Political persistence, innovation and economic growth*

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Abstract

This paper provides a theoretical and empirical investigation of the relationship between politicians' tenure, innovation and growth. We develop a model with quality improvements in the intermediate good sector, where administrative and regulatory costs of doing business can be reduced through political connections. Within this framework, we show conditions under which low-quality producers can exploit political connections to retain their monopoly position. In this case, incumbent firms can prevent entry and innovation and the model delivers a negative association between politicians' tenure and economic growth. Evidence based on a sample of 173 countries over the 1975-2004 period supports our main theoretical predictions on the effect of political persistence on economic growth.

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1 Introduction

Strong incumbency advantage is a feature of political systems in several countries. For example, in 2002, 398 US House members ran for re-election, and only 16 were defeated, while a mere 3 out of 26 senators running for re-election lost. A recent cross-country analysis of comparative turnover rates, based on lower house legislative elections from 1979 through 1994 for twenty-five countries, shows that the mean of incumbents returning rate is 67.7% (see Matland and Studlar [17]). For the US, Merlo et al. [19] report that reelection rate in the Congress between 1951 and 1994 was never below 80%. In Italy, re-election rate in Parliament between 1951 and 2008, though more volatile than in the US, never fell below 60% and was around 80% in several elections.[1]

In some countries, among which Italy is certainly a prominent example, the existence of long-lived economic and political elites is often blamed for the low rate of technological innovation and economic growth. The sociopolitical network between politicians and economic actors (mainly entrepreneurs) tends to create a gerontocratic elite that rules the country, by means of long-lasting personal relations, contacts and acquaintances that prevent the access to power by young and more dynamic individuals. As a result, economic outcomes tend to be driven by relations ("knowing the right person in the right place") more than by the market, and intergenerational mobility is likely to be low, both in terms of income and occupations.

In our view, political persistence can be linked to innovation and economic growth through the relationship between political connections and firms' competitiveness. In the presence of high levels of regulation, personal relations and experience tend to become an important instrument for incumbent firms to maintain their leadership. Having a strong and long-established network with politicians helps connected firms to avoid, or at least alleviate, bureaucratic costs thereby gaining a competitive advantage over non-connected firms, which may find very difficult even to enter the market.

This relationship-based system is likely to oppose technological innovation, especially when innovation implies radical changes in the status quo and destruction of incumbent rents. Thus, persistence of politicians may be detrimental to growth in countries with high levels of regulation (e.g. Italy), while it would be uninfluential (abstracting from other possible mechanisms that may imply a relationship between politicians' tenure and growth) in countries where regulation is low (e.g. the US).[2]

[1] The lowest re-election rate (60.5%) occured in the 1994 election, after the "Mani Pulite" scandal which decimated previously ruling parties.

[2] According to Doing Business 2008, Italy ranks 53 (out of 155 countries) in the ease of doing business,

To develop these ideas, we provide here a theoretical and empirical investigation of the relationship between politicians' tenure, innovation and growth. In the theoretical part of the paper, we incorporate political networks in a growth model with quality improvements in the intermediate good sector. In this sector administrative and regulation burdens to producers can be mitigated through political connections. Networks with politicians are established by active producers and pay off with one period lag, so that only re-elected politicians can provide favors to firms. The incumbent firm and the outside firm endowed with the leading-edge technology engage in Bertrand competition. Exploiting her network advantage and the resulting cost reductions, the next-to-top-quality (incumbent) producer has the opportunity to maintain her monopoly position and prevent innovation.

To our best knowledge, this is the first paper that sets up a theoretical model in which political persistence can hinder economic growth. The main implications are two-fold. In the short-run, keeping the political status-quo leads to income maximization as it allows to exploit lower production costs and lower prices. In the long-run, however, the perpetuation of the network between incumbent politicians and incumbent firms blocks innovation and is detrimental to economic growth, leading to technological backwardness. This negative effect of political persistence emerges only when bureaucratic and regulatory costs are large enough; when these costs are low, innovation cannot be blocked and political networks become irrelevant.

In the last part of the paper, we present empirical evidence supporting our main prediction of a negative association between persistence of politicians, technological innovation and economic growth in presence of high red-tape costs. Using data on 173 countries from 1975 to 2004 based on the Database of Political Institutions 2008 and Doing Business 2008, we find a negative and significant association between persistence of politicians and growth of per capita income when red-tape costs are high. When red-tape costs are low, we find no evidence of a significant relationship between persistence and growth.

Our paper is related to various theoretical and empirical contributions. First, a recent (mainly) empirical literature investigates the relevance of political connections on firms' performance. From a cross-country perspective, Faccio [11] documents the widespread existence of political connections and that these connections significantly add to company

well below many emerging and less developed economies, while the US ranks 3. Dealing with licenses (in the construction industry) takes on average 257 days in Italy and 40 days in the US, with a cost of 138% of income per capita in Italy and 13.4% in the US. Starting a business requires a cost of 18.7% of income per capita in Italy compared to only 0.7% in the US. According to the executive opinion survey of the Global Competitiveness Report 2007-2008, the main problematic factor for doing business in Italy is inefficient government bureaucracy.

values. Faccio, Masulis and McConnell [12] find that politically-connected firms are significantly more likely to be bailed out than similar non-connected firms. Desai and Olofsgard [8] investigate the consequences of political connections on influential firms and find that they encounter fewer administrative and regulatory burdens and invest and innovate less.

Second, a large empirical literature has studied the relationship between political instability and growth. Almost all contributions use data on revolutions, coups and assassinations to construct a measure of political instability (see, for instance Alesina et al. [2] and the survey of the literature in Carmignani [7]). Not surprisingly, they find a negative effect of instability on growth. An exception is the paper by Feng [13], who distinguishes the latter measure of instability (irregular government changes) from a measure of instability which includes democratic government changes (regular government changes). His empirical results based upon a panel of ninety-six countries from 1960 to 1980 show that instability hinders growth in the case of irregular changes, but is positively associated with growth in the case of regular changes.

Finally, our paper is related to the literature on the economics of corruption, although the political network in our analysis does not involve any form of administrative corruption.[3] Recently, Harstad and Svensson [15] developed a theoretical model where firms, instead of complying with regulation, can either bribe or lobby the government and study under which conditions firms decide to bribe or lobby and the effects of this choice on economic growth. Blackburn and Sarmah [5] study a model where private agents can bribe bureaucrats in return for being freed from red-tape and bureaucrats choose optimally the amount of red-tape, as an instrument of rent extraction. None of these papers, however, analyze the relationship between red-tape, politicians' tenure and innovation, which is instead the focus of our research.

The paper is organized as follows. Section 2 develops the theoretical model and characterizes the static equilibrium while Section 3 analyzes the dynamics of the model. Section 4 presents the cross-country empirical analysis on the relationship between political persistence and growth. Section 5 concludes.

2 The model

Consider an economy populated by a continuous mass of infinitely-lived agents. In each period, agents have one unit of time that can be supplied inelastically to production in

[3] For a review of the literature on corruption see Bardhan [3] and Svensson [20].

the final good sector or in managing a firm in the intermediate good sector.[4] The utility function is linear in consumption in each period. Future consumption is discounted at the subjective discount factor $\beta = 1/(1+r)$ where r is the interest rate, which implies that in each period consumption is equal to income.

In each period t output in the final good sector is given by:

$$y_t = \widetilde{x}_t^{\alpha} {L_t}^{1-\alpha} \tag{1}$$

where L_t is labor, $\widetilde{x}_t = \sum_{k=0}^{K(t)} \gamma^k x_k$ is a quality-adjusted intermediate input, with k denoting quality rung of intermediate good x_k that has quality γ^k. $K(t)$ denotes the highest quality level available at time t. We will take the final good as numeraire and normalize its price to one. We assume no population growth and normalize $L = 1$. The final good sector is perfectly competitive. The intermediate good is produced using the final good by means of a linear technology.

In each period exogenous technological progress makes a higher quality version of the intermediate good available. We assume that technological upgrade is limited to the next higher quality good. Thus, if technology j is the highest quality adopted at $t-1$, only technology $j+1$ can be adopted at time t, although other superior technologies may be available.[5]

Nature randomly chooses who has the monopoly right to produce the highest vintage of the intermediate good in each period. This power lasts for one period of time, after which the new vintage technology becomes freely available.

Operation in the intermediate good sector involves costs that can be reduced by establishing a network with politicians and bureaucrats in office. The working of the network does not require any illegal activity such as bribes and corruption; as we discussed in the Introduction, what is essential is to know the right person in the right place (a "rolodex effect"). The cost advantage of politically connected firms can be related to the economy's institutional and regulatory set-up which requires to abide by complex norms and regulations in order to undertake production (think of environmental regulation or industrial licensing where production is subject to administrative approval).

We denote with $\sigma > 1$ the marginal cost of production of firms with no political connections and normalize to 1 the marginal cost of production of politically connected

[4] We do not model the occupational choice of individuals between working or managing a firm. For the purpose of our analysis, the selection process can be considered as purely random.

[5] The assumption that technology improvements are limited to one-step upgrades is introduced for simplicity to keep the model tractable but is not essential for our results. For an extensive analysis of quality improving models of growth see Aghion and Howitt [1].

firms. In other words, the parameter σ captures in a reduced form the cost advantage of politically connected firms.[6] A key feature of our model is that it takes one period for the network to pay off so that the network advantage can be exploited by producers *only if a politician remains in office for more than one period*.

In each period, elections are held with two candidates (parties): I (which stands for incumbent) and O (which stands for opponent). We denote with π the (exogenous) probability that in each period the incumbent politician is reelected and assume that electoral results at t are independent of electoral results at any other $s \neq t$. Electoral results are relevant insofar as they affect the marginal cost of the incumbent producer. If I is reelected, the incumbent producer with technology j is politically connected and enjoys the cost advantage $\sigma - 1$ over competitors. Otherwise, if O is elected, no producer is politically connected and all firms face the same marginal cost σ. We assume that at time 0 there is an incumbent politician I who is connected with the owner of technology $\gamma^0 = 1$.[7]

2.1 The one-period equilibrium

A standard assumption in the literature on Schumpeterian models of growth (see Grossman and Helpman [14]) is that in the intermediate good sector owners of different vintages compete à la Bertrand. Since intermediate inputs are perfect substitutes in the production of the final good, if all producers faced the same marginal costs of production, the technological leader would enter the market in each period setting a limit price (slightly lower than) γ times the marginal cost of production of the incumbent producer.

In our framework, however, the incumbent producer may be politically connected and enjoy a cost advantage over the leader. In this case, the only active producer in each period may either be the incumbent, who owns vintage j or the new entrant, who owns vintage $j + 1$ and has no political connections.[8]

Notice that, in general, the incumbent firm can prevent entry of the more advanced

[6] Faccio [11] shows that politically connected firms tend to benefit from preferential access to credit and tax discounts. This type of benefits could also be captured by the difference $\sigma - 1$.

[7] Although it is natural to relate political persistence to electoral results, we could interpret π more generally as the probability of an incumbent politician to remain in office in the current period, indipendently of whether it is an electoral period or not.

[8] Notice that although we assumed that, after one period, technology becomes freely available (which means that at time t everybody may produce with technology j), the existence of political networks implies that the firm endowed with the new technology $j+1$ is the **only one** that can win competition with current producer.

competitor by setting a limit price equal to $p_{x_j} = c_{j+1}/\gamma$ where $c_{j+1} = \sigma$ is the marginal cost of production of the competitor. Conversely, the outside firm can enter the market by setting a limit price equal to $p_{x_{j+1}} = \gamma c_j$ where $c_j = \{1, \sigma\}$ is the marginal cost of production of the incumbent firm. Clearly, if $\gamma > \sigma$ the incumbent firm cannot make positive profits at the price which would keep the leading-edge firm out of the market, so that innovation would always occur. When $\gamma < \sigma$, if $c_j = 1$ the incumbent firm wins competition and prevents innovation; if $c_j = \sigma$ the leading-edge firm wins competition, enters the market and innovation takes place.

We can summarize this discussion in the following proposition which characterizes the economic equilibrium:

Proposition 1 (The one-period equilibrium) *Let $\alpha\sigma < \gamma < 1/\alpha$. Then:*

(i) If $1 < \sigma < \gamma$ the leading-edge producer enters the market setting a limit price $p_{x_{j+1}} = \sigma\gamma$ if and only if the next-to-leading edge (incumbent) producer is not politically connected. Otherwise, the leading-edge producer wins competition setting a limit price $p_{x_{j+1}} = \gamma$.

(ii) If $\sigma > \gamma$ the leading-edge producer enters the market setting a limit price $p_{x_{j+1}} = \sigma\gamma$ if and only if the next-to-leading edge (incumbent) producer is not politically connected. Otherwise, the next-to-leading edge (incumbent) producer wins competition setting a limit price $p_{x_j} = \sigma/\gamma$.

Proof. The leading-edge producer (new entrant) has a monopoly price equal to σ/α while the incumbent has monopoly price $1/\alpha$ if connected and σ/α if unconnected. If the incumbent is unconnected, the leading-edge producer can drive her out of the market by setting the monopoly price σ/α, when $\gamma > 1/\alpha$, or the limit price $\sigma\gamma$, when $\gamma < 1/\alpha$. In fact the next-to-leading edge producer (incumbent) can at most set a price $1/\gamma$ times that of the leader. If the incumbent is connected, she drives the leader out of the market by setting her monopoly price $1/\alpha$, when $\alpha\sigma > \gamma$, or the limit price σ/γ, when $\alpha\sigma < \gamma$ and $\sigma > \gamma$. If $\sigma < \gamma$ the next-to-leading edge producer makes negative profits at price σ/γ and the leader acts as constrained monopolist setting a limit price equal to γ (if the incumbent is connected) or $\sigma\gamma$ (if the incumbent is not connected). ■

The last result shows that when regulatory costs σ are low with respect to quality improvement γ political networks cannot prevent entry of the innovator and have no influence on the economic equilibrium in terms of which firm produces. However, political connections still influence prices and income as they limit the monopoly power of new entrants and drive prices down. On the contrary, when $\sigma > \gamma$ political connections become

crucial for the possibility of innovation, as the owner of quality γ^j is able to prevent entry of the innovator by exploiting the political connections that she established in the previous period. Clearly, this requires that the incumbent politician is reelected at time t.

We can explicitly link our economic equilibrium to electoral results by means of the following:

Corollary 1 *Whenever the opponent politician O wins elections, innovation takes place and the equilibrium price of the intermediate good is $\sigma\gamma$. If the incumbent politician I wins the elections and $1 < \sigma < \gamma$, innovation takes place and the equilibrium price of the intermediate good is γ. Otherwise, there is no innovation and the equilibrium price of the intermediate good is σ/γ.*

To conclude this section, we investigate the efficiency properties of the equilibrium. First of all, we can write GDP at time t as the sum of wages and profits, that is:

$$\begin{aligned} \Omega_t &= w_t + (p_{x_s} - c)x_t = (1-\alpha)\alpha^{\frac{\alpha}{1-\alpha}}\gamma^{\frac{\alpha s}{1-\alpha}}p_{x_s}^{\frac{\alpha}{\alpha-1}} + \alpha^{\frac{1}{1-\alpha}}\gamma^{\frac{\alpha s}{1-\alpha}}p_{x_s}^{\frac{1}{\alpha-1}}(p_{x_s} - c) \qquad (2) \\ &= \gamma^{\frac{\alpha s}{1-\alpha}}\left[\left(\frac{\alpha}{p_{x_s}}\right)^{\frac{\alpha}{1-\alpha}} - c\left(\frac{\alpha}{p_{x_s}}\right)^{\frac{1}{1-\alpha}}\right] \end{aligned}$$

where $c = \{1, \sigma\}$ if the producer is incumbent or new entrant respectively and $s = \{j, j+1\}$.

As established in Proposition 1, the price of the intermediate good and the level of GDP at time t depend on who wins the election at t and on the relative magnitude of σ and γ.

Let us denote with $\sigma_{_L}$, $\sigma_{_H}$ choices of σ such that $\sigma_L \in [1, \gamma)$ and $\sigma_H \in (\gamma, \infty)$, respectively. Then , when $\sigma = \sigma_L$, the GDP at time t is given by:

$$\Omega^I_{\sigma_{_L},t} = \left[\alpha^{\frac{\alpha}{1-\alpha}} - \alpha^{\frac{1}{1-\alpha}}\frac{\sigma_L}{\gamma}\right]\gamma^{\frac{\alpha j}{1-\alpha}} = \Omega^I_{\sigma_{_L}}\gamma^{\frac{\alpha j}{1-\alpha}} \qquad (3)$$

if the incumbent politician wins the election, and to:

$$\Omega^O_{\sigma_{_L},t} = \sigma_L^{\frac{\alpha}{\alpha-1}}\left[\alpha^{\frac{\alpha}{1-\alpha}} - \alpha^{\frac{1}{1-\alpha}}\gamma^{-1}\right]\gamma^{\frac{\alpha j}{1-\alpha}} = \Omega^O_{\sigma_{_L}}\gamma^{\frac{\alpha j}{1-\alpha}} \qquad (4)$$

if the opponent wins the election. Notice that, in this case, as established in Corollary 1, innovation occurs at each point in time so that the level of technology j at the beginning of period t is equal to t.

Similarly, when $\sigma = \sigma_H$, the GDP at time t is given by:

$$\Omega^I_{\sigma_{_H},t} = \sigma_H^{\frac{\alpha}{\alpha-1}}\left[\alpha^{\frac{\alpha}{1-\alpha}}\gamma^{\frac{\alpha}{1-\alpha}} - \alpha^{\frac{1}{1-\alpha}}\sigma_H^{-1}\gamma^{\frac{1}{1-\alpha}}\right]\gamma^{\frac{\alpha j}{1-\alpha}} = \Omega^I_{\sigma_{_H}}\gamma^{\frac{\alpha j}{1-\alpha}} \qquad (5)$$

if the incumbent politician wins the elections or to:

$$\Omega^{O}_{\sigma_H,t} = \sigma_H^{\frac{\alpha}{\alpha-1}} \left[\alpha^{\frac{\alpha}{1-\alpha}} - \alpha^{\frac{1}{1-\alpha}}\gamma^{-1}\right] \gamma^{\frac{\alpha j}{1-\alpha}} = \Omega^{O}_{\sigma_H} \gamma^{\frac{\alpha j}{1-\alpha}} \tag{6}$$

if the opponent wins the election. In this case, innovation occurs only in periods when the opponent politician is elected, so that $j \leq t$.

Comparing these levels of GDP, we can write the following proposition:

Proposition 2 (Static efficiency of the network) *In each period and for any possible level of σ, the price of the intermediate good is lower and the level of GDP is higher if the incumbent politician is re-elected.*

Proof. 1) $\Omega^{I}_{\sigma_H,t} > \Omega^{O}_{\sigma_H,t}$. It is easy to verify that if the leading-edge technology firm entered the market (when the opponent politician is elected) setting a price $p_{x_{j+1}} = \gamma p_{x_j}$ we would get:

$$\Omega^{I}_{\sigma_H,t} > \Omega^{O}_{\sigma_H,t} \Leftrightarrow \alpha^{\frac{1}{1-\alpha}}\gamma^{\frac{\alpha j}{1-\alpha}} p_{x_j}^{\frac{1}{\alpha-1}} < \alpha^{\frac{1}{1-\alpha}}\gamma^{\frac{\alpha(j+1)}{1-\alpha}} p_{x_j}^{\frac{1}{\alpha-1}} \gamma^{\frac{1}{\alpha-1}}\sigma$$

which holds as long as $\gamma < \sigma$. By Proposition 1 we know that $p_{x_{j+1}}$ is actually equal to $\gamma^2 p_{x_j}$ so that a fortiori $\Omega^{I}_{\sigma_H,t} > \Omega^{O}_{\sigma_H,t}$.

2) $\Omega^{I}_{\sigma_L,t} > \Omega^{O}_{\sigma_L,t}$. Here it is enough to notice that technology is the same regardless of which politician is elected and that p_x would be higher when the opponent politician is elected. ■

As the last proposition show, from a static point of view, in all cases the highest level of *GDP* is achieved when the incumbent politician is re-elected. This is due to the fact that, given the level of technology j achieved at the beginning of period t, the incumbent producer is more efficient when she can exploit her political network, that is when the incumbent politician wins. When $\sigma < \gamma$, this implies that the innovator faces a more efficient competitor and is forced to set a lower price when the incumbent politician is elected. When $\sigma > \gamma$, the innovator cannot enter the market when the incumbent politician is elected as the incumbent producer can set a lower (quality-adjusted price) by exploiting her connections.

3 Dynamics and welfare analysis

In the previous section we analyzed the properties of the one-period equilibrium of our economy and emphasized the static efficiency of the network, which reduces the production costs of the incumbent firm and brings about a reduction in the level of prices.

Here we extend the analysis to take into account the dynamic implications of the network between firms and politicians. As we have seen in the previous section, when regulatory costs are high ($\sigma > \gamma$), innovation can be blocked by the incumbent firm which exploits political connections at the expense of the technological leader. Thus, politicians' re-election entails a short-run benefit in terms of lower current prices and a long-run cost in terms of technological upgrades and future productivity.

To highlight the dynamic costs of network, let us compute the expected value at the beginning of time t of GDP at time $t+k$ with $k \geq 1$, which we denote as $E_t(\Omega_{t+k})$.[9] Notice that $E_t(\Omega_{\sigma,t+k}) = E_t\left(\gamma^{\frac{\alpha(j+z)}{1-\alpha}} \cdot \Omega_\sigma^P\right)$ where $P = \{I, O\}$, $\sigma = \{\sigma_L, \sigma_H\}$, j is the given level of technology at the beginning of time t and z denotes the number of times that innovation takes place between t and $t+k-1$.[10] Clearly, $E_t(\Omega_{\sigma,t}) = \gamma^{\frac{\alpha j}{1-\alpha}} E_t\left(\Omega_\sigma^P\right)$.

When $\sigma < \gamma$, we know from Proposition 1 that innovation always occurs, so that $z = k$ and we can write:

$$E_t(\Omega_{\sigma_L,t+k}) = \gamma^{\frac{\alpha(j+k)}{1-\alpha}} E_t\left(\Omega_\sigma^P\right) = \gamma^{\frac{\alpha(j+k)}{1-\alpha}} \left[\pi\Omega_{\sigma_L}^I + (1-\pi)\Omega_{\sigma_L}^O\right] = \gamma^{\frac{\alpha k}{1-\alpha}} E_t(\Omega_{\sigma_L,t}) \quad (7)$$

When $\sigma > \gamma$, in each period innovation depends on electoral results and z becomes a random variable with binomial distribution $b(k, 1-\pi)$ where the probability of success (i.e. innovation) in each of the k trials is equal to the probability that the opponent is elected, that is $1-\pi$. Using the fact that each electoral result is independent of the others so that $\gamma^{\frac{\alpha(j+k)}{1-\alpha}}$ and Ω_σ^P are independent, we can write:

$$\begin{aligned} E_t(\Omega_{\sigma_H,t+k}) &= E_t\left(\gamma^{\frac{\alpha(j+z)}{1-\alpha}}\right) E_t\left(\Omega_\sigma^P\right) = \gamma^{\frac{\alpha j}{1-\alpha}} \left[(1-\pi)\gamma^{\frac{\alpha}{1-\alpha}} + \pi\right]^k \left[\pi\Omega_{\sigma_H}^I + (1-\pi)\Omega_{\sigma_H}^O\right] \\ &= \left[(1-\pi)\gamma^{\frac{\alpha}{1-\alpha}} + \pi\right]^k E_t(\Omega_{\sigma_H,t}) \end{aligned} \quad (8)$$

Consider the second equality in each equation. In both cases, the expected level of future GDP is the product of two terms. The first is a "growth effect" and measures the expected quality of technology after the $t+k$ elections which is equal to $\gamma^{\frac{\alpha(j+k)}{1-\alpha}}$ when $\sigma < \gamma$, and equal to $\gamma^{\frac{\alpha j}{1-\alpha}} \left[(1-\pi)\gamma^{\frac{\alpha}{1-\alpha}} + \pi\right]^k$ when $\sigma > \gamma$.[11] The second is a "level effect" equal to $\left[\pi\Omega_\sigma^I + (1-\pi)\Omega_\sigma^O\right]$ which is related to the static consequences of the network and depends only on the electoral result at time $t+k$.

[9] To make it clear, from now on $E_t(x)$ denotes the expected value of x where expectation is taken *before* the election at t.

[10] In other words, here we are looking at the expected value of GDP after $k+1$ elections, from t to $t+k$.

[11] Notice that when $\sigma < \gamma$ the expected quality of technology is also the *actual* quality, as innnovation always occurs.

We can now use our previous results to derive welfare implications. More specifically, we can try to rank in welfare terms the two alternative technological trajectories associated with σ_L and σ_H. In so doing, we consider the point of view of an infinite-horizon benevolent planner who compares the corresponding discounted sums of aggregate GDP from time 0 to infinity. When $\sigma = \sigma_L$ the discounted sums of future is given by:

$$W_{\sigma_L} \equiv \left[\pi\Omega^I_{\sigma_L} + (1-\pi)\Omega^O_{\sigma_L}\right] \sum_{t=0}^{\infty} \beta^t \gamma^{\frac{\alpha t}{1-\alpha}} \tag{9}$$

while when $\sigma = \sigma_H$ it is:

$$W_{\sigma_H} \equiv \left[\pi\Omega^I_{\sigma_H} + (1-\pi)\Omega^O_{\sigma_H}\right] \sum_{t=0}^{\infty} \beta^t \left[(1-\pi)\gamma^{\frac{\alpha}{1-\alpha}} + \pi\right]^t \tag{10}$$

Assuming convergence of the two series,[12] we get

$$W_{\sigma_L} = \frac{\left[\pi\Omega^I_{\sigma_L} + (1-\pi)\Omega^O_{\sigma_L}\right]}{1 - \beta\gamma^{\frac{\alpha}{1-\alpha}}} \tag{11}$$

and

$$W_{\sigma_H} = \frac{\left[\pi\Omega^I_{\sigma_H} + (1-\pi)\Omega^O_{\sigma_H}\right]}{1 - \beta\left[(1-\pi)\gamma^{\frac{\alpha}{1-\alpha}} + \pi\right]} \tag{12}$$

so that we can write the following:

Proposition 3 (Welfare) *The trajectory with σ_L is superior in terms of welfare to the trajectory with σ_H.*

Proof. First of all, we need to prove that $\left[\pi\Omega^I_{\sigma_L} + (1-\pi)\Omega^O_{\sigma_L}\right] > \left[\pi\Omega^I_{\sigma_H} + (1-\pi)\Omega^O_{\sigma_H}\right]$. For this, it is sufficient to prove that $\Omega^I_{\sigma_L,t} > \Omega^I_{\sigma_H,t}$, that is:

$$\alpha^{\frac{\alpha}{1-\alpha}} - \alpha^{\frac{1}{1-\alpha}}\frac{\sigma_L}{\gamma} > \left[\alpha^{\frac{\alpha}{1-\alpha}}\gamma^{\frac{\alpha}{1-\alpha}}\sigma_H^{\frac{\alpha}{\alpha-1}} - \alpha^{\frac{1}{1-\alpha}}\gamma^{\frac{1}{1-\alpha}}\sigma_H^{\frac{1}{\alpha-1}}\right] \tag{13}$$

$$\alpha^{\frac{\alpha}{1-\alpha}} - \alpha^{\frac{1}{1-\alpha}}\frac{\sigma_L}{\gamma} > \alpha^{\frac{\alpha}{1-\alpha}}\left(\frac{\sigma_H}{\gamma}\right)^{\frac{\alpha}{\alpha-1}} - \alpha^{\frac{1}{1-\alpha}}\left(\frac{\sigma_H}{\gamma}\right)^{\frac{1}{\alpha-1}} \tag{14}$$

which is equivalent to comparing two levels of GDP in equation (2), the one on the LHS with $p_x = 1$ and $c = \sigma_L/\gamma$ and the one on the RHS with $p_x = \sigma_H/\gamma$ and $c = 1$. Clearly, the LHS is larger than the RHS ■

Finally, let us compute the expected rate of growth of the economy, defined as $E_t(g_{t+1}) = E_t\left(\ln\Omega_{t+1} - \ln\Omega_t\right)$. Given equations (3) - (6), we can write the following proposition:

[12] This requires assuming $\beta\gamma^{\frac{\alpha}{1-\alpha}} < 1$.

Proposition 4 (The average growth rate) *At any time t, the average growth rate of GDP between t and $t+1$ is constant. This growth rate is equal to $E(g_{\sigma_L}) = \frac{\alpha}{1-\alpha}\ln\gamma$ if $\sigma = \sigma_L$ and to $E(g_{\sigma_H}) = (1-\pi)\frac{\alpha}{1-\alpha}\ln\gamma$ if $\sigma = \sigma_H$.*

Proof. 1) Consider the case $\sigma = \sigma_L$. The expected growth rate is equal to:

$$\begin{aligned} & \pi^2[\ln\Omega^I_{\sigma_L,t+1} - \ln\Omega^I_{\sigma_L,t}] + \pi(1-\pi)[\ln\Omega^O_{\sigma_L,t+1} - \ln\Omega^I_{\sigma_L,t}] + \\ & +(1-\pi)\pi[\ln\Omega^I_{\sigma_L,t+1} - \ln\Omega^O_{\sigma_L,t}] + (1-\pi)^2[\ln\Omega^O_{\sigma_L,t+1} - \ln\Omega^O_{\sigma_L,t}] \\ = \; & \pi[\ln\Omega^I_{\sigma_L,t+1} - \ln\Omega^I_{\sigma_L,t}] + (1-\pi)[\ln\Omega^O_{\sigma_L,t+1} - \ln\Omega^O_{\sigma_L,t}] = \ln\gamma^{\frac{\alpha}{1-\alpha}}. \end{aligned}$$

2) Consider the case $\sigma = \sigma_H$. Here the expected growth rate is:

$$\begin{aligned} & \pi(1-\pi)[\ln\Omega^O_{\sigma_H,t} - \ln\Omega^I_{\sigma_H,t}] + (1-\pi)\pi[\ln\Omega^I_{\sigma_H,t+1} - \ln\Omega^O_{\sigma_H,t}] + \\ & +(1-\pi)^2[\ln\Omega^O_{\sigma_H,t+1} - \ln\Omega^O_{\sigma_H,t}] \\ = \; & \pi(1-\pi)[\ln\Omega^I_{\sigma_H,t+1} - \ln\Omega^I_{\sigma_H,t}] + (1-\pi)^2[\ln\Omega^O_{\sigma_H,t+1} - \ln\Omega^O_{\sigma_H,t}] = (1-\pi)\ln\gamma^{\frac{\alpha}{1-\alpha}} \end{aligned}$$

Q.E.D. ■

With regard to the relationship between growth and probability of reelection, notice that when the network advantage of the politically connected producer is not so strong to allow him to prevent entry of competitors with leading-edge technology, innovation takes place irrespective of electoral results and the expected growth rate of income is not affected by the probability that the incumbent politician is re-elected. Instead, when the next-to-leading edge producer can prevent entry of competitors with more advanced technology by exploiting her political connections, innovation will not take place whenever the incumbent politician is reelected, implying that the expected growth rate is decreasing with the probability that the incumbent politician is re-elected.

4 Cross country evidence

When the cost advantage associated to political connections $\sigma - 1$ is large enough, Proposition (4) entails a negative relation between the probability that a politician is reelected (or more generally the probability that a politician persists in office) π, and the expected growth rate of GDP per capita g, as the cost reduction granted to incumbent firms by knowing "the right person in the right place" allows them to to retain their monopoly position and prevent innovation. For small values of σ, Proposition (4) predicts no relation between π and g.

The aim of this section is to provide cross-national evidence supporting these implications. To do so, we use the fraction of politicians that remain in office in a given period of time as a proxy for π and include this measure of politicians' persistence as an explanatory variable in standard growth regressions.[13]

4.1 Data description

Since reliable cross-national measures of political persistence based on individual data on deputies, senators and politicians in local and national committees are not available, we use data from the World Bank's Database of Political Institution (DPI) to construct a measure of politicians' persistence. To do so, we define the variable *1-STABS*, where *STABS* is the percentage of main political entities (veto players) who *drop* from the government in any given year, relative to the previous one. The definition of veto players depends on the type of system in place (Parliamentary/Presidential), the electoral and legislative competitiveness (defined below) and other characteristics that are accurately recorded in Keefer [16]).[14] In any given year, *1-STABS* takes value 0 when all veto players change relative to the previous year (minimum persistence), while it takes value 1 when all of them remain in place (maximum persistence). We take the average of *1-STABS* over the period 1975-2004 as a measure of politicians' persistence, *PERS*. Using categorical variables from DPI on executive and legislative competitiveness, *EIEC* and *LIEC*, we also construct a dummy for low political competitiveness, *NONDEM*, a variable that we expect to be negatively associated with growth (as Besley et al. [4] find for the United States).[15]

From Doing Business we collect data on the number of procedures required to set up a business, *START_PROC*. We focus on this variable as a proxy for red-tape costs σ because *"a procedure is any interaction of the company's employees or managers with*

[13] Assuming that π is a country-specific characteristic that determines the individual probability to be still in office after one period and that this probability is the same for all the n politicians in the country, the expected number of politicians still in place after one period is equal to $n\pi$. Normalizing for n, the individual probability to be in office is equal to the expected share of politicians "surviving" from one year to the next.

[14] As an example, in a parliamentary system with high legislative competitiveness, veto players are defined as the prime minister, the three main parties in the winning coalition and the main party in the opposition.

[15] The variables EIEC and LIEC range between 1 (lowest competitiveness) and 7 (highest competitiveness). For example a value of 7 for LEIEC indicates that the largest party got less than 75% of the seats, a value of 6 indicates that multiple parties did win seats but the largest party received more than 75% of the seats, 5 means that multiple parties are legal but only one party won seats, and so on. The dummy variable NONDEM takes value 1 if EIEC or LIEC take a value less than 7. See Keefer [16] for details.

external parties" (see Doing Business [21]) and many of these interactions include some form of approval, licensing or certification by local or national bureaucratic authorities belonging, directly or indirectly, to the political system.[16] We will use this variable to classify countries into high or low red-tape costs.[17]

Data for the initial level of GDP per capita (in thousands of 2000 dollars), GDP_PC, the average yearly growth rate of GDP per capita, $GROWTH$, and the share of investment on GDP, INV, are taken from the World Development Indicators database (WDI). The share of total population with secondary school level education (EDU) is taken from the Barro and Lee dataset. The growth rate, $GROWTH$, is the average over the 1985-2004 period. For all other variables, we take the 1985 value. Table 1 reports descriptive statistics, while Table 2 reports correlations among some of our variables.

Variable	Obs	Mean	Std.Dev.	Min	Max
PERS	173	0.88	0.07	0.69	1
LIEC	173	5.33	1.64	1	7
EIEC	173	5.08	1.74	1.46	7
START_PROC	158	9.86	3.43	2	20
GDP_PC	161	4.235	6.564	0.124	44.978
GROWTH	137	1.26	2.07	-7.78	8.16
INV	132	22.36	9.01	3.15	57.8
EDU	105	20.61	14.64	0.7	60

Table 1: Descriptive statistics

[16] A comprehensive list of procedures for setting up a business can be found in Djankov, La Porta, Lopez and Shleifer [10].

[17] We are aware that a classification of countries not based on initial characteristics could determine selection bias (see DeLong [9]). However, comparable international data on red tape costs for a large set of countries are only available since very recently. Since the variation in the available time span (2003-2006) is very limited, we use the most recent observation (2006) to classify countries.

	PERS	*START_PROC*	*LIEC*	*GDP_PC*	*GROWTH*
PERS	1				
START_PROC	0.1277	1			
LIEC	-0.3024**	-0.3061**	1		
GDP_PC	0.075	-0.3181**	0.1178	1	
GROWTH	0.0151	-0.1646	0.1967*	0.0454	1
NONDEM	0.096	0.3859***	-0.4547***	-0.6320***	-0.1892**

Table 2. Pairwise correlations; * significant at 5%; ** significant at 1%

The measure of persistence, *PERS*, is significantly and negatively correlated only with the level of legislative competitiveness, *LIEC*, which is positively correlated with growth, *GROWTH*, and negatively correlated with the measure of red-tape costs, *START_PROC*. The latter variable is negatively correlated with the economic background of the country, *GDP_PC*. Finally, the dummy *NONDEM* is negatively correlated with *GDP_PC*.

4.2 Estimation results

In order to test the main implication of the model, we specify the regression equation:

$$g_i = \beta_0 + \beta_1 d_i^H + \beta_2 PERS_i + \beta_3 (d_i^H PERS_i) + \beta_4 \mathbf{X}_i + \varepsilon_i \tag{15}$$

where i denotes country, d_i^H is a dummy for high red-tape costs ($d_i^H = 1$ when $\sigma = \sigma_H$ in terms of our theoretical model) and $d_i^H PERS_i$ is the interaction of this dummy with the persistence measure *PERS*, our proxy for π. $\mathbf{X}_i$ is a vector of standard controls in growth regressions. We assume i.i.d. error terms ε_i and estimate (15) by weighted OLS, using within-country average population as weights. From (15), we can derive the expected growth rate for low and high cost countries, respectively:

$$E(g_i|\mathbf{X},\, d_i^H = 0) = \beta_0 + \beta_2 PERS_i + \beta_4 \mathbf{X}_i$$
$$E(g_i|\mathbf{X},\, d_i^H = 1) = (\beta_0 + \beta_1) + (\beta_2 + \beta_3) PERS_i + \beta_4 \mathbf{X}_i$$

Following our theoretical model, we expect $\beta_2 = 0$ and $(\beta_2 + \beta_3) < 0$.[18]

Table 3 collects estimation results and, when applicable, a test on the magnitude and significance of $(\beta_2 + \beta_3)$:

[18] This is true as long as high and low costs countries are both included in the sample. In the limit case where all countries were classified as high costs it would not be possible to estimate β_2 and β_3 because of collinearity problems. In this case, only β_2 will be estimated. In turn, if all countries were classified as low cost, β_3 could not be estimated because $d_i^H PERS_i = 0\ \forall i$.

	(1)	(2)	(3)	(4)	(5)
const.	6.549*	3.062	-2.679	6.782***	-0.987
	[3.527]	[2.530]	[4.898]	[2.321]	[4.524]
GDP_PC	-0.114***	-0.251***	-0.261***	-0.235***	-0.238***
	[0.0321]	[0.0391]	[0.0395]	[0.0360]	[0.0356]
EDU		0.112***	0.106***	0.0960***	0.0803***
		[0.0249]	[0.0254]	[0.0231]	[0.0243]
INV		0.227***	0.234***	0.201***	0.208***
		[0.0273]	[0.0276]	[0.0261]	[0.0259]
$NONDEM$		-0.0840	0.190	-0.392	-0.360
		[0.750]	[0.820]	[0.699]	[0.765]
$PERS$ (β_2)	-2.875	-7.261***	-0.371	-10.18***	-0.734
	[4.133]	[2.637]	[5.628]	[2.161]	[5.159]
$d^H PERS$ (β_3)			-8.727		-11.73**
			[6.406]		[5.868]
d^H			6.950		9.775*
			[5.461]		[5.149]
($\beta_2 + \beta_3$)			-9.098***		-12.46***
			[2.995]		[2.426]
Obs.	137	96	96	96	96
R^2	0.097	0.780	0.786	0.808	0.819
# high cost countries	137	96	63	96	63

Table 3. Dependent variable: yearly growth rate of GDP per capita (1985-2004). Standard error in parenthesis; * significant at 10%; ** significant at 5%; *** significant at 1%.

In specifications (1) and (2) we do not allow for differential effects across high and low red-tape costs countries.[19] Specification (1) only includes GDP_PC as a control variable beyond *PERS*, which turns out not to be significant. Estimation results improve once we introduce standard growth regression's controls, such as INV and EDU, as we do in specification (2). These controls are correctly signed and strongly significant.[20] The overall fit of the regression also increases ($R^2 = 0.780$). Most importantly for our analysis,

[19] Technically, we do not include d^H and $d^H PERS$ in the regressions.

[20] The reduced number of observations in specification (2) is due to data limitations in the human capital variable for the '80s.

the coefficient of *PERS* is now negative and significant at 1% level. The dummy variable *NONDEM* is not significant.

We now allow for the countries to be classified as low cost ($d_i^H = 0$) and high cost ($d_i^H = 1$). In the model, the relevant threshold of σ would correspond to γ and low (high) cost countries would be those with $\sigma < (>)\ \gamma$. Since this is hardly indicative of what would be a meaningful real-world threshold to split the sample, and we do not deem it reasonable to push the model's implications too far in this direction, we perform several regressions only changing the threshold of red-tape costs ($\tilde{\sigma}$) that separates countries between low and high cost.[21] We classify a country as low (high) red-tape costs if $\sigma_i \leq (>)\ \tilde{\sigma}$. In specification (3) we show the results obtained by setting, arbitrarily, $\tilde{\sigma} = 8$.[22] Using this threshold, low and high costs countries included in the regression are 33 and 63 respectively, with high cost countries representing 66% of the whole sample. Consistently with our model predictions, we can not reject the null hypothesis that $\beta_2 = 0$, that is politicians' persistence is not associated with growth in countries classified as low cost. Instead, politicians' persistence is negatively associated with growth in high cost countries, as the coefficient combination $(\beta_2 + \beta_3)$ shows a negative sign and it is significant at 1% level. Notice also that the estimated effect of persistence on growth is now larger in magnitude than the one we obtained in specification (2), where we made no distinction between high and low cost countries. These results may be driven by the fact that the association between politicians' persistence and growth is not significantly different from zero in the latter group, as predicted by our model.

Our regressions could suffer from a reverse effect running from economic growth to politicians' persistence. The usual theoretical argument is that good economic performances lead to the re-election of political representatives, implying a *positive* relation running from economic growth to politicians' persistence. This reverse effect would lead to lack of identification in the estimates of growth on persistence, due to correlation between the error term and the dependent variable, and determine a *downward* bias on the estimated effect of politicians' persistence on growth. In the empirical literature, this reverse effect has been questioned and support for this relation has been rejected for developed economies (see Brender and Drazen [6]), implying that distortions in our estimates may be, if any, rather small in magnitude.

[21] In Table 4 we show estimates, based on specification (5), of β_2 and $(\beta_2 + \beta_3)$ changing the threshold $\tilde{\sigma}$.

[22] According to this threshold, Italy, generally perceived as a country with large red-tape costs as discussed in the Introduction, is classified as high cost, with 9 procedures needed to set up a business. The median sample value is 10.

As a partial attempt to tackle this issue, in specifications (4) and (5) we rely on lagged observations of politicians' persistence, and define *PERS* as the average of (1-*STABS*) over the 1975-1990 period, so that there is a short overlap (1985-1990) of the time intervals over which *PERS* and *GROWTH* are calculated. Estimation results are qualitatively similar to those we already obtained: the coefficient of *PERS* is negative and significant at 1% level in specification (4) as it is the sum $(\beta_2 + \beta_3)$ in specification (5), where the threshold used is again $\tilde{\sigma} = 8$. The finding that the estimated effect of persistence on growth is now larger in absolute value confirms that the reverse effect of growth on persistence, with opposite sign relative to that implied by our argument, may determine a downward bias on the estimated effect of politicians' persistence on growth in specification (2) and (3).

We now explore further the issue that the relation between politicians' persistence and growth differs across low and high cost countries, that is central to our analysis. In particular, we want to check whether estimation results are sensitive to the threshold used to classify a country as high cost. Table 4 reports the estimates of β_2 and $(\beta_2 + \beta_3)$ using a threshold $\tilde{\sigma}$ ranging between 5 and 11.[23] Accordingly, the share (number) of countries included in the high cost sample ranges from 87.5% (84) to 34.3% (33), respectively. Note that for a wide range of thresholds $\tilde{\sigma}$ the signs and significance level of the coefficients are as expected. In the last column the coefficient β_2 turns out to be negative and significant because the threshold is very large, meaning that many countries, possibly erroneously, are classified as low cost. Doing this, countries that in principle should show a negative correlation between political persistence and growth (the high cost ones) wrongly contribute in adding this type of information to the low cost pool. We report in specification (6), in Table 5, full results using $\tilde{\sigma} = 6$. In this case the fit of the regression is slightly larger ($R^2 = 0.824$) than the case of $\tilde{\sigma} = 8$ ($R^2 = 0.819$).

$\tilde{\sigma}$	5	6	7	8	9	10	11
% high cost	87.5	82.3	75	65.6	53.1	42.7	34.3
β_2	-1.181	-1.906	-0.750	-0.734	-4.118	-4.877	-7.855**
$(\beta_2 + \beta_3)$	-11.85***	-12.16***	-12.27***	-12.46***	-11.92***	-12.24***	-12.20***

Table 4. Results for specification (5) using different thresholds. * significant at 10%; ** significant at 5%; *** significant at 1%.

[23] Results using $\tilde{\sigma} = 8$ are those already reported in specification (5) of Table 3.

	(6)	(7)	(8)	(9)	(10)
const.	0.409	-0.860	3.525	0.528	1.303
	[7.429]	[8.005]	[2.223]	[6.024]	[6.431]
GDP_PC	-0.252***	-0.257***	-0.116***	-0.147***	-0.141***
	[0.0356]	[0.038]	[0.0341]	[0.0348]	[0.0369]
EDU	0.0872***	0.0771***	0.0389*	0.0328*	0.0384*
	[0.0231]	[0.0262]	[0.0200]	[0.0193]	[0.0220]
INV	0.202***	0.190***	0.104***	0.124***	0.1313***
	[0.0254]	[0.0295]	[0.0362]	[0.0356]	[0.0387]
$NONDEM$	0.210	0.322			
	[0.759]	[0.809]			
COR		-1.546			0.993
		1.655			[1.669]
$PERS$ (β_2)	-1.906	0.603	-3.890	0.433	-1.175
	[8.095]	[8.996]	[2.379]	[6.509]	[7.348]
$d^H PERS$ (β_3)	-10.25	-12.86		-7.356	-5.280
	[8.537]	[9.441]		[6.938]	[8.059]
d^H	7.603	10.00		5.311	3.406
	[7.884]	[8.730]		[6.321]	[7.363]
$(\beta_2 + \beta_3)$	-12.16***	-12.26***		-6.923***	-6.456**
	[2.261]	[2.389]		[2.599]	[2.771]
Obs.	96	88	63	63	61
R^2	0.824	0.825	0.326	0.401	0.404
# high cost countries	79	72	63	48	47

Table 5. Dependent variable: yearly growth rate of GDP per capita (1985-2004). Standard error in parenthesis; * significant at 10%; ** significant at 5%; *** significant at 1%.

Overall, this exercise suggests that a negative relation between politicians' persistence and growth is in place and it is robust to the introduction of standard controls such as investment and human capital measures. Moreover, even if the findings in specifications (2) and (4) support an overall negative relation between political persistence and growth, we claim that splitting countries between low and high cost allows to assign to both these groups their contributions in the overall growth-persistence relation. We find that different coefficients (not different from zero for low cost countries, negative for high cost countries)

are found in our empirical investigation and this result is quite robust to changes in the value of separation threshold $\tilde{\sigma}$, as Table 4 shows. Changing the threshold value of red-tape costs led to slight improvements of results, in terms of R^2, from specification (5) to (6).

Another issue at stake is the possible heterogeneous nature, in terms of political competitiveness, of countries in the sample. Because of this, we investigate the issue whether different models explain the relationship between politicians' persistence and growth depending on the institutional and economic development of the country. In our view, political connections resulting from long-term relationship between firms and politicians, that provide incumbent firms with a competitive advantage over potential innovators, are likely to be a widespread feature of every economy, irrespective of its level of development. Yet, it may be argued that, in countries where political competitiveness is low, political connections more likely take the form of illicit interactions between entrepreneurs and politicians, involving bribery, corruption and rent-seeking, and may determine a negative effect on growth through channels that differ from those we emphasized in the theoretical analysis. As an example, in the case of corruption (whose detrimental effects on growth are extensively explored in Mauro [18]) we could have an *additional* source of obstruction to growth, but our mechanism should remain in place. The corruption dimension in fact is more related to red-tape costs than to political persistence: we build a measure of corruption, named *COR*, and we find that its correlation with *START_PROC* and *PERS* is 0.537 and 0.059, respectively.[24] To check the robustness of our findings, we run the regression of specification (6) including *COR*: as reported in specification (7), this variable shows a negative but not significant coefficient, while the main results are unchanged.

The possibility that the relation between politicians' persistence and growth could be explained by different models in non-democratic and democratic countries is taken into account in specifications (8) and (9), Table 5, where we exclude from the sample countries showing *LIEC* and *EIEC* both smaller than 5. This leaves us with a sample of 63 countries with relatively high level of political competitiveness. In specification (8), where all countries are all considered as high cost, the combination $(\beta_2 + \beta_3)$ is not statistically different from zero. Replicating the exercise of moving the threshold $\tilde{\sigma}$ (between 4 and 10) we find that β_2 is never significantly different from zero and $(\beta_2 + \beta_3)$ is negative and significant whenever the chosen threshold ranges between 5 and 8: if we are to belive

[24] Our measure of corruption (0 for no corruption, 1 for maximum corruption) is $COR = 1 - cc96$, where $cc96$ is the "Control of Corruption" variable for year 1996 available from Political Risk Service's website (`www.prsgroup.com`).

the theoretical model we can claim that the *right* threshold lies within this range. As in the full sample case, using $\tilde{\sigma} = 6$ (reported in specification (9)), R^2 reaches its maximum value. Results are summarized in Table 6.

$\tilde{\sigma}$	4	5	6	7	8	9	10
% high cost	87.3	80.9	76.2	68.2	55.5	44.4	34.9
β_2	-8.401	0.701	0.437	0.791	0.400	-2.653	-2.045
$(\beta_2 + \beta_3)$	-3.748	-5.83**	-6.923***	-6.922**	-6.193**	-3.872	-4.198

Table 6. Results for specification (9) using different thresholds. * significant at 10%; ** significant at 5%; *** significant at 1%.

In specification (10) we include the corruption variable, that in the restricted sample shows an even higher correlation with $START\_PROC$ (0.620): again results are confirmed, without corruption showing a significant coefficient in the growth regression.

Our results about sign and significance of $(\beta_2 + \beta_3)$ are confirmed in countries with relatively high level of political competitiveness, but the magnitude of the coefficient is reduced. We take this result as indicative that our mechanism plays a distinct role on top of those implied by rent-seeking and other growth-reducing practices, mostly widespread in countries with weak institutional background, that may have determined the larger estimated effects of politicians' persistence obtained in the entire sample.

5 Conclusions

Excessive regulatory and administrative burdens are often pointed out as a major hindrance to growth as they subtract resources to investment and innovation and represent a barrier to entry for new firms and superior technologies.

In this paper, we consider red tape as a production cost for firms that can be mitigated through acquaintance and connections with politicians and regulatory authorities. As establishing political connections requires time but no extra resources, firms that operate for long enough time face lower marginal costs of production than unconnected competitors who own a superior technology. Thus, incumbent firms may be able to prevent adoption of available superior technology if they have the opportunity to exploit their political connections, that is, if politicians do not change too frequently. For the society as a whole, this creates a trade-off between short-run benefits of keeping the status quo and enjoying low prices and long-run costs of retarding technological upgrade.

When red-tape costs are high enough, a relationship-based system will emerge where the incumbent economic elite (entrepreneurs) is able to prevent technological innovation and maintain her dominant position by exploiting political connections. This delivers a negative relationship between persistence of politicians and economic growth. When red-tape costs are low, instead, firms using superior technologies will be more competitive, and political connections will not allow incumbent firms to maintain their dominant position. In this case, the model implies no relation between politicians' persistence and growth.

Our story would then be consistent with two very different paradigmatic cases: Italy, a highly regulated economy where we observe persistence of political elites, low economic mobility and slow growth, and the US, with low regulatory and administrative burdens on firms, where we observe persistence of politicians, high rates of creative destruction, innovation and growth.

Empirical evidence based on data covering one-hundred seventy-three countries for the period 1975-2004 supports our model predictions. First, when we pool all countries together, we uncover a negative association between growth of GDP per capita and a measure of tenure of the political elite, which confirms and extends to a longer time span previous findings by Feng [13] on the association between major government changes and growth. Second, consistently with our main theoretical implications, the aforementioned relation turns out to be weaker (and even statistically insignificant) in countries with low red-tape costs. These results are robust to the exclusion of countries where political competitiveness is low, for which the negative relationship between politicians' persistence and growth could be explained by different channels (such as, for instance, harmful effects of dictatorship and non-democratic regimes).

Our analysis could be extended in different ways. In particular, it would be worthwhile to incorporate political economy considerations in order to endogenize the probability of being re-elected. Although potentially complicated by the dynamic nature of our model, this extension may deliver interesting results on the effects of bureaucratic (in)efficiency on the persistence of politicians, and possible explanations of why politicians are often reluctant to reform the bureaucracy. Moreover, this extension could highlight political and economic conflicts between short-sighted and long-sighted agents, which in an overlapping generations set-up would emerge as inter-generational conflicts between the young (more inclined to political turnover and economic change) and the old (supporting the status quo).

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