Social Capital, Government Expenditures, and Growth*

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Abstract

The impact of social capital on economic growth is empirically well documented. Yet the reasons for this relationship remain theoretically understudied. We present a tractable stochastic endogenous growth model that explains how social capital influences economic development. In our model, social capital increases citizens' awareness of government activity. Hence, it alleviates the electoral incentives to under-invest in education, whose returns are delayed and less visible to voters. In equilibrium, higher social capital raises the average output growth rate and reduces its volatility by increasing public investment in education while making its returns higher and less variable. Our theory also predicts that a more unequal distribution of social capital reduces public education expenditures. We provide suggestive cross-country evidence consistent with these predictions.

Keywords: Social Capital, Education Expenditures, Economic Growth, Elections, Government Expenditures, Imperfect Information

JEL classification: D72, D83, H52, I22, I25, O43, Z13

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1 Introduction

Social capital matters for economic growth (Knack and Keefer 1997; Tabellini 2009; Algan and Cahuc, 2010). However, the theoretical analysis of the precise mechanisms underpinning this relationship lags the growing body of evidence documenting it. In this paper, we present a new model of the channels through which social capital influences economic development. In our framework, lower social capital means that voters are less capable of acquiring and sharing the information required to monitor government activity. In particular, when voters are not aware of productive public investment in human capital or cannot accurately asses its returns in terms of future economic growth, they fail to reward ruling politicians for providing education expenditures. We find that the reduced monitoring ability associated with lower social capital exacerbates imperfections in political agency that cause both the amount and the productivity of public investment in education to fall below their optimal level. As a consequence, the long-run growth rate of output is permanently depressed.

Our theory accounts for several key empirical regularities. First, social capital positively affects economic growth. Second, social capital improves both political selection and politicians' incentives (Nannicini et al. 2013). Third, political-economy frictions induce insufficient public investment in education, particularly in developing countries. One key reason for such suboptimal investment is that voters underestimate its returns and thus have a distorted demand for education (Jensen 2010; Banerjee and Duflo 2011). Fourth, social capital is associated with lower volatility of output growth (Sangnier 2013). Finally, our model implies that social capital promotes economic growth by increasing productive investments in education and, hence, human capital. We document in this paper that the predicted pattern is borne out by cross-country evidence. Consistent with this fifth fact, Gennaioli et al. (2013) show that social capital loses power in predicting economic growth when differences in human capital are properly accounted for.

In our model of the political economy of government expenditures, the government provides two sets of public goods: productive investment in human capital, whose returns are delayed in time and less visible to voters, and public services that increase citizens' current utility. Politicians have stochastic productivity in providing either type of public good. The allocation of public spending is shaped by career concerns, as the incumbent tries to gain re-election by signaling his competence.

Public services generate immediate benefits to the voters, who thus perfectly observe their provision. In contrast, public investment in education yields delayed returns that only some voters correctly anticipate. Therefore, politicians reap more widespread popular support for improving public services than for productive public investment in education.

This asymmetric visibility determines two distortions. First, office-seeking politicians finance too little human-capital investment. Second, the probability of re-election of incumbent politicians rises too little with their competence at managing education expenditures.

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 and its expected returns. Second, greater social connectedness allows agents to share their information with a wider network of trusted neighbors. The increased acquisition and sharing of information makes voters more aware of all government activity and its effect on economic growth. Thus, the visibility of the two kinds of public goods becomes less asymmetric, reducing both political distortions. Politicians' incentives improve because more knowledgeable voters offer greater electoral rewards for public investment. The selection of politicians improves because their skill at managing education expenditure becomes more likely to get them re-elected.

The equilibrium of our analytically tractable model of stochastic endogenous growth establishes three main findings. First, lower social capital reduces the long-run growth rate of output by reducing government expenditure on education as a share of output. We provide empirical evidence consistent with this channel of causation, using measures of social capital based on the World Values Survey. The data bear out our theoretical prediction that countries where social capital is higher have higher public spending on education as a share of GDP. This finding holds both measuring social capital as generalized trust, and using alternative proxies more closely linked to the information-transmission mechanism highlighted by our model. To alleviate concerns of reverse causality, we show that our results are robust when we instrument social capital with language characteristics, following Licht, Goldschmidt and Schwartz (2007) and Tabellini (2008).

Our second finding is that lower social capital causes lower and more variable returns to public investment in human capital. As a consequence, not only does it reduce the average growth rate of output, but it also increases the volatility of output growth. Higher volatility is a consequence of worse political selection, because in our model endogenous government competence is the determinant of short-run fluctuations. Both our theoretical result relating social capital with volatility and the predicted channel of political selection are consistent with recent empirical evidence (Nannicini et al. 2013 and Sangnier 2013). A simple two-period model would not allow us to relate social capital to output growth volatility and to the evolution of political selection.

Finally, we establish that not only lower average social capital, but also a more unequal distribution of social capital has a detrimental effect on output growth and its volatility. The more social capital and information are concentrated in specific regions, the lower the

returns to social interaction. In such an unequal society, informed agents tend to share their knowledge with other agents who already possess it, and not with those who most need to acquire it. Therefore, within-country inequality in social capital proves hurts politicians' incentives and their selection, ultimately reducing government investment in human capital. Empirical evidence supports this prediction. We exploit regional data to construct measures of the dispersion of social capital within each country. We find that greater inequality in social capital, for a given average level, is negatively correlated with public spending on education, as predicted by our model.

This paper is connected to several strands of literature. First, economists and political scientists have documented that social capital positively affects economic development, financial development, institutional quality, and government performance (Banfield 1958; Putnam 1993, 2000; Knack and Keefer 1997; La Porta et al. 1997; Guiso, Sapienza, and Zingales 2004, 2008; Giuliano, 2007; Tabellini 2008, 2009; Gorodnichenko and Roland 2013). Second, our work is related to studies of social interactions and cultural transmission (Cavalli Sforza and Feldman 1981; Boyd and Richerson 1985; Bisin and Verdier 2000, 2001). Third, we contribute to the literature that incorporates values, beliefs and evolution into models of economic growth (Galor and Moav, 2002; Doepke and Zilibotti, 2008; Galor, Moav and Vollrath, 2009; Fogli and Veldkamp 2013).

We also contribute to the literature studying how differential visibility affects public-finance outcomes (Eisensee and Strömberg 2007; Mani and Mukand 2007; Chetty, Looney and Kroft 2009). Existing work has shown that democratic governments under-provide desirable expenditures that are relatively opaque to voters. We extend this analysis, first, by connecting asymmetric visibility with voters' social capital. Moreover, we incorporate political selection and heterogeneous social interactions into a fully fledged macroeconomic model with two types of public goods. The dynamic stochastic nature of our framework enables us to provide a rigorous new theoretical explanation for several key empirical regularities on the relationship between social capital and output growth.

Finally, our theory relates to the study of electoral incentives to pander to public opinion (Canes-Wrone, Herron, and Shotts 2001; Morris 2001; Maskin and Tirole 2004). Classic models of political pandering, however, cannot account for our results. If office-seeking politicians cater to voters' short-run preferences, distortions increase when voters more accurately observe government activity (Harrington 1993; Bonfiglioli and Gancia 2013). Instead, in our model better voter information improves policy outcomes by making politicians more responsive to voters' preferences, consistent with a growing body of empirical evidence (Besley and Burgess 2002; Adserà, Boix, and Payne 2003; Reinikka and Svensson 2005; Snyder and Strömberg 2010; Ponzetto 2011).

The paper proceeds as follows. Section 2 lays out the setting of our theoretical model. Section 3 presents the equilibrium of the model. In Section 4 we discuss the empirical content of our model. Section 5 concludes. All proofs are provided in the Appendix.

2 Setup of the Model

2.1 Economic Environment

The economic structure of our mode builds upon 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.[1] We innovate upon the classic framework by adding a novel political-economy structure. In our model, the source of stochastic fluctuations to output and growth is the endogenous competence of imperfectly monitored politicians who undertake productive investment in human capital.

We consider a closed economy 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:

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

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 labor earnings, and $\tau_t \in (0,1)$ the tax rate on labor income. Since labor supply is perfectly inelastic in our model, labor taxes coincide with non-distortive lump-sum taxes.

Firms have access to the Cobb-Douglas production technology

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

where A is an aggregate productivity shifter, while $H_{i,t}$ and $K_{i,t}$ are firm i's employment

[1] This set of assumptions is necessary for a stochastic growth model to have an exact analytical solution (Long and Plosser 1983).

respectively of human and physical capital, and $Y_{i,t}$ denotes its output. With perfectly competitive product and factor markets, each firm chooses an identical capital–labor ratio. Hence, aggregating across firms yields the neoclassical aggregate production function:

$$y_t = A h_t^{1-\alpha} k_t^{\alpha}, \tag{4}$$

where h_t is human capital, k_t physical capital, and y_t output. With an exogenous unit labor supply, each variable denotes identically an aggregate quantity and an amount per capita.

The return to capital equals

$$R_t = \alpha \frac{y_t}{k_t} + 1 - \delta = \alpha \frac{y_t}{k_t}, \tag{5}$$

taking into account that capital depreciates fully every period ($\delta = 1$). Each worker's labor earnings are

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

taking into account that each household is homogeneously endowed with h_t units of human capital.

The two types of capital are provided by different economic actors (Barro 1990). Physical capital is accumulated through private investment. In a closed economy with homogeneous agents, it coincides with household assets: $a_t = k_t$ for all t. Since capital is not durable, the dynamic budget constraint of the private sector can be rewritten

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

Human capital is produced by public investment in education. In every period the government raises revenue by levying a flat tax τ_t on labor income. It uses tax revenues to finance two types of public expenditure. First, it provides public services g_t that enter directly and contemporaneously into the citizens' utility function (equation 1). Second, it makes an investment in public education that determines the following period's stock of human capital. Intuitively, investment in public education at time t generates the human capital of the cohort of workers who will be active at time $t + 1$. Hence, human capital depreciates fully every period, just like physical capital.

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

$$x_t^g + x_t^h = (1 - \alpha)\, \tau_t y_t. \tag{8}$$

The two levels of expenditure translate into provision of public services and accumulation of human capital according to the stochastic technology

$$g_t = x_t^g \exp\left(\eta_t^g\right) \text{ and } h_{t+1} = x_t^h \exp\left(\eta_t^h\right). \tag{9}$$

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

$$\eta_t^g = \varepsilon_t^g + \varepsilon_{t-1}^g \text{ and } \eta_t^h = \varepsilon_t^h + \varepsilon_{t-1}^h. \tag{10}$$

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 that are symmetric around their mean $\mathbb{E}_t\varepsilon_t^g = \mathbb{E}_t\varepsilon_t^h = 0$. The distributions have variances $Var\left(\varepsilon_t^g\right) = \sigma_g^2$ and $Var\left(\varepsilon_t^h\right) = \sigma_h^2$, and finite supports $[-\hat{\varepsilon}_g, \hat{\varepsilon}_g]$ and $[-\hat{\varepsilon}_h, \hat{\varepsilon}_h]$ respectively.

The dynamics of competence shocks can intuitively represent an infinitely lived political party that consists of overlapping generations of politicians. In each period t, the government comprises a cohort of senior party leaders who are approaching retirement, and a cohort of rising young politicians who will take over the party leadership in the following period. The first cohort has productivity $\left(\varepsilon_{t-1}^g, \varepsilon_{t-1}^h\right)$ and the second $\left(\varepsilon_t^g, \varepsilon_t^h\right)$, so the aggregate productivity of the ruling party is $\left(\eta_t^g, \eta_t^h\right)$.

The stochastic productivity of public investment in education (η_t^g) drives short-run fluctuations in our model just as the stochastic productivity of private production (A_t) does in the classic real-business-cycle model (King, Plosser, and Rebelo 1988). Intuitively, Cobb-Douglas technology implies that all productivity shocks are Hicks neutral. Full depreciation implies that lagged shocks to capital accumulation are indistinguishable from current shocks to aggregate productivity. In our setting, however, the stochastic driver of aggregate fluctuations is no longer exogenous. The productivity of government expenditures depends both on exogenous shocks to politicians' ability and on the endogenous dynamics of their electoral success. We focus on the political frictions that affect the selection of politicians and their incentives to invest in human capital.[2]

[2]We abstain from considering productivity shocks for the private sector, which could be added without loss of tractability, because their implications are independent of the political-economy features we focus on.

2.2 The Politicians' Problem

The model contains two parallel optimization problems. On the one hand, private households choose to allocate their private budget between consumption and investment in physical capital, according to equation (7). On the other hand, the ruling politicians choose the tax rate and the allocation of the government budget between expenditure on public services and investment in human capital, according to equation (8).

We model public policy-making as the outcome of an electoral process that motivates politicians through career concerns. 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. As a consequence, a ruling politician does not make policy decisions purely to maximize social welfare. He also aims at delivering policy outcomes that signal his ability and thereby increase his chances of re-election (Holmström [1982] 1999; Alesina and Tabellini 2008).

In the standard model of political career concerns, all voters perfectly observe policy outcomes, though none observes the politician's choices underpinning them. We assume that information is even less complete, and that some voters reach the election with imperfect knowledge of policy outcomes. Thus, political incentives are shaped by the inferences of voters who reach the election with heterogeneous information (Besley and Burgess 2002; Strömberg 2004; Glaeser, Ponzetto, and Shapiro 2005; Ponzetto 2011; Boffa, Piolatto, and Ponzetto 2014; Glaeser and Ponzetto 2014). In the next section we will characterize how social capital determines incomplete and heterogeneous voter information.

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

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^g_{t-1} and ε^h_{t-1}.

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

3. Citizens choose consumption c_t and investment k_{t+1}. Simultaneously, the ruling politician chooses government expenditures x^g_t and x^h_t. No citizen can observe directly either expenditure, though all observe their sum.

4. The ruling politician's competence shocks ε^g_t and ε^h_t are realized, but they are not directly observable until the following period $t + 1$. The provision of public services g_t and the accumulation of human capital h_{t+1} are determined as a consequence.

5. All citizens observe the provision of public services g_t. Moreover, each citizen observes the returns to public investment h_{t+1} with probability $\theta \in (0,1)$; with probability $1-\theta$ he remains 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 whose ability is independently realized from the same distribution.

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 $\left(\varepsilon^g_{t-1}, \varepsilon^h_{t-1}\right)$, but nobody knows the period-t innovation $\left(\varepsilon^g_t, \varepsilon^h_t\right)$. 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 $\left(x^g_t, x^h_t\right)$, can then perfectly back out his productivity shock by comparing expenditures with results. Informed 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. 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 in vain in equilibrium because rational voters cannot be systematically fooled. Nonetheless, the possibility of off-equilibrium surprises shapes the allocation of government expenditures.

The different visibility of the two types of public goods is the key driving force in our analysis. Public services g_t generate immediate utility benefits which are directly perceived by all citizens. In contrast, public investments in human capital bear their fruits h_{t+1} only with a lag. These returns can be correctly anticipated by some voters—a fraction θ—who are better informed and characterized by higher civic engagement. The remainder $(1-\theta)$ remain unaware of the social returns to public education until they are realized. At the time of the election they cast their ballot based on rational expectations $\mathbb{E}_t h_{t+1}$ rather than actual observation of h_{t+1}.

Recent developments in the education literature support the notion that the return to public investments in education is high, but more delayed and less visible than the rest of government expenditures. This fact is particularly consistent with the finding that returns are highest for early-childhood interventions, whose fruits are the most delayed in time (Chetty et al. 2011; Cunha and Heckman 2008). Evidence from developing countries suggests that broad misperception of the returns to education is a key determinant of educational failure (Jensen 2010; Banerjee and Duflo 2011).

The asymmetric visibility of the two policy dimensions determines different electoral responses to different categories of government expenditure. Although all citizens have identical preferences and value both dimensions of government competence, voters respond differently to the same policy outcomes because of their different information. Everyone observes the current provision of public services g_t and can therefore 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 is also informed of the delayed returns to public investment h_{t+1} and can thus infer the relative competence ε_t^h as well. 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 aggregation of voters' preferences and information reflects an intensive margin of political support, following the probabilistic voting approach (Lindbeck and Weibull 1987; Persson and Tabellini 2000).[3] Each voter's preferences consist of two independent elements. 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 $\mathbb{E}_{t,i}\left(U_{t+1}|I_t\right)$ if the incumbent wins re-election, or $\mathbb{E}_{t,i}\left(U_{t+1}|C_t\right)$ if the challenger defeats him. In addition, voters are swayed by individual responsiveness $\xi_{I,t}^i$ and $\xi_{C,t}^i$ to 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 $\mathbb{E}_t^i\left(U_{t+1}|I_t\right)+\xi_{I,t}^i \geq \mathbb{E}_t^i\left(U_{t+1}|C_t\right)+\xi_{C,t}^i$.

Policy preferences can be summarized by the difference $\Delta_t^i \equiv \mathbb{E}_t^i\left(U_{t+1}|I_t\right)-\mathbb{E}_t^i\left(U_{t+1}|C_t\right)$. 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 $\Delta_t^i \geq \Psi_t+\psi_t^i$. The common shock Ψ_t is a measure of the incumbent's overall popularity, and it accounts for aggregate uncertainty in the electoral outcome. The idiosyncratic shock ψ_t^i accounts for imperfect predictability of each agent's voting decision. It is i.i.d. across voters and over time. Both shocks are symmetric around zero, so non-policy preferences do not induce a systematic pro- or anti-incumbent bias. Moreover, the support of the voters' preference shocks Ψ_t and ψ_t^i is sufficiently wide, and that of the politicians' competence shocks ε_t^g and ε_t^h sufficiently narrow, that neither the outcome of the election nor any single voter's ballot is perfectly predictable on the basis of policy outcomes g_t and h_{t+1} alone.

[3]This assumption facilitates the intuitive interpretation of a political contest with heterogeneously informed voters, but it does not drive any of our results. Our results would be qualitatively unchanged if we assumed instead that the representative (or median) voter observes the returns to public investment in education h_{t+1} with probability θ, and fails to do so with probability $1-\theta$.

Finally, we assume that both Ψ_t and ψ_t^i are uniformly distributed, and denote by ϕ the uniform density of Ψ_t.

2.3 Social Capital and Voter Information

Before analyzing the equilibrium dynamics of the economy in the political environment described in the previous section, we formalize the relationship between social capital and voters' ability to observe public investment in education and thus to 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 *Suppose that each individual independently observes the returns to public investment in education 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.*

Then, at the time of the election the probability that a voter is aware of h_{t+1} is $\theta(\nu, n) \in (\nu, 1)$. 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 $\theta(\nu, n+1) - \theta(\nu, n) > 0$). Both sources of information have decreasing returns ($\partial^2\theta/\partial\nu^2 < 0$ and $\theta(\nu, n+2) - \theta(\nu, n+1) < \theta(\nu, n+1) - \theta(\nu, n)$).

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 schooling (Reinikka and Svensson 2005) to disaster relief (Besley and Burgess 2002) and trade policy (Ponzetto 2011), as well as for politicians' individual effort (Snyder and Strömberg 2010). The prevalence of information sharing n represents a complementary social determinant of political accountability, consistent with empirical evidence that electoral punishment of misbehaving politicians increases with social capital (Nannicini et al. 2013).[4]

[4]Such empirical evidence is consistent with the view that social capital raises voter awareness of all government activity. In our model, all voters are perfectly informed of the quality of current public services g_t, regardless of their level of social capital. This simplifying assumption does not materially affect our

Decreasing returns on each dimension of social capital are intuitive. 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. As the network expands, it is increasingly likely that the marginal new member has no information that was not already being shared.

Concavity 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. Empirically, the extent of social interactions varies widely across individuals (Jackson 2010) and is characterized by stark ethnic segregation in most American cities (Echenique and Fryer 2007).

Theoretically, 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 require no changes to our model. Monitoring of public investment would simply depend on the average $E_t\theta(\nu, n_i)$ instead of the homogeneous value $\theta(\nu, n)$. By Jensen's inequality, $\mathbb{E}_t[\theta(\nu, n_i)] < \theta(\nu, \mathbb{E}_t n_i)$. Hence, in our framework, both low average levels of social capital and high inequality have detrimental effects.

2.4 Dynamic Equilibrium

The solution of our model describes the dynamic stochastic general equilibrium of the economy in terms of a welfare function and policy rules for private households. The additional political structure of our model entails that the solution also includes a value function for the ruling politician and the policy rules according to which he sets taxes and chooses public investment in education.

These political-economy functions are shaped by career concerns, as voters infer government competence from the provision of public services and the returns to human-capital investment. Given that ability follows a first-order moving average process, the incumbent's performance during his latest term in office contains all available information about his future competence. We will disregard the possibility of politicians developing a reputation for ignoring career concerns, and restrict our analysis to Markov perfect equilibria. The requirement of Markov perfection is not restrictive for economic decisions in our environment.

According to the sequence of events outlined above, agents make choices and inferences

results. Our key hypothesis is that government investment in human capital is a relatively more opaque dimension of public spending. Even if voters were imperfectly informed about all dimensions of government activity, greater social capital would make them disproportionately more knowledgeable about the more shrouded education expenditure (Glaeser and Ponzetto 2014).

as follows.

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

$$s_t \equiv \left(k_t, h_t, \varepsilon_{t-1}^g, \varepsilon_{t-1}^h\right), \tag{11}$$

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

$$y_t = y\left(k_t, h_t\right) \equiv A h_t^{1-\alpha} k_t^{\alpha}. \tag{12}$$

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

2. The government sets taxes according to the equilibrium rule

$$\tau_t = T\left(s_t\right). \tag{13}$$

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

$$k_{t+1} = K\left(s_t, \tau_t\right). \tag{14}$$

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

$$x_t^h = H\left(s_t, \tau_t\right). \tag{15}$$

Expenditure on public services is jointly determined by the public-sector budget constraint (8).

4. Public-good provision is realized according to the technology (9) and the evolution of government competence (10).

5. The observation of the state s_t, taxes τ_t, and public services g_t, jointly with rational expectations of the strategy $H\left(s_t, \tau_t\right)$, allows all voters to infer with certainty the incumbent's competence at providing public services

$$\varepsilon^g\left(s_t, \tau_t, g_t\right) \equiv \log g_t - \log\left[\left(1-\alpha\right)\tau_t y\left(k_t, h_t\right) - H\left(s_t, \tau_t\right)\right] - \varepsilon_{t-1}^g. \tag{16}$$

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 in education

$$\varepsilon^h(s_t, \tau_t, h_{t+1}) \equiv \log h_{t+1} - \log H(s_t, \tau_t) - \varepsilon^h_{t-1}. \tag{17}$$

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^h_t remains an unknown realization from the common-knowledge distribution of ability.

6. The future capital stocks 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 $\left(\varepsilon^g_t, \varepsilon^h_t\right)$ and that of the challenger, which will be denoted by $\left(\omega^g_t, \omega^h_t\right)$. 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

$$\Delta_1(s_t, \tau_t, k_{t+1}, g_t, h_{t+1}) \equiv V\left(k_{t+1}, h_{t+1}, \varepsilon^g(s_t, \tau_t, g_t), \varepsilon^h(s_t, \tau_t, h_{t+1})\right) - \mathbb{E}_t V\left(k_{t+1}, h_{t+1}, \omega^g_t, \omega^h_t\right), \tag{18}$$

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

$$\Delta_0(s_t, \tau_t, k_{t+1}, g_t) \equiv \mathbb{E}_t V\left(k_{t+1}, e^{\varepsilon^h_{t-1}+\varepsilon^h_t} H(\tau_t, s_t), \varepsilon^g(s_t, \tau_t, g_t), \varepsilon^h_t\right) - \mathbb{E}_t V\left(k_{t+1}, e^{\varepsilon^h_{t-1}+\varepsilon^h_t} H(\tau_t, s_t), \omega^g_t, \omega^h_t\right). \tag{19}$$

   Given the independent realizations of the uniform idiosyncratic shocks ψ^i_t, the incumbent is re-elected if and only if the realization of the aggregate popularity shock Ψ_t is such that

$$\Psi_t \leq \theta\Delta_1(s_t, \tau_t, k_{t+1}, g_t, h_{t+1}) + (1-\theta)\Delta_0(s_t, \tau_t, k_{t+1}, g_t). \tag{20}$$

To simplify the exposition, we give here a simplified intuitive description of the dynamic equilibrium. The complete formal definition is provided in the Appendix.

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

1. *The social welfare function V is defined recursively, given the policy rules T, K and*

H, and the equilibrium probability of the incumbent's re-election.

2. *The additional value of political incumbency Z is defined recursively, given the equilibrium probability of the incumbent's re-election.*

3. *Labor-income taxes T and expenditure on public investment H are chosen by the incumbent politician to maximize his objective function $V + Z$, which includes both social welfare and his private value of reelection Z. The politician rationally anticipates the private investment choice K as well as his re-election.*

4. *Private investment K is chosen by the representative household to maximize welfare V. The household rationally anticipates the government investment choice H as well as the incumbent's re-election.*

The first component of the dynamic equilibrium is the social welfare function, which is defined recursively taking into account the equilibrium policy rule. It is not simply defined by a Bellman equation because private citizens choose their investment in physical capital to maximize their utility—which coincides with social welfare—but politicians instead choose taxation and investment in human capital with an eye to re-election. The outcome of the election enters the welfare function because it governs whether in period $t+1$ the government has the competence of the period-t incumbent $(\varepsilon_t^g, \varepsilon_t^h)$ or his challenger's (ω_t^g, ω_t^h).

The second equilibrium component is the additional value of political incumbency that distorts politicians' choices away from social welfare maximization. Its recursive definition is simple because all the variation is coming from the probability of re-election, which responds to equilibrium policy choices and to the realization of competence shocks.

The ruling politician's policy choices take into consideration both his concern for welfare and his personal desire for re-election. The politician first sets a tax rate, which determines the budget constraints of both the private and the public sector. This choice incorporates rational expectations of the investments, both public and private, that it will induce. Then the incumbent allocates government expenditure taking into account the tax rate τ_t he had previously set and the consequent public-sector budget constraint.

Finally, households choose consumption and savings to maximize welfare. At the time of this choice, agents observe the tax rate τ_t that determines the private-sector budget constraint. Both the politicians and the representative household have rational expectations over each other's simultaneous investment choice and over electoral outcomes.

3 Equilibrium Dynamics

3.1 The Efficient Benchmark

We begin by characterizing the equilibrium in the absence of political-economy frictions. The solution to the welfare-maximizing social planner's problem provides a benchmark of first-best optimality to which the equilibrium dynamics of the decentralized economy can be compared.

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 to maximize social welfare.

Again, we give here an intuitive description of the social optimum, whose formal definition is provided in the Appendix.

Definition 2 *The solution to the planner's problem consists of a welfare function $V^*(s_t)$, a private investment rule $K^*(s_t)$, public spending rules $G^*(s_t)$ and $H^*(s_t)$, and a re-election rule such that:*

1. *The social welfare function V^* satisfies the Bellman equation for the welfare maximization problem, and the allocation of output K^*, G^*, H^* is the associated optimal policy rule.*

2. *The incumbent politician is re-elected if and only if*

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

Unlike the dynamic equilibrium of the decentralized economy characterized in Definition 1, the planner's problem is defined by a simple Bellman equation. Distortions arise from imperfections in political agency. The politician's objective does not coincide with the voters' and the benevolent planner's because he also cares for his own re-election ($z > 0$). This private concern is irrelevant for welfare maximization, both because the incumbent is a measure-zero atomistic agent, and because in any case there is a ruling politician enjoying the value of office z. His identity is irrelevant for a utilitarian social welfare function.[5]

[5]Moreover, our definition of the social optimum treats as mere flukes of electoral campaigning the non-policy factors that randomly sway voters towards or against the incumbent (Ψ_t and ψ_t^i). We assume that voters are influenced by transitory pouplarity shocks that do not truly translate into post-election welfare gains. Thus, electoral aggregation of preferences is another source of political frictions. Even fully informed

The planner's problem admits a closed-form analytical solution.

Proposition 2 *The solution to the planner's problem is characterized by:*

1. *The social welfare function*

$$V^*(s_t) = \frac{1}{1-\beta}\left\{\begin{array}{r}(1-\beta)(1-\gamma)\log[(1-\beta)(1-\gamma)] + \alpha\beta\log(\alpha\beta) \\ +(1-\beta)\gamma\log[(1-\beta)\gamma] + (1-\alpha)\beta\log[(1-\alpha)\beta] \\ +\log A + \alpha\log k_t + (1-\alpha)\log h_t \\ +(1-\beta)\gamma\varepsilon^g_{t-1} + \beta(1-\alpha)\varepsilon^h_{t-1}\end{array}\right\}$$
$$+\beta\mathbb{E}_t\left[\gamma\varepsilon^g_t + \frac{\beta}{1-\beta}(1-\alpha)\varepsilon^h_t \geq 0\right].$$

for an exogenous

$$\Gamma(\alpha,\beta,\gamma) = \begin{array}{l}(1-\beta)(1-\gamma)\log[(1-\beta)(1-\gamma)] + \alpha\beta\log(\alpha\beta) \\ +(1-\beta)\gamma\log[(1-\beta)\gamma] + (1-\alpha)\beta\log[(1-\alpha)\beta]\end{array}$$

2. *The allocation of output*

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

3. *Re-election of the incumbent politician if and only if*

$$\gamma\varepsilon^g_t + \frac{\beta}{1-\beta}(1-\alpha)\varepsilon^h_t \geq 0.$$

The model is solved by the educated guess of the tractable separable form

$$V(s_t) = v_0 + v_k\log k_t + v_h\log h_t + v^g_\varepsilon\varepsilon^g_{t-1} + v^h_\varepsilon\varepsilon^h_{t-1}. \tag{21}$$

The invariant optimal allocation of output is a standard feature of analytically tractable real-business-cycle models. With Cobb-Douglas technology and preferences, all types of consumption and investment have constant budget shares. Consumption is optimized when the ratio of expenditure on private consumption and public services equals the ratio of

voters fail to follow the welfare planner's optimal rule for the selection of politicians, which is based on inferred competence only. Alternatively, we could assume that the voters' taste shocks reflect a meaningful component of their welfare after the election. Then the outcome of the election would be welfare-maximizing if and only if voters are fully informed ($\theta = 1$). Our results would be qualitatively unaffected, and the only quantitative difference would be in the distribution of the government's optimal competence η^*_t.

their shares in the household utility function ($c_t/x_t^g = \gamma/(1-\gamma)$). Investment is optimized when the ratio of investments in private capital formation and public education equals the ratio of the shares of physical and human capital in the aggregate production function ($k_{t+1}/x_t^h = \alpha/(1-\alpha)$). With full capital depreciation every period, the allocation of output between consumption and investment is optimized when their ratio equals the ratio of the discounted weights of the current period and the infinite future in the social welfare function $((c_t + x_t^g)/\left(k_{t+1} + x_t^h\right) = (1-\beta)/\beta)$. All in all, output is optimally allocated to constant shares $c = (1-\beta)(1-\gamma)$ for private consumption, $x^g = (1-\beta)\gamma$ for government expenditure on public services, $k = \alpha\beta$ for private investment in physical capital, and $x^h = (1-\alpha)\beta$ for public investment in education.

While stochastic productivity is exogenous in the classic real-business-cycle model, the political dimension of our economy makes it endogenous to government turnover. The benevolent planner can optimally replace under-performing politicians and retain successful ones. This decision is independent of the initial state of the economy s_t, and determined exclusively by the realized competence innovations ε_t^g and ε_t^h. The weights on the two orthogonal shocks in the welfare-maximizing re-election rule are shaped by the very same consideration outlined above for the allocation of output. Government productivity in the provision of public services matters for the utility flow next period, and in proportion to the share of public services in the utility function γ. Government productivity in education investments matters for capital accumulation next period, and through it for output for the infinite future starting one period ahead (with a present value $\beta/(1-\beta)$), in proportion to the share of human capital in the production function $(1-\alpha)$.

Intuitively, the same weights appear also in the social welfare function that solves the planner's Bellman equation. Since our technology gives rise to an AK model of endogenous growth, both exogenous productivity A and the capital stock have fully persistent effects, weighted by $1/(1-\beta)$. The relative weights of the two types of capital are naturally their shares in the production function, α for physical capital k_t and $1-\alpha$ for human capital h_t. The predetermined shocks to the productivity of government expenditure on public services ε_{t-1}^g has a purely transient impact whose weight equals the utility share of public services γ. The predetermined shock to the productivity of government investment in education ε_{t-1}^h has a delayed but fully predictable effect on the future stock of human capital, whose impact on social welfare is fully persistent.

The final component of the value function highlights the welfare benefits of optimal political turnover. The benevolent planner anticipates the revelation of the competence innovations ε_t^g and ε_t^h by the end of the period. If they prove to be low, it is optimal to replace the incumbent with a fresh challenger whose ability is a random draw with mean zero on both

dimensions. However, if the incumbent is endowed with persistent high ability, welfare is maximized by retaining him and thereby ensuring that the following period's predetermined productivity is above average ($(1-\beta)\gamma\varepsilon_t^g+\beta(1-\alpha)\varepsilon_t^h \geq 0 \Leftrightarrow \chi^*\left(s_t,\varepsilon_t^g,\varepsilon_t^h\right)=1$). The value of this optimal selection rule is given precisely by the partial expectation of the combined welfare effect of the two skills when their aggregate is positive.[6]

We can complete the description of the first best by characterizing the growth path of the economy under the planner's solution.

Corollary 1 *The solution to the planner's problem defines a stochastic balanced growth path. The growth rate is*

$$\log y_{t+1} - \log y_t = \alpha\log\alpha + (1-\alpha)\log(1-\alpha) + \log A + \log\beta + (1-\alpha)\eta_t^*,$$

where the optimal competence of the ruling politician is

$$\eta_t^* = \chi^*\left(\varepsilon_{t-1}^g,\varepsilon_{t-1}^h\right)\left(\varepsilon_{t-1}^h+\varepsilon_t^h\right) + \left[1-\chi^*\left(\varepsilon_{t-1}^g,\varepsilon_{t-1}^h\right)\right]\left(\omega_{t-1}^h+\omega_t^h\right)$$

such that $\mathbb{E}_t\eta_t^* > 0$.

For any initial level of output $y_0 > 0$, the economy reaches immediately a stochastic balanced growth path. The average growth rate naturally reflects total factor productivity A and patience β, which raises the saving rate. In addition, government efficiency in providing public investment (η_t^*) is the stochastic process driving randomness in growth. Optimal re-election implies, as we have just seen, a filtering of persistent productivity shocks that endogenously increases trend growth ($\mathbb{E}_t\eta_t^* > 0$).

3.2 Public Investment and Growth

The main focus of our analysis is on distortions in public investment when political agency is imperfect. The crucial friction is that voters lack awareness of the returns to government investment in education. The lower the level of social capital, the less visible these delayed payoffs are relative to the immediate benefits of public services. As a consequence of this asymmetry, the electoral process is biased against human-capital investment.

The ensuing political-economy distortions complicate the structure of the dynamic equilibrium, as presented in Definition 1. Nonetheless, the model retains a tractable analytical solution.

[6] We denote the partial expectation by $\mathbb{E}_t[X \geq 0] \equiv \int_0^\infty X dF(X)$.

Proposition 3 *The equilibrium effect of social capital on the amount of public investment in education and government expenditure on public services is summarized by a monotone decreasing and convex function* $\zeta(\theta)$ *such that* $(1-\alpha)\beta > \zeta(0) > \zeta(1) = 0$.

The unique Markov-perfect dynamic equilibrium is characterized by:

1. *The social welfare function*

$$V(s_t) = \frac{1}{1-\beta}\left\{\begin{array}{c}(1-\beta)(1-\gamma)\log[(1-\beta)(1-\gamma)] + \alpha\beta\log(\alpha\beta) \\ +(1-\beta)\gamma\log[(1-\beta)\gamma+\zeta] + (1-\alpha)\beta\log[(1-\alpha)\beta-\zeta] \\ +\log A + \alpha\log k_t + (1-\alpha)\log h_t \\ +(1-\beta)\gamma\varepsilon_{t-1}^{g} + \beta(1-\alpha)\varepsilon_{t-1}^{h}\end{array}\right\} + \beta\phi\left\{(\gamma\sigma_g)^2 + \theta\left[\frac{(1-\alpha)\beta}{1-\beta}\sigma_h\right]^2\right\},$$

   which is monotone increasing in social capital ($\partial V/\partial\theta > 0$).

2. *The additional value of political incumbency*

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

3. *The policy rule for taxation*

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

4. *The policy rule for public investment in human capital*

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

   so the output shares of public investment in human capital and government expenditure on public services are

$$\frac{x_t^h}{y_t} = \beta(1-\alpha) - \zeta \text{ and } \frac{x_t^g}{y_t} = (1-\beta)\gamma + \zeta.$$

5. *The households' rule for private investment in physical capital*

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

so the output shares of private investment in physical capital and private consumption are

$$\frac{k_{t+1}}{y_t} = \beta\alpha \text{ and } \frac{c_t}{y_t} = (1-\beta)(1-\gamma).$$

Like the first best, the dynamic equilibrium can be characterized by guessing that the value function has the form given by equation (21). The impact of political-economy distortions is reflected in the coefficients of the welfare function, but it does not alter the overall functional form.

A second educated guess concerns the value of incumbency in the political equilibrium, which is a constant independent of the state of the economy s_t. This is an intuitive property of the model of political career concerns, which follows 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.

The exact solution for the value of incumbency $Z(s_t)$ highlights the absence of any incumbency bias. In equilibrium, each candidate has an equal ex-ante likelihood of winning each election. Thus, the expected net present value of office-holding is discounted both for a pure time preference β and for a constant hazard rate $1/2$ of losing re-election and thus terminating the otherwise infinite stream of benefits z.

The differences between the equilibrium welfare function $V(s_t)$ from Proposition 3 and the first-best welfare function $V^*(s_t)$ from Proposition 2 reflect the two distortions that arise from the asymmetric visibility of immediate public-service provision and delayed returns to human-capital. Voters cannot reward public investment in human capital if they have failed to notice or understand its delayed returns. This entails both a distortion in politicians' incentives to invest in human capital or to provide public services, and a distortion in the selection of politicians based on their skill at providing either public good.

The first distortion translates into a suboptimal allocation of output, which in turn permanently shifts down welfare as shown in the second line of the exact solution for $V(s_t)$. In equilibrium as in the first best, the GDP shares of private consumption, private investment in physical capital, public investment in human capital, and government expenditure on public services are all constant and independent of the state of the economy. However, politicians' incentives are skewed towards the provision of the more observable public services and against the less visible public investment in education. As a consequence, in equilibrium government education spending is too low a share of output ($x_t^h/y_t < \beta(1-\alpha)$). Populist

expenditure on current public service is instead too high ($x_t^g/y_t > (1-\beta)\gamma$).

If and only if social capital is so high that all citizens observe in advance the returns to public investment h_{t+1}, then the government's policy choices are undistorted by political career concerns and the allocation of output is optimal ($\zeta(1) = 0$). However, any imperfection in voters' information induces a distortion in the allocation of government expenditure. The lower is 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 while public investment x_t^h falls ($\zeta'(\theta) < 0$). The political equilibrium moves further away from the first best.

Our model thus accounts for the recent empirical evidence on the political economy of education expenditure in developing countries. A growing consensus in the literature recognizes that underinvestment in public education stems not only from supply-side problems such as government inability to fund and staff effective schools, but also from demand-side failures. Citizens routinely misunderstand what education can and should achieve. They misperceive the returns to schooling and signally underestimate the returns to primary education. Such misperception induces costly distortions in their demand for education (Jensen 2010; Banerjee and Duflo 2011).

Better information helps rectify these distortions at the individual level (Jensen 2010). Moreover, Reinikka and Svensson (2005) find that more informed voters provide an effective demand-side solution to supply-side distortions as well. Newspaper readership helps voters hold local government accountable and ensure that education expenditure is higher and more effective. Conversely, where voters are uninformed, evidence from Africa shows that central-government grants earmarked for primary schooling is overwhelmingly diverted to other uses by local officials (Reinikka and Svensson 2004, 2005).[7] Reinikka and Svensson (2004) show that under-provision of public investment in education is mitigated in areas with a higher socioeconomic status, which is also broadly consistent with the role of social capital established in our model.

Unlike the expenditure decisions, the politician's choice of a tax rate is not directly affected by political-agency considerations. In our model, politicians do not have ideological

[7]Empirically, it is unclear if the captured transfers are reallocated to other government spending programs that local politicians find more popular. It may be more likely that bureaucrats and politicians illegitimately appropriate them. Theoretically, it would be straightforward to extend our model to include a third category of government spending that only incumbent politicians benefit from. Then better monitoring by voters with higher social capital would also reduce political rent extraction, implying an even higher effect on public investment in education and on growth.

preferences for raising or lowering taxes, nor do they intrinsically prefer overseeing a larger or smaller budget. Their only motivations are welfare maximization and career concerns. To improve his prospects of re-election, the incumbent tries to demonstrate his skill. The tax rate is unaffected by these incentives because it does not signal competence, nor does it change the inference of competence from the observed realization of public-good provision, conditional on the taxes that all voters pay and thus correctly perceive.

In the equilibrium described by Proposition 3, the misallocation of government expenditure also generates no indirect effects on taxation. Both the tax rate τ, the total government budget $\left(x_t^g + x_t^h\right)/y_t$, and the output shares of private consumption c_t/y_t and private investment in physical capital k_{t+1}/y_t are invariant at their first-best levels described by Proposition 2. The political-economy distortion to the amount of public investment does not propagate to private-sector decisions because of the log-linear structure of preferences and technology, which implies unit elasticity of substitution between private and public investment.[8]

In addition to distorting the size of government investment in education, lower visibility of the returns to public education expenditure reduces its productivity by distorting the selection of politicians. In principle, voters are keen on re-electing incumbents whose competence at providing all types of public goods is high. In practice, they cannot reward productivity in managing public investment if they have failed to notice it. Rational expectations allow citizens to anticipate exactly the equilibrium allocation of government expenditure. Thus the direct observation of public-service provision g_t enables all voters to infer with certainty the true realization of the innovation ε_t^g. Analogously, knowledge of the returns to public investment h_{t+1} yields perfect inference about the realization of ε_t^h. But this knowledge belongs only to a fraction θ of the electorate, the more numerous the higher social capital.

In equilibrium, as in the first best, the incumbent's re-election χ_t is independent of the initial state of the economy s_t and determined exclusively by the realized competence innovations ε_t^g and ε_t^h. However, the importance of the latter is sub-optimally weighted by its visibility θ, so that re-election ($\chi_t = 1$) occurs if and only if

$$\Psi_t \leq \gamma \varepsilon_t^g + \frac{(1-\alpha)\,\beta}{1-\beta}\theta \varepsilon_t^h. \tag{22}$$

Lower levels of social capital make citizens less knowledgeable and thus, in a sense, more

[8] Assuming an elasticity of substitution above unity could be more realistic. Besley and Persson's (2011) analysis of the origins of state capacity shows that fiscal capacity goes hand in hand with cohesive political institutions that promote the common interest. This finding suggests that equilibrium demand for the public sector is effectively elastic: the size of government expands when the government more efficiently pursues public welfare. Qualitatively, this alternative assumption would strengthen our result that the share of output devoted to public investment rises with social capital. Quantiatively, however, it would preclude an analytical solution of the model, as is well known from the real-business-cycle literature.

cynical about politicians' efficiency in providing public investment. Uninformed voters are rationally disillusioned about the differences between rival candidates, whose competence in managing public education they perceive as identical. Thus their voting decision reflects to a greater extent random popularity shocks. Since these are pure noise, elections become less effective as a screening mechanism.

The value of social capital as a driver of the selection of better politicians is captured by the last term of the welfare function $V(s_t)$. Intuitively, screening for high ability in the provision of public investment is more valuable the more heterogeneous the skill distribution ($\partial V/\partial \sigma_h^2 > 0$). In turn, this makes a lack of social capital and voter information more detrimental ($\partial^2 V/\partial\theta\partial\sigma_h^2 > 0$).[9]

The same two distortions that drive a wedge between equilibrium welfare $V(s_t)$ in Proposition 3 and the first best $V^*(s_t)$ in Proposition 2 also entail a different growth path for the economy in the dynamic equilibrium with imperfect political agency.

Proposition 4 *The economy follows a stochastic balanced growth path. The growth rate is*

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

where the equilibrium competence of the ruling politician is

$$\hat{\eta}_t^h = \chi_{t-1}\left(\varepsilon_{t-1}^h + \varepsilon_t^h\right) + (1-\chi_{t-1})\left(\omega_{t-1}^h + \omega_t^h\right)$$

such that $\mathbb{E}_t\hat{\eta}_t^h > 0$ *provided that* $\theta > 0$.

Higher social capital and thus voter information θ *increases the growth rate of output in the sense of first-order stochastic dominance. It also reduces the variance of the output growth rate.*

In equilibrium, as in the first best, the economy reaches immediately a stochastic balanced growth path. However, a comparison with Proposition 1 establishes that the growth rate lags systematically behind the first best, and is the farther from it the lower the level of social capital. As we discussed in Proposition 3, voters' lack of information distorts politicians' incentives and thereby reduces the amount of public investment in human capital below the optimal level. This distortion to the allocation of output induces a deterministic downward shift in trend growth ($\partial(\log y_{t+1} - \log y_t)/\partial\zeta < 0$). Moreover, low social capital distorts

[9]Comparing $V(s_t)$ and $V^*(s_t)$ also shows that first-best electoral screening is not attained even with perfectly informed voters ($\theta = 1$). This is because voters remain subject to random shocks Ψ_t such that even the worst incumbent stands a chance of winning the election and the best of losing it on a wave of unpredictable popularity, independent of competence.

electoral screening and thereby reduces the productivity of government education spending below the first best. This distortion to the equilibrium competence of ruling politician entails a second downward shift in the entire distribution of the stochastic growth rate, reflected in the endogenous distribution of equilibrium competence $\hat{\eta}_t^h$. 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 concludes by establishing an intuitively appealing effect of better electoral screening on the volatility of output. When more voters are aware of the returns to public investment, politicians who are less effective 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, because 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 baseline of a symmetric distribution of innovations. Therefore, we should expect higher levels of social capital and better monitoring of politicians to lower the volatility of output growth as well as increasing its average. This theoretical prediction of our model is supported by the empirical findings of Sangnier (2013), who documents a negative correlation between trust and the standard deviation of the growth rate of real GDP per capita.

4 Empirical Evidence

The positive effects of social capital and education on economic growth are well known (Barro 1991; Knack and Keefer 1997; Tabellini 2009; Algan and Cahuc 2010; Gennaioli et al. 2013). The data also confirm the relationship between social capital and political selection as well as politicians' incentives. Nannicini et al. (2013) show that the electoral punishment of political misbehavior is considerably larger in electoral districts with high social capital, and that such misbehavior is less frequent where civic attitudes are widespread. Sangnier (2013) documents a negative correlation between trust and the standard deviation of the growth rate of real GDP per capita, which is consistent with one of the dynamic predictions of our model. Finally, empirical evidence from developing countries shows that citizens' demand for schooling is distorted by their misperception of the returns to education, and that better voter information induces higher and more effective public investment in education (Jensen 2010; Banerjee and Duflo 2011; Reinikka and Svensson 2005).

Our model connects these strands of evidence and provides a unified theoretical explanation of these observed phenomena. We do not attempt to test these predictions, which account for results already documented by the literature. Furthermore, our model yields two novel predictions that relate social capital to government expenditure on education. First, social capital and voter information should positively affect public spending on education. Second, greater heterogeneity in the distribution of social capital or voter information, for a constant average level, should decrease public spending on education.

We begin by showing in Figure 1 that public spending on education is indeed positively correlated across countries with social capital, measured by trust in strangers. This is arguably the most common measure of social capital in the literature, but not the best suited to capture the mechanism of political information transmission suggested by our model. Hence, we proceed to confirm that our results are robust to the use of various proxies for social capital that are more closely related to the information component suggested by our model. We measure social capital by the country-level average of the responses to the relevant questions in the World Values Survey Integrated Questionnaire 1981-2008.[10]

We first measure social capital by the average interest in politics across countries, and then we consider variables reflecting the probability that people in a given country acquired information during the week preceding the survey through several types of media (newspapers, news broadcasts, printed magazines, in-depth reports, books, the internet, or talking with people). The connection between such information measures and social capital has been emphasized since the beginning of the literature. For example, Putnam (1993) considers newspaper readership to be a direct proxy for social capital.

Table 2 documents the highly significant empirical relationship between social capital and government investment in education. The pattern is confirmed by visual inspection of Figures 2 and 3. The correlation is robust to controlling for population, ethnic fractionalization, inverse distance to coast and temperature. For instance, an increase of one standard deviation in the percentage of people who acquired any information by reading newspapers is associated with an increase in public spending on education by approximately 0.42 standard deviations.

We then explore whether the distribution of social capital across regions of a country has an additional association with public spending on education, as predicted by our model. Ideally, in order to construct a measure of how homogeneously social capital is distributed within countries, we would need social capital proxies at the zip-code or municipality level. Unfortunately, data at such a high level of disaggregation are not available for a broad cross-section of countries. We thus construct the variance of our measures of social capital as the

[10]Our main dataset is a cross-section of 71 countries. We focus on explaining the cross-section variation of education expenditures because the data exhibit limited variation over-time.

variation across regions, within each country, of the individual responses to the questions of interest. The regional level is the finest disaggregation at which World Values Survey data are provided.

Table 3 shows that the within-country variance of social capital has a negative association with our outcome for eight of the nine proxies considered. Although the coefficients are not always statistically significant, the results are robust to the inclusions of controls, and typically close to the level of statistical significance. The coefficients often show economically significant responses. For instance, an increase of one standard deviation of the variance of the newspapers proxy is associated with a reduction in public spending in education by approximately 0.325 standard deviations.

Evidence supporting the theoretical predictions of our model is robust across different proxies of social capital. Yet, these consistent correlations do not suffice to establish a causal link between social capital and public spending on education. In order to alleviate concerns of reverse causality, Table 4 provides a robustness check based on features of the language spoken in a country.

Recent research in linguistics suggest that systematic patterns in languages may offer a window into their speakers' dispositions. Linguists have argued that some components of language may have had an independent effect on specific cultural dimensions (Boroditsky 2000; Ozgen and Davies 2002; Zhoua et al. 2010). In particular, languages that forbid dropping the subject personal pronouns are associated with cultures that give more emphasis to the individual relative to the social context (Kashima and Kashima 1998). Licht, Goldschmidt and Schwartz (2007) and Tabellini (2008) use variation in this linguistic dimension as an instrument for social capital. With an analogous strategy, Givati and Troiano (2012) exploit gender-differentiated personal pronouns as a pre-determined instrument for attitudes toward women.[11]

Table 4 follows the same instrumental-variable strategy as Licht, Goldschmidt and Schwartz (2007) and Tabellini (2008). In column (2), we first confirm the strong, statistically significant positive correlation between social capital, now instrumented with our linguistic instrument, and public spending on education. The result obtains again with controls (column 4). Columns (1) and (3) show the first stage equations.[12]

Although culture may be affecting the long-term evolution of language, as well as vice-

[11]More broadly, the causal impact of language on economic outcomes is receiving growing attention. Chen (2013) finds that differentiation of verbal forms for the present and the future influences savings behavior through a discount-rate framing mechanism.

[12]In the specification without controls, 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.

versa, the instrument is valid in our setting so long as the distant cultural forces that were responsible for the evolution of grammatical rules on pronoun dropping—which typically date back several centuries—are not correlated with unobserved determinants of public spending on education today. Further research in linguistics ought to shed more light on the interaction between attitudes and language rules and, hence, on the plausibility of our orthogonality restriction.

5 Conclusion

Empirical evidence shows that social capital can substantially increase economic growth. Understanding the precise theoretical mechanisms behind this relationship is important to design effective growth-enhancing policies. Nonetheless, little is known about the channels through which social capital increases economic growth. This paper provides a new model and novel evidence that social capital promotes economic development by inducing productive public investments in human capital.

Under-provision of government expenditure on education arises because the returns to such investments are delayed, while households experience directly the immediate benefits from other type of public services, such as welfare or social spending. Office-seeking politicians who vie for the support of imperfectly informed voters then skew their budgetary choices towards more visible expenditures.

We have shown that higher and more equally distributed social capital makes citizens more likely to acquire and share political information. This greater awareness 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 in education 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. Our empirical analysis has shown that a country's average level of social capital is positively correlated with the percentage of GDP allocated to public investment in education. The correlation is robust to alternative proxies for social capital, including plausibly less endogenous ones such as grammatical features of a country's language. Heterogeneity in social capital across regions in a country is also consistently associated with lower education expenditures.

Our results suggest, both theoretically and empirically, that not only the average level of social capital, but also its unequal distribution affects economic growth. The economic impact of inequality in social capital is an important and hitherto unexplored topic whose

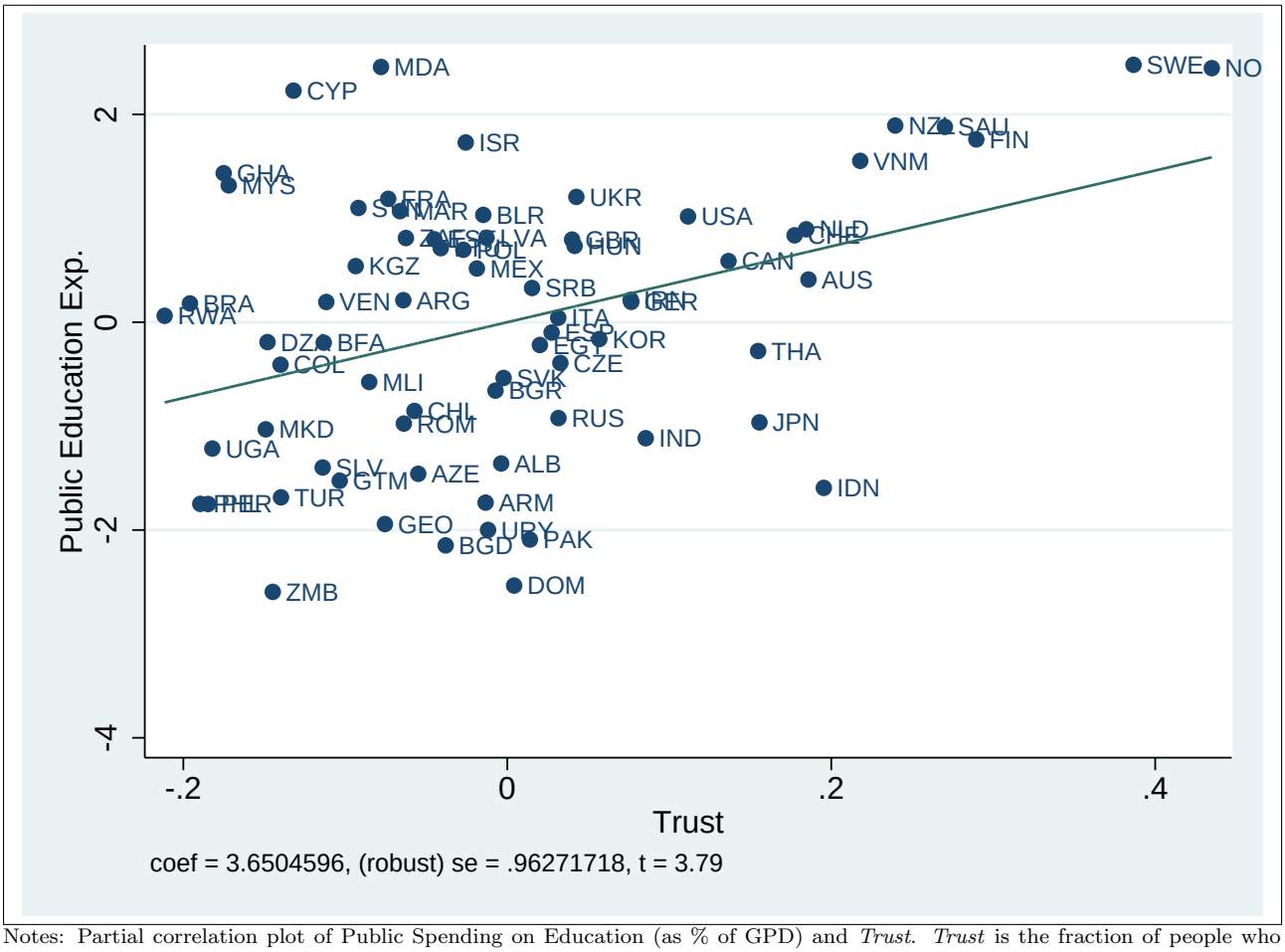
analysis this paper has just begun.

Furthermore, our findings provide an explanation based on social interactions for one of the fundamental problems in the political economy of development: underinvestment in human capital. Existing empirical evidence supports the view that better voter information promotes both individual and government investment in education (Reinikka and Svenson 2005; Jensen 2010). In this paper, we have argued that both the amount and the productivity of government education expenditure are increasing in social capital. Thus, policies aimed at fostering social capital could prove key to induce voter demand for and government supply of education, and thus to promote development.

Additionally, our dynamic model can be extended to study term-limits and electoral cycles, and we hope that future research can shed more light about the interactions between social capital, term limits and electoral cycles.

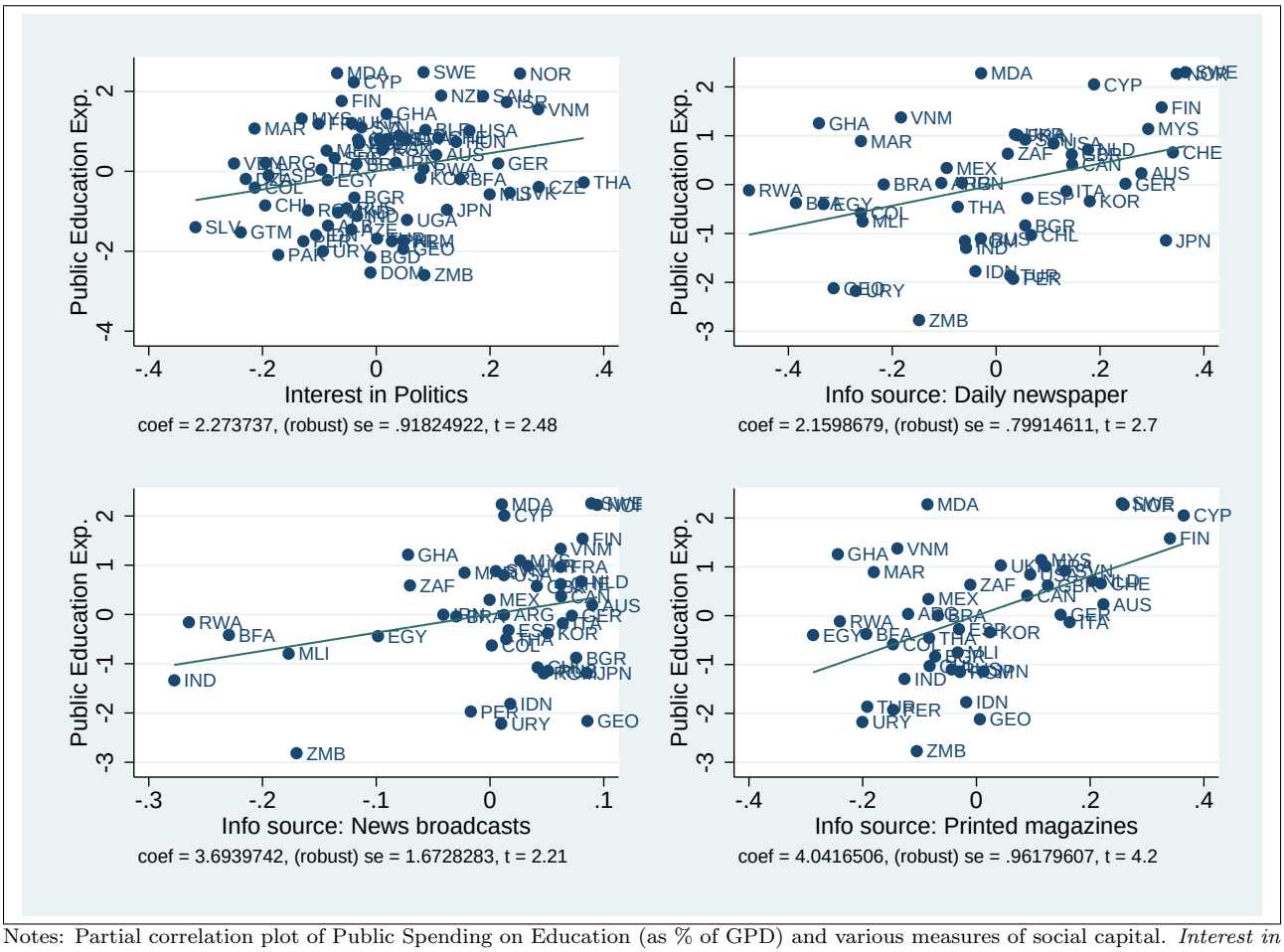
Finally, we have not formally explored the reverse impact of education on social capital. Yet, the empirical findings of Goldin and Katz (1999) and Algan, Cahuc and Shleifer (2013) are consistent with a two-way interaction between social capital and education. Such a nexus suggests the potential for a virtuous cycle of high social capital and high education expenditure, or conversely of a growth trap with mutually reinforcing low levels of both social and human capital.

Figure 1: Public Spending on Education and Trust



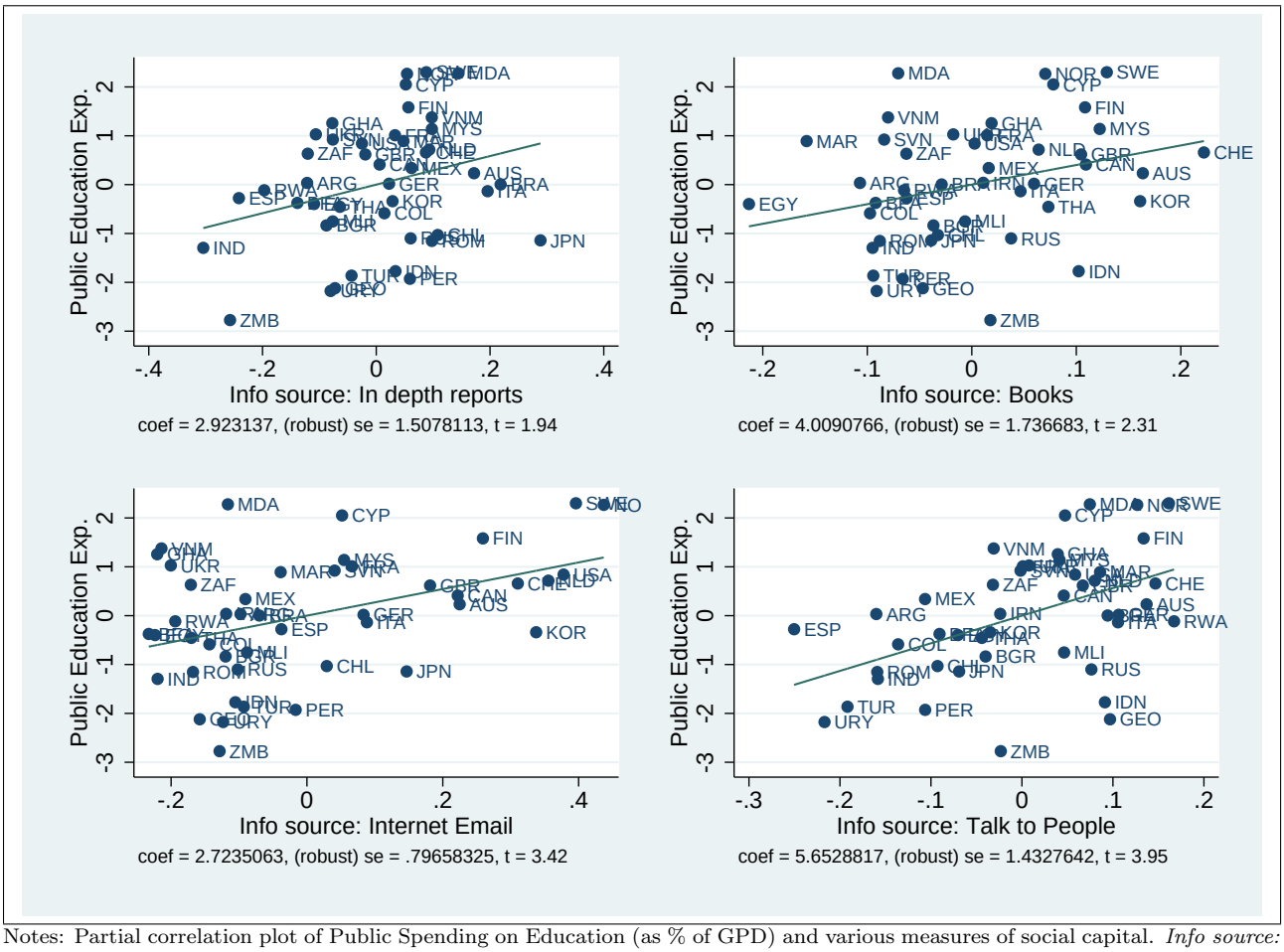
Notes: Partial correlation plot of Public Spending on Education (as % of GPD) and *Trust*. *Trust* is the fraction of people who agree with the following statement: "Most people can be trusted."

Figure 2: Public Spending on Education and Social Capital – Part 1



Notes: Partial correlation plot of Public Spending on Education (as % of GPD) and various measures of social capital. *Interest in Politics* is the fraction of people who replied positively to the question: "How interested are you in politics?" *Info source: Daily newspaper* is the fraction of people who replied positively to the question: "Did you use a daily newspaper last week to obtain information?" *Info source: News broadcasts* is the fraction of people who replied positively to the question: "Did you use news broadcasts on radio or TV last week to obtain information?" *Info source: Printed magazines* is the fraction of people who replied positively to the question: "Did you use printed magazines last week to obtain information?"

Figure 3: Public Spending on Education and Social Capital – Part 2



Notes: Partial correlation plot of Public Spending on Education (as % of GPD) and various measures of social capital. *Info source: In depth reports* is the fraction of people who replied positively to the question: "Did you use in depth reports last week to obtain information?" *Info source: Books* is the fraction of people who replied positively to the question: "Did you use books last week to obtain information?" *Info source: Internet Email* is the fraction of people who replied positively to the question: "Did you use internet or email last week to obtain information?" *Info source: Talk to People* is the fraction of people who replied positively to the question: "Did you talk with friends or colleagues last week to obtain information?"

Table 1: Summary Statistics

	(1) Mean	(2) Std. Dev.	(3) Obs.	(4) Min.	(5) Max.
Social Capital Proxies (Mean)					
Interest in Politics	0.470	0.142	71	0.153	0.835
Trust	0.260	0.138	71	0.049	0.695
Info source: Daily newspaper	0.574	0 .219	45	0.098	0.938
Info source: News broadcasts	0.891	0.094	44	0.613	0.985
Info source: Printed magazines	0.350	0.164	44	0.063	0.714
Info source: In depth reports	0.649	0.126	44	0.345	0.938
Info source: Books	0.312	0.093	45	0.099	0.534
Info source: Internet, Email	0.313	0.195	45	0.080	0.750
Info source: Talk with People	0.763	0.109	45	0.513	0.931
Pronoun Drop	0.654	0.479	43	0	1
Social Capital Proxies (Variance)					
Interest in Politics	0.114	0.047	71	0.048	0.239
Trust	0.100	0.052	71	0.021	0.281
Info source: Daily newspaper	0.102	0.049	45	0.011	0.211
Info source: News broadcasts	0.058	0.041	44	0.011	0.200
Info source: Printed magazines	0.095	0.043	44	0.028	0.196
Info source: In depth reports	0.110	0.059	44	0.014	0.231
Info source: Books	0.091	0.039	45	0.017	0.185
Info source: Internet, Email	0.094	0.041	45	0.016	0.232
Info source: Talk with People	0.106	0.060	45	0.020	0.274
Outcome					
Public Expenditures on Education	4.529	1.301	71	1.933	7.007
Controls					
Ln Population	16.803	1.436	71	13.824	20.810
Ln of Number of Ethnic Groups	1.565	0.429	71	0.693	2.303
Inverse Distance to Coast	0.829	0.135	71	0.360	0.987
Temperature	14.436	8.493	71	-5.107	28.3

Notes: *Social Proxies (Mean)* refers to the summary statistics of the average variation across countries of the measures of social capital. *Social Capital (Variance)* referes to the summary statistics of the variation of the variance (within the regions of each country) across countries. *Interest in Politics* is the fraction of people who replied positively to the question: "How interested are you in politics?" *Trust* is the fraction of people who agree with the following statement: "Most people can be trusted." *Info source: Daily newspaper* is the fraction of people who replied positively to the question: "Did you use a daily newspaper last week to obtain information?" *Info source: News broadcasts* is the fraction of people who replied positively to the question: "Did you use news broadcasts on radio or TV last week to obtain information?" *Info source: Printed magazines* is the fraction of people who replied positively to the question: "Did you use printed magazines last week to obtain information?" *Info source: In depth reports* is the fraction of people who replied positively to the question: "Did you use in depth reports last week to obtain information?" *Info source: Books* is the fraction of people who replied positively to the question: "Did you use books last week to obtain information?" *Info source: Internet Email* is the fraction of people who replied positively to the question: "Did you use internet or email last week to obtain information?" *Info source: Talk to People* is the fraction of people who replied positively to the question: "Did you talk with friends or colleagues last week to obtain information?" *Pronoun Drop* reflects whether a language allows the speaker to drop the subject personal pronoun in a sentence.

Table 2: Public Spending on Education and Social Capital

	(1)	(2)	(3)
Public Expenditures on Education (% of GDP)	**Without Controls**	**With Controls**	
Social Capital Proxy	Coefficient	Coefficient	Obs.
Interest in Politics	2.274**	2.202**	71
	(0.918)	(0.967)	
Trust	3.650***	3.555***	71
	(0.963)	(1.018)	
Info source: Daily newspaper	2.160**	2.156*	45
	(0.799)	(1.249)	
Info source: News broadcasts	3.694**	0.766	44
	(1.673)	(2.025)	
Info source: Printed magazines	4.042***	3.761***	44
	(0.962)	(1.365)	
Info source: In depth reports	2.923*	2.313	44
	(1.508)	(1.407)	
Info source: Books	4.009**	2.860	45
	(1.737)	(1.931)	
Info source: Internet, Email	2.724***	2.963***	45
	(0.797)	(1.070)	
Info source: Talk with People	5.653***	5.460***	45
	(1.433)	(1.602)	

Notes: * $p \leq 0.1$; **$p \leq 0.05$; ***$p \leq 0.01$. Standard errors are robust. The dependent variable is Public spending on education (% of GDP). *Interest in Politics* is the fraction of people who replied positively to the question: "How interested are you in politics?" *Trust* is the fraction of people who agree with the following statement: "Most people can be trusted." *Info source: Daily newspaper* is the fraction of people who replied positively to the question: "Did you use a daily newspaper last week to obtain information?" *Info source: News broadcasts* is the fraction of people who replied positively to the question: "Did you use news broadcasts on radio or TV last week to obtain information?" *Info source: Printed magazines* is the fraction of people who replied positively to the question: "Did you use printed magazines last week to obtain information?" *Info source: In depth reports* is the fraction of people who replied positively to the question: "Did you use in depth reports last week to obtain information?" *Info source: Books* is the fraction of people who replied positively to the question: "Did you use books last week to obtain information?" *Info source: Internet Email* is the fraction of people who replied positively to the question: "Did you use internet or email last week to obtain information?" *Info source: Talk to People* is the fraction of people who replied positively to the question: "Did you talk with friends or colleagues last week to obtain information?"

Table 3: Public Spending on Education and the Variance of Social Capital

	(1)	(2)	(3)
Public Expenditures on Education (% of GDP)	**Without Controls**	**With Controls**	
Social Capital Proxy	Coefficient	Coefficient	Obs.
Interest in Politics (Mean)	2.423**	2.395**	71
	(0.966)	(0.997)	
Interest in Politics (Variance)	-2.328	-2.675	
	(2.973)	(2.785)	
Trust (Mean)	3.812***	3.550***	71
	(1.080)	(1.160)	
Trust (Variance)	-1.17	0.031	
	(2.996)	(3.067)	
Info source: Daily newspaper (Mean)	1.766**	1.923	45
	(0.791)	(1.176)	
Info source: Daily newspaper (Variance)	-7.992**	-7.770*	
	(3.667)	(4.161)	
Info source: News broadcasts (Mean)	1.773	-3.216	44
	(2.588)	(4.640)	
Info source: News broadcasts (Variance)	-5.504	-8.757	
	(7.421)	(9.651)	
Info source: Printed magazines (Mean)	4.610***	4.548***	44
	(0.903)	(1.317)	
Info source: Printed magazines (Variance)	-7.016*	-7.581*	
	(4.008)	(4.314)	
Info source: In depth reports (Mean)	2.018	0.852	44
	(1.575)	(1.429)	
Info source: In depth reports (Variance)	-4.535	-6.302*	
	(3.608)	(3.477)	
Info source: Books (Mean)	4.611**	3.429*	45
	(1.875)	(2.021)	
Info source: Books (Variance)	-8.059*	-8.368*	
	(4.293)	(4.485)	
Info source: Internet, Email (Mean)	2.886***	3.345***	45
	(0.779)	(1.088)	
Info source: Internet, Email (Variance)	-5.011	-4.942	
	(4.627)	(4.448)	
Info source: Talk with People (Mean)	4.650***	4.200**	45
	(1.680)	(1.770)	
Info source: Talk with People(Variance)	-3.698	-4.907	
	(3.631)	(3.324)	

Notes: * $p \leq 0.1$; **$p \leq 0.05$; ***$p \leq 0.01$. Standard errors are robust. The dependent variable is Public spending on education (% of GDP). For each measure of social capital, *(Mean)* refers to the average variation, and *(Variance)* referes to the variance within the regions across each country. *Interest in Politics* is the fraction of people who replied positively to the question: "How interested are you in politics?" *Trust* is the fraction of people who agree with the following statement: "Most people can be trusted." *Info source: Daily newspaper* is the fraction of people who replied positively to the question: "Did you use a daily newspaper last week to obtain information?" *Info source: News broadcasts* is the fraction of people who replied positively to the question: "Did you use news broadcasts on radio or TV last week to obtain information?" *Info source: Printed magazines* is the fraction of people who replied positively to the question: "Did you use printed magazines last week to obtain information?" *Info source: In depth reports* is the fraction of people who replied positively to the question: "Did you use in depth reports last week to obtain information?" *Info source: Books* is the fraction of people who replied positively to the question: "Did you use books last week to obtain information?" *Info source: Internet Email* is the fraction of people who replied positively to the question: "Did you use internet or email last week to obtain information?" *Info source: Talk to People* is the fraction of people who replied positively to the question: "Did you talk with friends or colleagues last week to obtain information?"

Table 4: Robustness Check – Social Capital and Language

Dependent variable:	(1) & (3): Trust (2) & (4): Education		Exp.	
	First Stage	IV LIML	First Stage	IV 2SLS
	(1)	(2)	(3)	(4)
	Coefficient	Coefficient	Coefficient	Coefficient
Pronoun Drop	-0.147***		-0.144***	
	(0.050)		(0.044)	
Trust		10.971***		11.751***
		(3.267)		(3.383)
Ln Population			0.001	-0.152
			(0.016)	(0.214)
Ln of Number of Ethnic Groups			-0.109	0.763
			(0.078)	(0.678)
Inverse Distance to Coast			0.007	-0.460
			(0.294)	(3.293)
Temperature			-0.005*	0.064
			(0.003)	(0.041)
Instrument F-statistic	8.70		11.02	
Number of obs.	43	43	43	43

Notes: * p $\leq$ 0.1; **p $\leq$ 0.05; ***p $\leq$ 0.01. Standard errors are robust and clustered by language. The dependent variable is *Trust* in column (1) and (3) Public spending on education (% of GDP) in column (2) and (4). *Pronoun Drop* reflects whether a language allows the speaker to drop the subject personal pronoun in a sentence. *Trust* is the fraction of people who agree with the following statement: "Most people can be trusted."

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A Appendix [For Online Publication]

A.1 Proof of Proposition 1

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

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

such that

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

and

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

A.2 Definitions of the Equilibrium and of the Social Optimum

Let the random variable $\chi(s_t, \tau_t, k_{t+1}, g_t, h_{t+1})$ be an indicator for the event of re-election described by the condition

$$\Psi_t \leq \theta \Delta_1(s_t, \tau_t, k_{t+1}, g_t, h_{t+1}) + (1-\theta)\Delta_0(s_t, \tau_t, k_{t+1}, g_t). \tag{A4}$$

The dynamic equilibrium has the following definition.

Definition A1 *A Markov-perfect dynamic equilibrium consists of a welfare function $V(s_t)$, an additional 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 social welfare function satisfies the recursive definition*

$$\begin{aligned} V(s_t) = {} & (1-\gamma)\log\{[1-(1-\alpha)T(s_t)]y(k_t, h_t) - K(s_t, T(s_t))\} \\ & + \gamma\left\{\log[(1-\alpha)T(s_t)y(k_t, h_t) - H(s_t, T(s_t))] + \varepsilon^g_{t-1} + \mathbb{E}_t\varepsilon^g_t\right\} \\ & + \beta\mathbb{E}_t\left[\chi\left(s_t, \varepsilon^g_t, \varepsilon^h_t\right) V\left(K(s_t, T(s_t)), e^{\varepsilon^h_{t-1}+\varepsilon^h_t} H(s_t, T(s_t)), \varepsilon^g_t, \varepsilon^h_t\right)\right] \\ & + \beta\mathbb{E}_t\left\{\left[1-\chi\left(s_t, \varepsilon^g_t, \varepsilon^h_t\right)\right] V\left(K(s_t, T(s_t)), e^{\varepsilon^h_{t-1}+\varepsilon^h_t} H(s_t, T(s_t)), \omega^g_t, \omega^h_t\right)\right\}, \end{aligned}$$

where for ease of notation

$$\chi\left(s_t, \varepsilon^g_t, \varepsilon^h_t\right) \equiv \chi\begin{pmatrix} s_t, T(s_t), K(s_t, T(s_t)), \\ e^{\varepsilon^g_{t-1}+\varepsilon^g_t}\left[(1-\alpha)T(s_t)y(k_t, h_t) - H(s_t, T(s_t))\right], \\ e^{\varepsilon^h_{t-1}+\varepsilon^h_t} H(s_t, T(s_t)) \end{pmatrix}.$$

2. *The additional value of political incumbency satisfies the recursive definition*

$$Z(s_t) = z + \beta\mathbb{E}_t\left[\chi\left(s_t, \varepsilon^g_t, \varepsilon^h_t\right) Z\left(K(s_t, T(s_t)), e^{\varepsilon^h_{t-1}+\varepsilon^h_t} H(s_t, T(s_t)), \varepsilon^g_t, \varepsilon^h_t\right)\right],$$

with the same simplified notation for $\chi\left(s_t, \varepsilon_t^g, \varepsilon_t^h\right)$.

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

$$T\left(s_t\right) = \arg\max_{T} \left\{ \begin{array}{l} \left(1-\gamma\right)\log\left\{\left[1-\left(1-\alpha\right)T\right]y\left(k_t,h_t\right)-K\left(s_t,T\right)\right\} \\ \qquad +\gamma\log\left[\left(1-\alpha\right)Ty\left(k_t,h_t\right)-H\left(s_t,T\right)\right] \\ +\beta\mathbb{E}_t\left\{\chi\left(s_t,T,\varepsilon_t^g,\varepsilon_t^h\right)\left[\begin{array}{l} V\left(K\left(s_t,T\right),e^{\varepsilon_{t-1}^h+\varepsilon_t^h}H\left(s_t,T\right),\varepsilon_t^g,\varepsilon_t^h\right) \\ +Z\left(K\left(s_t,T\right),e^{\varepsilon_{t-1}^h+\varepsilon_t^h}H\left(s_t,T\right),\varepsilon_t^g,\varepsilon_t^h\right)\end{array}\right]\right\} \\ +\beta\mathbb{E}_t\left\{\left[1-\chi\left(s_t,T,\varepsilon_t^g,\varepsilon_t^h\right)\right]V\left(K\left(s_t,T\right),e^{\varepsilon_{t-1}^h+\varepsilon_t^h}H\left(s_t,T\right),\omega_t^g,\omega_t^h\right)\right\} \end{array} \right\},$$

where for ease of notation

$$\chi\left(s_t,T,\varepsilon_t^g,\varepsilon_t^h\right) \equiv \chi\left(s_t,T,K\left(s_t,T\right),e^{\varepsilon_{t-1}^g+\varepsilon_t^g}\left[\left(1-\alpha\right)Ty\left(k_t,h_t\right)-H\left(s_t,T\right)\right],e^{\varepsilon_{t-1}^h+\varepsilon_t^h}H\left(s_t,T\right)\right).$$

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

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

where for ease of notation

$$\chi\left(s_t,\tau_t,H,\varepsilon_t^g,\varepsilon_t^h\right) \equiv \chi\left(s_t,T\left(s_t\right),K\left(s_t,T\left(s_t\right)\right),e^{\varepsilon_{t-1}^g+\varepsilon_t^g}\left[\left(1-\alpha\right)\tau_t y\left(k_t,h_t\right)-H\right],e^{\varepsilon_{t-1}^h+\varepsilon_t^h}H\right).$$

5. *Private investment is chosen by utility-maximizing households:*

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

where for ease of notation

$$\chi\left(s_t, \tau_t, K, \varepsilon_t^g, \varepsilon_t^h\right) \equiv \chi\left(s_t, \tau_t, K, e^{\varepsilon_{t-1}^g + \varepsilon_t^g}\left[(1-\alpha)\tau_t y\left(k_t, h_t\right) - H\left(s_t, \tau_t\right)\right], e^{\varepsilon_{t-1}^h + \varepsilon_t^h} H\left(s_t, \tau_t\right)\right).$$

Let the binary function $\chi^*\left(s_t, \varepsilon_t^g, \varepsilon_t^h\right)$ equal one if the incumbent is retained and zero if he is replaced by a new random draw from the ability pool. The social optimum has the following characterization.

Definition A2 *The solution to the planner's problem consists of a welfare function $V^*(s_t)$, a private investment rule $K^*(s_t)$, public spending rules $G^*(s_t)$ and $H^*(s_t)$, and a re-election rule $\chi^*\left(s_t, \varepsilon_t^g, \varepsilon_t^h\right)$ such that:*

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

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

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

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

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

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

A.3 Proof of Proposition 2 and Corollary 1

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

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

Then the allocation of output solves

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

which implies constant output shares

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

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

and

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

the re-election rule is $\chi^*\left(s_t,\varepsilon_t^g,\varepsilon_t^h\right)=1$ if and only if

$$v_\varepsilon^g\varepsilon_t^g + v_\varepsilon^h\varepsilon_t^h \geq 0; \tag{A10}$$

and social welfare is

$$\begin{aligned} V^*(s_t) = (1-\gamma)\log\left[\frac{1-\gamma}{1+\beta(v_k+v_h)}y(k_t,h_t)\right] \\ +\gamma\left\{\log\left[\frac{\gamma}{1+\beta(v_k+v_h)}y(k_t,h_t)\right]+\varepsilon_{t-1}^g\right\} \\ +\beta v_k\log\left[\frac{\beta v_k}{1+\beta(v_k+v_h)}y(k_t,h_t)\right] \\ +\beta v_h\left\{\log\left[\frac{\beta v_h}{1+\beta(v_k+v_h)}y(k_t,h_t)\right]+\varepsilon_{t-1}^h\right\} \\ +\beta\mathbb{E}\left[v_\varepsilon^g\varepsilon_t^g+v_\varepsilon^h\varepsilon_t^h\geq 0\right], \end{aligned} \tag{A11}$$

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

Thus the guess is correct for

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

and

$$\begin{aligned} v_0 = (1-\gamma)\log\frac{1-\gamma}{1+\beta(v_k+v_h)}+\gamma\log\frac{\gamma}{1+\beta(v_k+v_h)}+\beta v_k\log\frac{\beta v_k}{1+\beta(v_k+v_h)} \\ +\beta v_h\log\frac{\beta v_h}{1+\beta(v_k+v_h)}+[1+\beta(v_k+v_h)]\log A+\beta\mathbb{E}\left[v_\varepsilon^g\varepsilon_t^g+v_\varepsilon^h\varepsilon_t^h\geq 0\right]. \end{aligned} \tag{A13}$$

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

The growth rate of output is

$$\log y_{t+1}-\log y_t = (1-\alpha)\log(1-\alpha)+\alpha\log\alpha+\log\beta+\log A+(1-\alpha)\eta_t^*, \tag{A14}$$

where the optimal competence of the ruling politician is

$$\eta_t^* = \chi_{t-1}^* \left(\varepsilon_{t-1}^h + \varepsilon_t^h\right) + \left(1 - \chi_{t-1}^*\right) \left(\omega_{t-1}^h + \omega_t^h\right) \tag{A15}$$

such that

$$\begin{aligned}\mathbb{E}\eta_t^* = \mathbb{E}\left(\chi_{t-1}^* \varepsilon_{t-1}^h\right) &= \int_{-\infty}^{\infty} \left[1 - F_g\left(-\frac{\beta\left(1-\alpha\right)}{\left(1-\beta\right)\gamma}\varepsilon\right)\right] \varepsilon dF_h\left(\varepsilon\right) = \\ &= \int_{-\infty}^{\infty} \left[F_g\left(0\right) - F_g\left(-\frac{\beta\left(1-\alpha\right)}{\left(1-\beta\right)\gamma}\varepsilon\right)\right] \varepsilon dF_h\left(\varepsilon\right) + \left[1 - F_g\left(0\right)\right] \int_{-\infty}^{\infty} \varepsilon dF_h\left(\varepsilon\right) \\ &= \int_{-\infty}^{\infty} \left| \left[F_g\left(0\right) - F_g\left(-\frac{\beta\left(1-\alpha\right)}{\left(1-\beta\right)\gamma}\varepsilon\right)\right] \varepsilon \right| dF_h\left(\varepsilon\right) \geq 0. \end{aligned} \tag{A16}$$

A.4 Proof of Proposition 3

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

$$V\left(s_t\right) = v_0 + v_k \log k_t + v_h \log h_t + v_\varepsilon^g \varepsilon_{t-1}^g + v_\varepsilon^h \varepsilon_{t-1}^h \tag{A17}$$

and of the value of incumbency

$$Z\left(s_t\right) = Z. \tag{A18}$$

The guess (A17) for the welfare function suffices to establish that private savings are

$$\begin{aligned} K\left(s_t, \tau_t\right) = \arg\max_K \left\{\left(1-\gamma\right) \log\left\{\left[1 - \left(1-\alpha\right)\tau_t\right] y\left(k_t, h_t\right) - K\right\} + \beta v_k \log K\right\} \\ = \frac{\beta v_k}{1 - \gamma + \beta v_k} \left[1 - \left(1-\alpha\right)\tau_t\right] y\left(k_t, h_t\right). \end{aligned} \tag{A19}$$

Recalling that $\mathbb{E}\omega_t^g = \mathbb{E}\omega_t^h = \mathbb{E}\varepsilon_t^h = 0$, (A17) also implies that voters' policy preferences are

$$\Delta_1\left(s_t, \tau_t, k_{t+1}, g_t, h_{t+1}\right) = v_\varepsilon^g \varepsilon^g\left(s_t, \tau_t, g_t\right) + v_\varepsilon^h \varepsilon^h\left(s_t, \tau_t, h_{t+1}\right) \tag{A20}$$

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

$$\Delta_0\left(s_t, \tau_t, k_{t+1}, g_t\right) = v_\varepsilon^g \varepsilon^g\left(s_t, \tau_t, g_t\right) \tag{A21}$$

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

$$\begin{aligned} \Psi_t \leq v_\varepsilon^g \varepsilon^g\left(s_t, T\left(s_t\right), \left[\left(1-\alpha\right) T\left(s_t\right) y\left(k_t, h_t\right) - H\left(s_t, T\left(s_t\right)\right)\right] \exp\left(\varepsilon_{t-1}^g + \varepsilon_t^g\right)\right) \\ + \theta v_\varepsilon^h \varepsilon^h\left(s_t, T\left(s_t\right), H\left(s_t, T\left(s_t\right)\right) \exp\left(\varepsilon_{t-1}^h + \varepsilon_t^h\right)\right). \end{aligned} \tag{A22}$$

In equilibrium, regardless of the form of the welfare function, voters' inference is correct: (16) and (17) imply that

$$\varepsilon^g\left(s_t, T\left(s_t\right), \left[\left(1-\alpha\right) T\left(s_t\right) y\left(k_t, h_t\right) - H\left(s_t, T\left(s_t\right)\right)\right] \exp\left(\varepsilon_{t-1}^g + \varepsilon_t^g\right)\right) = \varepsilon_t^g \tag{A23}$$

and

$$\varepsilon^h\left(s_t, T\left(s_t\right), H\left(s_t, T\left(s_t\right)\right) \exp\left(\varepsilon_{t-1}^h + \varepsilon_t^h\right)\right) = \varepsilon_t^h. \tag{A24}$$

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

$$\Psi_t \leq v_\varepsilon^g \varepsilon_t^g + \theta v_\varepsilon^h \varepsilon_t^h, \tag{A25}$$

whose distribution is independent of s_t.

We assume that the support of all shocks is such that neither the aggregate outcome of the election nor any single voter's ballot is perfectly predictable on the basis of g_t and h_{t+1} alone. Formally,

$$\Psi_t \sim U\left[-\frac{1}{2\phi}, \frac{1}{2\phi}\right] \text{ and } \psi_t^i \overset{iid}{\sim} U\left[-\bar{\psi}, \bar{\psi}\right] \tag{A26}$$

such that

$$\max\left\{-\frac{1}{2\phi}, \frac{1}{2\phi} - \bar{\psi}\right\} \leq -\left[\gamma\hat{\varepsilon}_g + \frac{(1-\alpha)\beta}{1-\beta}\hat{\varepsilon}_h\right] < \gamma\hat{\varepsilon}_g + \frac{(1-\alpha)\beta}{1-\beta}\hat{\varepsilon}_h \leq \min\left\{\frac{1}{2\phi}, \bar{\psi} - \frac{1}{2\phi}\right\}. \tag{A27}$$

Then the uniform distribution of Ψ_t implies that

$$\mathbb{E}\chi\left(s_t\right) = \frac{1}{2}. \tag{A28}$$

The guess (A18) for the value of holding political office is then correct for a constant

$$Z = \frac{2z}{2-\beta}, \tag{A29}$$

conditional on the guess (A17) for the welfare function being correct.

Given (A17) and the ensuing value of office Z, expenditure on public investment is then

$$H\left(s_t, \tau_t\right) = \arg\max_H \left\{ \begin{array}{c} \gamma \log\left[\left(1-\alpha\right)\tau_t y\left(k_t, h_t\right) - H\right] + \beta v_h \log H \\ +\beta\mathbb{E}\left[\left(v_\varepsilon^g \varepsilon_t^g + v_\varepsilon^h \varepsilon_t^h + Z\right)\chi\left(s_t, \tau_t, H\right)\right] \end{array} \right\}, \tag{A30}$$

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 (16) and (17) imply that $\chi\left(s_t, \tau_t, H\right)$ is an indicator for

$$\Psi_t \leq v_\varepsilon^g\left\{\varepsilon_t^g + \log\left[\left(1-\alpha\right)\tau_t y\left(k_t, h_t\right) - H\right] - \log\left[\left(1-\alpha\right)\tau_t y\left(k_t, h_t\right) - H\left(s_t, \tau_t\right)\right]\right\} + \theta v_\varepsilon^h\left[\varepsilon_t^h + \log H - \log H\left(s_t, \tau_t\right)\right], \tag{A31}$$

such that

$$\mathbb{E}\chi\left(s_t,\tau_t,H\right)=\frac{1}{2}$$
$$+\phi v_{\varepsilon}^{g}\left\{\log\left[\left(1-\alpha\right)\tau_t y\left(k_t,h_t\right)-H\right]-\log\left[\left(1-\alpha\right)\tau_t y\left(k_t,h_t\right)-H\left(s_t,\tau_t\right)\right]\right\}$$
$$+\phi\theta v_{\varepsilon}^{h}\left[\log H-\log H\left(s_t,\tau_t\right)\right], \quad \text{(A32)}$$

while

$$\mathbb{E}\left[\varepsilon_t^{g}\chi\left(s_t,\tau_t,H\right)\right]=\phi v_{\varepsilon}^{g}\sigma_g^2 \text{ and } \mathbb{E}\left[\varepsilon_t^{h}\chi\left(s_t,\tau_t,H\right)\right]=\phi\theta v_{\varepsilon}^{h}\sigma_h^2. \quad \text{(A33)}$$

Plugging these in,

$$H\left(s_t,\tau_t\right)=$$
$$\arg\max_{H}\left\{\left(\gamma+\beta Z\phi v_{\varepsilon}^{g}\right)\log\left[\left(1-\alpha\right)\tau_t y\left(k_t,h_t\right)-H\right]+\beta\left(v_h+Z\phi\theta v_{\varepsilon}^{h}\right)\log H\right\}$$
$$=\frac{\beta\left(v_h+Z\phi\theta v_{\varepsilon}^{h}\right)}{\gamma+\beta\left[v_h+Z\phi\left(v_{\varepsilon}^{g}+\theta v_{\varepsilon}^{h}\right)\right]}\left(1-\alpha\right)\tau_t y\left(k_t,h_t\right). \quad \text{(A34)}$$

Given the guess (A17) and the ensuing value of office Z, labor-income taxes are

$$T\left(s_t\right)=\arg\max_{T}\left\{\begin{array}{l}\left(1-\gamma\right)\log\left\{\left[1-\left(1-\alpha\right)T\right]y\left(k_t,h_t\right)-K\left(s_t,T\right)\right\}\\+\gamma\log\left[\left(1-\alpha\right)Ty\left(k_t,h_t\right)-H\left(s_t,T\right)\right]\\+\beta\left[v_k\log K\left(s_t,T\right)+v_h\log H\left(s_t,T\right)\right]\\+\beta\mathbb{E}\left[\left(v_{\varepsilon}^{g}\varepsilon_t^{g}+v_{\varepsilon}^{h}\varepsilon_t^{h}+Z\right)\chi\left(s_t,T\right)\right]\end{array}\right\}, \quad \text{(A35)}$$

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

$$\Psi_t\leq v_{\varepsilon}^{g}\varepsilon_t^{g}+\theta v_{\varepsilon}^{h}\varepsilon_t^{h}, \quad \text{(A36)}$$

such that

$$\mathbb{E}\chi\left(s_t,T\right)=\frac{1}{2},\ \mathbb{E}\left[\varepsilon_t^{g}\chi\left(s_t,T\right)\right]=\phi v_{\varepsilon}^{g}\sigma_g^2 \text{ and } \mathbb{E}\left[\varepsilon_t^{h}\chi\left(s_t,T\right)\right]=\phi\theta v_{\varepsilon}^{h}\sigma_h^2. \quad \text{(A37)}$$

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

$$T\left(s_t\right)=\arg\max_{T}\left\{\left(1-\gamma+\beta v_k\right)\log\left[1-\left(1-\alpha\right)T\right]+\left(\gamma+\beta v_h\right)\log T\right\}$$
$$=\frac{1}{1-\alpha}\frac{\gamma+\beta v_h}{1+\beta\left(v_k+v_h\right)}. \quad \text{(A38)}$$

Finally, using the guess (A17) on the right-hand side of the recursive definition of the

social welfare function itself,

$$\begin{aligned} V(s_t) = (1-\gamma)\log\left\{\left[1-(1-\alpha)T(s_t)\right]y(k_t,h_t) - K(s_t,T(s_t))\right\} \\ + \gamma\left\{\log\left[(1-\alpha)T(s_t)\,y(k_t,h_t) - H(s_t,T(s_t))\right] + \varepsilon_{t-1}^g\right\} \\ + \beta\left\{v_k \log K(s_t,T(s_t)) + v_h\left[\log H(s_t,T(s_t)) + \varepsilon_{t-1}^h\right]\right\} \\ + \beta\mathbb{E}\left[\left(v_\varepsilon^g\varepsilon_t^g + v_\varepsilon^h\varepsilon_t^h\right)\chi(s_t)\right] + \beta\mathbb{E}\left\{\left(v_\varepsilon^g\omega_t^g + v_\varepsilon^h\omega_t^h\right)\left[1-\chi(s_t)\right]\right\}. \quad \text{(A39)} \end{aligned}$$

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

$$\begin{aligned} V(s_t) = (1-\gamma)\log\left[\frac{1-\gamma}{1+\beta(v_k+v_h)}y(k_t,h_t)\right] \\ + \gamma\left(\log\left\{\frac{\gamma}{1+\beta(v_k+v_h)}\frac{(\gamma+\beta v_h)(\gamma+\beta Z\phi v_\varepsilon^g)}{\gamma\left[\gamma+\beta v_h+\beta Z\phi(v_\varepsilon^g+\theta v_\varepsilon^h)\right]}y(k_t,h_t)\right\} + \varepsilon_{t-1}^g\right) \\ + \beta v_k\log\left[\frac{\beta v_k}{1+\beta(v_k+v_h)}y(k_t,h_t)\right] \\ + \beta v_h\left(\log\left\{\frac{\beta v_h}{1+\beta(v_k+v_h)}\frac{(\gamma+\beta v_h)\left(\beta v_h+\beta Z\phi\theta v_\varepsilon^h\right)}{\beta v_h\left[\gamma+\beta v_h+\beta Z\phi(v_\varepsilon^g+\theta v_\varepsilon^h)\right]}y(k_t,h_t)\right\} + \varepsilon_{t-1}^h\right) \\ + \beta\phi\left[\left(v_\varepsilon^g\sigma_g\right)^2 + \theta\left(v_\varepsilon^h\sigma_h\right)^2\right]. \quad \text{(A40)} \end{aligned}$$

Recalling the Cobb-Douglas production function (12), our educated guess (A17) is correct for

$$v_k = \alpha\left[1+\beta(v_k+v_h)\right],\ v_h = (1-\alpha)\left[1+\beta(v_k+v_h)\right],\ v_\varepsilon^g = \gamma,\ v_\varepsilon^h = \beta v_h, \quad \text{(A41)}$$

and

$$\begin{aligned} v_0 = (1-\gamma)\log\frac{1-\gamma}{1+\beta(v_k+v_h)} + \beta v_k\log\frac{\beta v_k}{1+\beta(v_k+v_h)} \\ + \gamma\log\left\{\frac{\gamma}{1+\beta(v_k+v_h)}\frac{(\gamma+\beta v_h)(\gamma+\beta Z\phi v_\varepsilon^g)}{\gamma\left[\gamma+\beta v_h+\beta Z\phi(v_\varepsilon^g+\theta v_\varepsilon^h)\right]}\right\} \\ + \beta v_h\log\left\{\frac{\beta v_h}{1+\beta(v_k+v_h)}\frac{(\gamma+\beta v_h)\left(\beta v_h+\beta Z\phi\theta v_\varepsilon^h\right)}{\beta v_h\left[\gamma+\beta v_h+\beta Z\phi(v_\varepsilon^g+\theta v_\varepsilon^h)\right]}\right\} \\ + \left[1+\beta(v_k+v_h)\right]\log A + \beta\phi\left[\left(v_\varepsilon^g\sigma_g\right)^2 + \theta\left(v_\varepsilon^h\sigma_h\right)^2\right]. \quad \text{(A42)} \end{aligned}$$

Solving out,

$$v_k = \frac{\alpha}{1-\beta},\ v_h = \frac{1-\alpha}{1-\beta},\ v_\varepsilon^g = \gamma,\ v_\varepsilon^h = \frac{(1-\alpha)\beta}{1-\beta}, \quad \text{(A43)}$$

and

$$(1-\beta)\,v_0 = (1-\beta)\,(1-\gamma)\log\left[(1-\beta)\,(1-\gamma)\right] + \alpha\beta\log\left(\alpha\beta\right) + (1-\beta)\,\gamma\log\left[(1-\beta)\,\gamma+\zeta\right] + (1-\alpha)\,\beta\log\left[(1-\alpha)\,\beta-\zeta\right] + \log A + \frac{\beta}{1-\beta}\phi\left\{\left[(1-\beta)\,\gamma\sigma_g\right]^2 + \theta\left[(1-\alpha)\,\beta\sigma_h\right]^2\right\}, \quad \text{(A44)}$$

for

$$\zeta \equiv \frac{(1-\alpha)\,\beta^2\,(1-\beta)\,\gamma Z\phi\,(1-\theta)}{(1-\beta)\,\gamma\,(1+\beta Z\phi) + (1-\alpha)\,\beta\,(1+\beta Z\phi\theta)}. \quad \text{(A45)}$$

such that

$$\frac{\partial\zeta}{\partial\theta} = -\frac{(1-\alpha)\,\beta^2\,(1-\beta)\,\gamma\left[(1-\alpha)\,\beta+(1-\beta)\,\gamma\right](1+\beta Z\phi)\,Z\phi}{\left[(1-\beta)\,\gamma\,(1+\beta Z\phi) + (1-\alpha)\,\beta\,(1+\beta Z\phi\theta)\right]^2} < 0 \quad \text{(A46)}$$

and

$$\frac{\partial^2\zeta}{\partial\theta^2} = 2\frac{(1-\alpha)^2\,\beta^4\,(1-\beta)\,\gamma\left[(1-\alpha)\,\beta+(1-\beta)\,\gamma\right](1+\beta Z\phi)\,(Z\phi)^2}{\left[(1-\beta)\,\gamma\,(1+\beta Z\phi) + (1-\alpha)\,\beta\,(1+\beta Z\phi\theta)\right]^3} > 0. \quad \text{(A47)}$$

We can collect the results above in an exact solution for all equilibrium functions. The social welfare function depends on θ according to

$$\frac{\partial V}{\partial\theta} = -\frac{\left[(1-\alpha)\,\beta+(1-\beta)\,\gamma\right]\zeta}{(1-\beta)\left[(1-\alpha)\,\beta-\zeta\right]\left[(1-\beta)\,\gamma+\zeta\right]}\frac{\partial\zeta}{\partial\theta} + \beta\phi\left[\frac{(1-\alpha)\,\beta}{1-\beta}\sigma_h\right]^2 > 0. \quad \text{(A48)}$$

A.5 Proof of Proposition 4

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

$$\hat{\eta}_t = \chi_{t-1}\left(\varepsilon_{t-1}+\varepsilon_t\right) + \left(1-\chi_{t-1}\right)\left(\omega_{t-1}+\omega_t\right), \quad \text{(A49)}$$

where χ_{t-1} is an indicator for

$$\Psi_{t-1} \leq \gamma\varepsilon^g_{t-1} + \frac{(1-\alpha)\,\beta}{1-\beta}\theta\varepsilon^h_{t-1}. \quad \text{(A50)}$$

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

$$\begin{aligned}\Pr\left(\hat{\eta}^h_t \leq \eta\right) &= \Pr\left[\chi_{t-1}\left(\varepsilon^h_{t-1}+\varepsilon^h_t\right) + \left(1-\chi_{t-1}\right)\left(\omega^h_{t-1}+\omega^h_t\right) \leq \eta\right] \\ &= \Pr\left(\chi_{t-1}=1 \wedge \varepsilon^h_{t-1}+\varepsilon^h_t \leq \eta\right) + \Pr\left(\chi_{t-1}=0 \wedge \omega^h_{t-1}+\omega^h_t \leq \eta\right) \\ &= \Pr\left[\Psi_{t-1} \leq \gamma\varepsilon^g_{t-1} + \frac{(1-\alpha)\,\beta}{1-\beta}\theta\varepsilon^h_{t-1} \wedge \varepsilon^h_{t-1}+\varepsilon^h_t \leq \eta\right] + \frac{1}{2}\Pr\left(\omega^h_{t-1}+\omega^h_t \leq \eta\right) \\ &= \int_{-\infty}^{\infty}\left[1 + \frac{(1-\alpha)\,\beta}{1-\beta}\theta\phi\varepsilon\right]F_h\left(\eta-\varepsilon\right)f_h\left(\varepsilon\right)d\varepsilon, \quad \text{(A51)}\end{aligned}$$

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

$$\int_{-\infty}^{\infty} \varepsilon F_h(\eta-\varepsilon) f_h(\varepsilon)\, d\varepsilon = \mathbb{E}\left[\varepsilon_t^h F_h\left(\eta-\varepsilon_t^h\right)\right] < \mathbb{E}\varepsilon_t^h \mathbb{E}\left[F_h\left(\eta-\varepsilon_t^h\right)\right] = 0, \tag{A52}$$

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

The growth rate of output is

$$\log y_{t+1} - \log y_t = \log A + (1-\alpha)\log\left[\beta(1-\alpha)-\zeta\right] + \alpha\log(\beta\alpha) + (1-\alpha)\hat{\eta}_t^h. \tag{A53}$$

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

$$\mathbb{E}\hat{\eta}_t^h = \mathbb{E}\left(\chi_{t-1}\varepsilon_{t-1}^h\right) = \frac{(1-\alpha)\beta}{1-\beta}\theta\phi\sigma_h^2 \tag{A54}$$

and

$$\begin{aligned}
\mathbb{E}\left[\left(\hat{\eta}_t^h\right)^2\right] &= \mathbb{E}\left[\chi_{t-1}\left(\varepsilon_{t-1}^h+\varepsilon_t^h\right)^2\right] + \mathbb{E}(1-\chi_{t-1})\,\mathbb{E}\left[\left(\omega_{t-1}^h+\omega_t^h\right)^2\right] \\
&= \mathbb{E}\left[\chi_{t-1}\left(\varepsilon_{t-1}^h\right)^2\right] + \mathbb{E}\chi_{t-1}\mathbb{E}\left[\left(\varepsilon_t^h\right)^2\right] \\
&\quad +\mathbb{E}(1-\chi_{t-1})\left\{\mathbb{E}\left[\left(\omega_{t-1}^h\right)^2\right] + \mathbb{E}\left[\left(\omega_t^h\right)^2\right]\right\} \\
&= \mathbb{E}\left[\chi_{t-1}\left(\varepsilon_{t-1}^h\right)^2\right] + \frac{3}{2}\sigma_h^2 \\
&= \frac{(1-\alpha)\beta}{1-\beta}\theta\phi\mathbb{E}\left[\left(\varepsilon_{t-1}^h\right)^3\right] + 2\sigma_h^2,
\end{aligned} \tag{A55}$$

so the variance of the output growth rate is

$$\begin{aligned}
Var\left(\log y_{t+1} - \log y_t\right) &= (1-\alpha)^2 Var\left(\hat{\eta}_t^h\right) \\
&= (1-\alpha)^2\left\{\frac{(1-\alpha)\beta}{1-\beta}\theta\phi\mathbb{E}\left[\left(\varepsilon_{t-1}^h\right)^3\right] + 2\sigma_h^2 - \left[\frac{(1-\alpha)\beta}{1-\beta}\theta\phi\sigma_h^2\right]^2\right\} \\
&== (1-\alpha)^2\left\{2\sigma_h^2 - \left[\frac{(1-\alpha)\beta}{1-\beta}\theta\phi\sigma_h^2\right]^2\right\},
\end{aligned} \tag{A56}$$

given that $\mathbb{E}\left[\left(\varepsilon_{t-1}^h\right)^3\right] = 0$ since the distribution of ε_{t-1}^h is symmetric around $\mathbb{E}\varepsilon_{t-1}^h = 0$.

Table A1: Description and Sources of the Variables

Variable	**Definition and measure**	**Source**
Public Expenditures on Education	Total public expenditures on education expressed as a percentage of the GDP between 2000 and 2010.	WDI
Interest in Politics	Answer to "How interested are you in politics?" 1 for "very interested" and "somewhat interested;" 0 for "not very interested" and "not at all interested."	WVS
Trust	Answer to "Can most people be trusted?" 1 for "most people can be trusted;" 0 for "can't be too careful."	WVS
Info source: Daily newspaper	Answer to "Did you use a daily newspaper last week to obtain information?" 1 for "used last week;" 0 for "not used last week."	WVS
Info source: News broadcasts	Answer to "Did you use news broadcasts on radio or TV last week to obtain information?" 1 for "used last week;" 0 for "not used last week."	WVS
Info source: Printed magazines	Answer to "Did you use printed magazines last last week to obtain information?" 1 for "used last week;" 0 for "not used last week."	WVS
Info source: In depth reports	Answer to "Did you use in depth reports on radio or TV last week to obtain information?" 1 for "used last week;" 0 for "not used last week."	WVS
Info source: Books	Answer to "Did you use books last week to obtain information?" 1 for "used last week;" 0 for "not used last week."	WVS
Info source: Internet, Email	Answer to "Did you use internet or email last week to obtain information?" 1 for "used last week;" 0 for "not used last week."	WVS
Info source: Talk with People	Answer to "Did you talk with friends or colleagues last week to obtain information?" 1 for "used last week;" 0 for "not used last week."	WVS
Pronoun Drop	1 for languages allowing the speaker to choose whether or not to use a pronoun in a sentence. 0 for languages that make the use of subject pronouns obligatory.	Tabellini (2008)
Ln Population	Log of the number of inhabitants in the region in 2005. Data for years without census data is interpolated and extrapolated from the available census data for the period 1990 to 2008.	Gennaioli et al. (2013)
Ln of Number of Ethnic Groups	The log of the number of ethnic groups within the country.	Alesina et al. (2003)
Inverse distance to coast	The ratio of 1 over 1 plus the average distance of the region to the nearest coastline in thousands of kilometers.	Gennaioli et al. (2013)
Temperature	Average temperature by country during the period 1950 to 2000 in degrees Celsius.	Gennaioli et al. (2013)

Notes: WDI stands for *World Development Indicators*. WVS stands for *World Values Survey*.