Social Capital, Government Expenditures, and Growth[*]

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Abstract

Countries with greater social capital have higher economic growth. We show that social capital is also highly positively correlated across countries with government expenditure on education. We develop an infinite-horizon model of public spending and endogenous stochastic growth that explains both facts through frictions in political agency when voters have imperfect information. In our model, the government provides services that yield immediate utility, and investment that raises future productivity. Voters are more likely to observe public services, so politicians have electoral incentives to under-provide public investment. Social capital increases voters' awareness of all government activity. As a consequence, both politicians' incentives and their selection improve. In the dynamic equilibrium, both the amount and the efficiency of public investment increase, permanently raising the growth rate.

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1 Introduction

Social capital is positively associated with economic development, financial development, well-functioning institutions, and the quality of government (Banfield 1958; Putnam 1993, 2000; Fukuyama 1995; Knack and Keefer 1997; La Porta et al. 1997; Goldin and Katz 1999; Guiso, Sapienza, and Zingales 2004, 2008; Tabellini 2008, 2009; Aghion et al. 2010). Algan and Cahuc (2010) find that social capital had a significant causal impact on worldwide growth during the twentieth century. But what are the specific channels through which social capital increases economic growth? We explore one such channel: the role of social capital in creating incentives for politicians to invest in productivity-enhancing public projects. Government expenditure finances both public services and public investment. Citizens derive immediate benefits from services such as social spending, government subsidies, or "bread and circuses." Instead, long-term productivity rises with public investment in education, research and development, and infrastructure.

Figure 1 shows that the share of public spending devoted to education is strongly positively correlated with social capital in a cross section of countries. Table 1 documents in greater detail the highly significant empirical relationship between citizens' trust and government investment in education. The correlation is robust to controlling for income, government share of GDP, and population. In Table 2 we adopt an alternative strategy that tries to alleviate endogeneity concerns by using language as an instrument for social capital, following Tabellini (2009).[1] We confirm the strong, statistically significant positive correlation between social capital, now instrumented with our linguistic measure, and government spending on education. The result obtains again with controls (columns 3 and 4) as well as without (columns 1 and 2).[2]

In this paper, we account theoretically for this empirical regularity. We present a model of the political economy of government spending that explains why a low level of social capital induces a lack of public investment and thereby reduces long-run growth. We derive the dynamic general equilibrium of an economy in which the government provides both

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[1]Linguists have argued that some components of culture may have had an effect on specific dimensions of language (Boroditsky 2000; Ozgen and Davies 2002; Zhoua et al. 2010). In particular, languages that forbid dropping the first person pronoun are associated with cultures that give more emphasis to the individual relative to the social context (Kashima and Kashima 1998). Accordingly, Tabellini (2009) and Table 2 use this characteristic as an instrument for social capital. Language is a valid instrument if the long-lived cultural traits that affected the structure of present-day languages do not have an independent effect on public education expenditure other than through current social attitudes. Givati and Troiano (2012) similarly exploit language features as instruments for attitudes toward women.

[2]Our instrument is weak, with a first-stage F-statistic below 10. Since the two-stage least squares estimator performs poorly with weak instruments, we implement our instrumental-variable specification by limited information maximum likelihood estimation (Buse 1992; Bound, Jaeger and Baker 1995; Staiger and Stock 1997).

public services that increase citizens' current utility, and public investment that raises future productivity. Politicians have stochastic productivity in providing either type of public good. Thus, the composition of government spending is shaped by career concerns, as the incumbent tries to gain re-election by signalling his competence.

Policy distortions arise from the different visibility of the two types of public goods. Public services immediately benefit the representative household, so their provision is universally observed. Instead, only some voters are informed about public investment, which does not yield any immediate payoff. Therefore, politicians reap more widespread popular support for increasing public services than public investment. As a consequence, they finance too much of the former and too little of the latter.

Social capital increases voters' information through two complementary channels. First, greater civic engagement makes each individual more likely to acquire political information directly, for instance by following news reports of public-good provision. Second, greater social connectedness allows agents to share their information with a wider network of trusted neighbors. The increased acquisition and sharing of information make voters more aware of all government activity. The visibility of the two kinds of public goods becomes less asymmetric, reducing political distortion.

By increasing voter information, social capital improves both politicians' incentives and their selection. More knowledgeable voters offer greater electoral rewards for public investment. Politicians rationally respond by increasing investment spending towards the first best. In addition, the incumbent's skill at managing public investment becomes more likely to get him re-elected. In equilibrium, the productivity of government investment increases in the sense of first-order stochastic dominance. Larger expenditures and higher productivity in public investment combine to raise the steady-state growth rate. Its volatility is also reduced by better screening of politicians.

When social capital is very low, most voters are unaware of public investment. Then elections are a poor selection device, while political career concerns induce large distortions in the allocation of government spending. In these conditions, we show it can be optimal to impose term limits that preclude an incumbent from running for re-election. This last finding is common to any framework in which electoral incentives induce benevolent politicians to choose suboptimal policies (Smart and Sturm 2004; Bonfiglioli and Gancia 2011).

Existing models of this kind, however, cannot account for the main results in our analysis. The literature has considered electoral incentives to pander to voters' short-run preferences (Canes-Wrone, Herron, and Shotts 2001; Morris 2001; Maskin and Tirole 2004). The incumbent knows which policy is optimal, but he chooses instead the one voters expect to be optimal. In that case, more informed voters then tend to elicit more policy distortion (Har-

rington 1993). Bonfiglioli and Gancia (2011) study this phenomenon for macroeconomic reforms, which are unpopular with voters because they cause transitory output declines. Reform is more likely when greater volatility reduces voters' ability to monitor the consequences of government decisions.

We show instead that the allocation of public spending improves when voters are more informed. Key to this result is that productive public investment in education, research, and infrastructure is not unpopular. On the contrary, citizens understand its value and appreciate its provision. Lack of information causes distortions by preventing voters from learning when the government is making the investments they desire. The positive role of voter knowledge predicted by our model is consistent with a growing body of empirical evidence showing that media coverage improves policy outcomes by making politicians more responsive to voters' preferences (Besley and Burgess 2002; Snyder and Strömberg 2010; Ferraz and Finan 2011; Ponzetto 2011), and by enabling voters to replace bad politicians (Ferraz and Finan 2008). Nannicini et al. (2010) find that higher social capital has the same beneficial effects on political accountability.

2 Environment

2.1 Preferences and Technology

A closed economy is populated by a measure-one continuum of infinitely lived households, who have identical preferences over private consumption c_t and government-provided public services g_t:

$$U_t = \sum_{s=0}^{\infty} \beta^t \mathbb{E} \left[(1-\gamma) \log c_{t+s} + \gamma \log g_{t+s} \right], \tag{1}$$

where $\beta \in (0,1)$ is the discount factor and $\gamma \in (0,1)$ the relative weight of public services in the utility function. The representative household inelastically supplies one unit of labor, and its dynamic budget constraint is

$$a_{t+1} = R_t a_t + (1 - \tau_t) w_t - c_t, \tag{2}$$

where a_t denotes the household's assets, R_t their gross return, w_t the wage, and $\tau_t \in (0,1)$ the tax rate on labor income.

Firms have access to the Cobb-Douglas production technology

$$Y_{i,t} = A_t L_{i,t}^{1-\alpha} K_{i,t}^{\alpha} \text{ for } \alpha \in (0,1), \tag{3}$$

4

where A_t denotes aggregate productivity, while $L_{i,t}$ and $K_{i,t}$ are firm i's employment of labor and capital, and $Y_{i,t}$ its output. With perfectly competitive product and factor markets, each firm chooses an identical capital–labor ratio. Hence, with an exogenous unit labor supply, we can write the aggregate production function

$$y_t = A_t k_t^\alpha, \tag{4}$$

where k_t is the aggregate amount of private capital and y_t aggregate output. Factor rewards are

$$R_t = \alpha \frac{y_t}{k_t} \tag{5}$$

and

$$w_t = (1 - \alpha) y_t. \tag{6}$$

Capital depreciates fully every period. It coincides with household assets in a closed economy with homogeneous agents, so $a_t = k_t$ for all t. The dynamic budget constraint of the private sector can be rewritten

$$k_{t+1} = [1 - (1 - \alpha) \tau_t] y_t - c_t. \tag{7}$$

The government levies a flat tax τ_t on labor income, which causes no distortions since labor supply is exogenous. It uses tax revenues to finance two types of public expenditure. First, it provides public services g_t that enter directly citizens' utility function. Moreover, it provides productive public capital h_t that determines private-sector productivity, following Barro's (1990) model of productive government spending:

$$A_t = A h_t^{1-\alpha}. \tag{8}$$

Public capital, like private capital, depreciates fully every period, so it is determined by investment in the previous period.

The public sector operates under a balanced-budget constraint, setting expenditures on public services x_t^g and on public investment x_t^h such that

$$x_t^g + x_t^h = (1 - \alpha) \tau_t y_t. \tag{9}$$

Public spending generates public goods with the stochastic technology

$$g_t = x_t^g \exp(\eta_t^g) \text{ and } h_{t+1} = x_t^h \exp(\eta_t^h). \tag{10}$$

Public-sector productivity $\left(\eta_t^g, \eta_t^h\right)$ represents the stochastic competence of the ruling politician in providing each public good. It independent across the two types of expenditure, and it follows a first-order moving average process

$$\eta_t^g = \varepsilon_t^g + \varepsilon_{t-1}^g \text{ and } \eta_t^h = \varepsilon_t^h + \varepsilon_{t-1}^h. \tag{11}$$

The innovations ε_t^g and ε_t^h are independent over time, across policies, and across politicians. They are drawn from common-knowledge invariant distributions with moments $\mathbb{E}\varepsilon_t^g = \mathbb{E}\varepsilon_t^h = 0$, $Var\left(\varepsilon_t^g\right) = \sigma_g^2$, and $Var\left(\varepsilon_t^h\right) = \sigma_h^2$, and with finite supports $[\check{\varepsilon}_g, \hat{\varepsilon}_g]$ and $[\check{\varepsilon}_h, \hat{\varepsilon}_h]$ respectively.

Aside from political frictions, the structure of this economy essentially coincides with King, Plosser, and Rebelo's (1988) tractable model of endogenous growth with real business cycles. We follow their specification of a logarithmic utility function, a Cobb-Douglas production function, and non-durable capital. This set of assumptions is well known to be necessary for a stochastic growth model to have an exact analytical solution (Long and Plosser 1983). Then, Cobb-Douglas technology and full depreciation entail that random shocks to the productivity of public investment expenditure are isomorphic to the traditional assumption stochastic aggregate productivity. Moreover, log utility implies that stochastic productivity in the provision of public service enters the household's utility function separably, and does not interact with consumption and investment decisions.

2.2 Information and Decision-Making

Within each period t, events unfold according to the following sequence.

1. All agents observe the stocks of private capital k_t and public capital h_t, output y_t, factor rewards R_t and w_t, as well as the ruling politician's past competence shocks ε_{t-1}^g and ε_{t-1}^h.

2. The ruling politician sets the labor tax rate τ_t, which all citizens observe.

3. Citizens choose consumption c_t and investment k_{t+1}. Simultaneously, the ruling politician chooses expenditures x_t^g and x_t^h, which no citizen can observe directly.

4. The ruling politician's competence shocks ε_t^g and ε_t^h are realized, but they are not directly observable until the following period $t+1$. The provision of public services g_t and public investment h_{t+1} is determined.

5. All citizens observe the provision of public services g_t. Moreover, each citizen observes public investment h_{t+1} with probability $\theta \in (0, 1)$; with probability $1 - \theta$ he remains

6

completely uninformed about h_{t+1} until the following period $t+1$. The arrival of information about h_{t+1} is independent across agents.

6. An election is held, pitting the incumbent against a single challenger, randomly drawn from a continuum of potential office-holders.

Economic decisions are made by private agents and by the government based on the same information. When the household budget and the government budget are allocated, everybody knows the predetermined component of public-sector productivity $\left(\varepsilon_{t-1}^{g}, \varepsilon_{t-1}^{h}\right)$, but nobody knows the period-t innovation $\left(\varepsilon_{t}^{g}, \varepsilon_{t}^{h}\right)$. When the latter is realized, it is reflected in the actual provision of public goods (g_t, h_{t+1}). The politician, who knows his spending decisions $\left(x_t^g, x_t^h\right)$, can perfectly back out his productivity shock by comparing expenditures with results. Voters can similarly infer the politician's ability on the basis of their observation of public goods and their rational expectation of spending decisions. This inference generates career concerns for politicians, in the manner of Holmström ([1982] 1999). By increasing spending on either public good, the incumbent can attempt to convince the voters he is exceptionally capable at providing it. These attempts are vain in equilibrium, since rational voters cannot be systematically fooled; nonetheless the possibility of off-equilibrium surprises shapes the allocation of public spending.

The different visibility of the two types of public goods is the key driving force in our analysis. Public services g_t generate immediate consumption benefits which are directly perceived by all citizens. Public investment h_{t+1}, instead, does not enter the household's utility function, so voters may remain unaware of it. Only a fraction θ of citizens, who are better informed and more politically involved, reach the election with full knowledge of public good provision. As a consequence of this asymmetry, political incentives are skewed towards the provision of the more observable public services. While voters appreciate equally both types of public goods, they cannot reward the provision of public investment if they have failed to notice it. Our model thus accords with Eisensee and Strömberg's (2007) evidence that greater media coverage of a problem causes greater public spending on its relief.

2.3 Politicians and Elections

Politicians internalize the welfare of the representative household, out of benevolence or simply because each politician belongs to a representative household. In addition, however, a politician derives an ego rent $z > 0$ in every period in which he holds office. If an incumbent is defeated in an election, his probability of returning to power in the future is nil. Thus office-seeking candidates do not make policy decisions purely to maximize social welfare, but also to increase the probability of winning re-election.

In the election, citizens vote on the basis of political preferences that consist of two independent elements, following the probabilistic-voting approach (Lindbeck and Weibull 1987). First, citizens have preferences over future policy outcomes. On the basis of all information available to him, voter i has rational expectations that his future utility from private consumption and public services will be $\mathbb{E}_i\left(U_{t+1}|I_t\right)$ if the incumbent wins re-election, or $\mathbb{E}_i\left(U_{t+1}|C_t\right)$ if the challenger defeats him. In addition, voters have individual tastes $\xi_{I_t}^i$ and $\xi_{C_t}^i$ for the candidates' non-policy characteristics, such as their personal likability or the long-standing ideology of their party. Voter i casts his ballot for the incumbent if and only if

$$\mathbb{E}_i\left(U_{t+1}|I_t\right) + \xi_{I_t}^i \geq \mathbb{E}_i\left(U_{t+1}|C_t\right) + \xi_{C_t}^i. \tag{12}$$

Policy preferences can be summarized by the difference $\Delta_t^i \equiv \mathbb{E}_i\left(U_{t+1}|I_t\right) - \mathbb{E}_i\left(U_{t+1}|C_t\right)$. Non-policy preferences can be disaggregated into two independent components, a common and an idiosyncratic one: $\xi_{C_t}^i - \xi_{I_t}^i \equiv \Psi_t + \psi_t^i$. Then i supports the incumbent if and only if

$$\Delta_t^i \geq \Psi_t + \psi_t^i. \tag{13}$$

The common shock Ψ_t represents a measure of the incumbent's popularity, and it accounts for aggregate uncertainty in the electoral outcome. The idiosyncratic shock ψ_t^i to each voter's tastes provides the intensive margin of political support, and it is independent and identically distributed across agents. Both Ψ_t and ψ_t^i have uniform distributions, with supports respectively $[-1/\left(2\phi\right), 1/\left(2\phi\right)]$ and $[-\bar{\psi}, \bar{\psi}]$, sufficiently wide that neither the outcome of an election nor any given voter's ballot is perfectly predictable on the basis of policy considerations alone. Formally, this condition is reflected in the following assumption.

Assumption 1 *The support of the electoral shocks Ψ_t and ψ_t^i is sufficiently wide, and that of the competence shocks ε_t^g and ε_t^h sufficiently narrow, that*

$$\max\left\{-\frac{1}{2\phi}, \frac{1}{2\phi} - \bar{\psi}\right\} \leq \gamma\breve{\varepsilon}_g + \frac{(1-\alpha)\beta}{1-\beta}\breve{\varepsilon}_h < \gamma\hat{\varepsilon}_g + \frac{(1-\alpha)\beta}{1-\beta}\hat{\varepsilon}_h \leq \min\left\{\frac{1}{2\phi}, \bar{\psi} - \frac{1}{2\phi}\right\}.$$

Our model provides a novel combination of political career concerns, probabilistic voting, and heterogeneous information. Voters' stochastic non-policy preferences imply an intensive margin of political support. The incumbent is not simply re-elected if voters perceive him to be better than the challenger. His likelihood of re-election is continuously increasing in the extent of his perceived superiority over the challenger. The standard model of probabilistic voting combines this insight with the assumption that politicians can commit to binding policy proposals, so electoral competition is based on voters' comparison of campaign platforms

(Lindbeck and Weibull 1987; Persson and Tabellini 2000, ch. 3).

We assume instead the absence of any credible policy commitment, so that voters' policy preferences are based not on future promises, but on past policy outcomes that signal the incumbent's ability. The presence of an intensive margin of support sets our model apart from the standard analysis of political career concerns, which assumes purely Downsian competition (Persson and Tabellini 2000, ch. 4; Alesina and Tabellini 2007, 2008). The incumbent's concern for the intensity of voters' preferences aligns our framework with Holmström's ([1982] 1999) original model of career concerns in the private sector. A politician is motivated by his chances of re-election, rather than by the market valuation of skill. The probability of re-election, however, increases continuously with voters' approval of the incumbent's policy record. It does not jump abruptly from zero to one as the approval rating crosses 50%, as in a Downsian model. The structure of our economy implies that voters' approval, the intensity of their support, and the probability of re-election all increase linearly in the average perception of the incumbent's ability.

Finally, this average assessment results from the inferences of voters who reach the election with heterogeneous information (Besley and Burgess 2002; Strömberg 2004; Glaeser, Ponzetto, and Shapiro 2005; Ponzetto 2011). Although all citizens have identical preferences and value both dimensions of political ability, different voters respond differently to the same policy outcomes because of their different information. Everyone observes public services g_t and can infer the incumbent's competence at providing them, ε_t^g. Thus a politician with higher service-specific skill ε_t^g derives greater support from the entire electorate. Conversely, only a fraction θ of the electorate also observes public investment h_{t+1} and can infer the relative competence ε_t^h. Thus higher investment-specific skill ε_t^h only raises support for the incumbent among a subset of voters. Since re-election depends on the average intensity of support across all voters, the incumbent is more likely to be defeated if ε_t^g is low and ε_t^h high, rather than vice-versa. The electoral mechanism is more effective at screening on the dimension of ability that more citizens are capable of assessing.

2.4 Equilibrium and Social Optimum

The focus of our analysis is on the political-economy distortions that arise from the different visibility of public services and public investments when politicians are motivated by career concerns. When the provision of public goods is indicative of government competence, it is natural for the incumbent to try to demonstrate his ability. It seems implausible that an office-seeking politician would instead attempt to build and sustain a reputation for ignoring career concerns. We rule out this eventuality by concentrating on Markov perfect

9

equilibria, the standard equilibrium concept in the literature (Persson and Tabellini 2000, ch. 4; Alesina and Tabellini 2008). Given that competence is a first-order moving average process, the incumbent's performance during his latest term in office contains all available information about his future ability. Moreover, the requirement of Markov perfection is not restrictive for economic decisions in the environment specified above.

According to the sequence of events outlined in the previous section, agents make choices and inferences as follows.

1. The initial state of the economy is described by the vector

$$s_t \equiv \left(k_t, h_t, \varepsilon_{t-1}^g, \varepsilon_{t-1}^h \right), \tag{14}$$

   which includes the capital stocks and the known inherited components of the ruling politician's competence. Output is determined according to the aggregate production function

$$y_t = y\left(k_t, h_t \right) \equiv A h_t^{1-\alpha} k_t^\alpha. \tag{15}$$

   In equilibrium, the welfare of the representative household is defined by the function $V\left(s_t \right)$.

2. The government sets labor taxes according to the equilibrium rule

$$\tau_t = T\left(s_t \right). \tag{16}$$

3. Citizens observe the tax rate τ_t and choose private investment according to the equilibrium rule

$$k_{t+1} = K\left(s_t, \tau_t \right). \tag{17}$$

   Consumption is jointly determined by the private-sector budget constraint (7). At the same time, the government chooses spending on public investment according to the equilibrium rule

$$x_t^h = H\left(s_t, \tau_t \right). \tag{18}$$

   Expenditure on public services is jointly determined by the public-sector budget constraint (9).

4. Public-good provision is realized according to the technology (10) and the evolution of government competence (11).

5. The observation of the state s_t, taxes τ_t, and public services g_t, jointly with rational

expectations of the strategy $H(s_t, \tau_t)$, allows all voters to infer with certainty the incumbent's competence at providing public services

$$\varepsilon^g (s_t, \tau_t, g_t) \equiv \log g_t - \log \left[(1 - \alpha) \tau_t y (k_t, h_t) - H (s_t, \tau_t) \right] - \varepsilon_{t-1}^g. \qquad (19)$$

A fraction θ of more informed voters also observe h_{t+1}, and can likewise infer with certainty the incumbent's competence at providing public investment

$$\varepsilon^h (s_t, \tau_t, h_{t+1}) \equiv \log h_{t+1} - \log H (s_t, \tau_t) - \varepsilon_{t-1}^h. \qquad (20)$$

The remaining share $1 - \theta$ of less informed voters do not have any information about h_{t+1}, and therefore from their point of view ε_t^h remains an unknown realization from the common-knowledge distribution of ability.

6. Investments k_{t+1} and h_{t+1} are determined before the election and do not depend on its outcome. Policy preferences hinge on the comparison between the ability of the incumbent $\left(\varepsilon_t^g, \varepsilon_t^h \right)$ and that of the challenger, which we'll denote by $\left(\omega_t^g, \omega_t^h \right)$. The challenger has no track record in office, so the only information about his competence is that it is an independent draw from the common distribution of ability.

The share θ of voters who have observed h_{t+1} have policy preferences

$$\Delta_1 (s_t, \tau_t, k_{t+1}, g_t, h_{t+1}) \equiv V \left(k_{t+1}, h_{t+1}, \varepsilon^g (s_t, \tau_t, g_t), \varepsilon^h (s_t, \tau_t, h_{t+1}) \right)$$
$$- \mathbb{E} V \left(k_{t+1}, h_{t+1}, \omega_t^g, \omega_t^h \right), \qquad (21)$$

while the remainder $1 - \theta$ of voters who have not observed h_{t+1} have policy preferences

$$\Delta_0 (s_t, \tau_t, k_{t+1}, g_t) \equiv \mathbb{E} V \left(k_{t+1}, H (\tau_t, s_t) \exp \left(\varepsilon_{t-1}^h + \varepsilon_t^h \right), \varepsilon^g (s_t, \tau_t, g_t), \varepsilon_t^h \right)$$
$$- \mathbb{E} V \left(k_{t+1}, H (\tau_t, s_t) \exp \left(\varepsilon_{t-1}^h + \varepsilon_t^h \right), \omega_t^g, \omega_t^h \right). \qquad (22)$$

Given the independent realizations of the uniform idiosyncratic shocks ψ_t^i, the share of voters who support the incumbent is

$$\frac{1}{2} + \frac{1}{2\bar{\psi}} \left[\theta \Delta_1 (s_t, \tau_t, k_{t+1}, g_t, h_{t+1}) + (1 - \theta) \Delta_0 (s_t, \tau_t, k_{t+1}, g_t) - \Psi_t \right] \qquad (23)$$

depending on the realization of the aggregate popularity shock Ψ_t. Hence, the incum-

bent is re-elected if and only if

$$\Psi_t \leq \theta \Delta_1 (s_t, \tau_t, k_{t+1}, g_t, h_{t+1}) + (1 - \theta) \Delta_0 (s_t, \tau_t, k_{t+1}, g_t). \qquad (24)$$

All agents have rational expectations. Households choose consumption and savings to maximize welfare, while the ruling politician sets taxes and public spending taking into consideration both his concern for welfare and his personal desire for re-election. An equilibrium has the following characterization.

Definition 1 *An equilibrium consists of a welfare function $V(s_t)$, a value $Z(s_t)$ of holding political office, a tax-setting rule $T(s_t)$, a private investment rule $K(s_t, \tau_t)$, and a public investment rule $H(s_t, \tau_t)$ such that:*

1. *The value of political incumbency satisfies the recursive definition*

$$Z(s_t) = z + \beta \mathbb{E} \left[\chi(s_t) Z \left(K(s_t, T(s_t)), H(s_t, T(s_t)) \exp \left(\varepsilon_{t-1}^h + \varepsilon_t^h \right), \varepsilon_t^g, \varepsilon_t^h \right) \right],$$

where $\chi(s_t)$ is an indicator for

$$\Psi_t \leq \theta \Delta_1 \left(\begin{array}{c} s_t, T(s_t), K(s_t, T(s_t)), \\ [(1 - \alpha) T(s_t) y(k_t, h_t) - H(s_t, T(s_t))] \exp \left(\varepsilon_{t-1}^g + \varepsilon_t^g \right), \\ H(s_t, T(s_t)) \exp \left(\varepsilon_{t-1}^h + \varepsilon_t^h \right) \end{array} \right)$$

$$+ (1 - \theta) \Delta_0 \left(\begin{array}{c} s_t, T(s_t), K(s_t, T(s_t)), \\ [(1 - \alpha) T(s_t) y(k_t, h_t) - H(s_t, T(s_t))] \exp \left(\varepsilon_{t-1}^g + \varepsilon_t^g \right) \end{array} \right).$$

2. *The social welfare function satisfies the recursive definition*

$$\begin{aligned} V(s_t) = & (1 - \gamma) \log \{ [1 - (1 - \alpha) T(s_t)] y(k_t, h_t) - K(s_t, T(s_t)) \} \\ & + \gamma \{ \log [(1 - \alpha) T(s_t) y(k_t, h_t) - H(s_t, T(s_t))] + \varepsilon_{t-1}^g + \mathbb{E} \varepsilon_t^g \} \\ & + \beta \mathbb{E} \left[\chi(s_t) V \left(K(s_t, T(s_t)), H(s_t, T(s_t)) \exp \left(\varepsilon_{t-1}^h + \varepsilon_t^h \right), \varepsilon_t^g, \varepsilon_t^h \right) \right] \\ & + \beta \mathbb{E} \left\{ [1 - \chi(s_t)] V \left(K(s_t, T(s_t)), H(s_t, T(s_t)) \exp \left(\varepsilon_{t-1}^h + \varepsilon_t^h \right), \omega_t^g, \omega_t^h \right) \right\}. \end{aligned}$$

3. *Private investment is chosen by welfare-maximizing households:*

$$K\left(s_t, \tau_t\right) =$$

$$\arg\max_K \left\{ \begin{array}{c} (1-\gamma)\log\left\{[1-(1-\alpha)\tau_t]\,y\left(k_t, h_t\right) - K\right\} \\ +\beta\mathbb{E}\left[\chi\left(s_t, \tau_t, K\right) V\left(K, H\left(s_t, \tau_t\right)\exp\left(\varepsilon_{t-1}^h + \varepsilon_t^h\right), \varepsilon_t^g, \varepsilon_t^h\right)\right] \\ +\beta\mathbb{E}\left\{[1-\chi\left(s_t, \tau_t, K\right)] V\left(K, H\left(s_t, \tau_t\right)\exp\left(\varepsilon_{t-1}^h + \varepsilon_t^h\right), \omega_t^g, \omega_t^h\right)\right\}, \end{array} \right\}$$

where $\chi\left(s_t, \tau_t, K\right)$ is an indicator for

$$\Psi_t \leq \theta\Delta_1 \left(\begin{array}{c} s_t, \tau_t, K, \\ [(1-\alpha)\tau_t y\left(k_t, h_t\right) - H\left(s_t, \tau_t\right)]\exp\left(\varepsilon_{t-1}^g + \varepsilon_t^g\right), \\ H\left(s_t, \tau_t\right)\exp\left(\varepsilon_{t-1}^h + \varepsilon_t^h\right) \end{array} \right)$$

$$+ (1-\theta)\Delta_0\left(s_t, \tau_t, K, [(1-\alpha)\tau\left(s_t\right)y\left(k_t, h_t\right) - H\left(s_t, \tau_t\right)]\exp\left(\varepsilon_{t-1}^g + \varepsilon_t^g\right)\right).$$

4. *Expenditure on public investment is chosen by office-seeking politicians:*

$$H\left(s_t, \tau_t\right) =$$

$$\arg\max_H \left\{ \begin{array}{c} \gamma\log\left[(1-\alpha)\tau_t y\left(k_t, h_t\right) - H\right] \\ +\beta\mathbb{E}\left[\chi\left(s_t, \tau_t, H\right) V\left(K\left(s_t, \tau_t\right), H\exp\left(\varepsilon_{t-1}^h + \varepsilon_t^h\right), \varepsilon_t^g, \varepsilon_t^h\right)\right] \\ +\beta\mathbb{E}\left\{[1-\chi\left(s_t, \tau_t, H\right)] V\left(K\left(s_t, \tau_t\right), H\exp\left(\varepsilon_{t-1}^h + \varepsilon_t^h\right), \omega_t^g, \omega_t^h\right)\right\} \\ +\beta\mathbb{E}\left[\chi\left(s_t, \tau_t, H\right) Z\left(K\left(s_t, \tau_t\right), H\exp\left(\varepsilon_{t-1}^h + \varepsilon_t^h\right), \varepsilon_t^g, \varepsilon_t^h\right)\right] \end{array} \right\},$$

where $\chi\left(s_t, \tau_t, H\right)$ is an indicator for

$$\Psi_t \leq \theta\Delta_1 \left(\begin{array}{c} s_t, \tau_t, K\left(s_t, \tau_t\right), \\ [(1-\alpha)\tau_t y\left(k_t, h_t\right) - H]\exp\left(\varepsilon_{t-1}^g + \varepsilon_t^g\right), \\ H\exp\left(\varepsilon_{t-1}^h + \varepsilon_t^h\right) \end{array} \right)$$

$$+ (1-\theta)\Delta_0\left(s_t, \tau_t, K\left(s_t, \tau_t\right), [(1-\alpha)\tau\left(s_t\right)y\left(k_t, h_t\right) - H]\exp\left(\varepsilon_{t-1}^g + \varepsilon_t^g\right)\right).$$

5. *Labor-income taxes are chosen by office-seeking politicians:*

$$T\left(s_{t}\right) =$$

$$\arg\max_{T} \left\{ \begin{array}{c} (1-\gamma)\log\left\{[1-(1-\alpha)\,T]\,y\left(k_{t},h_{t}\right)-K\left(s_{t},T\right)\right\} \\ +\gamma\log\left[(1-\alpha)\,Ty\left(k_{t},h_{t}\right)-H\left(s_{t},T\right)\right] \\ +\beta\mathbb{E}\left[\chi\left(s_{t},T\right)V\left(K\left(s_{t},T\right),H\left(s_{t},T\right)\exp\left(\varepsilon_{t-1}^{h}+\varepsilon_{t}^{h}\right),\varepsilon_{t}^{g},\varepsilon_{t}^{h}\right)\right] \\ +\beta\mathbb{E}\left\{[1-\chi\left(s_{t},T\right)]V\left(K\left(s_{t},T\right),H\left(s_{t},T\right)\exp\left(\varepsilon_{t-1}^{h}+\varepsilon_{t}^{h}\right),\omega_{t}^{g},\omega_{t}^{h}\right)\right\} \\ +\beta\mathbb{E}\left[\chi\left(s_{t},T\right)Z\left(K\left(s_{t},T\right),H\left(s_{t},T\right)\exp\left(\varepsilon_{t-1}^{h}+\varepsilon_{t}^{h}\right),\varepsilon_{t}^{g},\varepsilon_{t}^{h}\right)\right] \end{array} \right\},$$

where $\chi\left(s_{t},T\right)$ *is an indicator for*

$$\Psi_{t} \leq \theta\Delta_{1}\left(\begin{array}{c} s_{t},T,K\left(s_{t},T\right), \\ [(1-\alpha)\,Ty\left(k_{t},h_{t}\right)-H\left(s_{t},T\right)]\exp\left(\varepsilon_{t-1}^{g}+\varepsilon_{t}^{g}\right), \\ H\left(s_{t},T\right)\exp\left(\varepsilon_{t-1}^{h}+\varepsilon_{t}^{h}\right) \end{array} \right)$$

$$+ (1-\theta)\,\Delta_{0}\left(s_{t},T,K\left(s_{t},T\right),[(1-\alpha)\,Ty\left(k_{t},h_{t}\right)-H\left(s_{t},T\right)]\exp\left(\varepsilon_{t-1}^{g}+\varepsilon_{t}^{g}\right)\right).$$

The equilibrium dynamics of the decentralized economy with political frictions should be compared to a benchmark of social optimality. The first-best level of welfare is given by the solution to the problem of a welfare-maximizing social planner. The benevolent planner controls both private and public spending, as well as political turnover. His choices occur with the same timing as those of the decentralized economy. He chooses c_{t}, k_{t+1}, x_{t}^{g} and x_{t}^{h} on the basis of s_{t} alone, before the competence shocks ε_{t}^{g} and ε_{t}^{h} are realized. After the realization of the shocks, the planner chooses political turnover according to the binary function $\chi^{*}\left(s_{t},\varepsilon_{t}^{g},\varepsilon_{t}^{h}\right)$, which equals one if the incumbent is retained and zero if he is replaced by a new random draw from the ability pool. Then the social optimum has the following characterization.

Definition 2 *A solution to the planner's problem consists of a welfare function* $V^{*}\left(s_{t}\right)$, *a private investment rule* $K^{*}\left(s_{t}\right)$, *public spending rules* $G^{*}\left(s_{t}\right)$ *and* $H^{*}\left(s_{t}\right)$, *and a turnover rule* $\chi^{*}\left(s_{t},\varepsilon_{t}^{g},\varepsilon_{t}^{h}\right)$ *such that:*

1. *The social welfare function satisfies the recursive definition*

$$V^* (s_t) = (1 - \gamma) \log \left[y \left(k_t, h_t \right) - K^* (s_t) - G^* (s_t) - H^* (s_t) \right]$$
$$+ \gamma \left[\log G^* (s_t) + \varepsilon_{t-1}^g + \mathbb{E} \varepsilon_t^g \right]$$
$$+ \beta \mathbb{E} \left[\chi^* \left(s_t, \varepsilon_t^g, \varepsilon_t^h \right) V \left(K^* (s_t), H^* (s_t) \exp \left(\varepsilon_{t-1}^h + \varepsilon_t^h \right), \varepsilon_t^g, \varepsilon_t^h \right) \right]$$
$$+ \beta \mathbb{E} \left\{ \left[1 - \chi^* \left(s_t, \varepsilon_t^g, \varepsilon_t^h \right) \right] V \left(K^* (s_t), H^* (s_t) \exp \left(\varepsilon_{t-1}^h + \varepsilon_t^h \right), \omega_t^g, \omega_t^h \right) \right\}.$$

2. *The allocation of output $K^* (s_t)$, $G^* (s_t)$, $H^* (s_t)$ solves*

$$\max_{K,G,H} \left\{ \begin{array}{c} (1 - \gamma) \log \left[y \left(k_t, h_t \right) - K - G - H \right] + \gamma \log G \\ + \beta \mathbb{E} \left[\chi^* \left(s_t, \varepsilon_t^g, \varepsilon_t^h \right) V \left(K, H \exp \left(\varepsilon_{t-1}^h + \varepsilon_t^h \right), \varepsilon_t^g, \varepsilon_t^h \right) \right] \\ + \beta \mathbb{E} \left\{ \left[1 - \chi^* \left(s_t, \varepsilon_t^g, \varepsilon_t^h \right) \right] V \left(K, H \exp \left(\varepsilon_{t-1}^h + \varepsilon_t^h \right), \omega_t^g, \omega_t^h \right) \right\} \end{array} \right\}.$$

3. *The turnover rule is $\chi^* \left(s_t, \varepsilon_t^g, \varepsilon_t^h \right) = 1$ if and only if*

$$V \left(K^* (s_t), H^* (s_t) \exp \left(\varepsilon_{t-1}^h + \varepsilon_t^h \right), \varepsilon_t^g, \varepsilon_t^h \right) \geq$$
$$\mathbb{E} V \left(K^* (s_t), H^* (s_t) \exp \left(\varepsilon_{t-1}^h + \varepsilon_t^h \right), \omega_t^g, \omega_t^h \right).$$

As we detail in the appendix, both the planner's problem and the equilibrium of the decentralized economy have closed-form solutions that can be derived by guessing the specific form of the value functions. In both cases the social welfare function has the form

$$V (s_t) = v_0 + v_k \log k_t + v_h \log h_t + v_\varepsilon^g \varepsilon_{t-1}^g + v_\varepsilon^h \varepsilon_{t-1}^h. \tag{25}$$

The same guess provides the solution to the standard model of real business cycles with exogenous stochastic productivity (Long and Plosser 1983; King, Plosser, and Rebelo 1988). The behavior of our economy is more complex, since the political dimension makes stochastic productivity endogenous. Unproductive politicians can be replaced, either optimally by the benevolent planner, or less than optimally by voters with imperfect information and random non-policy tastes. Moreover, in the decentralized economy, political career concerns further complicate the solution by introducing frictions that distort the equilibrium allocation of resources. Nonetheless, the model remains tractable: the impact of political economy is reflected in the coefficients of the welfare function, but it does not alter the overall functional form.

The second educated guess concerns the value of incumbency in the political equilibrium,

which is

$$Z\left(s_t\right) = Z. \tag{26}$$

independent of s_t. Intuitively, this results from the symmetry of the ruling politician's and the voters' information when policy choices are made. The incumbent has no private information to signal, and he cannot fool rational voters in equilibrium. His re-election then depends exclusively on the realizations of the shocks ε_t^g, ε_t^h, and Ψ_t. Since their distribution is invariant, so is the probability of re-election and hence the value of holding office.

3   Equilibrium Dynamics

3.1   Social Capital and Voter Information

Before analyzing the equilibrium dynamics of the economic and political environment described in the previous section, we formalize the relationship between social capital and voters' ability to observe public investment and monitor politicians. We highlight two dimensions of social capital that contribute to voter information θ. First, greater civic engagement leads an individual to pay closer attention to events in his community, and particularly to politics. Thus, Putnam (1993) considers newspaper readership a direct proxy for social capital. Second, higher levels of trust and social connectedness imply that the individual is part of a wider network of neighbors. Interpersonal relationships supported by mutual trust allow agents to share credibly the information that each possesses. Such social interactions play a key role in the acquisition of political knowledge (Granovetter 1973; Cialdini 1984; Zaller 1992; Beck et al. 2002). The following proposition provides a simple formal setting to capture the working of both channels.

Proposition 1 *Each individual independently observes public investment h_{t+1} with probability $\nu \in (0,1)$. Furthermore, each individual belongs to a network of $n > 1$ trusted neighbors with whom he credibly shares his observation.*

At the time of the election, the probability that a voter is aware of h_{t+1} is $\theta\left(\nu, n\right) \in (\nu, 1)$. Voter knowledge is increasing in both the exogenous level of information ν and the degree of social connectedness n ($\partial\theta/\partial\nu > 0$ and $\theta\left(\nu, n+1\right) - \theta\left(\nu, n\right) > 0$). Both sources of information have decreasing returns ($\partial^2\theta/\partial\nu^2 < 0$ and $\theta\left(\nu, n+2\right) - \theta\left(\nu, n+1\right) < \theta\left(\nu, n+1\right) - \theta\left(\nu, n\right)$). Individual information acquisition and the social sharing of information are complements ($\partial\left[\theta\left(\nu, n+1\right) - \theta\left(\nu, n\right)\right]/\partial\nu > 0$).

A voter's ability ν to observe directly government activity is naturally related to media coverage. The role of the media in increasing accountability and improving policy outcomes is

documented empirically for government interventions that range from disaster relief (Besley and Burgess 2002) to trade policy (Ponzetto 2011), and also for politicians' corruption (Ferraz and Finan 2011) and their individual effort (Snyder and Strömberg 2010). The prevalence of information sharing n represents a complementary social determinant of political accountability, consistent with Nannicini et al.'s (2010) evidence that electoral punishment of misbehaving politicians increases with social capital.

Complementarity is intuitive, since the two mechanisms of knowledge formation leverage each other. If every individual is more informed, there is more to learn from one's neighbors, making a larger network more valuable. As the network grows wider, an increase in the level of members' knowledge is more valuable since it is reflected across more contacts. Decreasing returns on each dimension are also natural. As the network expands, it is increasingly likely that the marginal new member has no information that was not already being shared. As each individual's direct information increases, it becomes more likely that the marginal observation replicates knowledge that would have been obtained anyway from trusted neighbors.

Concavity also implies that inequality in social connectedness has adverse impacts on political accountability. Suppose that all individual have the same probability ν of observing h_{t+1} personally, or learning about it from the media. However, they belong to neighborhood networks of varying size n_i. By Jensen's inequality, $\mathbb{E}\left[\theta\left(\nu, n_i\right)\right] < \theta\left(\nu, \mathbb{E}n_i\right)$. In the previous section we have assumed that all citizens are homogeneous. However, introducing heterogeneity of n_i alone, with homogeneous preferences and endowments, would not require changes to the model. Monitoring of public investment would simply depend on the average $\mathbb{E}\left[\theta\left(\nu, n_i\right)\right]$ instead of the homogeneous value $\theta\left(\nu, n\right)$. Hence, in our framework, both low average levels of social capital and high inequality have detrimental effects.

3.2   Public Investment and Growth

The political-economy distortions connected with a lack of social capital impact first of all on the equilibrium allocation of government spending, as shown formally in the following proposition.

Proposition 2 *In equilibrium, the allocation of output is invariant. Private consumption is $c_t = (1 - \beta)(1 - \gamma) y_t$ and private investment $k_{t+1} = \alpha \beta y_t$. The government sets an invariant tax on labor income $\tau = (\beta + \gamma - \beta\gamma) / (1 - \alpha)$ and spends $x_t^g = [(1 - \beta)\gamma + \zeta(\theta)] y_t$ on public services and $x_t^h = [(1 - \alpha)\beta - \zeta(\theta)] y_t$ on public investment.*

The allocation of government spending depends on voter information according to the monotone decreasing function $\zeta(\theta)$ such that $(1 - \alpha)\beta > \zeta(0) > \zeta(1) = 0$. In the limit as

voters become perfectly informed about public investment ($\theta = 1 \Leftrightarrow \zeta = 0$), the equilibrium allocation reaches the first best.

The invariant allocation of output is a standard feature of the economic environment we are considering (Long and Plosser 1983; King, Plosser, and Rebelo 1988; Barro 1990). It obtains both in equilibrium and in the first-best solution to the planner's problem. Despite the presence of political frictions, equilibrium household choices always coincide with the first best. The private consumption-savings decision is resolved optimally because it is independent of the accumulation of public capital, just as it is independent of productivity dynamics, due to the log-linear structure of preferences and technology.

The non-distortive tax on labor income (τ), and thus the overall size of government ($\left(x_t^g + x_t^h\right)/y_t$), also coincide with the first best. Government choices on the revenue side are undistorted because the incumbent fully internalizes their welfare consequences. Politicians do not have ideological preferences for raising or lowering taxes, nor do they prefer overseeing a larger or smaller budget. To improve his prospects of re-election, the incumbent tries to demonstrate his skill. The tax rate is unaffected because it is not an effective signal of competence. Inference of ability depends on the observed realization of public-good provision, conditional on the taxes that all voters pay and thus correctly perceive.

When social capital is so high that public investment is also observed by all citizens, all government activity is undistorted by political career concerns. However, any imperfection in voters' information induces a distortion in the allocation of government expenditure. The lower social capital, the fewer the citizens who learn about public investment before the election. The visibility of government services and investment then becomes more asymmetric. The incumbent's incentives are increasingly skewed towards the provision of crowd-pleasing public services. In response, spending on immediate public consumption x_t^g increases and spending on public investment x_t^h falls ($\zeta'\left(\theta\right) < 0$). The political equilibrium moves further away from the first best.

In addition to distorting politicians' choice of the composition of public spending, lower information reduces voters' ability to reward competence with re-election. The following proposition describes the equilibrium outcomes of electoral turnover.

Proposition 3 *In equilibrium, government competence $\left(\hat{\eta}_t^g, \hat{\eta}_t^h\right)$ is endogenously determined by the electoral process. Productivity in the provision of public services $\hat{\eta}_t^g$ is independent of voter information θ. Productivity in the provision of public investment $\hat{\eta}_t^h$ is increasing in voter information, in the sense of first-order stochastic dominance.*

Rational expectations allow citizens to anticipate exactly the equilibrium allocation of public spending. Thus the direct observation of public-service provision enables all voters

to infer with certainty the true realization of the innovation ε_t^g. Analogously, knowledge of public investment yields perfect inference about the realization of ε_t^h. But the latter is only revealed to a fraction θ of the electorate, the more numerous the higher social capital. Weighing knowledge of the incumbent's skill and individual non-policy preferences, a fully informed citizen i votes for the incumbent if and only if $v_\varepsilon^g \varepsilon_t^g + v_\varepsilon^h \varepsilon_t^h \geq \Psi_t + \psi_i$. On the other hand, a voter j who is uninformed about public investment retains a rational expectation $\mathbb{E}\varepsilon_t^h = 0$ of the incumbent's ability. Thus he will support his re-election if and only if $v_\varepsilon^g \varepsilon_t^g \geq \Psi_t + \psi_j$.

A higher observation of ε_t^g generates the same intensity of support across the entire electorate, regardless of the level of social capital. As a consequence, politicians who provide public services more effectively are always more likely to be re-elected. This selection mechanism is independent of θ. Therefore, intuitively, so is the equilibrium distribution of efficiency $\hat{\eta}_t^g$

Conversely, lower levels of social capital make citizens less knowledgeable and thus, in a sense, more cynical about politicians' efficiency in providing public investment. Uninformed voters are rationally disillusioned about the differences between rival candidates, whose competence they perceive as identical. Thus their voting decision reflects to a greater extent random taste shocks. Since these are pure noise, elections become less effective as a screening mechanism. Incumbents with lower skill ε_t^h are more likely to be re-elected, and those with higher ε_t^h are more often defeated. This deterioration in electoral filtering monotonically shifts down the entire distribution of efficiency $\hat{\eta}_t^h$.

Whereas Proposition 2 showed that full information induces the optimal budget allocation, first-best electoral screening is unattainable. Greater social capital θ improves the quality of politicians. But even fully informed voters ($\theta = 1$) are swayed by non-policy preferences that do not feature in the planning problem. In fact, Assumption 1 implies that, for any level of monitoring, even the worst incumbent stands a chance of winning the election, and the best of losing it, on a wave of random popularity independent of his performance in managing the government budget.

Propositions 2 and 3 have established that poor monitoring of politicians worsens both their incentives and their selection. Through both channels, a lack of social capital negatively impacts on growth.

Proposition 4 *In equilibrium, the economy follows a stochastic balanced growth path. The growth rate is*

$$\log y_{t+1} - \log y_t = \log A + \log \beta + \alpha \log \alpha + (1-\alpha) \log \left[1 - \alpha - \zeta\left(s\right)/\beta \right] + (1-\alpha) \hat{\eta}_t^h,$$

which is increasing in voter information θ, in the sense of first-order stochastic dominance.

If the distribution of the competence innovation ε_t^h does not have positive skew, an increase in voter information reduces the variance of the growth rate.

For any initial level of output $y_0 > 0$, the economy reaches immediately a stochastic balanced growth path (King, Plosser, and Rebelo 1988; Barro 1990). The average growth rate naturally reflects total factor productivity A and patience β, which raises the saving rate. Similarly, the distorted political incentives analyzed in Proposition 2 reduce growth by reducing public investment below the optimal level, consistent with Easterly and Rebelo's (1993) finding that general government investment, and especially transport and communication investment, is positively correlated with growth. Moreover, government efficiency in providing public investment ($\hat{\eta}_t^h$) is the stochastic process driving randomness in growth. The distorted electoral selection analyzed in Proposition 3 further weakens growth by shifting down the entire distribution of productivity. Thus, our model provides a theoretical explanation for Algan and Cahuc's (2010) finding that social capital, measured by inherited trust, had a significant causal impact on worldwide growth during the twentieth century.

Proposition 4 also shows the intuitive effect of better electoral screening on the volatility of output. When more voters have knowledge of public investment, politicians who are inefficient at providing it are more likely to be replaced. This selection essentially acts as a truncation of the left tail of the distribution of ability. As a consequence, the variance of the growth rate, which coincides with the variance of the government's investment productivity shock, tends to decline unless the distribution of innovation is strongly positively skewed. A positive skew tends to counteract the decline in variance, since higher θ induces greater retention of incumbents with ability in the right tail. However, the negative effect prevails even for a modest positive skew, and a fortiori for the common assumption of a symmetric distribution of innovations. Therefore, we would expect higher levels of social capital and better monitoring of politicians to lower the volatility of output growth as well as increasing its average.

3.3   Term Limits

We have assumed so far that incumbent politicians run for re-election indefinitely until they are defeated by a challenger. Yet, when the desire for re-election prompts the government to distort policy choices, it can be desirable to remove the temptation by imposing binding term limits (Smart and Sturm 2004; Bonfiglioli and Gancia 2011). To assess this constitutional choice within our framework, we consider the case in which an incumbent can never run for re-election.

Proposition 5 *In a political system with term limits, the allocation of output coincides with the first best. Both components of government competence are lower than in a political system without term limits, in the sense of first-order stochastic dominance.*

There is a threshold $\bar{\theta}\left(\sigma_g^2, \sigma_h^2, z\right) \in [0, 1)$ such that term limits are welfare-increasing for $\theta < \bar{\theta}\left(\sigma_g^2, \sigma_h^2, z\right)$. The threshold is decreasing in the variance of politicians' competence $(\partial\bar{\theta}/\partial\sigma_g^2 < 0$ and $\partial\bar{\theta}/\partial\sigma_h^2 < 0)$ and increasing in the ego rent from holding political office $(\partial\bar{\theta}/\partial z > 0)$.

Term limits impose a trade off between the benefits of providing optimal incentives for the allocation of the government budget, and the cost of relinquishing any electoral selection of more efficient politicians. Proposition 2 has shown that the benefits are lower when voters are more informed. Proposition 3 has shown that the costs are higher when voters are more informed. Hence, it is immediately intuitive that term limits are never desirable for high levels of social capital, but may become welfare-increasing when social capital is low.

The comparative statics for the threshold level of information $(\bar{\theta})$ are equally natural. The greater the dispersion of ability (σ_g^2, σ_h^2), the more important it is to use elections as a screening device, albeit imperfect. The greater politicians' desire to cling to power (z), the more career concerns distort their budgetary choices. Therefore, sharper office-seeking makes term limits more attractive, and more uncertain government productivity makes them less desirable.

Analogous results would obtain if we assessed the two constitutional choices by their effect on the growth rate instead of welfare. In fact, the logic behind Proposition 5 is quite general. In our model, term limits are particularly attractive because politicians are welfare maximizers when their career concerns are removed. If politicians' preferences were less aligned with voters', for instance because of a desire to spend public funds on pet projects or in any way extract them as rents, elections would be more attractive, as they would provide positive incentives on that dimension. Greater voter information would still make elections more attractive, as better monitoring of politicians would heighten beneficial incentives, as well as blunting detrimental ones and improving screening. We can be quite confident, therefore, that tight term limits are more desirable in societies with lower levels of social capital. Needless to say, such confidence does not extend to the optimistic hypothesis that stricter term limits are in fact adopted in polities where voters are less informed.

4 Conclusion

Why does social capital have a positive impact on long-run growth? In this paper, we have presented an explanation based on the allocation of public spending between public services that yield current utility and public investment that raises future productivity.

Political distortions arise because the two types of spending are not equally observable. Households experience directly the immediate benefits of government services. Instead, they may or may not obtain information about public investments. Office-seeking politicians vying for the support of imperfectly informed voters skew their budgetary choices towards more visible expenditures. Public services are oversupplied, and public investment undersupplied.

Greater social capital makes citizens more likely to acquire and share political information. This increases their ability to monitor public-good provision, and thereby improves both politicians' incentives and their selection. In the dynamic general equilibrium, the level of public investment rises closer to the first best. Furthermore, its productivity also increases, as more capable incumbents win re-election. The two effects combine to increase the growth rate of the economy and reduce its volatility.

Cross-country evidence is consistent with the causal mechanism presented in our model. We have shown that a country's average level of trust is positively correlated with the percentage of GDP allocated to public investment in education, controlling for economic and political variables. The correlation is robust to alternative proxies for social capital, such as grammatical features of a country's language. A natural next step will be to test our theoretical predictions in a within-country setting.

A Analytical Derivations

A.1 Proof of Proposition 1

The probability that a voter knows h_{t+1} at the time of the election is

$$\theta\left(\nu, n\right) = 1 - \left(1 - \nu\right)^n \geq \nu \tag{A1}$$

such that

$$\frac{\partial\theta}{\partial\nu} = n\left(1 - \nu\right)^{n-1} > 0 \text{ and } \frac{\partial^2\theta}{\partial\nu^2} = -n\left(n - 1\right)\left(1 - \nu\right)^{n-1} < 0, \tag{A2}$$

and

$$\theta\left(\nu, n + 1\right) - \theta\left(\nu, n\right) = \nu\left(1 - \nu\right)^n > \theta\left(\nu, n + 2\right) - \theta\left(\nu, n + 1\right) = \nu\left(1 - \nu\right)^{n+1} > 0, \tag{A3}$$

while

$$\frac{\partial}{\partial\nu}\left[\theta\left(\nu, n + 1\right) - \theta\left(\nu, n\right)\right] = \left[1 + \left(n - 1\right)\nu\right]\left(1 - \nu\right)^{n-1} > 0. \tag{A4}$$

A.2 Solution of the Planner's Problem

To solve the planner's problem, we make an educated guess for the form of the social welfare function

$$V^*\left(s_t\right) = v_0 + v_k \log k_t + v_h \log h_t + v_\varepsilon^g \varepsilon_{t-1}^g + v_\varepsilon^h \varepsilon_{t-1}^h. \tag{A5}$$

Then the allocation of output solves

$$\max_{K,G,H}\left\{\left(1 - \gamma\right)\log\left[y\left(k_t, h_t\right) - K - G - H\right] + \gamma\log G + \beta\left(\left[v_k \log K + v_h \log H\right]\right)\right\}, \tag{A6}$$

which implies constant output shares

$$\frac{K^*\left(s_t\right)}{y\left(k_t, h_t\right)} = \frac{\beta v_k}{1 + \beta\left(v_k + v_h\right)}, \tag{A7}$$

$$\frac{G^*\left(s_t\right)}{y\left(k_t, h_t\right)} = \frac{\gamma}{1 + \beta\left(v_k + v_h\right)}, \tag{A8}$$

and

$$\frac{H^*\left(s_t\right)}{y\left(k_t, h_t\right)} = \frac{\beta v_h}{1 + \beta\left(v_k + v_h\right)}; \tag{A9}$$

the turnover rule is

$$\chi^*\left(s_t, \varepsilon_t^g, \varepsilon_t^h\right) = 1 \text{ if and only if } v_\varepsilon^g \varepsilon_t^g + v_\varepsilon^h \varepsilon_t^h \geq 0; \tag{A10}$$

and social welfare is

$$V^* (s_t) = (1 - \gamma) \log \left[\frac{1 - \gamma}{1 + \beta (v_k + v_h)} y (k_t, h_t) \right]$$

$$+ \gamma \left\{ \log \left[\frac{\gamma}{1 + \beta (v_k + v_h)} y (k_t, h_t) \right] + \varepsilon_{t-1}^g \right\}$$

$$+ \beta v_k \log \left[\frac{\beta v_k}{1 + \beta (v_k + v_h)} y (k_t, h_t) \right]$$

$$+ \beta v_h \left\{ \log \left[\frac{\beta v_h}{1 + \beta (v_k + v_h)} y (k_t, h_t) \right] + \varepsilon_{t-1}^h \right\}$$

$$+ \beta \mathbb{E} \left[v_\varepsilon^g \varepsilon_t^g + v_\varepsilon^h \varepsilon_t^h \geq 0 \right], \quad \text{(A11)}$$

where $\mathbb{E} [X \geq 0]$ denotes the partial expectation $\int_0^\infty X dF (X)$.

Thus the guess is correct for

$$v_k = \alpha [1 + \beta (v_k + v_h)], \ v_h = (1 - \alpha) [1 + \beta (v_k + v_h)], \ v_\varepsilon^g = \gamma, \ v_\varepsilon^h = \beta v_h, \quad \text{(A12)}$$

and

$$v_0 = (1 - \gamma) \log \frac{1 - \gamma}{1 + \beta (v_k + v_h)} + \gamma \log \frac{\gamma}{1 + \beta (v_k + v_h)} + \beta v_k \log \frac{\beta v_k}{1 + \beta (v_k + v_h)}$$

$$+ \beta v_h \log \frac{\beta v_h}{1 + \beta (v_k + v_h)} + [1 + \beta (v_k + v_h)] \log A + \beta \mathbb{E} \left[v_\varepsilon^g \varepsilon_t^g + v_\varepsilon^h \varepsilon_t^h \geq 0 \right]. \quad \text{(A13)}$$

Solving for the coefficients and plugging them into the expressions above yields the exact solution to the planner's problem.

Lemma A1 *The solution to the planner's problem is:*

1. The social welfare function

$$V^* (s_t) = \frac{1}{1 - \beta} \left[V_0^* + \alpha \log k_t + (1 - \alpha) \log h_t + (1 - \beta) \gamma \varepsilon_{t-1}^g + \beta (1 - \alpha) \varepsilon_{t-1}^h \right],$$

for

$$V_0^* \equiv (1 - \beta) (1 - \gamma) \log [(1 - \beta) (1 - \gamma)] + (1 - \beta) \gamma \log [(1 - \beta) \gamma] + \alpha \beta \log (\alpha \beta)$$

$$+ (1 - \alpha) \beta \log [(1 - \alpha) \beta] + \log A + \beta (1 - \beta) \mathbb{E} \left[v_\varepsilon^g \varepsilon_t^g + v_\varepsilon^h \varepsilon_t^h \geq 0 \right].$$

2. The allocation of output

$$K^* (s_t) = \alpha \beta y (k_t, h_t), \ G^* (s_t) = (1 - \beta) \gamma y (k_t, h_t), \ and \ H^* (s_t) = (1 - \alpha) \beta y (k_t, h_t).$$

3. The turnover rule

$$\chi^* \left(s_t, \varepsilon_t^g, \varepsilon_t^h\right) = 1 \ \textit{if and only if} \ \gamma \varepsilon_t^g + \frac{(1-\alpha)\beta}{1-\beta} \varepsilon_t^h \geq 0.$$

A.3 Proof of Proposition 2

To solve for the equilibrium, we make educated guesses for the functional forms of social welfare

$$V\left(s_t\right) = v_0 + v_k \log k_t + v_h \log h_t + v_\varepsilon^g \varepsilon_{t-1}^g + v_\varepsilon^h \varepsilon_{t-1}^h \tag{A14}$$

and of the value of incumbency

$$Z\left(s_t\right) = Z. \tag{A15}$$

The guess (A14) for the welfare function suffices to establish that private savings are

$$K\left(s_t, \tau_t\right) = \arg\max_K \left\{(1-\gamma)\log\left\{[1-(1-\alpha)\tau_t]\,y\left(k_t, h_t\right) - K\right\} + \beta v_k \log K\right\}$$

$$= \frac{\beta v_k}{1-\gamma+\beta v_k}\left[1-(1-\alpha)\tau_t\right]y\left(k_t, h_t\right). \tag{A16}$$

Recalling that $\mathbb{E}\omega_t^g = \mathbb{E}\omega_t^h = \mathbb{E}\varepsilon_t^h = 0$, (A14) also implies that voters' policy preferences are

$$\Delta_1\left(s_t, \tau_t, k_{t+1}, g_t, h_{t+1}\right) = v_\varepsilon^g \varepsilon^g \left(s_t, \tau_t, g_t\right) + v_\varepsilon^h \varepsilon^h \left(s_t, \tau_t, h_{t+1}\right) \tag{A17}$$

for the share θ of citizens who have observed h_{t+1}, and

$$\Delta_0\left(s_t, \tau_t, k_{t+1}, g_t\right) = v_\varepsilon^g \varepsilon^g \left(s_t, \tau_t, g_t\right) \tag{A18}$$

the remainder $1-\theta$ of voters who have not observed h_{t+1}. Then $\chi\left(s_t\right)$ as defined in Definition (1) is an indicator for

$$\Psi_t \leq v_\varepsilon^g \varepsilon^g \left(s_t, T\left(s_t\right), \left[(1-\alpha)T\left(s_t\right)y\left(k_t, h_t\right) - H\left(s_t, T\left(s_t\right)\right)\right]\exp\left(\varepsilon_{t-1}^g + \varepsilon_t^g\right)\right)$$
$$+ \theta v_\varepsilon^h \varepsilon^h \left(s_t, T\left(s_t\right), H\left(s_t, T\left(s_t\right)\right)\exp\left(\varepsilon_{t-1}^h + \varepsilon_t^h\right)\right). \tag{A19}$$

In equilibrium, regardless of the form of the welfare function, voters' inference is correct: (19) and (20) imply that

$$\varepsilon^g \left(s_t, T\left(s_t\right), \left[(1-\alpha)T\left(s_t\right)y\left(k_t, h_t\right) - H\left(s_t, T\left(s_t\right)\right)\right]\exp\left(\varepsilon_{t-1}^g + \varepsilon_t^g\right)\right) = \varepsilon_t^g \tag{A20}$$

and

$$\varepsilon^h \left(s_t, T\left(s_t\right), H\left(s_t, T\left(s_t\right)\right)\exp\left(\varepsilon_{t-1}^h + \varepsilon_t^h\right)\right) = \varepsilon_t^h. \tag{A21}$$

As a consequence, $\chi\left(s_t\right)$ is an indicator for

$$\Psi_t \leq v_\varepsilon^g \varepsilon_t^g + \theta v_\varepsilon^h \varepsilon_t^h, \tag{A22}$$

whose distribution is independent of s_t. Furthermore, the uniform distribution of Ψ_t, jointly

with Assumption (1), implies that

$$\mathbb{E}\chi\left(s_{t}\right)=\frac{1}{2}.\tag{A23}$$

The guess (A15) for the value of holding political office is then correct for a constant

$$Z=\frac{2z}{2-\beta},\tag{A24}$$

conditional on the guess (A14) for the welfare function being correct.

Given (A14) and the ensuing value of office Z, expenditure on public investment is then

$$H\left(s_{t},\tau_{t}\right)=\arg\max_{H}\left\{\begin{array}{c}\gamma\log\left[\left(1-\alpha\right)\tau_{t}y\left(k_{t},h_{t}\right)-H\right]+\beta v_{h}\log H\\+\beta\mathbb{E}\left[\left(v_{\varepsilon}^{g}\varepsilon_{t}^{g}+v_{\varepsilon}^{h}\varepsilon_{t}^{h}+Z\right)\chi\left(s_{t},\tau_{t},H\right)\right]\end{array}\right\},\tag{A25}$$

recalling that $\chi\left(s_{t},\tau_{t},H\right)$ is independent of the unobservable challenger shocks ω_{t}^{g} and ω_{t}^{h}. Moreover, the simplification for Δ_{1} and Δ_{0} found above and the inferences (19) and (20) imply that $\chi\left(s_{t},\tau_{t},H\right)$ is an indicator for

$$\Psi_{t}\leq v_{\varepsilon}^{g}\left\{\varepsilon_{t}^{g}+\log\left[\left(1-\alpha\right)\tau_{t}y\left(k_{t},h_{t}\right)-H\right]-\log\left[\left(1-\alpha\right)\tau_{t}y\left(k_{t},h_{t}\right)-H\left(s_{t},\tau_{t}\right)\right]\right\}$$
$$+\theta v_{\varepsilon}^{h}\left[\varepsilon_{t}^{h}+\log H-\log H\left(s_{t},\tau_{t}\right)\right],\quad\text{(A26)}$$

such that

$$\mathbb{E}\chi\left(s_{t},\tau_{t},H\right)=\frac{1}{2}$$
$$+\phi v_{\varepsilon}^{g}\left\{\log\left[\left(1-\alpha\right)\tau_{t}y\left(k_{t},h_{t}\right)-H\right]-\log\left[\left(1-\alpha\right)\tau_{t}y\left(k_{t},h_{t}\right)-H\left(s_{t},\tau_{t}\right)\right]\right\}$$
$$+\phi\theta v_{\varepsilon}^{h}\left[\log H-\log H\left(s_{t},\tau_{t}\right)\right],\quad\text{(A27)}$$

while

$$\mathbb{E}\left[\varepsilon_{t}^{g}\chi\left(s_{t},\tau_{t},H\right)\right]=\phi v_{\varepsilon}^{g}\sigma_{g}^{2}\text{ and }\mathbb{E}\left[\varepsilon_{t}^{h}\chi\left(s_{t},\tau_{t},H\right)\right]=\phi\theta v_{\varepsilon}^{h}\sigma_{h}^{2}.\tag{A28}$$

Plugging these in,

$$H\left(s_{t},\tau_{t}\right)=$$
$$\arg\max_{H}\left\{\left(\gamma+\beta Z\phi v_{\varepsilon}^{g}\right)\log\left[\left(1-\alpha\right)\tau_{t}y\left(k_{t},h_{t}\right)-H\right]+\beta\left(v_{h}+Z\phi\theta v_{\varepsilon}^{h}\right)\log H\right\}$$
$$=\frac{\beta\left(v_{h}+Z\phi\theta v_{\varepsilon}^{h}\right)}{\gamma+\beta\left[v_{h}+Z\phi\left(v_{\varepsilon}^{g}+\theta v_{\varepsilon}^{h}\right)\right]}\left(1-\alpha\right)\tau_{t}y\left(k_{t},h_{t}\right).\tag{A29}$$

Given the guess (A14) and the ensuing value of office Z, labor-income taxes are

$$T\left(s_{t}\right)=\arg\max_{T}\left\{\begin{array}{c}\left(1-\gamma\right)\log\left\{\left[1-\left(1-\alpha\right)T\right]y\left(k_{t},h_{t}\right)-K\left(s_{t},T\right)\right\}\\+\gamma\log\left[\left(1-\alpha\right)Ty\left(k_{t},h_{t}\right)-H\left(s_{t},T\right)\right]\\+\beta\left[v_{k}\log K\left(s_{t},T\right)+v_{h}\log H\left(s_{t},T\right)\right]\\+\beta\mathbb{E}\left[\left(v_{\varepsilon}^{g}\varepsilon_{t}^{g}+v_{\varepsilon}^{h}\varepsilon_{t}^{h}+Z\right)\chi\left(s_{t},T\right)\right]\end{array}\right\},\tag{A30}$$

where $\chi(s_t, T)$ is an indicator for

$$\Psi_t \leq v_\varepsilon^g \varepsilon_t^g + \theta v_\varepsilon^h \varepsilon_t^h, \tag{A31}$$

such that

$$\mathbb{E}\chi(s_t, T) = \frac{1}{2}, \ \mathbb{E}\left[\varepsilon_t^g \chi(s_t, T)\right] = \phi v_\varepsilon^g \sigma_g^2 \text{ and } \mathbb{E}\left[\varepsilon_t^h \chi(s_t, T)\right] = \phi \theta v_\varepsilon^h \sigma_h^2. \tag{A32}$$

Hence, considering the solutions for $K(s_t, \tau_t)$, and $H(s_t, \tau_t)$, taxes are

$$T(s_t) = \arg\max_T \left\{ (1 - \gamma + \beta v_k) \log\left[1 - (1 - \alpha)T\right] + (\gamma + \beta v_h) \log T \right\}$$

$$= \frac{1}{1 - \alpha} \frac{\gamma + \beta v_h}{1 + \beta(v_k + v_h)}. \tag{A33}$$

Finally, using the guess (A14) on the right-hand side of the recursive definition of the social welfare function itself,

$$V(s_t) = (1 - \gamma) \log\left\{ \left[1 - (1 - \alpha)T(s_t)\right] y(k_t, h_t) - K(s_t, T(s_t)) \right\}$$
$$+ \gamma \left\{ \log\left[(1 - \alpha)T(s_t) y(k_t, h_t) - H(s_t, T(s_t)) \right] + \varepsilon_{t-1}^g \right\}$$
$$+ \beta \left\{ v_k \log K(s_t, T(s_t)) + v_h \left[\log H(s_t, T(s_t)) + \varepsilon_{t-1}^h \right] \right\}$$
$$+ \beta\mathbb{E}\left[\left(v_\varepsilon^g \varepsilon_t^g + v_\varepsilon^h \varepsilon_t^h \right) \chi(s_t) \right] + \beta\mathbb{E}\left\{ \left(v_\varepsilon^g \omega_t^g + v_\varepsilon^h \omega_t^h \right)\left[1 - \chi(s_t) \right] \right\}. \tag{A34}$$

The distribution of $\chi(s_t)$ and the solutions for $K(s_t, \tau_t)$, $H(s_t, \tau_t)$, and $T(s_t)$ then imply that

$$V(s_t) = (1 - \gamma) \log\left[\frac{1 - \gamma}{1 + \beta(v_k + v_h)} y(k_t, h_t) \right]$$
$$+ \gamma \left(\log\left\{ \frac{\gamma}{1 + \beta(v_k + v_h)} \frac{(\gamma + \beta v_h)(\gamma + \beta Z \phi v_\varepsilon^g)}{\gamma[\gamma + \beta v_h + \beta Z \phi(v_\varepsilon^g + \theta v_\varepsilon^h)]} y(k_t, h_t) \right\} + \varepsilon_{t-1}^g \right)$$
$$+ \beta v_k \log\left[\frac{\beta v_k}{1 + \beta(v_k + v_h)} y(k_t, h_t) \right]$$
$$+ \beta v_h \left(\log\left\{ \frac{\beta v_h}{1 + \beta(v_k + v_h)} \frac{(\gamma + \beta v_h)(\beta v_h + \beta Z \phi \theta v_\varepsilon^h)}{\beta v_h[\gamma + \beta v_h + \beta Z \phi(v_\varepsilon^g + \theta v_\varepsilon^h)]} y(k_t, h_t) \right\} + \varepsilon_{t-1}^h \right)$$
$$+ \beta\phi\left[\left(v_\varepsilon^g \sigma_g \right)^2 + \theta\left(v_\varepsilon^h \sigma_h \right)^2 \right]. \tag{A35}$$

Recalling the Cobb-Douglas production function (15), our educated guess (A14) is correct for

$$v_k = \alpha\left[1 + \beta(v_k + v_h)\right], \ v_h = (1 - \alpha)\left[1 + \beta(v_k + v_h)\right], \ v_\varepsilon^g = \gamma, \ v_\varepsilon^h = \beta v_h, \tag{A36}$$

and

$$v_0 = (1-\gamma)\log \frac{1-\gamma}{1+\beta\left(v_k+v_h\right)} + \beta v_k \log \frac{\beta v_k}{1+\beta\left(v_k+v_h\right)}$$
$$+ \gamma \log\left\{ \frac{\gamma}{1+\beta\left(v_k+v_h\right)} \frac{(\gamma+\beta v_h)\left(\gamma+\beta Z\phi v_\varepsilon^g\right)}{\gamma\left[\gamma+\beta v_h+\beta Z\phi\left(v_\varepsilon^g+\theta v_\varepsilon^h\right)\right]} \right\}$$
$$+ \beta v_h \log\left\{ \frac{\beta v_h}{1+\beta\left(v_k+v_h\right)} \frac{(\gamma+\beta v_h)\left(\beta v_h+\beta Z\phi\theta v_\varepsilon^h\right)}{\beta v_h\left[\gamma+\beta v_h+\beta Z\phi\left(v_\varepsilon^g+\theta v_\varepsilon^h\right)\right]} \right\}$$
$$+ \left[1+\beta\left(v_k+v_h\right)\right]\log A + \beta\phi\left[\left(v_\varepsilon^g\sigma_g\right)^2 + \theta\left(v_\varepsilon^h\sigma_h\right)^2\right]. \quad (A37)$$

Solving out,

$$v_k = \frac{\alpha}{1-\beta}, \ v_h = \frac{1-\alpha}{1-\beta}, \ v_\varepsilon^g = \gamma, \ v_\varepsilon^h = \frac{(1-\alpha)\beta}{1-\beta}, \quad (A38)$$

and

$$(1-\beta)\,v_0 = (1-\beta)\,(1-\gamma)\log\left[(1-\beta)\,(1-\gamma)\right] + \alpha\beta\log\left(\alpha\beta\right)$$
$$+ (1-\beta)\,\gamma\log\left[(1-\beta)\,\gamma+\zeta\right] + (1-\alpha)\,\beta\log\left[(1-\alpha)\,\beta-\zeta\right]$$
$$+ \log A + \frac{\beta}{1-\beta}\phi\left\{\left[(1-\beta)\,\gamma\sigma_g\right]^2 + \theta\left[(1-\alpha)\,\beta\sigma_h\right]^2\right\}, \quad (A39)$$

for

$$\zeta \equiv \frac{(1-\alpha)\,\beta^2\,(1-\beta)\,\gamma Z\phi\,(1-\theta)}{(1-\beta)\,\gamma\,(1+\beta Z\phi) + (1-\alpha)\,\beta\,(1+\beta Z\phi\theta)}. \quad (A40)$$

We can collect the results above in an exact solution for all equilibrium functions.

Lemma A2 *In equilibrium:*

1. *The value of political incumbency is*

$$Z\left(s_t\right) = Z \equiv \frac{2z}{2-\beta}.$$

2. *The social welfare function is*

$$V\left(s_t\right) = \frac{1}{1-\beta}\left[V_0 + \alpha\log k_t + (1-\alpha)\log h_t + (1-\beta)\,\gamma\varepsilon_{t-1}^g + \beta\,(1-\alpha)\,\varepsilon_{t-1}^h\right],$$

   for

$$V_0 \equiv (1-\beta)\,(1-\gamma)\log\left[(1-\beta)\,(1-\gamma)\right] + \alpha\beta\log\left(\alpha\beta\right)$$
$$+ (1-\beta)\,\gamma\log\left[(1-\beta)\,\gamma+\zeta\right] + (1-\alpha)\,\beta\log\left[(1-\alpha)\,\beta-\zeta\right]$$
$$+ \log A + \beta\,(1-\beta)\,\phi\left\{\left(\gamma\sigma_g\right)^2 + \theta\left[\frac{(1-\alpha)\,\beta}{1-\beta}\sigma_h\right]^2\right\}$$

and

$$\zeta \equiv \frac{(1 - \alpha) \beta^2 (1 - \beta) \gamma Z \phi (1 - \theta)}{(1 - \beta) \gamma (1 + \beta Z \phi) + (1 - \alpha) \beta (1 + \beta Z \phi \theta)}.$$

3. Private investment follows the rule

$$K (s_t, \tau_t) = \frac{\alpha \beta}{\alpha \beta + (1 - \beta) (1 - \gamma)} [1 - (1 - \alpha) \tau_t] y (k_t, h_t).$$

4. Expenditure on public investment follows the rule

$$H (s_t, \tau_t) = \frac{(1 - \alpha) \beta - \zeta}{(1 - \alpha) \beta + (1 - \beta) \gamma} (1 - \alpha) \tau_t y (k_t, h_t).$$

5. Labor-income taxes are

$$T (s_t) = \frac{(1 - \alpha) \beta + (1 - \beta) \gamma}{1 - \alpha}.$$

Plugging the tax rule into the investment rules shows that output is allocated in constant proportions to private consumption

$$c_t = (1 - \beta) (1 - \gamma) y_t, \tag{A41}$$

private investment

$$k_{t+1} = \beta \alpha y_t, \tag{A42}$$

expenditure on public investment

$$x_t^h = [\beta (1 - \alpha) - \zeta] y_t, \tag{A43}$$

and expenditure on public services

$$x_t^g = [(1 - \beta) \gamma + \zeta] y_t. \tag{A44}$$

If $\theta = 1 \Leftrightarrow \zeta = 0$ the equilibrium allocation in Lemma A2 coincides with the first best from Lemma A1. Moreover

$$\frac{\partial \zeta}{\partial \theta} = - \frac{(1 - \alpha) \beta^2 (1 - \beta) \gamma [(1 - \alpha) \beta + (1 - \beta) \gamma] (1 + \beta Z \phi) Z \phi}{[(1 - \beta) \gamma (1 + \beta Z \phi) + (1 - \alpha) \beta (1 + \beta Z \phi \theta)]^2} < 0. \tag{A45}$$

A.4   Proof of Proposition 3

The electoral process implies that the competence of the ruling politician evolves according to

$$\hat{\eta}_t = \chi_{t-1} (\varepsilon_{t-1} + \varepsilon_t) + (1 - \chi_{t-1}) (\omega_{t-1} + \omega_t), \tag{A46}$$

where χ_{t-1} is an indicator for

$$\Psi_{t-1} \leq \gamma \varepsilon_{t-1}^g + \frac{(1-\alpha)\beta}{1-\beta} \theta \varepsilon_{t-1}^h. \tag{A47}$$

The cumulative distribution function of $\hat{\eta}_t^g$ is

$$
\begin{aligned}
\Pr\left(\hat{\eta}_t^g \leq \eta\right) &= \Pr\left[\chi_{t-1}\left(\varepsilon_{t-1}^g + \varepsilon_t^g\right) + \left(1 - \chi_{t-1}\right)\left(\omega_{t-1}^g + \omega_t^g\right) \leq \eta\right] \\
&= \Pr\left(\chi_{t-1} = 1 \wedge \varepsilon_{t-1}^g + \varepsilon_t^g \leq \eta\right) + \Pr\left(\chi_{t-1} = 0 \wedge \omega_{t-1}^g + \omega_t^g \leq \eta\right) \\
&= \Pr\left[\Psi_{t-1} \leq \gamma \varepsilon_{t-1}^g + \frac{(1-\alpha)\beta}{1-\beta}\theta\varepsilon_{t-1}^h \wedge \varepsilon_{t-1}^g + \varepsilon_t^g \leq \eta\right] \\
&\quad + \frac{1}{2}\Pr\left(\omega_{t-1}^g + \omega_t^g \leq \eta\right) \\
&= \int_{-\infty}^{\infty}\left(1 + \gamma\phi\varepsilon\right)F_g\left(\eta - \varepsilon\right)f_g\left(\varepsilon\right)d\varepsilon, \tag{A48}
\end{aligned}
$$

where $F_g\left(\varepsilon\right)$ is the cumulative distribution function of ε_t^g and $f_g\left(\varepsilon\right)$ its probability density function. Thus the distribution of $\hat{\eta}_t^g$ is independent of θ.

The cumulative distribution function of $\hat{\eta}_t^h$ is

$$\Pr\left(\hat{\eta}_t^h \leq \eta\right) = \int_{-\infty}^{\infty}\left[1 + \frac{(1-\alpha)\beta}{1-\beta}\theta\phi\varepsilon\right]F_h\left(\eta - \varepsilon\right)f_h\left(\varepsilon\right)d\varepsilon, \tag{A49}$$

where $F_h\left(\varepsilon\right)$ is the cumulative distribution function of ε_t^h and $f_h\left(\varepsilon\right)$ its probability density function. Since

$$\int_{-\infty}^{\infty}\varepsilon F_h\left(\eta - \varepsilon\right)f_h\left(\varepsilon\right)d\varepsilon = \mathbb{E}\left[\varepsilon_t^h F_h\left(\eta - \varepsilon_t^h\right)\right] < \mathbb{E}\varepsilon_t^h \mathbb{E}\left[F_h\left(\eta - \varepsilon_t^h\right)\right] = 0, \tag{A50}$$

an increase in θ induces an increase in $\hat{\eta}_t^h$ in the sense of first-order stochastic dominance.

A.5   Proof of Proposition 4

The growth rate of output is

$$\log y_{t+1} - \log y_t = \log A + (1-\alpha)\log\left[\beta\left(1-\alpha\right) - \zeta\right] + \alpha\log\left(\beta\alpha\right) + (1-\alpha)\hat{\eta}_t^h. \tag{A51}$$

The equilibrium distribution of $\hat{\eta}_t^h$ has raw moments

$$\mathbb{E}\hat{\eta}_t^h = \mathbb{E}\left(\chi_{t-1}\varepsilon_{t-1}^h\right) = \frac{(1-\alpha)\beta}{1-\beta}\theta\phi\sigma_h^2 \tag{A52}$$

and

$$
\begin{aligned}
\mathbb{E}\left[\left(\hat{\eta}_t^h\right)^2\right] &= \mathbb{E}\left[\chi_{t-1}\left(\varepsilon_{t-1}^h + \varepsilon_t^h\right)^2\right] + \mathbb{E}\left(1 - \chi_{t-1}\right)\mathbb{E}\left[\left(\omega_{t-1}^h + \omega_t^h\right)^2\right] \\
&= \mathbb{E}\left[\chi_{t-1}\left(\varepsilon_{t-1}^h\right)^2\right] + \mathbb{E}\chi_{t-1}\mathbb{E}\left[\left(\varepsilon_t^h\right)^2\right] \\
&\quad + \mathbb{E}\left(1 - \chi_{t-1}\right)\left\{\mathbb{E}\left[\left(\omega_{t-1}^h\right)^2\right] + \mathbb{E}\left[\left(\omega_t^h\right)^2\right]\right\} \\
&= \mathbb{E}\left[\chi_{t-1}\left(\varepsilon_{t-1}^h\right)^2\right] + \frac{3}{2}\sigma_h^2 \\
&= \frac{(1-\alpha)\beta}{1-\beta}\theta\phi\mathbb{E}\left[\left(\varepsilon_{t-1}^h\right)^3\right] + 2\sigma_h^2,
\end{aligned}
\tag{A53}
$$

so the variance of the growth rate is

$$
\begin{aligned}
Var\left(\log y_{t+1} - \log y_t\right) &= (1-\alpha)^2 Var\left(\hat{\eta}_t^h\right) \\
&= (1-\alpha)^2\left\{\frac{(1-\alpha)\beta}{1-\beta}\theta\phi\mathbb{E}\left[\left(\varepsilon_{t-1}^h\right)^3\right] + 2\sigma_h^2 - \left[\frac{(1-\alpha)\beta}{1-\beta}\theta\phi\sigma_h^2\right]^2\right\}.
\end{aligned}
\tag{A54}
$$

A.6   Proof of Proposition 5

Under term limits, the competence of the ruling politician $\check{\eta}_t$ is the sum of two random draws from the distribution of innovations ε. Thus $\check{\eta}_t^g$ has cumulative density function

$$
\Pr\left(\check{\eta}_t^g \leq \eta\right) = \int_{-\infty}^{\infty} F_g\left(\eta - \varepsilon\right) f_g\left(\varepsilon\right) d\varepsilon,
\tag{A55}
$$

and is, therefore, lower than $\hat{\eta}_t^g$ in the sense of first-order stochastic dominance. Similarly, $\check{\eta}_t^h$ has cumulative density function

$$
\Pr\left(\eta_t^h \leq \eta\right) = \int_{-\infty}^{\infty} F_h\left(\eta - \varepsilon\right) f_h\left(\varepsilon\right) d\varepsilon,
\tag{A56}
$$

and is, therefore, lower than $\hat{\eta}_t^g$ in the sense of first-order stochastic dominance for all $\theta > 0$.

Term-limited politicians make welfare-maximizing policy choices. The allocation of output then coincides with the solution to the planner's problem in Lemma A1.

Optimal allocations and no selection of politicians yield welfare

$$
V^T\left(s_t\right) = \frac{1}{1-\beta}\left[V_0^T + \alpha\log k_t + (1-\alpha)\log h_t + (1-\beta)\gamma\varepsilon_{t-1}^g + \beta(1-\alpha)\varepsilon_{t-1}^h\right],
\tag{A57}
$$

for

$$
\begin{aligned}
V_0^T \equiv &(1-\beta)(1-\gamma)\log\left[(1-\beta)(1-\gamma)\right] + (1-\beta)\gamma\log\left[(1-\beta)\gamma\right] + \alpha\beta\log(\alpha\beta) \\
&+ (1-\alpha)\beta\log\left[(1-\alpha)\beta\right] + \log A.
\end{aligned}
\tag{A58}
$$

Term limits increase social welfare if

$$\Delta_V \equiv (1-\beta)\gamma \log\left[1 + \frac{\zeta}{(1-\beta)\gamma}\right] + (1-\alpha)\beta \log\left[1 - \frac{\zeta}{(1-\alpha)\beta}\right]$$

$$+ \beta(1-\beta)\phi\left\{(\gamma\sigma_g)^2 + \theta\left[\frac{(1-\alpha)\beta}{1-\beta}\sigma_h\right]^2\right\} \leq 0, \quad \text{(A59)}$$

where

$$\frac{\partial \Delta_V}{\partial \zeta} = -\frac{[(1-\alpha)\beta + (1-\beta)\gamma]\zeta}{[(1-\beta)\gamma + \zeta][(1-\alpha)\beta - \zeta]} < 0 \tag{A60}$$

implies a fortiori $\partial \Delta_V / \partial \theta > 0$. At one extreme

$$\theta = 1 \Rightarrow \zeta = 0 \Rightarrow \Delta_V = \beta(1-\beta)\phi\left\{(\gamma\sigma_g)^2 + \left[\frac{(1-\alpha)\beta}{1-\beta}\sigma_h\right]^2\right\} > 0. \tag{A61}$$

At the other extreme,

$$\theta = 0 \Rightarrow \zeta = \frac{(1-\alpha)\beta^2(1-\beta)\gamma Z\phi}{(1-\beta)\gamma(1+\beta Z\phi) + (1-\alpha)\beta}; \tag{A62}$$

in the limit as $Z \to \infty$

$$(\theta = 0 \wedge Z \to \infty) \Rightarrow \zeta \to (1-\alpha)\beta \Rightarrow \Delta_V \to -\infty, \tag{A63}$$

while in the limit as $Z \to 0$

$$(\theta = 0 \wedge Z \to 0) \Rightarrow \zeta \to 0 \Rightarrow \Delta_V \to \beta(1-\beta)\phi\left\{(\gamma\sigma_g)^2 + \left[\frac{(1-\alpha)\beta}{1-\beta}\sigma_h\right]^2\right\} > 0. \tag{A64}$$

By continuity there is a threshold $\bar{\theta} \in [0,1)$ such that term limits are welfare increasing for $\theta < \bar{\theta}$. The threshold is decreasing in σ_g^2 and σ_h^2, since Δ_V is increasing in the variance of ability, and increasing in Z, since Δ_V is decreasing in career concerns:

$$\frac{\partial \zeta}{\partial Z} = \frac{(1-\alpha)\beta^2(1-\beta)\gamma[(1-\beta)\gamma + (1-\alpha)\beta]\phi(1-\theta)}{[(1-\beta)\gamma(1+\beta Z\phi) + (1-\alpha)\beta(1+\beta Z\phi\theta)]} > 0. \tag{A65}$$

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Figure 1: Public Expenditure on Education (% of GDP) and Trust
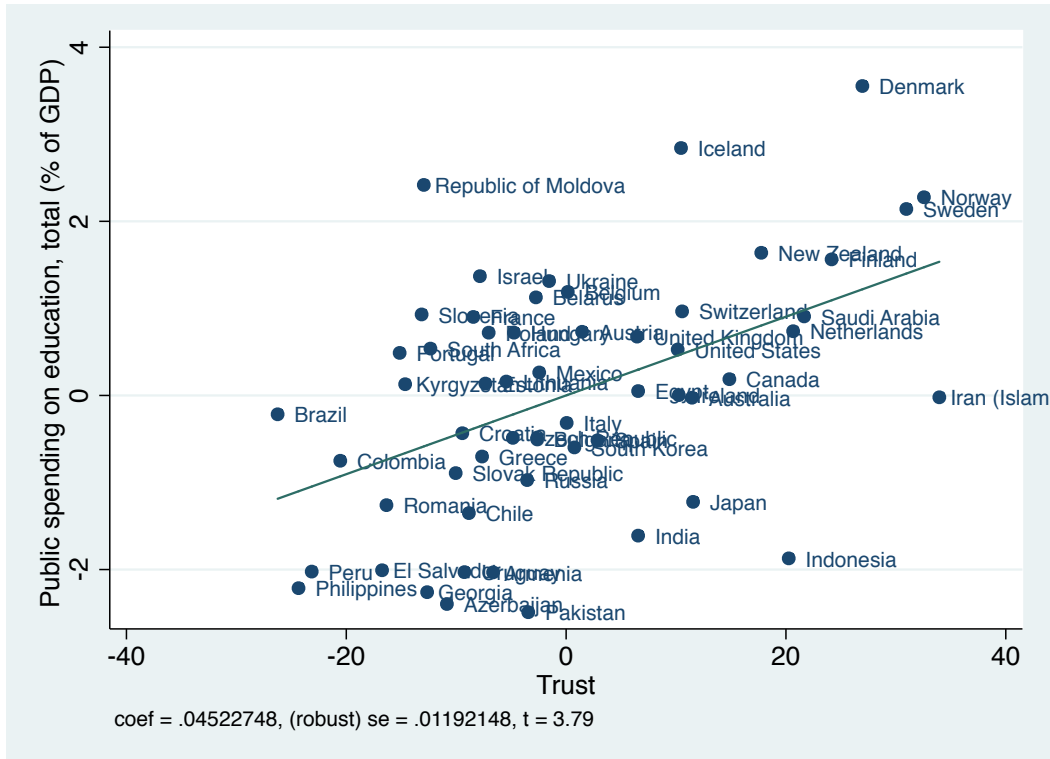
Correlation between Public spending on education, total (% of GDP) and Trust. Sources are respectively the World Development Indicators and the World Values Survey.

Table 1: Public Expenditure on Education (% of GDP) and Trust

Dependent variable:	Public expenditure on education (% of GDP)			
	(1)	(2)	(3)	(4)
Trust	0.04	0.03	0.03	0.03
	$(0.01)^{***}$	$(0.01)^{**}$	$(0.01)^{***}$	$(0.01)^{***}$
GDP per capita		0.80	0.88	0.77
		$(0.29)^{***}$	$(0.30)^{***}$	$(0.34)^{***}$
Government share of GDP			0.21	0.22
			(0.35)	(0.37)
Population				-1.17
				(0.71)
R^2	0.22	0.38	0.39	0.40
Number of obs.	55	55	55	55

$^*p \leq 0.1$, $^{**}p \leq 0.05$, $^{***}p \leq 0.01$. Standard errors are robust. The dependent variable is from the World Development Indicators. Trust is from the World Values Survey. GDP per capita, Government share of GDP and Population are from the Penn World Table.

Table 2: Instrumental Variable Approach

Dependent variable:	(1) & (3): Trust			
	(2) & (4): Public exp. on education (% of GDP)			
	First Stage	IV LIML	First Stage	IV LIML
	(1)	(2)	(3)	(4)
Pronoun drop	-12.72		-8.72	
	$(4.79)^{**}$		$(3.89)^{**}$	
Trust		0.11		0.08
		$(0.01)^{***}$		$(0.05)^{*}$
GDP per capita			7.65	0.27
			$(2.82)^{**}$	(0.76)
Government share of GDP			0.39	0.07
			(0.32)	$(0.03)^{**}$
Population			20.10	-2.33
			$(5.82)^{***}$	$(1.22)^{*}$
R^2	0.17		0.34	
Instrument F-statistic	7.08		5.01	
Number of obs.	42	42	42	42

$^*p \leq 0.1$, $^{**}p \leq 0.05$, $^{***}p \leq 0.01$. Standard errors are robust and clustered by language. Trust is from from the World Values Survey. Public expenditure on education (% of GDP) is from the World Development Indicators. The language instrument Pronoun drop is from Tabellini (2009). GDP per capita, Government share of GDP and Population are from the Penn World Table.