# Education, Corruption, and the Distribution of Income

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**Abstract:** We model the two way interaction between education, corruption and the level of output. Corruption reduces income levels and hence educational attainment. Education in turn affects the incentives for corruption: more education increases output and thus the rents from corruption, but it also increases the probability that the electorate identifies corrupt behavior and ousts the incumbent politician. In this context, we identify the conditions under which an opportunist politician has the incentives to take actions that will allow the economy to escape from a poverty trap. Our analysis shows that the relationship between education, output levels and the level of corruption is non-monotonic, and that both institution-led development and education-led development are possible. Which path occurs crucially depends on the initial level of inequality.

**Key words:** Inequality, corruption, education, economic development.

**JEL Classification:** O1

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## 1. Introduction

It is well established that education is associated with greater electoral participation,[1] and a number of authors have studied the implications that the relationship between education and participation has for economic development; see Bourguignon and Verdier (2000). What has received less attention is the fact that education also affects individuals' level of "political knowledge" and hence their capacity to assess policies and politicians' behavior. In this paper we examine the idea that a more educated electorate has a greater capacity to identify corrupt politicians and hence can reduce rent-extraction by the political class. This generates two-way relationship at the aggregate level between corruption and education that can help us understand some of the puzzles concerning the relationship between education, institutional quality, and development.

Our analysis is based on two crucial mechanisms On the one hand, an honest politician sets lower tax rates than a corrupt one, which increases the net income of the population and allows more individuals to afford education. On the other, more educated individuals have two, opposing effects on the politician's payoff from corruption. More education increases output and hence potential corruption rents, but it also lowers the reelection probability of a corrupt incumbent since more educated voters are more likely to identify corrupt politicians. As a result the expected payoff from corruption is non-monotonic in the average level of education.

The strategic behavior of the politician is the key element in our analysis. We find that under certain circumstances, an opportunistic politician may behave honestly, or even pass what we term *constitutional reform*, that improves transparency and prevents future corruption, thus bringing the economy out of a poverty trap. Which strategy dominates crucially depends on two things: the level of education and the degree of wealth inequality. Education is crucial as it determines both the current level of rents and the probability of being identified as corrupt. The degree of inequality, in turn, determines the number of individuals that can become educated and hence future rents.

We find that it is countries with intermediate levels of education that are most likely to be stuck in a poverty trap. The strategic decisions of opportunistic politicians lead to corruption for intermediate levels of education, and to honest behavior for high

[1] See for example U.S. Department of Education, (2003).

and low levels of human capital, implying that the at the aggregate level the relationship between education, corruption and output is non-monotonic. This can explain the finding by Acemoglu et al. (2005) that increases in the aggregate level of education do not necessarily lead to lower corruption, despite the substantial evidence supporting a correlation between education and political knowledge and participation in elections at the individual level.

We also find that there are two ways in which an economy can get out of a poverty trap. Economic development can be led either by political reform which results in low taxation and then generates education expansion, or by an initial accumulation of human capital that eventually forces politicians to behave honestly. This multiplicity of development paths can help us understand why the empirical literature has had so much difficulty in identifying whether it is good institutions that "cause" education, or whether education leads to good institutions; see Acemoglu, Johnson and Robinson (2001, 2002) and Glaeser et al. (2004). We explore the circumstances under which one or the other path to development is likely to take place, and find that initial wealth inequality plays a crucial role in determining which of these paths is followed. Our results are in line with the evidence provided by Easterly (2005), who after carefully instrumenting for inequality, finds that an unequal distribution is a major impediment to prosperity, good institutions, and high educational achievement.

There exists substantial empirical support for our key assumption that education improves political knowledge. Survey evidence documents that more educated individuals better identify the quality of political institutions, politicians, and implemented policies (Galston 2001). Education has also been shown to improve individuals' abilities to comprehend political events and form consistent political views (Delli Carpini and Keeter 1996, Nie et al. 1996). Individuals with lower levels of political knowledge have been shown to be more likely to rely on character impressions rather than policy evaluation in their voting behavior (Popkin and Dimock 1999, see Galston 2001 for a survey).

Further evidence supporting our key mechanisms is provided by Reinikka and Svensson (2005) and Wallis (2005). Reinikka and Svensson find that Uganda a newspaper campaign informing parents and schools of the funds provided by the government for education substantially reduced the fraction of the funds captured by

bureaucrats and politicians and increase true spending in educational infrastructure. This indicates the potential role of information in preventing corruption. Compelling evidence for our concept of constitutional reform is presented by Wallis (2005), who constitutional reforms at the state level in the US states in the mid-nineteenth century. Major transport infrastructure projects were ridden with corruption that led to a fiscal crisis in the early 1840s. Many states responded by writing new constitutions that increased the transparency of government borrowing and expenditure, and succeeded in reducing corruption.

Our results add to the growing literature on endogenous political participation. Existing models have explored the implications when election participation depends on the level of education and agents vote on the extent of redistribution. Closest to our analysis are Acemoglu and Robinson (2000) and Bourguignon and Verdier (2000). The political elite in Bourguignon and Verdier faces a similar trade-off as the politician in our model: increased education leads to higher output (due to a technological externality) but also to increased electoral participation, and hence more redistribution. However, their model generates a monotonic relationship between initial income, education, and the extent of democratization, which has proven difficult to confirm empirically. Our analysis shares with Acemoglu and Robinson (2000) the idea that politicians may be interested in committing to institutional changes which limit their power in order to maximize their long term well being. For Acemoglu and Robinson it is the threat of revolution that forces politicians to extend franchise and commit to redistribution in the future; in our setup it is the threat of no reelection that can lead to the introduction of constitutional reform.

The paper is also related to the recent literature on corruption. One strand of this literature has tried to understand what are the incentives for corruption and rent-seeking, and the degree of competition has emerged as an essential determinant of corruption. Another strand has examined the impact of corruption on growth, and presented both theoretical arguments and empirical support for the idea that more corruption reduces growth.[2] In contrast, the relationship between education and corruption has received little attention. Two notable exceptions are Ehrlich and Lui (1999), and Glaeser and Saks (2006). Ehrlich and Lui have examined the relationship

[2] This literature started with Krueger (1974). For recent work on the determinants of corruption see Shleifer and Vishny (1993), Bliss and Di Tella (1997), Ades and Di Tella (1999), or Emerson (2006). The relation between corruption and growth is explored by Murphy, Shleifer and Vishny (1991) and Mauro (1995), among others, and that between corruption and development by Bardhan (1997).

between corruption and growth when agents choose how to divide their time between the accumulation of human capital and rent-seeking activities. However, their focus is on the diversion of resources into rent-seeking, rather than on the institutional aspect. Glaeser and Saks provide empirical evidence on the relationship between corruption and education. They use data on corruption convictions in the US to examine the determinants of corruption, and find a strong positive correlation between the level of education and corruption across states, as well as a weak correlation between corruption and income inequality.

A number of recent papers have emphasized the endogeneity of institutions. Particularly close to our work is Galor, Moav and Vollrath (2005), who emphasize the endogeneity of institutions that tend to promote human capital accumulation, and argue that it is the degree of land inequality that has historically played a central role in the appearance of such institutions. Imperfect information plays a central role in our analysis, as in Aghion, Alesina, and Trebbi (2004) who model endogenous constitutional design under imperfect information. Our approach contrasts with Esteban and Ray (2006) and their analysis of inefficient governments. In their case, honest governments take inappropriate allocative decisions because of an information problem which is aggravated by the presence of inequality. We argue that intrinsically opportunistic politicians may behave honestly, and even undertake reforms that prevent future corruption, if they have the right incentives.

The paper is organized as follows. Section 2 describes the production sector and education decisions, using the OLG model with imperfect capital markets developed by Galor and Zeira (1993). It shows how the tax rate affects bequests and the level of human capital, and highlights the role played by initial inequality. Section 3 introduces the political structure of the model, in which a self-interested politician chooses the tax rate. Section 4 examines the strategic behavior of the politician as a function of education and initial inequality. We then examine the dynamics of education, and characterize the possible development paths. Section 5 concludes.

## 2. Production, Education and Taxation

### 2.1. Description of the economy

The production and education structures follow Galor and Zeira (1993),[3] to which we add a proportional income tax that is levied in order to finance a public good. The tax rate is endogenous and chosen by the politician in power, as will be specified in section 3.

***Production***

Consider a small, open economy with skilled and unskilled labour, denoted $L_{St}$ and $L_{Ut}$, respectively. Skilled and unskilled workers produce output in separate, competitive sectors denoted by *j*, with $j = U, S$. The production functions are given by,

$$Y_{jt} = A_j K_{jt}^{\alpha} L_{jt}^{1-\alpha}, \qquad 0 < \alpha < 1 \tag{1a}$$

where $K$ and *A* represent physical capital and technology, respectively. We assume $A_S > A_U$, implying that technology used by skilled workers is more productive.

Firms can borrow at the constant world interest rate, *r*. All income is taxed at rate $\tau_t$, where the tax rate is determined endogenously in the political process described below. Equality between the world interest rate and the domestic after-tax return on capital determines the amount of capital employed in each sector. The capital-labor ratios are given by $k_{jt} = \left(\alpha A_j (1-\tau_t)/r\right)^{1/(1-\alpha)}$, where $k_{jt} \equiv K_{jt} / L_{jt}$. As a result, wages, $w_{jt}$, are independent of the supplies of the two types of workers, with

$$w_{jt} = \lambda_j (1-\tau_t)^{\alpha/(1-\alpha)}, \text{ where } \lambda_j = (1-\alpha) A_j^{1/(1-\alpha)} (\alpha/r)^{\alpha/(1-\alpha)}. \tag{2}$$

Note that the wage depends negative on the tax rate, through the effect that the latter has on the capital stock. Using the labor market clearing constraint, $L_{Ut} + L_{St} = 1$, aggregate output can be expressed as

$$Y_t \equiv Y_{Ut} + Y_{St} = (1-\tau_t)^{\alpha/(1-\alpha)} \frac{\lambda_U (1-L_S) + \lambda_S L_S}{1-\alpha} \tag{1b}$$

To no surprise, higher taxes depress output while an increase in the fraction of the labor force that is educated raises output.

[3] We refer the reader to the original paper for a detailed discussion and motivation of the assumptions. See also Galor and Moav (2004, 2006) for work on the long-run relationship between inequality, education and income levels.

We assume that production requires the provision of a public good, which can be thought of as an infrastructure requirement. We follow García-Peñalosa and Turnovsky (2005), and assume that $\phi Y_t$ units of the public good are required to produce a level of output $Y_t$, with $0 < \phi < 1$. The public good has a constant unit costs, *c*, implying that the total cost of the public good is $c\phi Y_t$.

***Education, Consumption and Bequests***

There is a mass 1 of overlapping-generations dynasties indexed by *i*. Agents live for two periods, implying that the population measure is 2. Agents differ in their initial wealth, with all the skilled holding $x_{s,0}$ and all the unskilled $x_{u,0} < x_{s,0}$. The timing is as follows. At the beginning of her first period of life an individual receives a bequest from her parent and decides whether or not to invest in education. Education takes no time. She then works for that period as either skilled or unskilled, and has an offspring at the end of the period. In the second period, she does not work, but consumes and leaves a bequest to her child. There are elections at the beginning of each period, and all agents vote in them.

Each worker derives utility from own consumption, $c_i$, and the bequest left to her offspring, $b_i$, with the utility function taking the form

$$U_{it} = \left(\frac{c_{it}}{1-\beta}\right)^{1-\beta}\left(\frac{b_{it}}{\beta}\right)^{\beta}, \qquad \text{where} \quad \beta < 1. \tag{3}$$

Utility optimization implies that consumption and bequests are constant fractions of per capita output, $c_{it} = (1-\beta)y_{it}$ and $b_{i,t} = \beta y_{i,t} = x_{i,t+1}$, where $x_{i,t+1}$ is the inheritance that a young individual from dynasty *i* receives from her parents, i.e. her wealth. Substituting for consumption and the bequest, the indirect utility function is given by

$$U_i = y_i \tag{3'}$$

which implies that individuals are risk-neutral.

We assume there is a fixed education cost, *e*, and that borrowing to finance education is not possible.[4] The incomes of an unskilled and a skilled agent are then

$$y_{u,t} = (1+r)\left[(1-\tau_t)w_u(\tau_t) + x_t\right], \tag{4a}$$

[4] None of our results would change in the more general case in which borrowing to invest in education is possible but costly due to imperfect capital markets, as in Galor and Zeira (1993).

$$y_{s,t} = (1+r)\left[(1-\tau_t)w_s(\tau_t) + (x_t - e)\right]. \qquad (4b)$$

After receiving their bequest, young agents decide whether or not study. A necessary condition for investment in education is then that their bequest is large enough to cover the cost of education, i.e. $x_{it} \geq e$. Wealthy agents then invest in education if the lifetime income of being skilled is higher than that of being unskilled, that is, if $y_s > y_u$. This inequality reduces to the condition that the return in terms of a higher skilled wage must outweigh the interest an agent could obtain from investing *e* in physical capital,

$$(1-\tau_t)\left[w_s(\tau_t) - w_u(\tau_t)\right] = (1-\tau_t)^{1/(1-\alpha)}(\lambda_s - \lambda_u) \geq e.$$

Note, first, that this equation is independent of the agents' wealth, implying that if it is satisfied, all agents wish to become educated. Second, for given parameter values, this equation implies that a low enough tax $\tau < \hat{\tau} \equiv 1-(e/(\lambda_S - \lambda_u))^{1-\alpha}$ is required for agents to want to study.

***Dynamics***

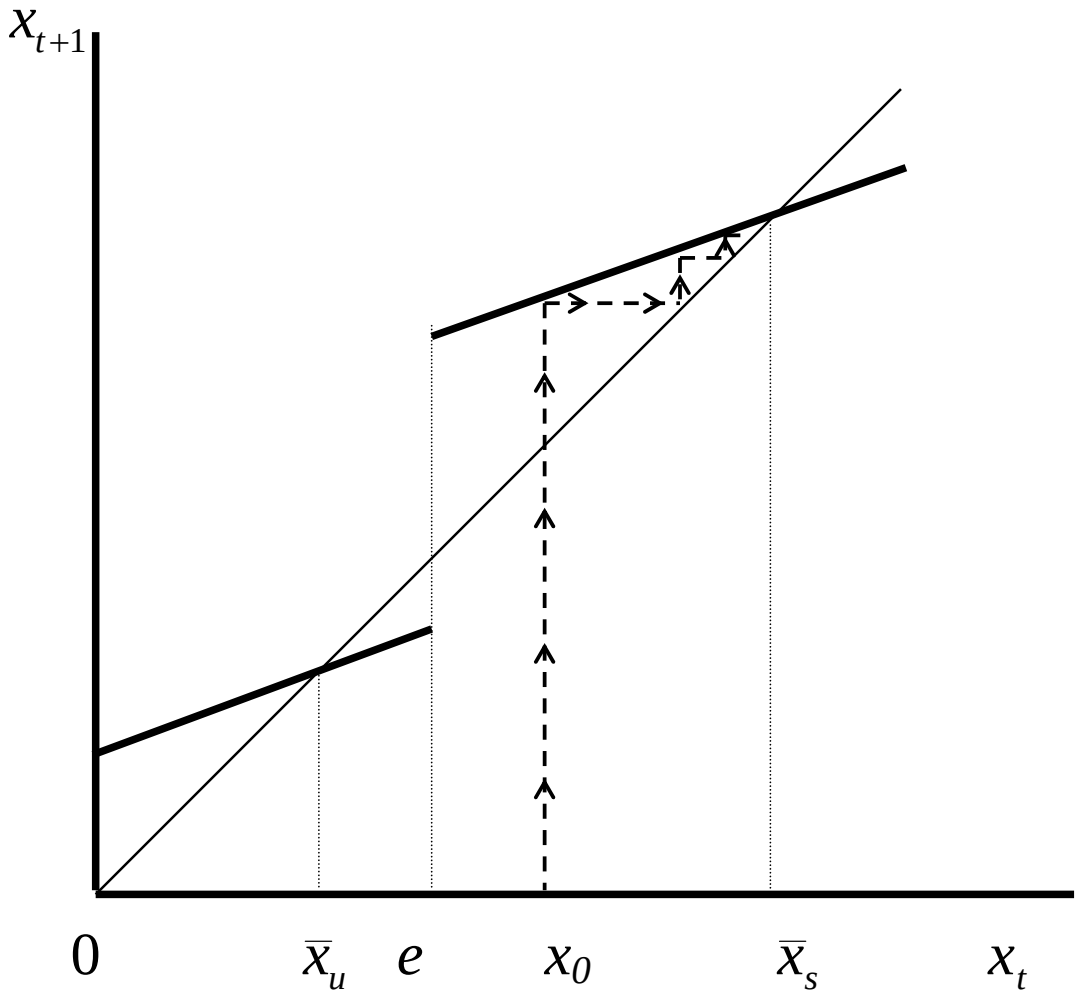
The dynamics of the model are given by the evolution of bequests; they are characterized by the two difference equations:

$$x_{u,t+1} = \beta(1+r)\left(\lambda_U (1-\tau_t)^{1/(1-\alpha)} + x_{U,t}\right), \qquad (5a)$$

$$x_{s,t+1} = \beta(1+r)\left(\lambda_S (1-\tau_t)^{1/(1-\alpha)} + (x_{s,t} - e)\right). \qquad (5b)$$

The bequests of all dynasties with wealth $x_t < e$ are governed by equation (5a), while those of dynasties with bequests $x_t \geq e$ are governed by (5b). These two functions are depicted in Figure 1, where the lower line represents the bequest function of the unskilled and the higher one the bequest function of the skilled. Under the assumption of a constant tax rate and $(1+r)\beta < 1$ (which occurs if the propensity to bequeath is not loo large), these two functions intersect the 45° degree line and converge to the steady states $x_{u,t+1} = x_{u,t} = \bar{x}_u$ and $x_{s,t+1} = x_{s,t} = \bar{x}_s$.

**Figure 1: Equilibrium Inequality**




Assuming a constant tax rate, the long-run distribution of wealth converges to an invariant distribution which is a function of the initial distribution; see Galor and Zeira (1993). The long-run levels of wealth held by the unskilled and by the skilled are, respectively,

$$\bar{x}_u[\tau] = \frac{\beta(1+r)}{1-(1+r)\beta}\lambda_u(1-\tau)^{1/(1-\alpha)}, \qquad (6a)$$

$$\bar{x}_s[\tau] = \frac{\beta(1+r)}{1-(1+r)\beta}\left(\lambda_s(1-\tau)^{1/(1-\alpha)} - e\right), \qquad (6b)$$

while the steady state fraction of skilled (unskilled) workers is given by the proportion of dynasties whose initial wealth exceeds (falls below) the cost of education.

Galor and Zeira discuss the equilibrium at length. They examine the role of the production function (technology and interest rate), and the initial distribution of wealth in determining the feasible equilibria. Here, we are interested in the political economy of taxation and hence investigate the impact of the tax on the education decision.

An equilibrium with inequality requires a tax such that rich dynasties can afford education, while poor dynasties cannot, i.e. $\bar{x}_s(\tau) \geq e$ and $\bar{x}_u(\tau) < e$. From (6) this implies a tax in the interval $[\bar{\tau}_u, \hat{\tau}]$, where $\bar{\tau}_u = 1 - (e(1-\beta(1+r))/\beta(1+r)\lambda_u)^{1-\alpha}$. Any tax rate lower than $\bar{\tau}_u$ allows a descendent of those currently unskilled to eventually study, while any tax greater than $\hat{\tau}$ implies that even the children of the skilled are not able to afford education in the long-run.

In what follows we suppose

*Assumption 1: The initial tax rate $\tau_0$ and initial distribution of wealth are such that the initial equilibrium exhibits inequality. That is, $\tau_0 \in (\bar{\tau}_u, \hat{\tau})$ and $x_{u,0} < e < x_{s,0}$.*

We make assumption 1 in order to focus on the interesting case of an initially unequal society. The analysis of how political corruption and reform affect educational attainment would be irrelevant if all workers could afford education from time $t$=0.

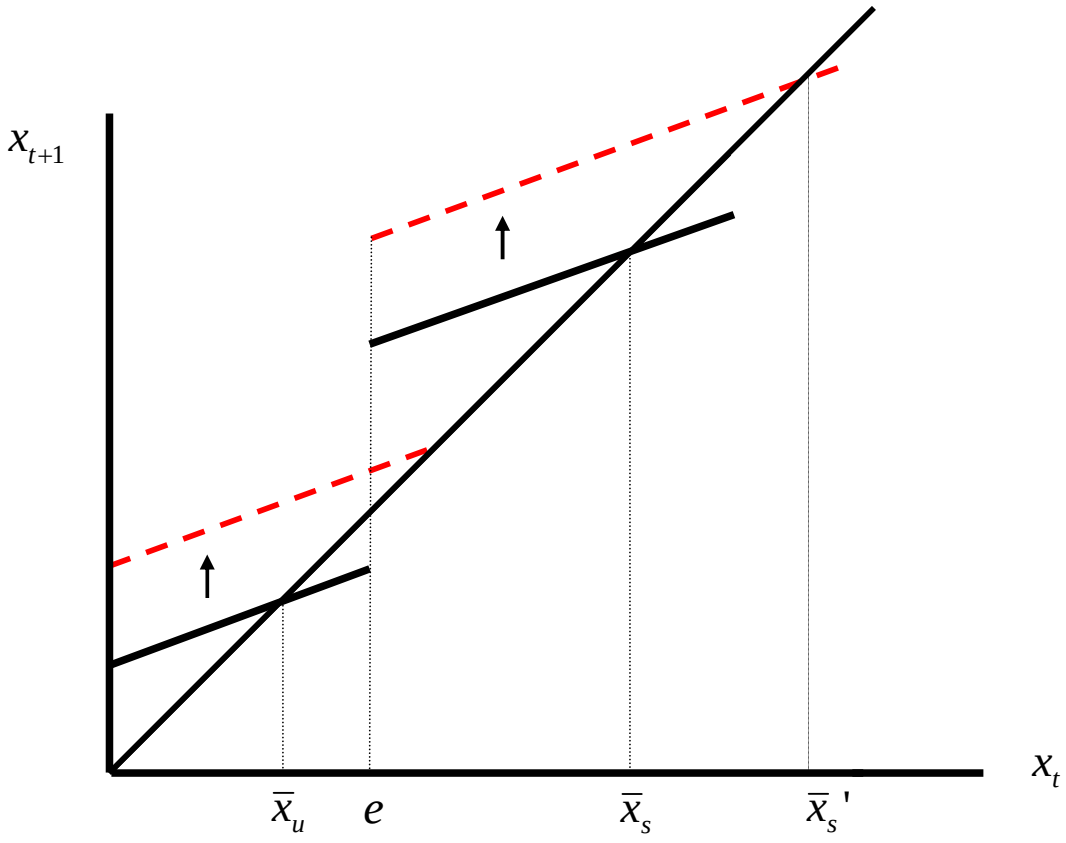
**2.2. Dynamic Effects of Taxation**

We can now analyze the impact of tax changes on income and bequests, and hence on the distribution of income and educational attainment. Lower taxes have a direct and an indirect effect on individual incomes: for a given wage, lower taxes increase disposable income; they also increase the net return to capital leading to a capital inflow that raises skilled and unskilled wages. These two effects shift upwards the bequest functions, implying a higher bequest at $t+1$ for any given bequest at $t$.

The impact on education depends on whether the tax level is higher or lower than the threshold $\bar{\tau}_u$. Any tax rate $\tau > \bar{\tau}_u$ generates an equilibrium with inequality represented by $(\bar{x}_U, \bar{x}_S)$. The reduction of the tax to a level below $\bar{\tau}_u$ would shift the bequest function sufficiently for the fixed point of the unskilled bequest function to disappear, as depicted in Figure 2. Consequently, all dynasties end up being skilled in

the long-run with a bequest level of $\bar{x}_S^{'}$. This equilibrium results in higher output and equality.

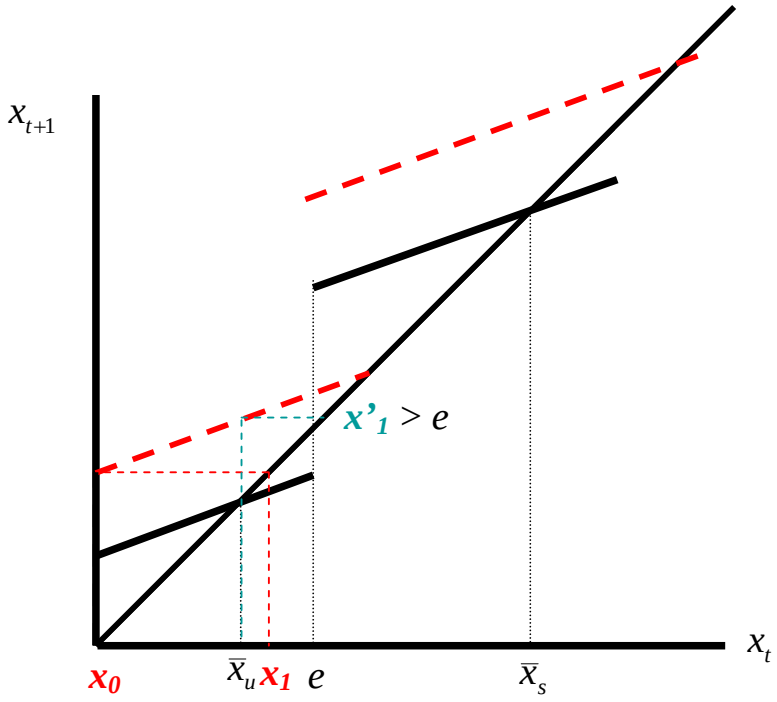
**Figure 2: Bequests and Taxation**




These changes may, however, take time depending on the initial level of inequality. Figure 3 depicts the dynamic adjustment of the economy in response to a reduction in the tax rate from $\tau_0$ to $\tau^1 < \bar{\tau}_u$. The tax reduction shifts up the bequest schedule, which increases the wealth of the next generation. If the initial wealth level of the unskilled at *t* is low, say $x_0$, their offsprings will receive an inheritance of $x_1$ which is less than the cost of education. They will hence be unable to study and the skilled labor supply at *t*+1 will be equal to that at *t*. Some descendent of this dynasty will eventually be able to study, but it will take time. Suppose now that the initial level of wealth of the unskilled is high, say $\bar{x}_U$. Then the bequest they will leave to

their offsprings will be $x_1' > e$, implying that all those born at $t$+1 will be able to afford education and the skilled labor force at $t$+1 will be equal to 1.

**Figure 3: Dynamic Effects of Lower Taxes on Education**




In our two-class economy, we can define the degree of inequality as the distance between the initial wealth of the educated and that of the non-educated, $x_{s,0} - x_{u,0}$. For a given level of average wealth in the economy and given skilled and unskilled populations, a lower value of $x_{u,0}$ implies greater inequality. Then, the degree of inequality determines whether a change in the tax rate results in an immediate increase in the level of education, or a progressive one over several periods. We can summarize the results on the effect of tax changes on education as follows:

***Proposition 1: Dynamic Effects of Tax Cuts***

*Let* $x_{s,0} - x_{u,0}$ *be the initial level of inequality. A reduction in the tax rate from* $\tau_0$ *to* $\tau^1 < \bar{\tau}_u$ *increases bequests and leads to a fully educated labor force* $L_S = 1$. *The dynamics of the education expansion depend on the initial level of inequality:*

*(i) For a low degree of inequality, the increase in educational attainment will take place next period.*

*(ii) For a high degree of inequality, the education expansion occurs only after several periods during which unskilled dynasties accumulate wealth.*

Having established the dynamic response of education and the distribution of wealth to a change in the tax rate, we can now turn to the political economy question and examine how the level of education affects corruption.

## 3. Political Economy

### 3.1. Political Rents

A single politician is elected each period in order to provide the public good.[5] We suppose that the cost of the public good is not known to the electorate, and this is what creates the possibility for corruption, defined as the pocketing of part of the tax revenue by the politician.

Since the total cost of providing the public good is $c\phi Y_t$ and tax revenue is given by $\tau Y_t$, the tax rate necessary to finance the public good is $\tau^c = c\phi$. We will term this the "competitive tax". The politician could, however, claim that the cost of provision is greater than it actually is, and set a higher tax rate, $\tau \geq \tau^c$. The difference between tax revenues and expenditure in the public good then generates monetary rents that will be pocketed by the politician. Monetary rents are given by

$$\pi_t = (\tau_t - c\phi)Y_t, \tag{7}$$

and, for given aggregate income, are increasing in the tax rate. However, as we saw in section 2, a higher tax rate reduces the capital-labor ratio and hence aggregate output. These two opposing forces imply that rents are a concave function of $\tau$, hence the politician will choose the tax rate that maximizes rents from corruption. Using (1b) to substitute for $Y_t$, we obtain the tax rate that maximizes rents,

[5] For the sake of simplicity, we match a discrete number of politicians with a rent taken from a continuum of agents. In a former version of this paper (see Eicher et al. 2006) we assumed that the government was a measure of the population, and our results were the same.

$$\tau^* = 1 - \alpha(1 - c\phi), \tag{8}$$

and the rent obtained by a corrupt politician

$$\pi_t = a(1 + \varphi L_{St}), \tag{9}$$

where $a = (1-\alpha)^2 A_u^{\frac{1}{1-\alpha}} \left(\alpha^2 / r\right)^{\alpha/(1-\alpha)} (1 - c\phi)^{1/(1-\alpha)} \Big/ P$, and $\varphi = (A_s / A_u)^{\frac{1}{1-\alpha}} - 1$. Clearly, a higher level of education results in a larger rent, as this increases the tax base. Rents also increase in the levels of technology, $A_u$ and $A_s$, and decrease in the world interest rate, *r*, which determines the cost of capital and hence output, and in the cost of providing the public good, *c*. The parameter *a* will play an important in the politician's choice of strategy; it can be thought of as an indicator of the level of development, or productivity, as it depends positively on $A_u$ and the negatively on the interest rate.

The analysis of corrupt regimes would be irrelevant if corrupt taxes were associated with equality, either because they allow all agents or none to study. Hence we introduce Assumption 2 to assure that political reform can have an impact on the level of education:

<u>Assumption 2:</u> *The competitive tax rate satisfies* $\tau^c < \bar{\tau}_u$, *while the corrupt tax rate* $\tau^*$ *lies in the range* $(\bar{\tau}_u, \hat{\tau})$.

This assumption is satisfied for an intermediate range of the cost of providing the public good, relative to the level of development, *a*. If the cost is too high, even the competitive tax rate will be too large for the wealthiest individuals to study; if the cost is too low, all dynasties will be able to afford education even when $\tau^*$ is imposed. Assumption 2 then implies that when the corrupt tax rate $\tau^*$ is chosen the level of education is unchanged, while under the competitive tax rate $\tau^c$ all dynasties can eventually study.

### 3.2. The Political Process

At the beginning of each period an election takes place to elect the politician for a term that lasts one period. The politician is chosen among the skilled and unskilled populations. We shall assume that a young agent continues to work in production if elected. The politician is risk-neutral and, if young, may be reelected for a second

term. The probability of election depends on the politicians actions and the level of education in the economy, as specified below.

The politician can undertake two actions. First, he announces the cost of the public good and sets the tax rate for that period. He can set a competitive tax, $\tau^c$, in which case we say he is honest, or claim that the cost of the public good exceeds *c*, charge $\tau^* > \tau^c$, and pocket the excess tax revenues, in which case we say he is corrupt. Second, irrespective of the tax rate chosen, he may decide to pass *constitutional reform*. For simplicity, constitutional reform is not modelled as a gradual process but as a move towards complete transparency regarding *c*: the true cost of the public good is announced and becomes known to all agents.[6] Once constitutional reform is undertaken, it remains in place, implying that future politicians cannot levy taxes in excess of $\tau^c$. That is, future corruption is not possible. Constitutional reform is passed at the end of the period, implying that a reform passed in *t* will be applicable from *t*+1 onwards.

We suppose that there are two types of individuals, *idealists* and *opportunists*, but that the type of a candidate can not be observed by voters. There is a small proportion of idealist individuals in the population, denoted $\varepsilon$. Voters prefer young to old politicians as even if opportunistic a young politician may have incentive to behave honestly in the first period, as will become clear below. Assuming that it is impossible for voters to distinguish between altruistic and opportunistic candidates, all young individuals have the same probability of being elected.

If an idealist individual were elected, he would set $\tau^c$ and try to pass constitutional reform, hence preventing any future politicians from extracting rents and leading to a high-human-capital equilibrium. We shall assume that with some probability (close to zero) he fails in passing constitutional reform. Therefore, it is not possible for voters to distinguish between an idealist politician who failed to pass the reform and an opportunistic one that chooses (strategically) to impose the competitive tax rate. An honest politician is elected with a low probability, $\varepsilon$, hence we focus on the more interesting case in which an opportunist politician is elected.

At each period, an opportunist politician may either act honest, *H*, or corrupt (dishonest), *C*, depending on which action gives him greater utility. The utility of a

[6] The importance of budget institutions and, in particular, the role of transparency in generating fiscal discipline is documented by Alesina, Hausmann, Hommes, and Stein (1999) and by Wallis (2005).

politician who has chosen behavior *j* in the first period, and *g* in the second, with *j,g* = *H, C,* is assumed to be

$$U_{pt}(j,g) = u + \gamma_j \pi_t + \delta p_{j,t+1}\left(u + \gamma_g \pi_{t+1}\right). \qquad (10)$$

where *u* denotes the ego rent obtained each period he is in power, $\pi$ the monetary rent obtained when corrupt, $\delta < 1$ the politicians discount rate, and $\gamma$ is an indicator function that takes the value 1 if the politician is corrupt and gets a monetary rent, and is 0 if he behaves honestly. The probability of being reelected given behavior *j* at *t* is $p_{j,t+1}$, which depends on the politician's actions and the macroeconomic conditions as will be specified below. It is clear from equation (10) that the payoff to a politician depends both on the rents obtained when corrupt and on the probability of reelection. We now turn to the determinants of the probability of reelection.

### 3.4. Reelection Probabilities

A politician may be reelected in his second period of life. However the politician's actions in period 1 reveal information about his type. If his actions make a majority of voters believe that he is corrupt, he will not be reelected; if the majority of the electorate believes he is honest, he will. Note that when voters elect a new politician, there is a probability, $\varepsilon$, (close to zero) that the new government is honest and sets the competitive tax. Voters prefer this than to re-elect someone they believe to be corrupt.

The reelection probability $p_{j,t+1}$ depends on whether or not the politician was corrupt in the previous period, and on the level of education in the economy.[7] In order to relate education to voting behavior, we assume that educated individuals are informed about the cost of the public good and realize when the competitive tax level is or is not imposed. The unskilled, on the other hand, possess only an imperfect notion about the cost of the public good and thus receive a noisy signal, *q*, regarding the politician's behavior. Our key assumption is then [8]

[7] Any agent would have an incentive to vote against the incumbent as it increases his probability of being elected and therefore of getting the political rent. This would imply that any time all agents would vote for themselves. In order to avoid this outcome, we could assume that only a fraction *f* of agents have "political skills" and hence only those run for elected office. We assume that *f* is infinitely small.

[8] We also assume that the parents of educated individuals (who may or may not be educated themselves) acquire the information from their offspring, and hence vote like their children.

*Assumption 3: Skilled individuals are informed about the cost of providing the public good, and can distinguish between a corrupt and an honest politician. Unskilled individuals are uninformed about this cost and receive a signal about the type of government, that is correct with probability,* $q < 1$.

The reelection probabilities at time *t* can then be expressed as a function of two factors: the politician's behavior at *t*-1 and the number of skilled individuals at *t* . The reelection probabilities when the government has been honest or corrupt then take the form, respectively,

$$p_H(L_{S,t}) = L_{S,t} + q(1 - L_{S,t}), \tag{11a}$$

$$p_C(L_{S,t}) = (1-q)(1 - L_{S,t}). \tag{11b}$$

Recall that the politician can also pass constitutional reform, which imposes the competitive tax in all future times if it succeeds. Successful constitutional reforms are correctly observed by all agents, and the politician that passed it is reelected with certainty, that is,

$$p_R = 1, \qquad \forall L_S. \tag{11c}$$

The reason for this is that by passing reform politicians "tie their hands" and make it impossible for themselves to tax excessively. This commitment implies that voters are certain that the tax rate will be the lowest possible.[9]

The politician then has two ways of increasing his reelection probability. One is to be honest in the first period, forgoing the first period rent in order to make a second mandate more likely. Note, however, that even if he behaved honestly in the first period he is not assured reelection if there are too many unskilled individuals who receive only an imperfect signal about his behavior. The other way to increase his reelection probability is to pass constitutional reform, which will ensure reelection whatever the level of education, but will prevent the politician from extracting monetary rents in the second period.

[9] This rules out a world were voters punish a politician for his past behavior, in essence viewing past uncompetitive taxes as sunk costs. Our results below would not change qualitatively if we allowed for $p_H < p_R < 1$. However, if punishment for past behavior is so strong that the reform reelection probability falls below that of an honest politician, constitutional reform can be shown never be a dominant strategy.

## 4. Politician's Behavior and the Dynamics of Education

### 4. 1. Corruption, Honesty and Reform

It is clear from our discussion above that an opportunistic politician who would like to extract monetary rents may strategically set $\tau^c$ in period 1.[10] There are then three possible behaviors: being corrupt in both periods, being honest in the first and corrupt in the second, and being corrupt in the first period and passing constitutional reform (in the Appendix we show that all other strategies are dominated). The utility associated which each of these is given by

$$U_{pt}(C,C) = u + \pi_t + \delta p_{C,t}\left(u + \pi_{t+1}\right) \quad (12a)$$

$$U_{pt}(C,R) = u + \pi_t + \delta u \quad (12b)$$

$$U_{pt}(H,C) = u + \delta p_{H,t}\left(u + \pi_{t+1}\right) \quad (12c)$$

We need to examine under which circumstances a politician chooses any of these three behaviors. There are two possible scenarios depending on the initial conditions. The first is the case in which wealth inequality is high, that is $x_{u,0}$ is low. The initial wealth of the unskilled is then so low relative to the cost of education that even a competitive tax would not allow the children of the unskilled to become educated next period. Alternatively, if initial wealth inequality is low (i.e. $x_{u,0}$ is high), the wealth of the unskilled is close to the cost of education. Introducing the competitive tax would allow the children of the currently-unskilled to study, leading to a skilled labor supply of 1 next period. We discuss these two cases in turn in the next section.

### 4.2. Viable Equilibria and Incentives for Corruption

#### 4.2.1 High initial inequality

When wealth inequality is high, the choice of tax rate at *t* has no impact on the number of skilled individuals at *t*+1, and corruption rents are constant over time, i.e. $\pi_t = \pi_{t+1}$. Then, a politician's strategy of being honest in the first period and dishonest

[10] Note that a dishonest politician could set a tax rate above $\hat{\tau}_s$ such that nobody wants to become skilled next period and hence their probability of reelection increases at the cost of a lower rent. We rule out this possibility. We may justify it by assuming that there exists an outside option for skilled workers, say emigration, which is good enough to justify education and therefore negative vote for the politician.

in the second is dominated by being dishonest in the first period and instituting constitutional reform, as in the latter case reelection is assured.

Two viable political strategies remain to be compared: reform (12b) and full corruption (12a). The difference in the payoff from these two strategies can be expressed as

$$\Psi_{CC,CR} \equiv U_p(C,C) - U_p(C,R) = p_C(u+\pi) - u \qquad (13)$$

Equation (13) highlights the tradeoff faced by a corrupt politician regarding the second period: receiving ego rents with certainty, or opting for ego rents and monetary rent with uncertainty.

Substituting for the reelection probability and rents from (9) and (11b), and given that $L_{S,t} = L_{S,t+1} = L_S$ , we can rewrite the payoff to utterly corrupt behavior and to reform, respectively, as

$$U_p(C,C) = \big(1+\delta(1-q)(1-L_S)\big)\big(u+a(1+\varphi L_S)\big) \qquad (14a)$$

$$U_p(C,R) = u + a(1+\varphi L_S) + \delta u \qquad (14b)$$

The level of education plays a crucial role in the choice between these two strategies. The function $U_p(C,R)$ is strictly increasing in $L_S$, as the only effect of more educated individuals is to increase the rent, as depicted in figure 4. The function $U_p(C,C)$ is first increasing and then decreasing in $L_S$, as more education has two offsetting effects. The less educated the electorate is, the less likely it is that voters identify corrupt behavior and the closer the election probably of a corrupt, non-reforming politician is to 1, increasing the payoff from full corruption. However, a more educated labour force implies higher rents, increasing the incentives to be corrupt in the second period. For low values of $L_S$, the rent effect dominates, while for higher values the re-election effect dominates, due to the presence of diminishing returns to skilled labour in production. Note that for $U_p(C,C)$ to ever dominate, the probability that the unskilled can correctly infer the behaviour of a politician cannot be too high (i.e. *q* should not be too close to 1). Otherwise, the re-election probability would be too low and committing to low taxes through constitutional reform would always dominate; see the Appendix for the details.

When we compare these two utilities, there are two possible scenarios that depend on the size of *a*, our proxy for the level of productivity or development. Figure

4a is drawn for the case where $a$ is high, implying that monetary rents are high relative to ego rents, $a > uq/(1-q)$. In this case the two utilities intersect only once, at the education level $L_S^*$, indicating that for economies with a labour supply smaller than $L_S^*$, politicians are dishonest in both periods, since the expected monetary gain of behaving dishonestly in the second period is sufficiently high. For societies with sufficiently educated populations, $L_S > L_S^*$, politicians opt for constitutional reform after an initial period of corruption. The reason for this is that the high level of education implies that his re-election probability is low. He then chooses to commit to low future taxes by passing constitutional reform and obtains the ego rent in period 2 with probability 1.

Figure 4b considers the case in which the level of productivity is low $a < uq/(1-q)$. There are three possible situations, depending on the initial level of education $L_S$. For low levels, $L_S < L_s^{**}$, the output effect dominates and rents are so low that a politician chooses reform over utter corruption, in order to get a second ego rent with certainty. For intermediate values of $L_S$, rents are higher, leading to corruption in the second period; while for $L_S > L_S^*$, the effect of education on the probability of re-election dominates, leading to reform as above.

**Figure 4: Politician Utility with High Initial Inequality**

**Figure 4a:**
**Highly Productivity Economy**

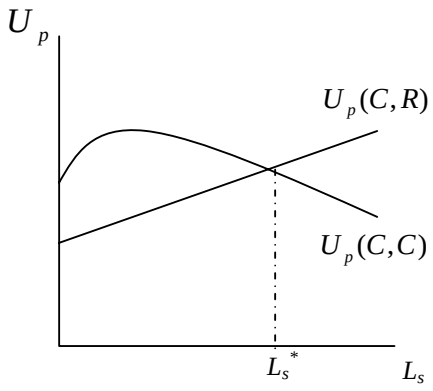
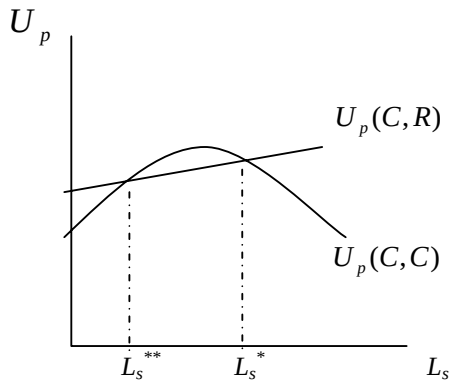



**Figure 4b**
**Low Productivity Economy**




The comparative statics on the net benefit to utter corruption highlights the implications for development. Differentiating (13), we can show

$$\frac{\partial \Psi_{CC,CR}}{\partial A_u} > 0 \quad \frac{\partial \Psi_{CC,CR}}{\partial A_s} > 0 \quad \frac{\partial \Psi_{CC,CR}}{\partial q} < 0$$

An increase in the productivity of either type of worker raises not only national income, but also the incentives for corruption. If the education level and thus the ability to discern a corrupt politician are constant, corruption will increase. This suggests that the presence of natural resources or an international transfer of technology which raises productivity will raise the incentives for corruption.

Alternatively, any improvement in the political knowledge of the unskilled increases the likelihood of reform. Improvements in the transparency of fiscal procedures thus reduce corruption, since they make the reelection of a corrupt politician less likely. This implies that technological transfers should be accompanied either by increases in the transparency of the political process or by education subsidies that reduce the cost of education, so as to avoid increased incentives for corruption.

### 4.2.2. The Evolution of Wealth

We can now examine the dynamics of wealth under the two possible strategies. If politicians are always dishonest, the economy maintains the two class distribution with the same number of skilled and unskilled as there were initially, and their steady state wealth will converge to $\bar{x}_u(\tau^*) < e < \bar{x}_s(\tau^*)$. Output will be low for two reasons, because the high tax rate implies a low capital-labor ratio, and because a fraction of the labor force remains uneducated.

If reform is passed at time *t*, the skilled labor force at *t*+1 will be the same as at *t*. However, the reduction in the tax rate allows the unskilled dynasties to increase their bequest. Their wealth will keep increasing over time until it eventually reaches the cost of education. At this point, all the labor force will become skilled, and aggregate output will be high. Note that in this case, development is fostered by political reform, with reform taking place first and eventually triggering the education expansion. We can summarize these results in the following proposition:

***Proposition 2: Political equilibria when initial inequality is high***
*Consider an economy with high inequality. Then*

*(a) In countries with high levels of productivity, there exists a threshold level of education $L_S^*$ such that*

*(i) For low levels of education, i.e. $L_S < L_S^*$, the politician is corrupt and the economy remains in a low-education, low-output, high-inequality trap.*

*(ii) For high levels of education, i.e. $L_S \geq L_S^*$, an opportunist politician chooses to implement constitutional reform; this eventually allows the unskilled to acquire education, generating high output and an equal distribution of wealth.*

*(b) In countries with low levels of productivity, there exist two threshold levels of education, $L_s^{**}$ and $L_S^*$, such that*

*(i) For intermediate levels of education, i.e. $L_s^{**} < L_S < L_S^*$, the politician is corrupt and the economy remains in a low-education, low-output, high-inequality trap.*

*(ii) For high or low levels of education, i.e. $L_S \leq L_s^{**}$ or $L_S \geq L_S^*$, an opportunist politician chooses to implement constitutional reform; this eventually allows the unskilled to acquire education, generating high output and an equal distribution of wealth.*

Proposition 2 has a number of important implications. The first one is the crucial role played by the initial level of education. High levels of education render corruption unsustainable in the long-term, while middle and low levels of education may allow for pervasive corruption. Second, for very low levels of education, poor countries may have an advantage over middle-income countries. A low level of productivity implies that output and hence monetary rents are low compared to ego rents. This reduces the incentives to behave dishonestly, and a politician prefers to be honest in the first period in order to increase his probability of obtaining the ego rent in the second. Lastly, note that institutional change always precedes educational expansion, which will occur only a number of periods after the constitutional reform is introduced and corruption eradicated.

**4.2.3. Low initial inequality**

Above we examined the politician's behavior when the equilibrium level of education is not affected by the tax policy. It is possible, however, that changes in the tax rate allow low-income dynasties to become educated. This occurs when inequality is not too high and the wealth of unskilled dynasties is close to the education cost (see Figure 3). If this is the case, the number of skilled at time $t+1$ depends on the tax rate at $t$. Specifically, if the competitive tax rate $\tau^c$ is chosen at $t$, the entire population will be educated, $L_{s,t+1} = 1 > L_{s,t}$, while setting $\tau^*$ would leave the size of the skilled

population unchanged. The possibility of increasing the skilled population has two effects on the strategies of politicians. First, the probability of reelection of an honest government becomes one, as all agents are now skilled. Second, the increase in the number of skilled raises output and hence the rents obtained at *t*+1 as compared to those at *t*. Both effects increase the utility obtained by a politician who is honest in the first period and dishonest in the second. We hence need to compare the three following utilities:

$$U_{pt}(C,C) = \left(1+\delta(1-q)(1-L_{s,t})\right)\left(u+a(1+\varphi L_{s,t})\right) \qquad (15a)$$

$$U_{pt}(C,R) = u + a(1+\varphi L_{s,t}) + \delta u \qquad (15b)$$

$$U_{pt}(H,C) = u + \delta\left(u + a(1+\varphi)\right) \qquad (15c)$$

It is immediately clear from (15a) and (15c) that there is a tradeoff between being corrupt in the first period and receiving a lower rent twice, and being honest and getting a higher rent once and with certainty.

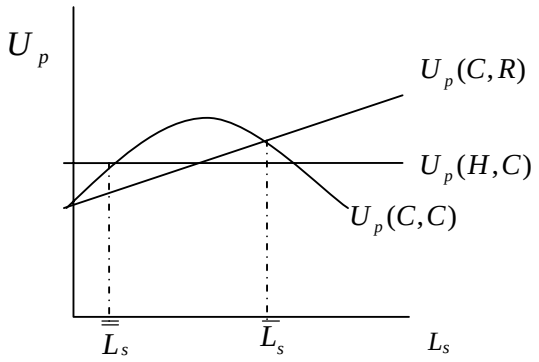
The utilities in equations (15a) and (15b) look just like those depicted in the previous figure, with $U_p(C,C)$ being concave in the level of education and $U_p(C,R)$ increasing. The utility $U_p(H,C)$ is independent of $L_{s,t}$ as neither the level of rents nor the probability of reelection at *t*+1 depend on it; the schedule is therefore flat. The three schedules are represented in figure 5.[11] We can see that $U_p(H,C)$ dominates the other two strategies for low levels of education, and $U_p(C,C)$ dominates for intermediate levels of education.

The intuition is straight forward. For low levels of education, being honest in the first period leads to a large increase in output and hence in the monetary rent obtained in the second period, hence this strategy dominates. Meanwhile, for intermediate levels of $L_s$ there are two effects in operation: on the one hand, because education is not too low, the increase in the second period rent obtained by setting $\tau_c$ is not too large, but because education is not too high, being corrupt at *t* does not jeopardize much the probability of being reelected at *t*+1. Hence being corrupt twice

[11] The schedules are drawn for reasonable levels of the rate of time preference, specifically, $\delta > \left(1+\varphi L_s^*\right)/(1+\varphi)$. Note that since $L_s^*$ does not depend on $\delta$ (see equation 13), this condition simply requires $\delta$ to be sufficiently large. We examine alternative cases in the Appendix. They are qualitatively the same as the case discussed in the text.

and getting the monetary rents twice dominates. For high levels of education $U_p(C,R)$ will deliver the highest utility.

**Figure 5: Politician utility with high inequality**




Combining these results with the wealth dynamics discussed in section 2, we have the following proposition:

***Proposition 3: Political equilibria when initial inequality is low***
*Consider an economy with low inequality. There exist two threshold levels of education,* $\overline{\overline{L}}_s$ *and* $\underline{L}_s$*, such that*

- *(i) For low levels of education, i.e.* $L_S \le \overline{\overline{L}}_S$*, an opportunist politician chooses to be honest in his first term in office. The resulting increase in the level of education leads to high income and an equal distribution of wealth, and renders corrupt behavior a dominated strategy for all future politicians.*
- *(ii) For intermediate levels of education, i.e.* $\overline{\overline{L}}_S < L_S < \underline{L}_S$*, the politician is corrupt in both periods, preventing access to higher income and education. The result is low output and persistent inequality.*
- *(iii) For high levels of education, i.e.* $L_S \ge \underline{L}_S$*, an opportunist politician chooses to implement constitutional reform, generating high education, high output, and an equal distribution of wealth.*

The crucial implication of proposition 2 is that there are two possible paths to development. For low levels of education, a low tax rate results in an education expansion which then prevents corruption; for high levels of education, constitutional reform comes first and this in turn generated the increase in the level of education.

## 5. Discussion and Conclusions

Propositions 2 and 3 summarize the possible patterns of development (or lack of it) in an economy with endogenous education, and corruption. Three main results emerge. The first one concerns the relationship between education and corruption at the aggregate level. Although we have postulated a positive relationship between education and political knowledge at the individual level, this does not translate into a monotonic relationship between the aggregate level of education and politician's behavior. The reason for this is the strategic choice of actions by politicians. Education tends to increase the rent obtained by a corrupt politician, but reduces the probability of reelection next period. The rent effect dominates for intermediate levels of education, and in this case the economy remains in a low-education, low-income, high-corruption trap. For high and low levels of education, the strategies of opportunist politicians eradicate corruption and lead to high-education, high-output and no corruption.

The second implication of our analysis is that there are two possible paths to development. In one case, constitutional reform reduces corruption and this eventually leads to education expansion. That is, an improvement in institutions brings about high education and equality. Alternatively, low taxation results in a highly educated labor force, and this will in turn prevent corrupt behavior. Institution-led development is more likely to occur in highly unequal societies, while education-led development can only take place in highly equal economies.

Lastly, we have shown that countries with very low levels of education may fare better in the long-run than those with intermediate levels of education. There are two circumstances under which the former are likely to get out of the poverty trap. One is the case of a very poor economy. Because productivity is low, monetary rents are low, and the politician has no incentive to be corrupt. He chooses to commit to low taxation in the next period through constitutional reform so as to ensure reelection and obtain ego rents. In doing so, however, he impedes corruption in the future and sets the conditions that will lead to education expansion. An implication of this last result is that resource-rich countries are more likely to remain locked in a high-

corruption/low-education equilibrium. This can help understand the evidence that the resource curse leads not only to low growth rates but also to poor governance.[12]

The other scenario is the case of an economy with a large proportion of uneducated labor but low wealth inequality. In this case, honest behavior one period can allow the entire labor force to become educated thus increasing the rents obtained from corruption in the second period. The education expansion, however, means an increase in the political knowledge of the electorate and rule out corrupt behavior for any future government.

The cases we have identified in the model can be illustrated with two examples. First, Latin American economies have been, to a large extent, characterized by poor institutions and widespread corruption. In the mid-20$^{th}$ century these were economies with intermediate levels of education. Rents were sufficiently high to create the incentives for corruption, but the level of political knowledge of the electorate was not high enough to identify corrupt behavior. As a result, these economies were locked in a bad-institutions/low-output/high-inequality equilibrium.

Our second example concerns East Asian and sub-Saharan African economies, which in the mid-20$^{th}$ century, at the end of colonization, were both characterized by extremely low levels of educational attainment. In the 1950s the perception among development economists was that the serious problem was faced by East Asia. African countries were resource rich, and natural resources would bring in the revenues needed to trigger growth (see Hance, 1956); East Asian economies were uneducated, resource poor, and highly populated, and hence had no way of escaping the poverty trap. Yet, the next few decades witnessed a massive increase in both education and per capita incomes in the Asian economies and stagnation in most African countries (Temple, 1999). Our analysis suggests a possible explanation for these observed disparities. As well as poor, East Asian countries were relatively equal (see the discussions in Benabou, 1996, and Aghion, Caroli and García-Peñalosa, 1999). The model predicts education-led development, with an expansion in educational attainment leading to higher output levels though not necessarily accompanied by institutional change. This is precisely what took place in the last decades of the 20$^{th}$ century. In Africa, abundant natural resources made the

[12] See Bulte, Damania and Deacon (2005) for empirical evidence, and Robinson, Torvik and Verdier (2005) for an analysis of institutional determinants of the resource curse.

productivity of the unskilled high, leading to large potential rents. Corruption prevailed, impeding education and maintaining low output levels.

A number of questions remain. The most important one is that the mechanism that we have studied is operational in a democracy. Are there ways in which the level of education of the population can constrain politicians' behavior even in non-democratic regimes? Also, we have emphasized the importance of the level of productivity in an economy in order to determine the strategy chosen by politicians. A more detailed analysis of how productivity is affected by the presence of natural resources, trade, or international technology transfers would be welcome.

## Appendix

In this appendix we derive a number of results concerning the politician's strategies.

**A.1. Potential behavior of the politician**

There are potentially six behavioral modes for an opportunistic politician: he can either act honest or corrupt in both periods, switch from honest to corrupt or vice versa, or engage in constitutional reforms after having been either corrupt or honest. The utility associated which each behavior is then given by

$$U_p(H,H) = u + \delta p_H u \quad \text{(A.1a)}$$

$$U_p(H,C) = u + \delta p_H (u + \pi_{t+1}) \quad \text{(A.1b)}$$

$$U_p(C,H) = u + \pi_t + \delta p_C u \quad \text{(A.1c)}$$

$$U_p(C,C) = u + \pi_t + \delta p_C (u + \pi_{t+1}) \quad \text{(A.1d)}$$

$$U_p(H,R) = u + \delta u \quad \text{(A.1e)}$$

$$U_p(C,R) = u + \pi_t + \delta u \quad \text{(A.1f)}$$

For any given level of skills in the economy, we can immediately exclude three cases. Comparing the lifetime utilities of politicians who behave honestly in period 1, (A.1a) and (A.1b), we can see that the higher return in period 2 due to corruption rules out honest behavior in both periods, which eliminates (A.1a) as a viable strategy for politicians. By the same reasoning, a corrupt period 1 politician never turns honest in period 2, which eliminates (A.1c). Analogously, any reform equilibrium is preceded by a corrupt regime, since the second period return is identical in (A.1d) and (A.1f), but the first period returns dominates in (A.1f). There are hence three possible behaviors: (A.1b), (A.1d), and (A.1f).

**A. 2. Potential equilibria and existence conditions**

First note that for $U(C,C)$ to be above $U(C,R)$, $q$ cannot be too high. More specifically, define

$$\overline{q} = \frac{(a+u)^2 + a^2\varphi(4+\varphi)}{4a\varphi(a+u)} - \frac{1}{2}$$

If $q \geq \overline{q}$ then $U(C,C)$ is always below $U(C,R)$, and corruption in the two periods is never a dominant strategy. For $U(C,C)$ to ever yield the highest utility, it must be $q < \overline{q}$. In what follows we assume that this condition holds.

Next, we study the relative position of the three viable utility functions for politicians when choosing the competitive tax rate at $t$ increases the stock of human capital at $t$+1. There are a large number of cases, but some of them can be ruled out. Recall that the utility functions are given by

$$U_p(C,C) = (1+\delta(1-q)(1-L_s))(u + a(1+\varphi L_s))$$

$$U_p(C,R) = (1+\delta)u + a(1+\varphi L_s)$$

$$U_p(H,C) = (1+\delta)u + \delta a(1+\varphi)$$

First recall that if

$$u < (1-q)a/q \quad \text{(C1)}$$

is satisfied, then at $L_s = 0$, $U_p(C,C) > U_p(C,R)$. Second, note that if

$$\delta(1+\varphi) > 1 \quad \text{(C2)}$$

is not satisfied then $U_p(C,R) > U_p(H,C)$ for all values of $L_s$. In this case, politicians would never choose honest-dishonest behavior, and the analysis would be identical to that in the absence of a dynamic effect of taxation. We hence assume that C2 holds, which is equivalent to supposing that there is not too much discounting, i.e. $\delta$ is high enough. Condition (C2) is certainly verified if there is no discounting. Now consider the three functions at $L_s = 0$ ,

$$U_p(C,C) = \big(1+\delta(1-q)\big)(u+a)$$
$$U_p(C,R) = (1+\delta)u + a$$
$$U_p(H,C) = (1+\delta)u + \delta a(1+\varphi)$$

Condition C2 implies that $U_p(H,C) > U_p(C,C)$ and $U_p(H,C) > U_p(C,R)$ at $L_s = 0$. Next consider the functions at $L_s = 1$

$$U_p(C,C) = u + a(1+\varphi)$$
$$U_p(C,R) = (1+\delta)u + a(1+\varphi)$$
$$U_p(H,C) = (1+\delta)u + \delta a(1+\varphi)$$

Clearly, as long as $\delta$ <1, then $U_p(C,R) > U_p(H,C)$ and $U_p(C,R) > U_p(C,C)$ at $L_s = 1$. Lastly, examine the position of the functions at $L_S^*$. We can see that $U_p(H,C) > U_p(C,C) = U_p(C,R) = (1+\delta)u + a(1+\varphi L_s^*)$ if and only if

$$\delta(1+\varphi) > 1 + \varphi L_s^* \qquad \text{(C3)}$$

Since $L_S^*$ does not depend on $\delta$, this condition simply says that $\delta$ has to be high enough. Again, it will hold for $\delta$ =1. This case is studied in the text.

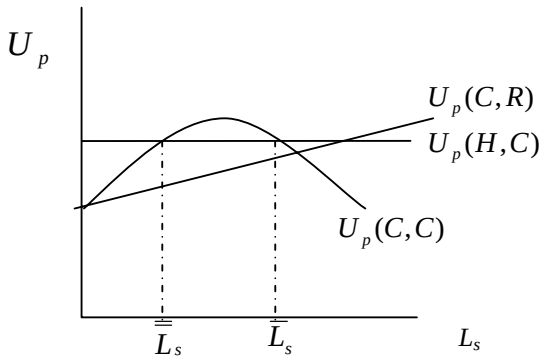
In the text we examined the case in which C3 holds. If C3 does not hold, i.e. if the discount rate is not high enough, two patterns are possible, depending on whether

$$\delta(1+\varphi) > 1 + \varphi L_s^{**} \qquad \text{(C4)}$$

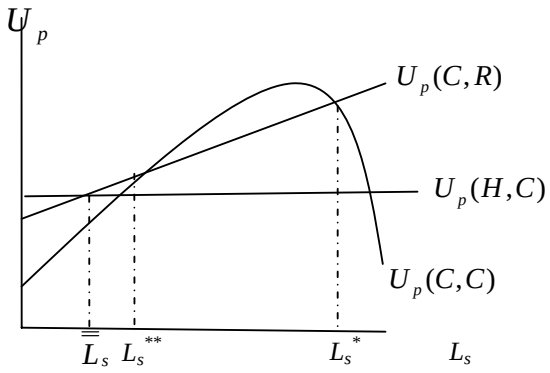
holds or not. Consider first, the situation where C4 holds, depicted in Figure A.1a. For low levels of education the strategy chosen is as discussed in the text. For high levels of education, however, the strategy that delivers highest utility depends on whether (C3) holds. If it does not, then $U_p(C,R)$ will deliver the highest utility; if it holds, there is a range of $L_s > \overline{L}_s$ for which $U_p(H,C)$ is above $U_p(C,R)$, while for $L_s$ close to 1 $U_p(C,R)$ will dominate. The case in which C4 does not hold is depicted in figure A.1b.

**Figure A.1: Politicians' utility when C3 is not satisfied and C4 is**

**A.1a: C4 is satisfied**




**A.1b: C4 is not satisfied**



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