ replacing $y_{it}$ there. Also note that the optimal ex

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[21] For notational brevity we focus on internal solutions.

post level of institutional quality for the median income voter, $y_{it} = y_{mt}$, from (17), is the maximal one, $Q_{t+1} = 1$. In this case, we calculate the equilibrium values:

$$k_{it+1} = \beta y_{it}/(1+\beta), \ r_{it+1} = 0, \ c_{it} = y_{it}/(1+\beta), \ K_{t+1} = \beta Y_t/(1+\beta); \ G_{t+1} = T_{t+1}\beta Y_t/(1+\beta),$$

$$y_{it+1} = A \ \varepsilon_{it+1} \ (1- T_{t+1})^{\beta}[\beta y_{it}/(1+\beta)]^{\beta} \ [T_{t+1}\beta Y_t/(1+\beta)] \tag{18}$$

and the resulting utility levels are:

$$u_{it}^{Dem} = \ln[y_{it}/(1+\beta)] + \ln \{A\varepsilon_{it+1} \ (1- T_{t+1})^{\beta}[\beta y_{it}/(1+\beta)]^{\beta} \ [T_{t+1}\beta Y_t/(1+\beta)]\} \tag{19}$$

whereas if the political bias is preserved, the utility levels are:

$$u_{it}^{Bias} = \ln[y_{it}/(2-Q_{t+1}+\beta)] +$$

$$\ln \{A\varepsilon_{it+1}(1- T_{t+1})^{\beta}[\beta y_{it}/(2-Q_{t+1}+\beta)]^{\beta} \ [(T_{t+1}\beta Y_t/(2-Q_{t+1}+\beta)) \ y_{it}^{1-Q_{t+1}}/\int_0^1 y_{jt}^{1-Q_{t+1}}dj \ ]\} \tag{20}$$

where $Q_{t+1}$ is determined from

$$- \ln(y_{dt}) + \mu_t + (1- Q_{t+1})\sigma_t^2 = -(\mu_t + b_t\sigma_t^2) + \mu_t + (1- Q_{t+1})\sigma_t^2 = 0 \tag{21}$$

or,

$$Q_{t+1} = 1 - b_t \tag{22}$$

In other words, $Q_{t+1} = 1$ under democratization and $Q_{t+1} = 1 - b$ under the elite-controlled political system, so that we have

**Proposition 3**. There is an inverse relationship between the extent of the political bias and the chosen level of institutional quality. The latter is maximal, $Q_{t+1} = 1$, in the case of complete democracy.

The welfare differential,

$$u_{it}^{Bias} - u_{it}^{Dem} = (2+\beta)\ln[(1+\beta)/(2-Q_{t+1}+\beta)] + \ln\left[y_{it}^{1-Q_{t+1}}/\int_0^1 y_{jt}^{1-Q_{t+1}}dj\right] =$$

$$(2+\beta)\ln[(1+\beta)/(1+b+\beta)] + b\ln(y_{it}) - [b\mu_t + b^2\sigma_t^2/2] \tag{23}$$

increases in income implying that richer individuals tend to favor the biased political system. In particular, from the viewpoint of the politically decisive voter,

$$u_{dt}^{Bias} - u_{dt}^{Dem} = (2+\beta)\ln[(1+\beta)/(1+b+\beta)] + b\ln(y_{dt}) - (b\mu_t + b^2\sigma_t^2/2) =$$

$$(2+\beta)\ln[(1+\beta)/(1+b+\beta)] + b^2\sigma_t^2/2 \tag{24}$$

which is obtained by substituting $\ln(y_{dt})$ from (21). Analysis of (24) reveals that it is convex in $b$, decreasing first and increasing afterwards; further, (24) is negative for small values of $b$. This then implies that a small enough bias leads to democratization, whereas under a substantial bias the elite controlled system is preserved provided that income variance is sufficiently large.

Summing up,

**Proposition 4**. The preference by the politically decisive coalition to maintain the existing political bias increases with income inequality as measured by the variance of the income distribution; when the level of inequality is high enough, the biased system is preserved, whereas when it is low, democratization will prevail. A large enough political bias implies preference for the biased system, and a small enough bias leads to democratization.

The politically decisive voter faces a tradeoff. On the one hand, preservation of the political bias – hence holding on to political power – signals poor institutional choices in the future, which adversely effects the individual investment decisions. Democratization commits the economy to high-quality institutions, thereby enhancing investments and promoting growth; however, the currently decisive voter consequently loses power, hence the ability to appropriate a larger share of the accumulated capital. High inequality means that the appropriative ability of the rich voters dominates their desire to commit to high-quality institutions thereby enhancing investment, and low inequality leads to the opposite outcome; in particular, note that if inequality is low enough, a corner solution of $Q_{t+1} = 1$ may well constitute the equilibrium choice.

## 6. Intertemporal evolution and developmental paths

We now proceed to study the intertemporal implications of the above analysis. Consider first the case of full democratization, where the median income household is decisive. It then follows from (17) that $Q_{t+1} = 1$, so that income evolves according to (18), and

$$\sigma_{t+1}^2 = \beta^2 \sigma_t^2 + \phi^2 \qquad (25)$$

which converges to $\sigma^*_{Dem}{}^2 = \phi^2/(1-\beta^2)$; inequality increases for as long as it is below the steady state level and decreases when it is larger than the steady state level.[22]

Suppose now, in contrast, that the prevailing political system is biased, and that the level of institutional quality is determined from (22), $Q_{t+1} = 1-b$, and income variance is given by

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[22] Recalling the assumption that $\sigma_t^2 > (2+\beta)/(1+\beta)^2$, this enables us to obtain a more explicit restriction on $\phi^2$: $\phi^2 > (2+\beta)(1-\beta)/1+\beta)$.

$$\sigma_{t+1}{}^2 = (b+\beta)^2 \sigma_t^2 + \phi^2 \qquad\qquad\qquad (26)$$

converging in the steady state to $\sigma^*_{Bias}{}^2 = \phi^2/[1 - (b+\beta)^2] > \sigma^*_{Dem}{}^2$.

**INSERT FIGURE 2a HERE**

Suppose first that $\sigma^*_{Bias}{}^2 < \sigma_I^2$, as depicted in Figure 2a, where the lower line corresponds to the evolution of income variance under democracy, and the upper line corresponds to the case of the political bias. Then the economy eventually democratizes, and $\sigma^*_{Dem}{}^2$ constituted the steady state level of inequality. This, in particular, is more likely to happen when the political bias is small.

In contrast, Figure 2b depicts the case where $\sigma^*_{Dem}{}^2 > \sigma_I^2$, and the economy converges to the biased system – which is, for example, the case when the political bias is large enough, hence $\sigma_I^2$ is small.

**INSERT FIGURE 2b HERE**

The most interesting case is where the bias is in the intermediate range, so that $\sigma^*_{Dem}{}^2 < \sigma_I^2 < \sigma^*_{Bias}{}^2$, as illustrated in Figure 2c.

**INSERT FIGURE 2c HERE**

Suppose first that income inequality level is initially sufficiently high, in particular higher than $\sigma_I^2$, so that (24) is positive. Then the decisive political coalition favors the biased system; but this choice then leads income inequality to converge to $\sigma^*_{Bias}{}^2 = \phi^2/[1 - (b+\beta)^2] > \sigma_I^2$. In contrast, if income inequality is initially small enough, so that (24) is negative, democratization will result, and the economy will converge to $\sigma^*_{Dem}{}^2 < \sigma_I^2$. Further, somewhat cumbersome but simple calculations reveal that average income growth, (14), is

faster in the latter steady state.

To summarize,

**Proposition 5**. If the political bias is sufficiently small, democratization will be realized in order to create commitment to a better institutional quality. If the political bias is large enough, the biased system will remain in place. If the bias is in the intermediate range, the economy's intertemporal evolution hinges upon the initial level of income inequality. If it is small, democratization will follow, with the resulting high-quality institutional choices, the reduction in inequality, and fast growth. If, in contrast, it is large, then the politically decisive elite will hold to power, institutional quality will be poor, income inequality will be large, and economic growth slow.

Existence of a significant political bias is a necessary condition for divergent developmental paths. But the convergence to each of the two equilibria identified in the above analysis hinges upon the initial level of income inequality. Thus, both political and economic inequalities determine the economy's evolution: for it to remain in the bad equilibrium, both the political and the initial income inequality have to be large enough. In this case, the elite will not find in its best interest to relinquish its power, thus sacrificing income growth and perpetuating low-quality institutions. The intuition here is that a more egalitarian distribution of income and institutional quality may, under the indicated conditions, reinforce each other; and the political choice affects both.

## 7. Discussion

The basic structure of this paper's argument is as follows. Political economic fundamentals – the extent of political bias coupled with income inequality – determine via a political process the degree of institutional quality that, in turn, affects the propensity to engage in wasteful rent seeking. This is then the key to the economy's evolution in terms of aggregate income and its distribution. In particular economic fundamentals (in particular, income distribution) affect and are being affected by institutional quality.

We now discuss some of the main specific assumptions and the implications of the model. One assumption concerns the particular sequence of events in each period whereby commitment to institutional quality ex ante of individual choices is ruled out. While this assumption is essential for the analysis of endogenous democratization, it is much less important for the claim that initial inequality matters for economic growth and institutional development. Consider, alternatively, the situation where the political bias is exogenously given (and is large) and institutional quality can be committed to prior to the individual allocation choices. Analysis similar to the above reveals then that if initial inequality is high, a low level of institutional quality will be chosen by the decisive rich voter, generating much rent seeking and slow growth; further, inequality may well be reinforced. The opposite happens when initial income inequality is low. Thus, qualitatively at least, multiple trajectories are obtained in a similar fashion to the above (see Sonin, 2003, for a related analysis). Adding the possibility of endogenous democratization, however, illustrates how political and economic forces interplay along these trajectories; it also contributes to a long standing debate in the political science literature on whether democratization is endogenous (see Boix and Stokes, 2003, and references therein). Further, some interesting recent empirical work finds, in the context of the countries in transition, that the economy's

characteristics are important determinants of the propensity to democratize, see Papaioannou and Siourounis, 2006, which is consistent with this paper's focus.

Another assumption concerns the "warm glow" motive for parental altruism. A richer model would link the generations in a more comprehensive manner, through dynastic altruism for example. Analysis of such extension would likely require further restrictive assumptions (such as on income distribution, production technology, and the nature of the equilibrium). Far-sighted members of the elite, anticipating the snowball effect of democratization, may then be even ore reluctant to relinquish their powers; the qualitative flavor of the main results is, however, unlikely to be changed.

Additionally, we assume that the economy enters period $t$ with a given threshold, $b_{t-1}$, so that it is completely characterized by this political aspect, and by the economic aspect represented by the prevailing income distribution. Together, these two determine the distribution of political weights, hence, the identity of the decisive voter in the beginning of a period. An extension stipulates the choice of $b_t$ that constitutes a majority voting equilibrium from the perspective of the existing political majority. (Because the preferred identity of the decisive voter is monotonic in current voters' incomes, such voting equilibrium exists and is given by the optimal choice from the viewpoint of the existing current decisive voter.) As follows from the analysis, see Figure 1, the incentive to create a future commitment to better institutional quality implies then a process of a gradual democratization whereby, in each period, the decisive voter prefers relegation of decision making power to another, poorer voter. Note, however, that by a similar logic, thus determined $b_t$ creates a new politically decisive coalition which, in turn, favors further relegation of political power. In this sense, it is inherently unstable. Since by assumption, $b = 0$ is the minimal bias, the logic inherent in the incentives to relegate decision making then implies that such equilibrium results in full democratization, i.e., one-man-one-vote system.

The above model has a number of implications for development. In a very broad sense, it can serve to explain the divergent paths of the West and "the rest". Since early nineteenth century the countries in the European continent and its offshoots such as in North America and in Australia have developed economically, instituted stable democracies, and reduced inequalities, whereas much of the rest of the world has remained relatively poor, often with autocratic or unstable regimes, and a high degree of inequalities between ruling elites and the masses. A narrower – and cleaner – comparison has been presented in the work of Engerman and Sokoloff that studies the evolution of the New World's colonies (see Sokoloff and Engerman, 2000, for a summary of this work). It is shown there that initial distribution of resources had long lasting effects for the subsequent evolution of institutions and economic development in North America versus South America. Easterly, 2001, 2007, provides a more detailed and comprehensive econometric evidence to this end, using novel instruments and concluding that inequality causes underdevelopment.

Yet another implication of the model concerns causal interpretations of institutions and economic fundamentals. While there is substantial evidence that institutions cause development (Acemoglu et al., 2005), some work suggests that other characteristics, such as human capital, may be the ultimate cause of institutional quality (Glaeser et al., 2004). Our analysis implies that, to the extent that an institutional trap is materialized, the two forces can hardly be distinguished, and that initial conditions determine the joint evolution of institutional quality and factor accumulation.

## 8. Concluding remarks

This paper is motivated by high correlations among observable characteristics pertaining to development, such as aggregate income, political and income inequality, institutional quality,

and intergenerational income mobility. It then exhibits a model whereby a mutual feedback between political and income inequality on the one hand and institutional quality on the other hand feed each other while impacting economic growth. Initial conditions, in this view, bear on the subsequent economy's evolution thus providing analytical underpinnings for the observations by Sokoloff and Engerman, 2000, made in the context of the historical evolution of the economies in the New World.[23]

Another conceptual contribution of the paper is in stressing the importance of economic and political fundamentals for the viability of institutional arrangements. In this view, the ultimate determinants of successful performance consist not so much of the institutional blueprint per se as of the underlying economic structure, without which the blueprint may not be sustainable.

Several extensions of the above framework could be considered. One extension concerns a more fully dynamic model. The snowball effect of democratization may then deter far sighted individuals from initiating the process in the first place. Another extension is related to the use of public funds. The model assumes that they are allocated to produce a publicly provided good; assuming that a fraction can be allocated for redistributional purposes would enrich the model – but also make it somewhat less analytically tractable. Finally, incorporation of social norms against rent seeking could lead to additional insights as to the relationship between the economy's initial characteristics and its evolution (an early attempt in this direction was undertaken in the previous version of the paper). This line of research could also provide microeconomic foundations for the concept of institutional quality.

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[23] Cf., "…the initial conditions had lingering effects, not only because certain fundamental characteristics of New World economies were difficult to change, but also because government policies and institutions tended to reproduce them. Specifically, in those societies that began with extreme inequality, elites were better able to establish a legal framework that insured them disproportionate shares of political power, and to use that greater influence to establish rules, laws, and other government policies that advantaged members of the elites relative to nonmembers – contributing to persistence over time of the high degree of inequality."

# APPENDIX

Let $w_{it}$ denote the political weight of individual $i$ in period $t$ and let $W_t$ denote the distribution of weights in period $t$. Define decreases in the political bias as a transfer of weights from the population in a higher interval $[\zeta_3, \zeta_4]$ to the population in a lower interval $[\zeta_1, \zeta_2]$, $\zeta_2 < \zeta_3$.[24] Formally, let $W$ and $Z$ be two weight distributions; then $W$ has a lower political bias than $Z$ if[25]

$$\int_o^\omega [W(x) - Z(x)]dx \leq 0 \quad \text{for all} \quad \omega \geq 0 \qquad (A1)^{[26]}$$

A move from $Z$ to $W$ reduces political bias. Consider now two weight functions, $w(y)$ and $z(y)$, along with the distributions of weighted incomes, $G$ and $H$, respectively induced by them, $G = F(w^{-1})$ and $H = F(z^{-1})$. It then follows from the definition of the political bias that $w$ has less political bias than $z$ if

$$\int_0^y [H(x) - G(x)]dx = \int_0^y [F(z^{-1}) - F(w^{-1})]dx \leq 0 \text{ for all } y \geq 0 \qquad (A2)$$

Then, in particular, letting $y_d(w)$ and $y_d(z)$ denote the respective weighted medians under the two weight functions, it follows almost immediately that $y_d(w) < y_d(z)$, so that a smaller political bias implies that the induced distribution generates a lower median.

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[24] This is analogous to Dalton's principle of progressive transfers from the measurement of income inequality.
[25] We will omit time subscripts for notational brevity.

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[26] This is equivalent to stating that *W* Lorenz dominates *Z*.

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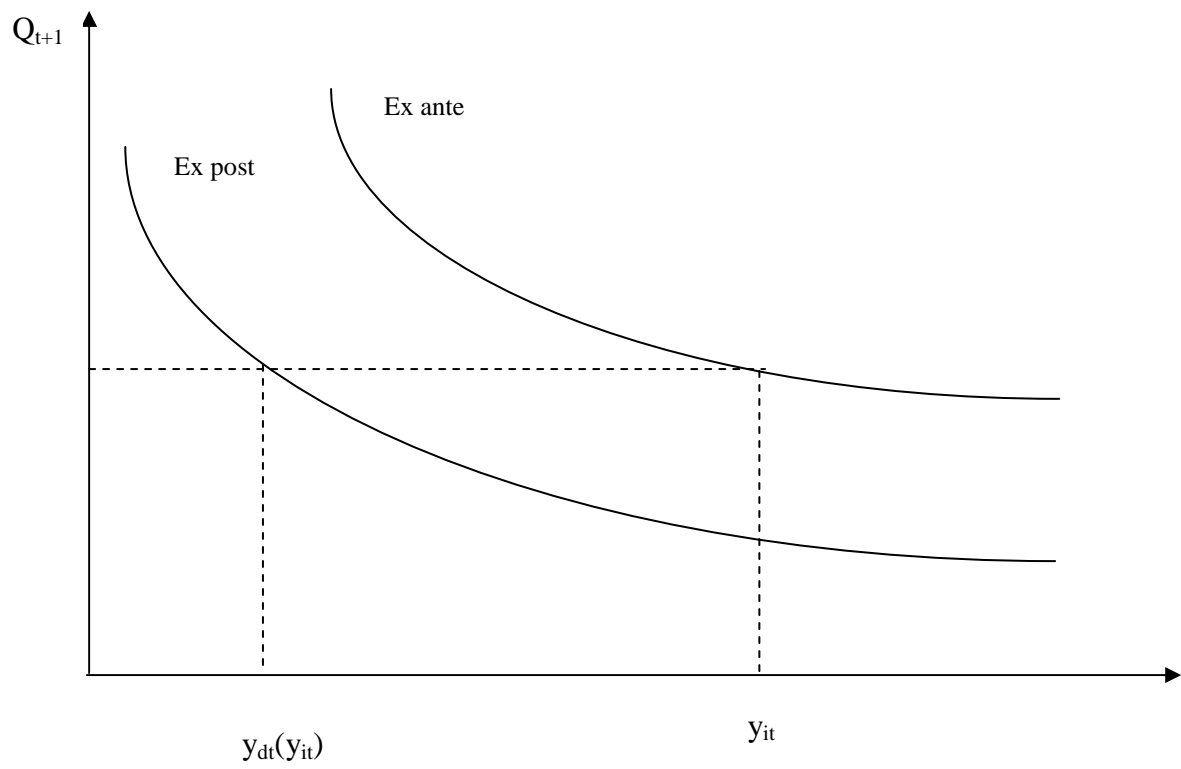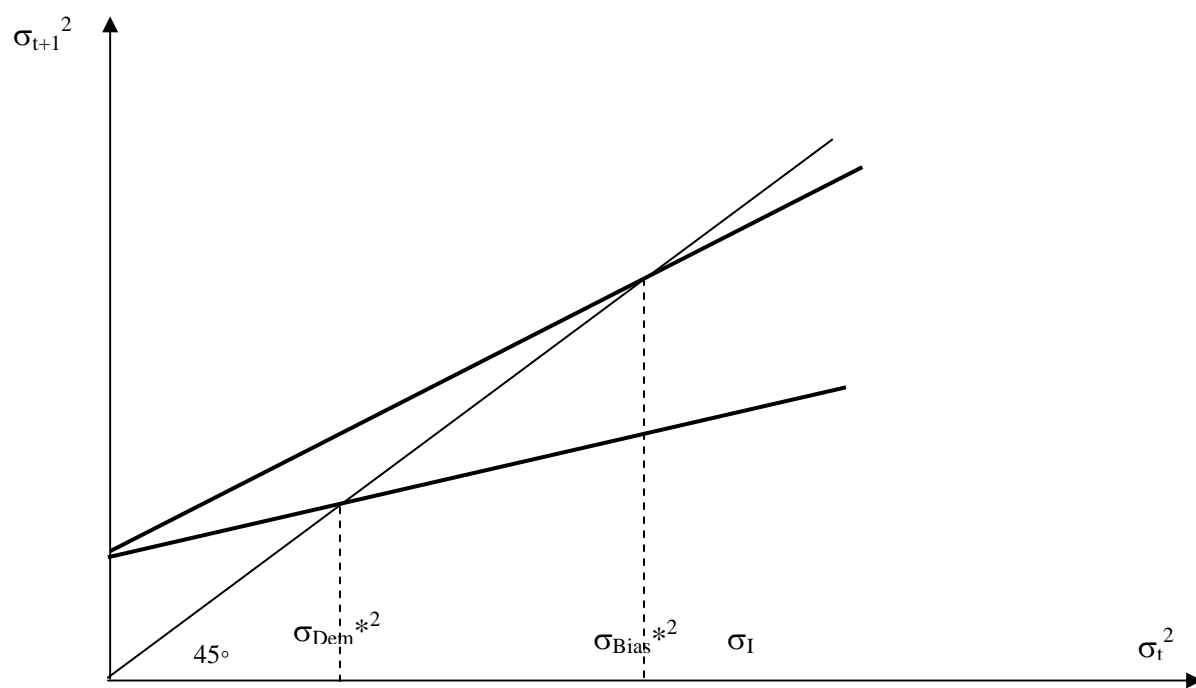
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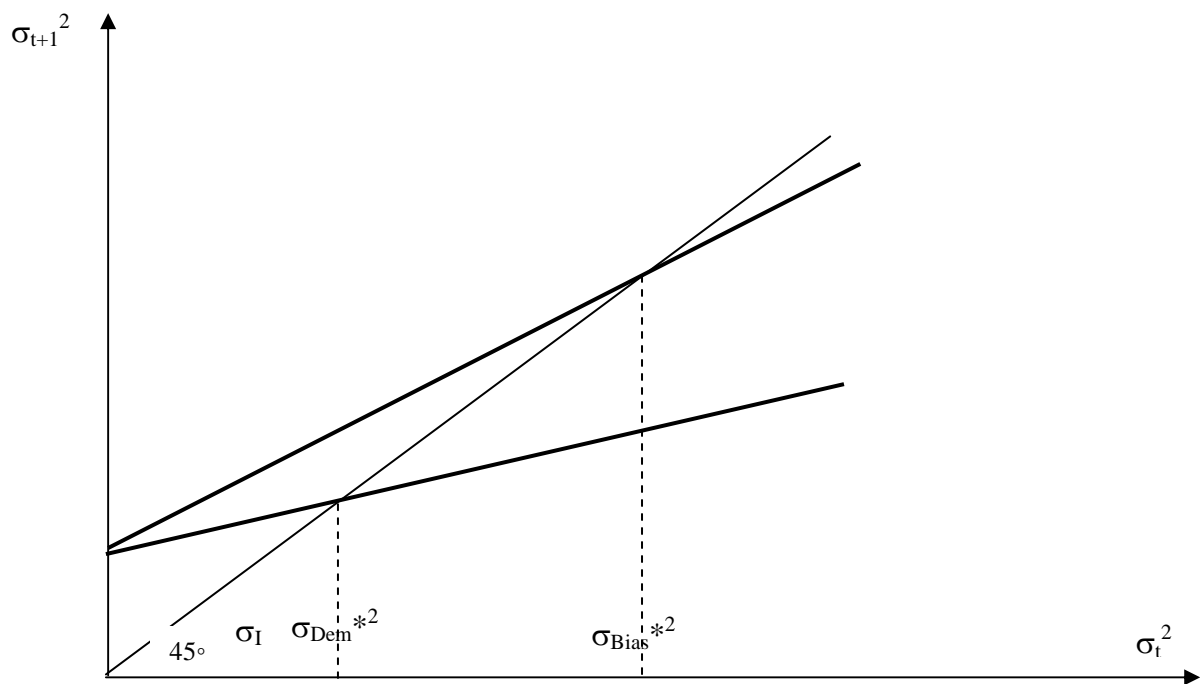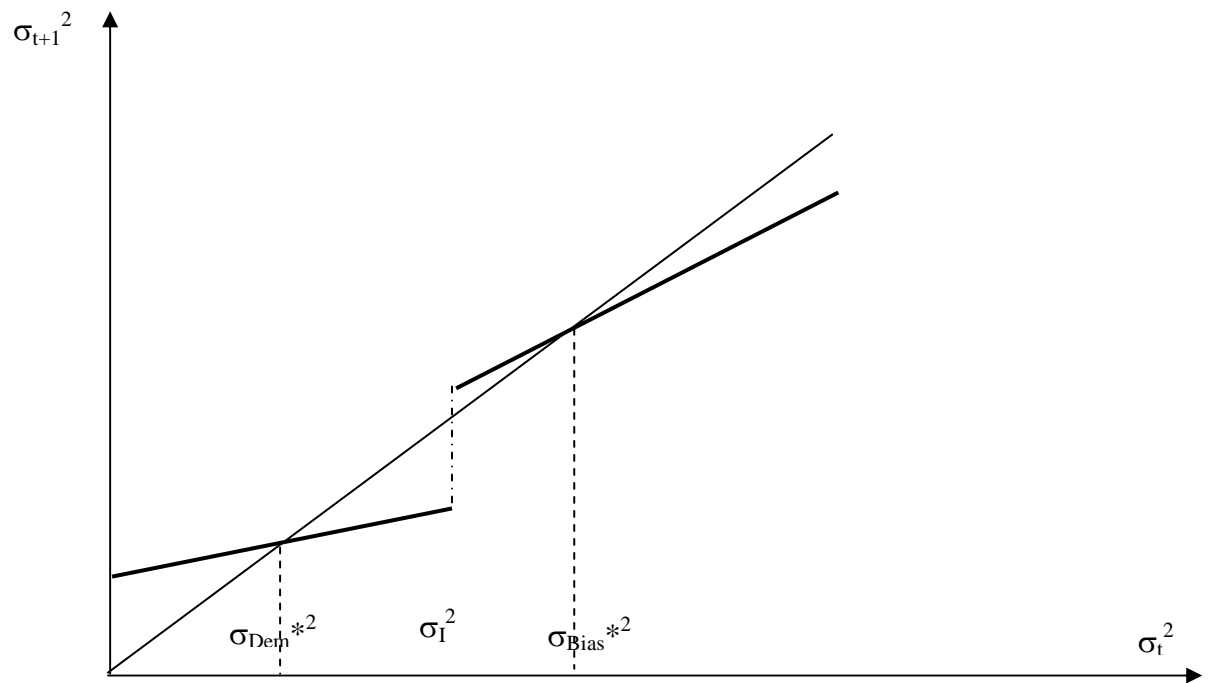
Figure 1

Figure 2a

Figure 2b

Figure 2c