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Governance, Social Infrastructure, and Productivity*

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Abstract

I develop a neoclassical growth model in which the government accumulates contestable social infrastructure. In this framework, both a more accountable and more fairness governance encourages governmental accumulation of social infrastructure which fosters productivity. According to the calibrated model, for a country in the lower decile of the distribution of the index of social infrastructure, improving governance fairness by one standard deviation increases, on average, social infrastructure by 84% and GDP per worker by around 38%. However, the quantitative impact of improving governance accountability on social infrastructure and productivity is negligible.

Keywords: Governance, productivity, rent-seeking, social infrastructure.

JEL classification: O10, O43, O57.

1 Introduction

Good public governance is crucial for the prosperity of nations (Olson (1993)) because governments are in charge of setting and maintaining the formal economic institutional

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structure of society, which shapes human behavior (North (1990)) and, consequently, determines resource allocation. Using the terminology of Hall and Jones (1999), the governments are in charge of social infrastructure. Social infrastructure refers to the institutions and government policies that determine the economic environment within which individuals accumulate skills, and firms accumulate capital and produce output (Hall and Jones, 1999).[1] While, governments set and maintain social infrastructure, it must also be recognized that, quite often, individuals or groups with competing interests engage in a contest to influence political or bureaucratic decisions in their favor (Olson (2000)). The theory of rent-seeking (Tullock, 1967) views contests as an inevitable feature of political discretion. Therefore, it should come as no surprise that weaker states also display higher levels of corruption (Shleifer and Vishny (1993)).

Empirical evidence suggests that good governance is positively related to economic development. Table 1 displays the coefficients of correlation between six governance indicators, Total Factor Productivity (TFP), Gross Domestic Product (GDP) per worker and an index of social infrastructure for a sample of 157 countries (Panel (a)) as well as the average values of these variables for the deciles of the distribution of the index of social infrastructure (Panel (b)).[2] The coefficients of correlation between the governance indicators and both TFP and GDP per worker are positive and high. Keefer (2004) reviews the economic literature on governance and argues that a growing body of evidence points to governance failures as a root cause of slow and inequitable economic growth as well as a defining characteristic of most poor countries. Gradstein (2004) also surveys some works presenting empirical evidence that the quality of governance has a robust effect on growth.

The objective of this work is to analyze the relationship between governance, social infrastructure and productivity and to evaluate the extent to which differences in governance can account for cross-country differences in social infrastructure and productivity.

[1] Hall and Jones (1999) include not only institutions but also policies in their concept of social infrastructure. The inclusion of policies is controversial. However, Baland et al. (2010) justify this by arguing that policies, like institutions, are chosen by those with political power and they have a large impact on the incentive structure of society

[2] The governance indicators are provided by the Worldwide Governance Indicators (WGI) project of the World Bank (see Kaufman et al., 2010). I describe the way how the index of social infrastructure is elaborated in Section 5. Furthermore, I provide the definitions of the governance indicators.

To this end, I develop a neoclassical growth model in which the government accumulates non-rival social infrastructure, while individuals contest the productive services of social infrastructure with lower or higher success depending on governance fairness. Contest for social infrastructure is a rent-seeking activity because it implies the unproductive use of resources.[3] In the model, the government seeks to maximize its political support which is a function of both the utility enjoyed by households and the free provision of services by the government to households. This function of political support intends reflect the idea that the political support to the government might depend on clientelistic relationships between government and the citizens as well as the idea that citizens observing poorly the influence of governmental policies on their utility and with weak capacity to monitor governmental performance might base their political support on some variable that they observe more accurately, in particular on the direct provision of government services.

Patrimonialism or clientelism is a style of governance where policies/favors are distributed in exchange of political support and that prevails in developing countries (Baland et al. (2010)).[4] Some empirical works find an effect of targeted transfers on individual voting intentions and behavior (see, for example, Markus (1988), Levitt and Snyder (1997), Elinder et al. (2008), and Manacorda et al. (2011). Moreover, there also is some empirical evidence that political institutions can affect the clientelistic behavior of the government.[5] Manzetti and Wilson (2007) cite a lot of works arguing both empirical and theoretically that clientelism is most entrenched in polities where resources are scarce and controlled by political cliques. Some authors show that the electoral system influences the clientelistic behavior of the government (see, for example, Ames (1995), Cain et al. (1987), Carey and Shugart (1995), Mitchell (2000), Persson et al. (2003) and Samuels (1999)). Keefer (2005) finds empirical evidence suggesting a strong association between weak institutions and clientelism in young democracies. Geddes (1991) argues that robust, balanced party

[3] As Tullock (1980) asserts: "the term rent-seeking is designed to describe behavior in institutional settings where individual efforts to maximize value generate social waste rather than social surplus."

[4] The provision of goods and services by the government with clientelistic purposes is very usual in development countries. Argentinian newspaper La Razón entitled in June, 20th 1997 "They denounce that Maduro gives away " scholarships, tablets, washing machines and refrigerators" to win the elections". In Galicia, a region in the northwestern of Spain, the prototype of the clientelistic gifts is that the government places a lamppost in front of the door of your house.

[5] Hicken (2011) argues that clientelism can adapt to a variety of political settings and, in democracies, it is a tool for building a loyal network of political supporters.

competition induces politicians to abandon clientelism.

Some empirical evidence shows that the institutional settings fostering voice and accountability lead that political support provided by the citizens to the government depends to a larger extent on their welfare and less on clientelistic policies.[6] Criado and Herreros (2007) discuss how the institutional context can affect the attribution of responsibilities for policy outcomes (see Powell (2000)). In particular, Powell and Whiten (1993), using data of 102 elections in 19 developed democracies, show that if political institutions foster the clarity of political responsibility of government, then citizen's political support depends on economic performance to a larger extent and Criado and Herreros (2007), using evidence from 17 European countries, show that the effect of the government performance on political support is higher in majoritarian democracies, where the attribution of responsibility for policy outcomes is clear, than in proportional democracies. The findings by Aaskoven (2016) suggest that lacking government transparency might encourage creation of public employment for clientelistic purposes. In particular, using panel data for 20 OECD countries, Aaskoven (2016) finds that economic growth increases public employment under low fiscal transparency and that this effect is strongest in years of election; however, higher fiscal transparency lowers the positive effect of growth on public employment, primarily in election years.[7]

The model is intended to capture the idea that governments design the institutional framework and implements the policies under which the economic activities are developed, while individuals devote resources to manipulate existing institutions and policies as well as to achieve that the government sets new institutions and implements new policies in their benefit. An example may be useful to better understand the model. Suppose that a government issues transport licenses which increase the utility of services provided by carriers who are licensed because possession of the license guarantees better services to their customers. The government should invest resources in drafting a law regulating licenses, in issuing licenses and their oversight. A law regulating licenses is a non-rival

[6] Some authors have argued that political support depends on the government policies affecting welfare of households (see, for example, Kramer (1971), Nordhaus (1975); Fair (1978), Fiorina (1981), Weatherford (1984, 1987), Levi and Stoker (2000), and Hetherington (2005)).

[7] Kitschelt (2000) noted how poorer and less educated people are less interested in politicians who promise public goods (as opposed to individualized ones).

good. Carriers compete for getting these licenses: the higher resources a carrier invests to get a license, the higher his probability to get it, while the higher resources other carriers invest to get a license, the lower his probability to get it. Many others examples in addition to licensing of transport services can be found. Lobbyism is other good example: the lobbyists try that the government implements the rules more suitable for their interests or applies the existing rules in line with them.[8] According to a widely accepted definition, institutions are the rules of game and their enforcement. Therefore, to some extent, when local or regional governments contest public revenues or local public goods, implicitly they are contesting the social infrastructure. For example, if two governments are competing for setting a police station in their jurisdiction, then, to some extent, they are contesting the rule of law. The contestation of social infrastructure is everywhere. To some extent, household spending in protecting its property implies to contest the social infrastructure because the higher the spending of a household regarding its neighbor, the lower the probability that its property is violated and the higher the confronted probability by its neighbors.

Therefore, in the model, governance is characterized by two attributes: accountability and fairness. Accountability refers to the weight that the individuals gives to their utility relatively to the free and direct provision of services by the government in determining their political support. Fairness refers to the ability of the government to resist the pressures of the individuals to manipulate the social infrastructure in their favor or, the flip side, the ability of individuals to influence the government and to manipulate the social infrastructure for their own benefit. These attributes are related to some concepts concerning government developed by the political science, although the correspondence is far from perfect. In particular, Dahl (1971) argues that democracy -or polyarchy, according to his terminology- is characterized by two features: contestation and inclusiveness. Contestation means that citizens have unimpaired opportunities to formulate their preferences, to signify their preferences to their fellow citizens and the government, and to have their preferences weighted equally in the conduct of the government. Inclusiveness is

[8] Campos and Giovannoni (2017) find that lobbysm is an effective way to influence political decissions and that the ability of lobbysts to influence policies depends on institutions, in particular on electoral rules.

referred to the proportion of population entitled to participate in contesting the conduct of the government.

According to the model, differences in governance do not influence accumulation of physical capital —which is consistent with the empirical evidence reported by Inklaar and Timmer (2013) according to which the ratio of capital to GDP is not markedly correlated with GDP per worker across countries—, but they affect productivity through TFP. In particular, higher governance fairness discourages rent-seeking and fosters investment in social infrastructure, while a more accountable government invests more in social infrastructure and is less clientelistic because reduces its free provision of services. Therefore, improving governance increases TFP and productivity because countries with better governance have more social infrastructure. The results are consistent with the empirical evidence that connects higher corruption —an indicator of government unfairness— and worse economic performance (see, for example, Mauro (1995), Lambsdorff (2003) and Johnson et al. (2011)).[9]

The model is calibrated and simulated to assess the quantitative impact of improving governance of social infrastructure and productivity. To this end, an index of social infrastructure as well as proxies for governance fairness and governance accountability are built. In particular, the proxy used for governance fairness is built using the indicator Control of Corruption, while the proxy used for governance accountability is built using the indicator Voice and Accountability. An index of social infrastructure is built using other four governance indicators: Government Effectiveness, Regulatory Quality, Rule of Law and Political Stability. In the data, countries in the ten decile of social infrastructure distribution have, on average, 39.24 times higher social infrastructure, 3.16 times higher TFP and 6.83 times higher GDP per worker than countries in the first decile. In the model, these figures are 2.51, 1.39 and 1.64.

According to the calibrated model, improving governance fairness has a significant impact on social infrastructure and productivity of countries with low levels of social infrastructure, but improving governance accountability has a negligible impact. In par-

[9] Recently, Campos et al. (2016) survey the econometric evidence on the relationship between corruption and growth.

ticular, for countries in the average of the first decile of the distribution of the index of social infrastructure, an increase by one standard deviation in the indicator Control of Corruption increases, on average, social infrastructure by 84.1% and GDP per worker by around 38%. However, social infrastructure and GDP per worker only increase by around 0.4% and 0.20%, respectively, if the indicator Voice and Accountability increases by one standard deviation. I report the impact of a one standard deviation increase because, according to the distribution of the index, it can be considered a normal (or likely) increase that might be achieved by means of reasonable institutional reforms.[10]

The paper is organized as follows. In Section 2, I describe previous works in related areas. The model is described in Section 3. The long-run impact of governance on social infrastructure and productivity is analyzed in Section 4. The model is calibrated and simulated in Section 5 in order to assess the quantitative impact of improving governance on social infrastructure and productivity. Finally, Section 6 concludes.

2 Related literature

The model extends the standard neoclassical growth model to include a government that accumulates social infrastructure contested by households. In this framework, rent-seeking activities are devoted to manipulate institutions and government policies. In this sense, this paper is related to the literature introducing rent-seeking in growth models. Some works consider that rent-seeking entails predatory activities devoted to appropriate the property of others in a context of imperfect security of property rights (see, for example, Tornell and Velasco (1992), Benhabib and Rustichini (1996), Grossman and Kim (1996), Barelli and De Abreu Pessôa (2012), Bethencourt and Perera-Tallo (2014) and del Rio (2018)). Park et al. (2005) consider that rent-seeking activities are devoted to appropriate the government tax revenues, Torvik (2002) considers that rent-seeking activities are devoted to appropriate the rents of a natural resource, and Gonzalez (2005) argues that

[10] Pande and Udry (2006) provide an excellent and comprehensive review of the macroeconomic literature on institutions and growth that has largely relied on cross-country regression evidence. In order to summarize the findings of the literature, they also reported on the impact of one standard deviation increase in the indexes of institutional quality on productivity and growth.

anticipation of conflict caused by rent-seeking gives rise to technological backwardness. In these works, security of property rights is exogenous and government does not play any role. However, Gradstein (2004) endogenizes the emergence of property rights within a simple growth framework and Chin and Chou (2004) develop a growth model with rent-seeking in which government creates new social infrastructure. In the Gradstein's (2004) model, the individuals are in charge of protecting their properties, it is not the tasks of a government, and in the Chin and Chou's (2004) model, government is benevolent planner and the rent-seeking activities are predatory.[11]

Very often it has been emphasized that defective institutions encourage rent-seeking, but, as the model developed here shows, rent-seeking might also hamper the development of virtuous institutions by discouraging government investment in social infrastructure. The works cited in the previous paragraph highlight that rent-seeking leads to the waste and misallocation of resources as well as discourages capital accumulation, innovation, technological adoption or effort. However, in my model, rent-seeking affects negatively productivity because it disincentives government investment in social infrastructure (i.e., rent-seeking worsen the institutional context). In this sense, my work is related to Gradstein's (2008) model in which individuals contest a public good whose provision is determined by a weighted majority rule (the rich are more weighted than the poor) as well as to De Vaal and Ebben's (2011) growth model in which the effect of bureaucratic corruption on economic growth is highly dependent on the institutional setting of a country because corruption entails wasting of resources in rent-seeking activities and stealing public goods, but it also may fulfill positive role by taking over the role of institutions.[12]

The model is empirically implemented in order to quantitatively evaluate the impact of improving governance on social infrastructure and productivity. In this sense, my paper is related to the literature evaluating the relationship between institutions and economic development. Some authors, in the tradition of North and Thomas (1973) (see, for example, Knack and Keefer,1997, Hall and Jones,1999, Acemoglu et al., 2001, and Rodrik et al., 2004) find that cross-country income differences are largely explained by institutional

[11] Gradstein (2007) considers the emergence of property rights protection as a political outcome.

[12] Aidt (2003) surveys the economic literature on corruption and finds that, sometimes, corruption can improve the economic performance.

differences.[13] Other authors have focused their attention on the effects of governance on economic performance. In particular, using cross-country data, Campos and Nugent (1999) find that good governance is positively related to GDP per capita and negatively related to child mortality and adult illiteracy, while Globerman and Shapiro (2002) focus on governance and find that good governance has a positive impact on foreign direct investment. Jonasson (2011), using data from $5,500$ Brazilian municipalities, shows that informal employment is lower in regions with better governance. Using panel data over $1990 - 2010$, Cingolani et al. (2015) find that bureaucratic autonomy has an important impact on two indicators of economic development: child mortality and tuberculosis prevalence. Fatas and Mihov (2013) find that governments that implement frequent and large changes in government spending unrelated to the state of the business cycle generate lower economic growth.[14] The authors mentioned above follow an econometric approach to evaluate the impact of institutions on cross-country income differences as well as other economic variables. However, I develop a general equilibrium growth model to evaluate the impact of governance on social infrastructure and productivity.

Therefore, this paper also relates to a strand of macroeconomic literature that develop general equilibrium macroeconomic models that analyze how and to what extent institutions and economic policies that are responsible for resource misallocation (see, for example, Restuccia and Rogerson, 2008, Hsieh and Klenow, 2009, Poschke 2010, Barseghyan and DiCecio, 2011, Moscoso-Boedo and Mukoyama, 2012, del Río and Sampayo, 2017 and del Río, 2018) or technological backwardness (see Parente and Prescott, 2000) can account for the observed differences in productivity across countries.

Finally, my model analyzes how some government features affect its performance. In particular, my model shows that governance accountability reduces free provision of government services and encourages governmental investment in social infrastructure as well as that political institutions that promote governance fairness discourage rent-seeking and foster the accumulation of social infrastructure. In this sense, my work is related

[13] Holcombe and Boudreaux (2016) analyze whether market institutions generate income inequality, but they find that the results depend on the used dataset.

[14] However, Kwon and Kim (2014) only find a significant impact of good governance on reducing poverty in middle-income countries, but not in low-income countries, and Wilson (2016), using data for China provinces, finds that causality runs from growth to governance.

to the literature on the political economy of state capacity. For example, Besley and Persson (2009) argue that political stability and inclusive political institutions enhance state capacity to tax and to provide productivity-enhancing public goods and Acemoglu (2005) argues that weak states where rulers have short time horizons spend too little on productive public goods, while strong states where rulers have too much security of tenure have blunt accumulation incentives.[15] However, unlike these authors, I incorporate the analysis of governance into a standard neoclassical growth model.

3 The model

The economy is inhabited by a continuum of identical households with measure 1. Households produce output that they devote to consumption, investment in physical capital, to pay taxes to the government, and rent-seeking activities contesting the productive services of non-rival social infrastructure. The government finances its investment in social infrastructure and its provision of government services to households by collecting taxes, user fees and bribes.

Social infrastructure

The aggregate stock of non-rival social infrastructure at time $t+1$, $\overline{z}_{t+1}$, is the result of accumulative decisions by the government,

$$\overline{z}_{t+1} = \frac{g_t}{\overline{y}_t} + \delta_z \overline{z}_t, \tag{1}$$

where $0 < 1 - \delta_z < 1$ is the economic depreciation rate of social infrastructure, g_t is government investment per capita in social infrastructure at time t, and $\frac{1}{\overline{y}_t}$ is government effectiveness in accumulating social infrastructure at time t which t depends inversely on aggregate output per capita at time t, $\overline{y}_t$. It expresses the idea that a larger economy is also more complex and needs more and more complex institutions to work. Therefore, the higher the output, the greater the required government effort to maintain the level of social infrastructure.[16]

[15] Acemoglu et al. (2011) analyze the role of bureaucracies in creating effective states.

[16] Barro (1990) considers in Section IV of his now-classic paper the case in which the amount of public

Households

Each household has n^t individuals at time t, where $n > 0$ is the population gross growth rate. Each individual is endowed with a unit of labor. Household output per capita at time t, y_t, is given by

$$y_t = \gamma^{(1-\theta)t} z_t^{\alpha} k_t^{\theta}, \tag{2}$$

where $\gamma \geq 1$ is the gross rate of labor-augmenting technological progress, $0 < \alpha < 1$, $0 < \theta < 1$, z_t are the productive services per capita for a household of the social infrastructure at time t, and k_t is household physical capital per capita at time t, which evolves according to,

$$nk_{t+1} = x_t + \delta_k k_t, \tag{3}$$

where x_t is household investment per capita in physical capital and $0 < 1 - \delta_k < 1$ is the depreciation rate of physical capital.

Households contest social infrastructure. In particular, the productive services per capita that a household obtains from the existing social infrastructure at time t are

$$z_t = h\left(\frac{s_t}{\overline{s}_t}\right)\overline{z}_t, \tag{4}$$

where s_t are the resources per capita devoted by a household to contesting social infrastructure at time t and $\overline{s}_t$ are the aggregate (by all households) resources per capita devoted to contesting social infrastructure at time t. Function h is the contest success function: $h' > 0$, $h'' < 0$, $h(1) = 1$, and $h'(1) \equiv \chi > 0$.[17] The activities aimed to contesting the social infrastructure are purely rent-seeking activities because they do not increase productivity or output.

The instantaneous utility function of a member of a household is $u(c_t, b_t) = \ln c_t +$

services that an individual receives is roughly proportional to the amount of property that the person has to protect. Barro (1990) points out that this hypothesis is reasonable for some public services such as police, fire protection and national defense. The assumption also seems reasonable for most of economic institutions securing property, enforcing contracts and regulating economic activity. As Barro (1990) writes: "These cases can be approximated by assuming that each individual holds constant his ratio of public services to output , g/y, rather than his level of public services".

[17] Mills (1961) proposed a contest success function to model promotional competition and Tullock (1975, 1980) introduced it in the theory of rent-seeking. Van Long (2013) reviews the theory of contests.

$\omega \ln b_t$, where $\omega > 0$, c_t is household private consumption per capita at time t and b_t is the provision of government services per capita at time t. The government services are freely provided by the government, but they are not public goods (i.e., non-excludible and non-rival goods).[18] A household maximizes its intertemporal utility,

$$U = \sum_{t=0}^{\infty} (\beta n)^t (\ln c_t + \omega \ln b_t) \tag{5}$$

subject to its production function (2), the evolution law of capital per capita (3), the contest constraint (4), and its budget constraint per capita $c_t + x_t + s_t = y_t - l_t$, where l_t are net lump-sum taxes per capita paid by a household to the government at time t and β is the time discount rate. It is assumed that $0 < \beta n < 1$ which guarantees that the transversality condition is satisfied. Every household is atomistically small; therefore, it assumes that its rent-seeking efforts do not have aggregate consequences.

The optimal choice of a household is characterized by the Euler condition,

$$\theta \frac{y_{t+1}}{k_{t+1}} + \delta_k = \frac{1}{\beta} \frac{c_{t+1}}{c_t}, \tag{6}$$

which states that the marginal return to investment in physical capital for a household equals the marginal rate of substitution of current for future consumption, and

$$\alpha \frac{y_t}{z_t} h' \left(\frac{s_t}{\overline{s}_t} \right) \frac{\overline{z}_t}{\overline{s}_t} = 1, \tag{7}$$

which states that the marginal revenue of contesting social infrastructure equals its marginal cost, which is equal to 1.

Symmetric equilibrium

In a symmetric equilibrium, the aggregate variables per capita and the household variables per capita are equal, $s_t = \overline{s}_t$ and $y_t = \overline{y}_t$. From equation (4) and the first order condition (7), it follows that, in a symmetric equilibrium, the productive services

[18] The education and healthcare services could be good examples of government services which are not public goods. Moreover, other services provided directly by government to households reflecting clientelistic relationships could also be included in b.

per capita for a household of social infrastructure equal the aggregate stock of social infrastructure, $z_t = \overline{z}_t$, and that the fraction of output devoted to rent-seeking is constant, $\frac{s_t}{y_t} = \alpha\chi$. It is assumed that $0 < \alpha\chi < 1$ in order to guarantee that the resources devoted to rent-seeking are not higher than output.

A fraction $0 < \eta < 1$ of the resources devoted to rent-seeking by households are transferred to the government through bribes or user fees that, together the lump-sum transfers from households, l_t, are the government revenues, while the fraction $1 - \eta$ is wasted in the rent-seeking process. In a symmetric equilibrium, the amount per capita of bribes and user fees is $\eta s_t = \eta\alpha\chi y_t$ and aggregate output per capita after rent-seeking is $\widehat{\chi} y_t$ where $\widehat{\chi} \equiv 1 - (1 - \eta)\,\alpha\chi$. Therefore, the aggregate resource constraint per capita is

$$c_t + g_t + b_t + x_t = \widehat{\chi} y_t, \tag{8}$$

which states that he sum of resources devoted by households to consumption and investment in physical capital and by the government to investment in social infrastructure and provision of government services equals the available resources after rent-seeking.

Government

Political support given by households to the government is $PS = U + \pi B$ where $\pi > 0$, U is household intertemporal utility given by (5) and $B = \sum_{t=0}^{\infty} (\beta n)^t \,\omega \ln b_t$ is the weighted discounted sum of the provision of government services per capita (in logs). The government chooses investment in social infrastructure, g_t, and the provision of government services, b_t, to maximize its political support subject to the resource constraint (8) considering (3), the household Euler condition (6) and the evolution law of social infrastructure (1). Therefore, the maximization problem of the government is

$$\max_{\{g_t, b_t\}_{t=0}^{\infty}} \sum_{t=0}^{\infty} (\beta n)^t \left(\ln c_t + \widehat{\pi} \ln b_t\right)$$

subject to

$$c_t = \widehat{\chi} y_t - b_t - g_t - n k_{t+1} + \delta_k k_t, \tag{9}$$

$$c_{t+1} = \beta \left(\theta \frac{y_{t+1}}{k_{t+1}} + \delta_k\right) c_t \tag{10}$$

and

$$z_{t+1} = \frac{g_t}{y_t} + \delta_z z_t \tag{11}$$

where y_t is given by (2) and $\widehat{\pi} \equiv \omega\,(1+\pi)$.[19]

The first order conditions of the maximization problem of the government are

$$(\beta n)^t \widehat{\pi} \frac{1}{b_t} = \varrho_{1,t}, \tag{12}$$

$$(\beta n)^t \frac{1}{c_t} = \varrho_{1,t} - \beta \left(\theta \frac{y_{t+1}}{k_{t+1}} + \delta_k \right) \varrho_{2,t} \tag{13}$$

$$(\beta n)^{t+1} \frac{1}{c_{t+1}} = \varrho_{2,t}, \tag{14}$$

$$\varrho_{3,t} \frac{1}{y_t} = \varrho_{1,t}, \tag{15}$$

and

$$\varrho_{1,t+1} \widehat{\chi} \alpha \frac{y_{t+1}}{z_{t+1}} + \varrho_{2,t} \beta \theta \alpha \frac{y_{t+1} c_t}{z_{t+1} k_{t+1}} + \varrho_{3,t+1} \left(\delta_z - \alpha \frac{g_{t+1} \left(\alpha \chi z_{t+1}^{-\rho} \right)^{-\mu}}{y_{t+1} z_{t+1}} \right) = \varrho_{3,t}, \tag{16}$$

where $\varrho_{1,t}$, $\varrho_{2,t}$ and $\varrho_{3,t}$ are the Lagrange multipliers. From (12)-(14) it follows that

$$(1 + \beta n)\, b_t = \widehat{\pi} c_t, \tag{17}$$

which states that the government equates its marginal rate of substitution of government services to private consumption to $1 + \beta n$. From (16), using (12)-(15), it follows the Euler equation of the government,

$$\left[\alpha \frac{y_{t+1}}{z_{t+1}} \frac{1}{y_t} \left(\widehat{\chi} - \frac{g_{t+1}}{y_{t+1}} + \frac{\beta \theta}{1 + \beta n} \frac{c_t}{k_{t+1}} \right) + \delta_z \frac{y_{t+1}}{y_t} \right] n = \frac{1}{\beta} \frac{c_{t+1}}{c_t}, \tag{18}$$

which states that the marginal return to investment in social infrastructure equals the marginal rate of substitution of current for future consumption. The return to investment in social infrastructure depends on (i) the marginal productivity of social infrastructure,

[19] The government solves a Ramsey-type problem.

$\alpha\frac{y_{t+1}}{z_{t+1}}$, adjusted by (i.a) the efficiency in accumulating social infrastructure, $\frac{1}{y_t}$, (i.b) the resource wastage in rent-seeking activities, $\widehat{\chi}$, (i.c) the loss of efficiency in accumulating social infrastructure due to the increase in output caused by a higher rate of investment in social infrastructure, $\frac{g_{t+1}}{y_{t+1}}$, (i.d) the increase in marginal productivity of capital and, consequently, in the return of saving, $\frac{\beta\theta}{1+\beta n}\frac{c_t}{k_{t+1}}$, (ii) the economic depreciation rate of social infrastructure, $\delta_z\frac{y_{t+1}}{y_t}$, which depends on the growth rate of output per capita because the efficiency in accumulating social infrastructure decreases when output per capita grows, and (iii) the population gross growth rate, n, because social infrastructure is non-rival.

The features of governance

Parameter χ is elasticity of the productive services per capita with respect to the effort per capita when $s_t = \overline{s}_t$.[20] It indicates the increase in the productive services of the social infrastructure that a household obtains when it increases a little, with regard to the other households, its rent-seeking activities. Therefore, it reflects the ability of households to influence the government and to manipulate the social infrastructure for their own benefit as well as the ability of the government to maintain its neutrality or impartiality when it is pressured by households. It is called the degree of governance unfairness or, alternatively, its inverse, $1/\chi$, is called the degree of governance fairness.

Parameter π weights the importance that an individual gives to the provision of government services relatively to its utility in determining its political support. The importance that an individual gives to its utility can depend on several and different circumstances, but, in particular, such as suggested by some empirical evidence discussed in the introductory section, an individual might give more importance to its utility in determining its political support if it trusts that government policies aim improving its welfare. Trust will be foster by institutional settings in which citizens are well informed and exert a severe control over government. For this reason, π is called the degree of governance unaccountability or, alternatively, its inverse, $1/\pi$, is called the degree of governance accountability.

In the next section, the long-run effects of governance on social infrastructure and productivity are analyzed.

[20] $\varepsilon_{z,s} \equiv \frac{\mathrm{d}\ z_t}{\mathrm{d}\ s_t}\frac{s_t}{z_t} = h'\left(\frac{s_t}{\overline{s}_t}\right)\frac{\overline{z}_t}{\overline{s}}\frac{s_t}{z_t}$, which, if $s_t = \overline{s}_t$, then it is equal to χ.

4 The long-run influence of governance on social infrastructure and productivity

Along a BGP, variables per capita y_t, k_t, c_t, x_t, s_t, l_t, g_t, and b_t, grow at the same constant rate, $\gamma - 1$, while social infrastructure, z_t, remains constant.

It follows from the production function (2) that output per capita is a function of the ratio of physical capital to output, $\frac{k_t}{y_t}$, and TFP, A_t,

$$y_t = A_t^{\frac{1}{1-\theta}} \left(\frac{k_t}{y_t}\right)^{\frac{\theta}{1-\theta}}. \tag{19}$$

On one hand, along a BGP, the ratio of physical capital to output is

$$\frac{k_t}{y_t} = \frac{\theta}{\frac{1}{\beta}\gamma - \delta_k}, \tag{20}$$

which follows from the Euler condition (6) taking into account that, along a BGP, household private consumption per capita grows at the rate $\gamma - 1$. On the other hand, TFP depends on the productive services of social infrastructure and the state of technical progress,

$$A_t = \gamma^{(1-\theta)t} z^{\alpha}, \tag{21}$$

which follows from (2) and (19).Taking into account that, along a BGP, the stock of social infrastructure remains constant, it follows from (11) that, along a BGP, social infrastructure is given by

$$z = \frac{1}{1-\delta_z}\frac{g_t}{y_t}, \tag{22}$$

where $\frac{g_t}{y_t}$ is the investment rate in social infrastructure. Under the BGP conditions, it follows from the Euler equation for the government (18) and equation (22) that, along a BGP, the investment rate in social infrastructure is

$$\phi_0 \frac{g_t}{y_t} = \widehat{\chi} + \phi_1 \frac{c_t}{y_t}, \tag{23}$$

where $\phi_0 \equiv \frac{\frac{1}{\beta n}-\delta_z}{(1-\delta_z)\alpha}+1>1$ and $\phi_1 \equiv \frac{\beta}{1+\beta n}\left(\frac{1}{\beta}-\frac{\delta_k}{\gamma}\right)>0$. From the aggregate resource constraint per capita (8), using (17), it follows that

$$\phi_2 \frac{c_t}{y_t} = \widehat{\chi} - \phi_3 - \frac{g_t}{y_t}, \tag{24}$$

where $\phi_2 \equiv 1+\frac{\widehat{\pi}}{1+\beta n}>1$ and

$$0 < \frac{x_t}{y_t} = \theta \frac{\gamma n - \delta_k}{\frac{\gamma}{\beta}-\delta_k} \equiv \phi_3 < 1, \tag{25}$$

is the investment rate. Equation (25) follows from the evolution law of physical capital (3) taking into account (20) and that, along a BGP, physical capital per capita grows at the rate $\gamma - 1$.

The following parameter condition is necessary to guarantee the existence of an interior BGP. I call interior BGP to a BGP in which the ratios $\frac{c_t}{y_t}$, $\frac{b_t}{y_t}$, $\frac{g_t}{y_t}$, and $\frac{x_t}{y_t}$ are constant and between 0 and $\widehat{\chi}$. In particular, Assumption 1 imposes that along a BGP the investment rate $\frac{x_t}{y_t}=\phi_3$ is sufficiently lower than the fraction of resources remaining after rent-seeking to guarantee that $\frac{g_t}{y_t}>0$.

Assumption 1 $\widehat{\chi} > \phi_3\left(1-\frac{1}{\phi_0}\right)^{-1}$.

The following proposition states that under Assumption 1 there exists a unique interior equilibrium.

Proposition 1 *Under Assumption 1, there exists a unique interior BGP.*

Proof: From (23)-(24) it follows that

$$\frac{g_t}{y_t} = \frac{\widehat{\chi}\left(\phi_2+\phi_1\right)-\phi_1\phi_3}{\phi_0\phi_2+\phi_1} \tag{26}$$

and

$$\frac{c_t}{y_t} = \frac{\widehat{\chi}\left(\phi_0-1\right)-\phi_0\phi_3}{\phi_0\phi_2+\phi_1}. \tag{27}$$

Under assumption 1, it follows from (26) and (27) that $0<\frac{g_t}{y_t}<\widehat{\chi}$ and $0<\frac{c_t}{y_t}<\widehat{\chi}$. From Assumption 1, it follows that $0<\frac{x_t}{y_t}=\phi_3<\widehat{\chi}$. If $0<\frac{g_t}{y_t}<\widehat{\chi}$, $0<\frac{c_t}{y_t}<\widehat{\chi}$ and $0<\frac{x_t}{y_t}=\phi_3<\widehat{\chi}$, then from the aggregate resource constraint per capita (9) and equation (17), it follows

that $0 < \frac{b_t}{y_t} < \widehat{\chi}$.□

The following proposition states that improving any of the two considered features of governance —fairness and accountability— entails an increases of the government investment rate in social infrastructure. Moreover, the investment rate in physical capital does not depend on any governmental attribute, thus, the ratio of physical capital does not depend on quality of governance. Therefore, governance influences output per worker through TFP because the latter depends on social infrastructure.

Proposition 2 *Along an interior BGP, under Assumption 1, (i) the investment rate in social infrastructure,* $\frac{g_t}{y_t}$*, and the stock of social infrastructure,* z_t*, are increasing functions of governance fairness,* $\frac{1}{\chi}$*,* and *governance accountability,* $\frac{1}{\pi}$ *(ii) the investment rate in physical capital,* $\frac{x_t}{y_t}$*, and the ratio of physical capital to output,* $\frac{k_t}{y_t}$*, do not depend on either* $\frac{1}{\chi}$ *or* $\frac{1}{\pi}$*.* (iii) *TFP,* A_t*, and output per capita,* y_t*, are increasing functions* $\frac{1}{\chi}$*, and* $\frac{1}{\pi}$*.*

Proof: Differentiation of the Napierian logarithm of (26) with respect to the Napierian logarithm of χ, and $\widehat{\pi}$ yields

$$\frac{\mathrm{d}\ \ln \frac{g_t}{y_t}}{\mathrm{d}\ \ln \chi} = -\frac{(1-\eta)\,\alpha\chi}{\widehat{\chi}\phi_0\phi_2 + \phi_1\phi_3} < 0, \tag{28}$$

and

$$\frac{\mathrm{d}\ \ln \frac{g_t}{y_t}}{\mathrm{d}\ \ln \widehat{\pi}} = -\frac{\widehat{\pi}\widehat{\chi}\left(\phi_0 - \frac{g_t}{y_t}\right)}{(1+\beta n)\left(\phi_0\phi_2 + \phi_1\right)} < 0 \tag{29}$$

From (22) it follows that z is an increasing function of $\frac{g_t}{y_t}$. Therefore, (i) follows from (28), (29) and (22).(ii) follows from (20) and (25).(iii) follows from (i), (ii), (19), (21) and (22).□

On one hand, a higher degree of governance fairness (i.e., a lower χ) leads households to decrease their rent-seeking intensity, which encourages government investment in social infrastructure because lower resource wastage increases the return to investment in social infrastructure. On the other hand, higher governance accountability (i.e., a lower π) leads the government to reduce its free provision of services and its tax burden on households that increase their private consumption, which leads the government to increase its investment in social infrasctructure because the return to investment in social infrastructure increases. Therefore, social infrastructure, TFP and output per capita increase when both

fairness and accountability of governance improve.[21]

5 Cross-country differences in governance, social infrastructure and productivity

In this section, I analyze the quantitative impact of improving governance on social infrastructure and both TFP and GDP per worker. To this end, the model is calibrated and simulated.

The index of social infrastructure

The WGI project reports aggregate and individual governance indicators for 215 economies over the period 1996–2014, for the following six dimensions of governance: (1) *Rule of Law* (I_L), which reflects perceptions of the extent to which agents have confidence in and abide by the rules of society, and in particular the quality of contract enforcement, property rights, the police, and the courts, as well as the likelihood of crime and violence. (2) *Regulatory Quality* (I_R), which reflects perceptions of the ability of the government to formulate and implement sound policies and regulations that permit and promote private sector development. (3) *Political Stability and Absence of Violence/Terrorism* (I_S), which measures perceptions of the likelihood of political instability and/or politically-motivated violence, including terrorism. (4) *Government Effectiveness* (I_E), which reflects perceptions of the quality of public services, the quality of the civil service and the degree of its independence from political pressures, the quality of policy formulation and implementation, and the credibility of the government's commitment to such policies. (5) *Voice and Accountability* (I_V), which reflects perceptions of the extent to which a country's citizens are able to participate in selecting their government, as well as freedom of expression, freedom of association, and a free media. (6) *Control of Corruption* (I_C), which reflects perceptions of the extent to which public power is exercised for private gain, including

[21] If the government gets a higher fraction of the resources devoted to rent-seeking (that is, η is higher), then it increases its investment rate in social infrastructure. This is because fewer resources are wasted in rent-seeking activities and, consequently, the return to investment in social infrastructure for the government is higher. Cowen et al. (1994) argue that, when some public policies generate rents for public officials, rent-seeking in politics can motivate them to provide public goods.

both petty and grand forms of corruption, as well as "capture" of the state by elites and private interests.

Governance is among the more elastic concepts in the social science and development lexicons (Keefer (2004)). However, according to Keefer (2004), it can be defined as (i) the extent to which government are responsive to citizens and provide them with certain core services and (ii) the extent to which institutions and processes of government give to decision makers an incentive to be responsive to citizens. Therefore, governance has two dimensions: on one hand, the results of government and, on the other hand, the incentives faced by the government. According to these two dimensions, the economic literature on governance has focused its interest in analyzing the relationship between the results of governance and economic development as well as in analyzing the relationship between the features of governance and the performance of governments.

The governance indicators provided by the World Bank are proxies of both the results of government (Rule of Law, Regulatory Quality, Government Effectiveness and Political Stability) and the attributes of government (Voice and Accountability and Control of Corruption).[22] In the empirical analysis below, it is assumed that the indicator Control of Corruption reflects the concept of governance fairness (the inverse of χ in the model), while the indicator Voice and Accountability reflects the concept of accountability (the inverse of π in the model).

An index of social infrastructure relative to the United States is calculated for each country in the sample as the geometric average of three indicators of governance (Rule of Law, Regulatory Quality and Political Stability) relative to those indicators for the United States. The two first indicators (Rule of Law and Regulatory Quality) are multiplied by the indicator Government Effectiveness in order to adjust for quality. In particular, the elaborated index of social infrastructure, $\widehat{z}_i$, is

$$\widehat{z}_i = \left(\widehat{I}_{L,i}\widehat{I}_{E,i}\right)^{\frac{1}{3}} \left(\widehat{I}_{R,i}\widehat{I}_{E,i}\right)^{\frac{1}{3}} \left(\widehat{I}_{S,i}\right)^{\frac{1}{3}},$$

[22] Really, sometimes the difference between the results of governance and the features of governance is a little contrived, and a same indicator can be reflecting both the results of governance and the features of governance.

where $\widehat{I}_{j,i}$ denotes the value for country i of indicator I_j, $j = E, L, R, S$, relative to the United States.[23] The indicator Rule of Law measures the security of property rights and contract enforcement. The indicator Regulatory Quality measures quality of business regulations. Therefore, the indicators Rule of Law and Regulatory Quality provide important information about the rules that determine the allocation of resources. However, both indicators are adjusted by the indicator Government Effectiveness because the extent to which this set of institutions are effective depends on government effectiveness in their implementation and enforcement. Moreover, the efficacy of many institutions and policies depends on their stability. Political instability can motivate frequent changes in institutions and policies, which might imply a loss of their efficacy. For this reason, the indicator Political Stability is included in the index.

Proxies for the features of governance

Using the indicator Control of Corruption, I build a proxy for the degree of governance unfairness in each country, $\chi_i = (\chi_M)^{1-\widehat{I}_{C,i}} (\chi)^{\widehat{I}_{C,i}}$, where $\widehat{I}_{C,i}$ is the value for country i of the indicator Control of Corruption relative to the United States, χ_i is the degree of governance unfairness in country i, χ is its calibrated value below and χ_M is an upper bound such that the highest fraction of output devoted to carrying out rent-seeking activities is 1, $\alpha\chi_M = 1$, and it is also calibrated below. I use the indicator Voice and Accountability to build a proxy for the degree of governance unaccountability in each country, $1 + \pi_i = (1 + \pi)\, \widehat{I}_{V,i}^{-1}$, where $\widehat{I}_{V,i}$ is the value for country i of the indicator Voice and Accountability relative to the United States, π_i is the degree of governance unaccountability in country i and π is its calibrated value below. Building the degree of governance unaccountability in this way allows to define $\widehat{\pi}_i = \widehat{\pi}\widehat{I}_{V,i}^{-1}$ which is suited for the quantitative exercises because equilibrium depends on $\widehat{\pi}$, not on the particular combination of π and ω giving rise to $\widehat{\pi}$.

Calibration

I assign the following values to the parameters of the model. (i) $\theta = \frac{1}{3}$, which is the norm in the literature and is close to the output elasticity for capital estimated by Kydland

[23] Easterly and Levine (2003) build an Institutions Index equal to the arithmetic average of the six governance indicators elaborated by Kaufman *et al.* (1999a, b) which are similar to the WGI.

and Prescott (1982) for the United States, 0.365. (ii) The output elasticity for social infrastructure is estimated using the cross-country regression $\ln \widehat{TFP}_i = \beta_0 + \beta_1 \ln \widehat{z}_i$, where $\widehat{TFP}_i$ is TFP of country i relative to the United States.[24] The estimated value for β_1 is 0.351, therefore, I set $\alpha = 0.351$. (iii) Upper bound χ_M is such that $\alpha\chi_M = 1$. Therefore $\chi_M = 2.85$. (iv) According to NIPA, U.S. government consumption expenditures and gross investment represented $3,157$ billions of dollars in 2014 which was around 17% of U.S. GDP in this year, while U.S. government expenditures in general public services, national defense and public order and safety represented $1,856.7$ billions of dollars.[25] Therefore I set $\frac{g_t}{y_t} = 0.10$ and $\frac{b_t}{y_t} = 0.07$. (v) Gorodnichenko and Sabirianova (2007) find that in Ukraine the amount of bribery accounted for $1\% - 1.5\%$ of GDP in 2003.[26] Since government revenues from rent-seeking do not come exclusively from bribes, but also from user fees, $\eta\alpha\chi = 0.02$ is a reasonable figure. (vi) The U.S. annual population growth rate and the U.S. annual growth rate of GDP per worker were around 1% and 1.8%, respectively. Therefore, I set $n = 1.01$ and $\gamma = 1.018$. (vii) I set $i = 1.08$ which means an annual interest rate by 8% that, together with $\gamma = 1.018$, implies an annual discount rate $\beta = 0.943$. (viii) The annual depreciation rate of NIPA fixed assets is around 5%, therefore I set $\delta_k = 0.95$. (ix) Social infrastructure is a kind of intangible capital and Parente and Prescott (2001) argue that the depreciation rate of intangible capital is around 2%-3%. Therefore, I set $\delta_z = 0.975$. (x) From the resource constraint (Under (i)-(ix), from (17), (23) and (24), considering that $\widehat{\chi} = 1 - \alpha(1-\eta)\chi$, it follows that $\widehat{\pi} = 0.246$, $\chi = 0.271$, $\frac{c_t}{y_t} = 0.555$ and $\eta = 0.211$.[27]

Results

[24] Data on GDP, employment, and capital are taken from the Penn World Tables 9.1 (PWT 9.1) for the year 2014. TFP for each country has been calculated according to

$$TFP = \left(\frac{cgdpo}{emp}\right)^{1-\theta} \left(\frac{ck}{cgdpo}\right)^{-\theta},$$

where *cgdpo* is GDP, *emp* is employment, *ck* is capital, and $\theta = \frac{1}{3}$.

[25] General public services include three items: executive and legislative, tax collection and financial managment and other. Public order and safety include four items: police, fire, law courts and prisons

[26] Svensson (2003) finds that in Uganda bribes account for roughly 8% of the total costs of the firms on average.

[27] The calibrated parameters implies that around 9.5% of output is devoted to contesting social infrastructure. Laband and Sophocleus (1992) estimate that total expenditures in transfer activities to be around 25% of U.S. GNP.

The model is simulated for the different pairs of $(\chi_i, \widehat{\pi}_i)$ in a sample of 157 countries for the year 2014. The results of the simulation are displayed in Table 2. The 157 countries sampled are grouped in the ten deciles of the distribution of the index of social infrastructure. The average values for each decile of the simulated TFP, simulated output per worker and simulated social infrastructure are displayed in the last three columns, while in the first two columns are displayed the average values of χ_i and $\widehat{\pi}_i$ for each decile. All variables are relative to the calibrate values (i.e., to the United States). In the model, countries in the ten decile of social infrastructure distribution have, on average, 2.51 times higher social infrastructure, 1.39 times higher TFP and 1.67 times higher GDP per worker than countries in the first decile (see the last row of Table 2), while in the data these figures are 39.24, 3.16 and 6.83 (see the last row of Panel (b) in Table 1).

In order to calculate the impact of improving governance on social infrastructure and productivity, I perform three quantitative exercises in which I calculate the response of social infrastructure and productivity to increases by one standard deviation of the indicators Voice and Accountability and Control of Corruption. First, I calculate the relative values of social infrastructure, GDP per worker and TFP corresponding to the average values of the indicator Voice and Accountability for each decile of the social infrastructure distribution (see column 4 in Panel (b) of Table 1) and the average values plus one standard deviation (0.3191) of the indicator Control of Corruption. Second, I calculate the relative values of social infrastructure, GDP per worker and TFP corresponding to the average values of the indicator Control of Corruption for each decile of the social infrastructure distribution (see column 10 in Panel (b) of Table 1) and the average values plus one standard deviation (0.3495) of the indicator Voice and Accountability. Third, I calculate the relative values of social infrastructure, GDP per worker and TFP corresponding to the average values for each decile plus one standard deviation of both the indicator Control of Corruption and the indicator Voice and Accountability. In the three cases, I calculate the percentage differences regarding to the relative values of social infrastructure, GDP per worker and TFP corresponding to the average values for each decile of both the indicator Control of Corruption and the indicator Voice and Accountability. The resulting percentage differences are displayed in the three panels of Table 3.

In the model, improving governance fairness has a significant impact on social infrastructure and productivity of countries with low levels of social infrastructure, but, for countries with high levels, the impact is much more reduced. In particular, if the indicator Control of Corruption increases by one standard deviation, then, for a country with values of this indicator and the indicator Voice and Accountability equal to the average values of the first decile of the social infrastructure distribution, social infrastructure increases by 83.1%, which implies an increase of TFP and GDP per worker by 23.7% and 37.5%, respectively, while, for a country with the average values of the tenth decile, social infrastructure increases by 3.6%, TFP by 1.25% and GDP per worker by 1.9% (see Panel (a) of Table 3).

However, improving governance accountability has a negligible impact on both social infrastructure and productivity. In particular, if the indicator Voice and Accountability increases by one standard deviation, then, for a country with values of this indicator and the indicator Control of Corruption equal to the average values of the first decile of the social infrastructure distribution, social infrastructure increases by 0.4%, which implies an increase in TFP and GDP per worker by 0.14% and 0.20%, respectively, while, for a country with the average values of the tenth decile, social infrastructure increases by 0.09%, TFP by 0.03% and GDP per worker by 0.05% (see Panel (b) of Table 3).

The effect of improving both features of governance at the same time is similar to the sum of their separate effects. In particular, if both the indicator Voice and Accountability and the indicator Control of Corruption increase by one standard deviation, then, for a country with values of these indicators equal to the average values of the first decile of the social infrastructure distribution, social infrastructure increases by 84.2%, which implies an increase in TFP and GDP per worker by 23.9% and 37.9%, respectively, while, for a country with the average values of the tenth decile, social infrastructure increases by 3.7%, TFP by 1.28% and GDP per worker by 1.92% (see Panel (c) of Table 3).

6 Conclusion

I develop a neoclassical growth model in which the government accumulates non-rival social infrastructure contested by households. In this framework, improving both governance fairness and governance accountability increases government investment in social infrastructure. However, the accumulation of physical capital by households does not depend on any feature of governance. On one hand, a fairer government invest more in social infrastructure because higher governance fairness discourages households rent-seeking activities aimed to contesting social infrastructure. On the other hand, a more accountable government reduces free provision of government services and increases its investment in social infrastructure. Therefore, countries with better governance accumulate more social infrastructure and, consequently, are more productive.

According to the calibrated model, improving governance fairness has an important impact on social infrastructure and productivity of countries with low levels of social infrastructure. Therefore, considering that developing countries often have low endowments of social infrastructure, the improvement of governance fairness can be a successful development policy. In particular, if the indicator Control of Corruption —my proxy of governance fairness— increases by one standard deviation, then, for a country with values of this indicator and the indicator Voice and Accountability equal to the average values of the first decile of the social infrastructure distribution, social infrastructure increases by 83%, while TFP and GDP per worker increases by around 24% and 38%, respectively.

My quantitative results show that the impact of improving governance accountability on social infrastructure and productivity is negligible. In particular, if the indicator Voice and Accountability —my proxy of governance accountability— increases by one standard deviation, then, for a country with values of this indicator and the indicator Control of Corruption equal to the average values of the first decile of the social infrastructure distribution, social infrastructure increases by 0.4%, while TFP and GDP per worker increases by around 0.14% and 0.20%, respectively. However, it must be taken into account that the model does not consider the interrelation between both features of governance and, consequently, does not allow to evaluate the potential impact of improving gover-

nance accountability on rent-seeking and governmental corruption. In future research, this interaction might be considered.

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Table 1: Coefficients of correlation and deciles of the distribution

	Panel (a). Coefficients of correlation								
	z	y	A	V&A	PS	GE	RQ	RL	CC
Soc. Infrastruc.	1.00	0.67	0.62	0.69	0.78	0.94	0.88	0.94	0.91
GDP p. w.		1.00	0.98	0.42	0.45	0.72	0.56	0.56	0.61
TFP			1.00	0.35	0.40	0.69	0.52	0.51	0.55
V&A				1.00	0.57	0.58	0.72	0.65	0.64
PS					1.00	0.62	0.57	0.63	0.72
GE						1.00	0.76	0.85	0.85
RQ							1.00	0.87	0.77
RL								1.00	0.88
CC									1.00

All variables in logs. Year 2014.

	Panel(b). Averages								
Decile	z	y	A	V&A	PS	GE	RQ	RL	CC
1	0.03	0.12	0.25	0.24	0.22	0.12	0.15	0.12	0.11
2	0.09	0.13	0.25	0.31	0.31	0.22	0.26	0.25	0.27
3	0.15	0.17	0.31	0.48	0.51	0.34	0.35	0.25	0.31
4	0.23	0.17	0.30	0.42	0.48	0.40	0.42	0.44	0.36
5	0.34	0.24	0.39	0.56	0.68	0.51	0.54	0.47	0.43
6	0.43	0.29	0.41	0.50	0.57	0.67	0.64	0.62	0.61
7	0.58	0.39	0.49	0.81	0.86	0.69	0.71	0.70	0.66
8	0.81	0.49	0.56	0.86	1.08	0.84	0.84	0.84	0.80
9	0.99	0.72	0.73	1.01	1.16	0.96	0.98	0.96	0.94
10	1.23	0.83	0.81	1.13	1.40	1.06	1.08	1.07	1.07
Ratio of the average of the last decile to the average of the first decile									
	39.24	6.83	3.17	4.72	6.38	8.85	7.14	8.98	9.59

Al variables relative to U.S.Year 2014. V&A= Voice and Accountability, PS= Political Stability, GE=Government Effectiveness, RQ=Regulatory Quality, RL=Rule of Law, CC=Control of Corruption, A=TFP, z=Social Infrastruc--ture,y =GDP per worker.-

Table 2: Simulated data

Decile	χ	$\widehat{\pi}$	z	A	y
1	8.24	7.23	0.40	0.72	0.61
2	5.82	4.77	0.60	0.83	0.76
3	5.34	2.92	0.64	0.85	0.79
4	4.75	4.21	0.69	0.87	0.82
5	4.02	2.31	0.75	0.90	0.86
6	2.64	3.26	0.86	0.95	0.92
7	2.34	1.27	0.89	0.96	0.94
8	1.65	1.34	0.95	0.98	0.97
9	1.19	1.04	0.98	0.99	0.99
10	0.84	0.92	1.01	1.00	1.01
Ratio of the average of the last decile to the average of the first decile					
	0.10	0.13	2.51	1.39	1.64

All variables relative to the calibrated values, y=GDP per worker, z=Social infrastructure-, A=TFP.

Table 3: Simulated percentage changes in productivity and social infrastructure

Percentage variation in response to 1 standard deviation increase in									
	(a) CC			(b) V&A			(c) V&A and CC		
Decile	z	A	y	z	A	y	z	A	y
1	83.07	23.65	37.49	0.39	0.14	0.20	84.19	23.91	37.93
2	38.89	12.22	18.88	0.43	0.15	0.22	39.59	12.42	19.20
3	32.54	10.39	15.99	0.26	0.09	0.13	32.92	10.50	16.16
4	27.07	8.77	13.44	0.32	0.11	0.17	27.51	8.91	13.65
5	21.77	7.16	10.93	0.23	0.08	0.12	22.06	7.25	11.07
6	12.22	4.13	6.26	0.27	0.10	0.14	12.54	4.24	6.42
7	10.75	3.65	5.52	0.14	0.05	0.07	10.91	3.70	5.60
8	7.32	2.51	3.79	0.13	0.05	0.07	7.47	2.56	3.86
9	5.08	1.75	2.64	0.10	0.04	0.05	5.19	1.79	2.70
10	3.59	1.25	1.88	0.09	0.03	0.05	3.68	1.28	1.92

z=Social Infrastructure, A=TFP, y= Output per worker, V&A=Voice and Accountability, CC=Control of Corruption.