Decentralization and growth: Do informal institutions and rule of law matter?

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Abstract

We develop a model of the interactions among decentralization, informal institutions and the rule of law. The model sheds light on the ambiguous empirical results reported in the literature regarding the growth effects of the policy of devolving fiscal responsibility to local governments. We find that the distribution of civicness within a country determines the magnitude of the effects of decentralization on its regional convergence, as well as whether decentralization fosters or dampens the country's national growth. We perform a series of simulated "reforms" using Monte Carlo methods parameterized using OECD countries data set. We then test our findings using a panel data set of 23 OECD countries covering the period 1975–2010. We find that the short and the long run growth effect of decentralization policy depends on the size of the policy reform and can range from extremely negative to positive depending on the rule of law, the level of social capital and its regional dispersion, in line with the model predictions.

JEL classifications: O4; N9; R5

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1. Introduction and motivations

The devolution of political and economic power to local governments is a worldwide policy of fiscal reform (OECD, 2014) that presents a well-established trend (Bardhan, 2002; Rodriguez-Pose & Gill, 2003) with "decentralization of spending responsibilities outpacing the decentralization of revenue powers" (OECD, 2014).[1] This policy is grounded on the literature on fiscal decentralization (Musgrave, 1959; Oates, 1972; Tiebout, 1956; Vo, 2010) that emphasizes the theoretical comparative advantage of local governments in providing public goods.[2] Yet several decades of decentralization reforms have failed to provide clear-cut evidence on the economic effects of decentralization. Specifically, the empirical literature provides a wide spectrum of results, ranging from positive, to nil, to negative effects (for instance: Asatryan & Feld, 2011; Davoodi & Zou, 1998; Feld, Zimmermann, & Döring, 2004; Rodriguez-Pose & Ezcurra, 2010, 2011; Thornton, 2007).

This paper aims to reconcile this mixed empirical evidence and find some quantitative policy predictions of fiscal devolution reforms. We do that by developing a growth model in which formal institutions – understood as the multi-level governance design of a state and its rule of law – interact with informal institutions, such as unwritten norms, beliefs and cultural traits. These informal institutions fall under the definition of social capital in the sense of "civicness," as in Guiso, Sapienza, and Zingales (2010).[3] The rationale behind the intersection of the two research fields, social capital and fiscal decentralization, is the following: we believe that, just as the preferences of a territory's citizens have a stronger influence on local versus central government as postulated by the classical literature on fiscal federalism — so does a territory's endowment of civicness on the provision of public goods after devolution.[4] We model this idea assuming that iceberg costs are attached to the process by which tax revenues and grants are transformed into new public capital. These iceberg costs are endogenized by a stylized model of corruption in which public-project contractor firms, after winning a public tender, can decide how much to cheat on costs, capturing illegal rents and, thus, decreasing public capital accumulation. The representative contractor is assumed to maximize the expected net benefit of its illegal activity, taking into account that both the share of the project it seizes and the civicness that exists where the project takes place affect the probability of being caught. We also allow for the possibility that firms internalize the social norms where they operate as suggested by the literature on corporate responsibility (Jha & Cox, 2015) and parameterize the degree of this internalization. When solving

[1] In the OECD sample, the share of government expenditures that is controlled by Sub-National Governments (SNG) in 2011 reached a high of 31% (ranging from 15% in Israel to 66% in Canada), while the share of Local Capital Expenditures reached a significant 65% over the total of Public Capital Expenditures (OECD, 2014). By contrast, tax autonomy, measured as the share of tax revenue under the responsibility of SNG was on average only 11% of the total.

[2] For an empirical investigation on the causes fostering decentralization see Cerniglia (2003).

[3] In this paper, we adopt their definition of social capital as "those persistent and shared beliefs and values that help a group overcome the free rider problem in the pursuit of socially valuable activities." On the critical role played by trust in economic performance, see Arrow (1972) and Alesina and Giuliano (2015) for a recent survey. On the persistent character of social capital, see Guiso, Sapienza, and Zingales (2008), Guiso and Pinotti (2012) and Bisin and Verdier (2010). For a discussion about the similarities between informal institutions and social capital, see Knowles (2006). The two terms are used interchangeably in this paper.

[4] Oates (1972), Lockwood (2006) and Besley and Coate (2003) all show that local governments are more responsive to local preferences. Prud'homme (1995) maintains that in territories presenting low social capital, "local politicians and bureaucrats are likely to be more subject to pressing demands from local interest groups (whose money and votes count)" and according to Faguet (2012, 2014) also more responsive to local needs and more accountable. Corrado and Rossetti (2018) reach the same conclusions as for corruption with respect to the Italian Regions.

the general equilibrium growth model, the iceberg cost function yields an equilibrium long-run growth rate for the regional economy that is a positive piecewise function of the civicness, the expected sanctions and the degree of internalization of the social capital.

Our first result is a clear, positive link among decentralization, social capital heterogeneity and regional economic divergence. We then consider the net effect of devolution on the aggregate national growth rate. The post-reform national growth rate might result lower or higher depending on the parameters defining the shape of the iceberg cost function together with the distribution of regional social capital within the country. In order to shed some light on these complex links we perform a series of simulated "reforms" using Monte Carlo methods. We consider several distributions of regional social capital measured as "trust," and parameterize them using our 23 OECD countries data set. We, then, calculate the post-reform regional growth rates as the first moment of the distributions as implied by our model. Our Monte Carlo calculations show that when the distribution is such that a sufficient number of regions lie below the threshold, decentralization can have positive effect on national growth but this case is unlikely to take place in the OECD data set. When instead the distribution presents most of the regions above the threshold but below the flex point, decentralization can cause a negative effect on the economy's national growth rate and that effect is worsened the higher the regional heterogeneity of civicness. This is the most likely case in our data sample. Finally, when the social capital of the regions is so high to set the regions in the convex area we obtain a positive effect of decentralization. This result is obtained only for a small set of Nordic European countries. Since the contribution is mostly about the literature on the aggregate growth effects of devolution we test our model's predictions on the set of model implications for the aggregate national growth.[5] We therefore estimate a set of panel growth regressions derived by our theory on a sample of 23 OECD countries for the period 1975–2010. We find empirical evidence in favor of our model; in particular, there is evidence that the national income elasticity of decentralization is a nonlinear function of the degree of decentralization and it is interrelated with the first and second moment of the regional social capital distribution as well as the rule of law. We built three clusters of countries based on the average national social capital, its regional dispersion and the rule of law. We were able to calculate both the short run elasticity as well as the long run one for the three clusters. The short run effects were found to be initially positive then negative according to the increasing level of decentralization reform. However we found that the negative effects took place sooner for the clusters of countries with low and intermediate social capital and rule of law, and whose social capital is more regionally dispersed.

We also calculated the growth effects in the long run for a policy that implies a large devolution reform (from 10% to 65% of public expenditure). The effects are positive only for those countries with high rule of law, high social capital and that present a low regional dispersion of social capital. Positive effects can be found for all clusters but for different devolution levels that are lower the lower are the rule of law of the country, its social capital and the higher is the regional dispersion of social capital. The policy recommendation for a centralized country willing to begin a devolution process is clearly to decentralize small shares of government expenditures when it presents low and highly dispersed social capital and low rule of law.

[5] As for those for the regional convergence/divergence, a calibration exercise on the Italian case is available on earlier versions of the paper available upon request.

2. The model

In this section, we analyze the basic mechanism described above – decentralization and its interaction with social capital – and its macroeconomic effects within an endogenous growth model inspired by Futagami, Morita, and Shibata (1993), who extended the famous Barro's growth model (Barro, 1990) to consider public capital instead of public services. In our model, civicness affects the economy through its influence on the effectiveness of government in providing public capital. Since the model focuses on capital expenditures, leaving taxation exogenously determined, it differs from other growth models on the subject.[6]

We consider a sub-national economy j that is part of an economic union that is populated by N infinitely-lived individuals, each endowed with one unit of time inelastically supplied to M firms. Private firms produce output (Y) using labor (L) and, private capital (K), taking the rival but non-excludable public capital (P/N) as given. The technology of the i-th firm is given by:

$$Y_{ij} = A_j {K_{ij}}^{\alpha} {L_{ij}}^{1-\alpha} (P_j/N_j)^{1-\alpha}, \tag{1}$$

where all variables are implicitly a function of time. Not all N individuals are employed in the sector producing final output only a fraction l; a marginal fraction, lp, is hired by government as supervisors of the public investment projects, (l = 1 − lp). Normalizing N to one, the per capita output of region j is defined as:

$$y = Ak^{\alpha} l^{1-\alpha} p^{1-\alpha}, \tag{2}$$

where the sub-indexes have been dropped without any loss of information. In order to focus on the effect of social capital on growth in the presence of decentralization, we analyze our model under full employment. Assuming the public employee are paid at market wage rate w, the total taxable income of the economy is given by:

$$\tilde{y} = y + y_p = y + wlp = wl + l\ r\, a_l + lp\, r\, a_p + wlp = (w + a\ r) \tag{3}$$

where r is the return of capital and a, equal to k, is the total asset that is equal to the weighted average of the asset stock held by the two types of workers: $(l\, a_l + lp\, a_p)$.[7] The only task of government in this context is to raise taxes and provide public capital accumulation. In our sub-national economy, $(\tau + \upsilon)\tilde{y}$, investment projects of value one are implemented by private contractor firms, where τ is the tax rate set at the national level and υ is the positive or negative fiscal residual-to-income ratio or "transfer rate"[8] from the center. The public employees are hired to monitor these projects. We assume that these monitoring costs are a fixed share (ε) of the project value and take the form

[6] In fact, most of these models (e.g., Brueckner, 2006; Davoodi & Zou, 1998; Hatfield, 2012; Köthenbürger & Lockwood, 2010; Rauscher, 2007) hinge on some type of tax competition mechanism among local entities that limits distortionary taxation, along the lines of Brennan and Buchanan (1980). Typically, an unambiguous positive effect of decentralization on growth is obtained, which is not in line with the empirics. Alternatively, Cerniglia and Longaretti (2013) obtain positive results hinging on asymmetric information between local and central authorities concerning local human capital distribution.

[7] The $\tilde{y}$ is close to GDP of national accounts since it consists of the sum of the value added of the two sectors, As better explained in the following, Eq. (3) is obtained under the assumption of fully immobile factors and firms operating in a competitive setup such that they equalize marginal factor productivity to their factor cost, taking public capital as given.

[8] The interval [−1,+1] for ν is more a sensible assumption than a binding constraint since transfers could, in principle, be a multiple of a region's GDP. Nevertheless, the actual data on fiscal decentralization seem in line with this assumption. Italian data, for example, set υ within −0.07 to 0.18 (Southern regions); for the USA in the period 1990–2009, we observe a net fiscal residual from −0.2 up to +0.3 (Puerto Rico) (Manasse & Baldini, 2013).

of stipends to the public officials (lp) who monitor the projects. The government budget balances in the aggregate. At the local level the income of public employees is: $y_p = (\tau + \upsilon)(w + a\,r)\,\epsilon$.[9] Therefore, we conveniently express the taxable income of the regional economy in terms of private sector income only[10]:

$$\tilde{y} = y + y_p = [1 - \epsilon(\tau + \upsilon)]^{-1} y. \tag{4}$$

Had there been no any further inefficiencies, the instantaneous regional public capital accumulation would be: $(\tau + \upsilon)\tilde{y}(1 - \epsilon)$ or $(\tau + \upsilon)(1 - \epsilon)[1 - \epsilon(\tau + \upsilon)]^{-1} y$. However, that might well be not the case. In our stylized investment sector, contractor firms are assumed to bid on these projects in a competitive setup. Competition drives the contractors' economic profits to zero; nevertheless, once a contractor has won the tender, it can still extract a share $\tilde{S}$ of illicit rents from the value of the project by cheating on the costs or the quality of materials defined in the public tendering. However, contractors are assumed to be able to extract public resources in this way only if they can find crooked public officials and a social environment with a code of silence. It is in this setting that social capital, in the sense of civicness (Guiso et al., 2010), can exert its effects through two possible channels: (a) the honesty and civicness of the officials who control the public tendering; and (b) the endowment of people's civicness in the region in which the investment project takes place. Regarding the first channel, we assume that the probability of an official being corrupt is linked to his/her cultural heritage, the unwritten norms of civicness and, particularly, the social stigma on corruption in the community in which the official was raised — in line with Tabellini (2010). Also, Ichino and Maggi (2000), using data on shirking, and, especially, Fisman and Miguel (2007), using data on UN officials' parking tickets in NY, show that individual cultural backgrounds matter to a certain extent, even when a public official moves to another location. As for the second channel, since investments are tangible goods and the possible fraud of contractors is, to a certain degree, observable, social capital in the sense of civicness, S_k, is thought to increase the probability of whistle-blowing and the demand of accountability. The higher the civicness the higher the probability that other institutions, media, groups or merely simple citizens break the code of silence and denounce the illegal behavior. In addition, the partial observability of the fraud also implies that the larger the illegal share of the project that the contractor seizes, $\tilde{S}$, the higher is the probability of being caught for any given level of social capital in the location where the investment is made. Moreover, we cannot exclude *a priori* the possibility that firms internalize the informal rules where they operate. It could be the case that the management or the ownership of firms consider some type of moral costs associated with their illegal behavior or that firms consider the loss of reputation implied by the illegal behavior. In this case these additional cost of fraud are likely to be dependent on the level of civicness where the firms are found to operate as reported by Jha and Cox (2015) for the USA.[11] We will go back to this point. We start formalizing the above mechanisms considering the probability of being caught as a function of civicness and

[9] Clearly the fiscal residuals are assumed to balance in the aggregate and we assume $\sum_{1}^{H} (\tau + \upsilon_j) n_j \tilde{y}_j = \tau \tilde{y}_{nation}$, where j is the region index H is regions' number and n_j the region's population weight.

[10] This assumption implicitly determines the number of public officials, *lp*, given the private market wage and the number of projects.

[11] Jha and Cox (2015) find that "a firm headquartered in a high social capital county in the United States has greater corporate social responsibility". On how social environment affects firms' behavior see also: McGuire et al. (2012) and Hilary and Hui (2009). On the influence of local beliefs on firms' behavior Di Giuli and Kostovetsky (2014).

the share of illegal rent:

$$pr = P(Being\ Caught \mid \tilde{S},\ S_k) \text{ with } \partial P/\partial \tilde{S} > 0,\ \partial P/\partial S_k > 0$$
$$\text{and } \tilde{S} \in [0,1],\ S_k \in [0,1]. \tag{5}$$

In line with the above considerations, we also assume that the cross derivatives $P_{\tilde{S},S_k}$ are positive. Nevertheless, assuming the second derivative to have either a positive or a negative sign is questionable. In fact, one could easily justify increasing, as well as decreasing, the marginal effect of both S_k and $\tilde{S}$on the probability of being caught. Therefore, instead of imposing either a convex or a concave relationship, we assume a linear one. A compact way to formalize this hypothesis is:

$$pr = P(Being\ Caught \mid \tilde{S},\ S_k) = \tilde{S} \cdot S_k. \tag{6}$$

The interpretation of (6) is straightforward: when a region displays, for example, the highest possible level of social capital – e.g. one – and the contractor appropriates 100% of the value of public investment, the contractor is caught for sure ($pr = 1$).[12] With regard to the fine, we can think of three factors affecting its expected value: the amount of the fraud, the formal penalty and the efficacy of the judicial system. In fact, a review of the laws and enforcement on corrupt practices in 19 national jurisdictions (Linklaters, 2012) reports that the typical sanction of a company or individual that bribes consists of a variable fine and several years of imprisonment of the briber, depending upon the seriousness of the fraud, which the court decides. Therefore the fine appears to be a positive function of the fraud. It also appears that these sanctions are generally quite severe in almost all countries (Linklaters, 2012). Nevertheless, we know that countries do differ in the enforcement of sanctions, as the data on the *de facto* rule of law show. In our model, the fine is to be thought as the actual punishment expected by contractors; thus, it is the *de facto* and not just the *de jure* fine. As a matter of fact, when, later on, we test the model through data, we will make explicit use of *de facto* rule-of-law indexes. We model the fine as a parameter F times the chosen illegal rents $\tilde{S}$. As mentioned above, in addition to the fine we include an extra cost term into the firm decision problem as a function of the illegal rents $\tilde{S}$ and S_k to capture the possible internalization of civicness by firms when they engage in stealing. Adding these additional costs of fraud to the problem of firms is a reduced-form way to capture what in the growing literature of managerial economics is defined as "social responsibility" or "business ethic". How firms' ethic is influenced by culture and beliefs has been recently a subject of study by many scholars (Di Giuli & Kostovetsky, 2014; Hilary & Hui, 2009; Jha & Cox, 2015; McGuire, Omer, & Sharp, 2012; among others). In particular, Jha and Cox (2015) report that their index of corporate social responsibility is empirically linked to the social capital of the counties of US where firms have their headquarters showing that, at least in the case of US firms, social norms have a role. In our context these social norms are assumed to impose moral costs to managers and/or the owners of the contractor firms limiting their misconduct (Guiso, Sapienza, & Zingales, 2004; Levitt & List, 2007). Finally, the additional cost term can also be thought to capture the possible loss of reputation caused by firm's illegal behavior that could prevent the firm from winning other tenders. Clearly these reputational costs are expected to be more effective in the contest of civic societies

[12] Nussim and Tabbach (2009) propose a model of crime close to ours in which the probability of punishment is not fixed but depends on criminal activity.

(Levitt & List, 2007). Indeed a full model would consider formalizing the ethics of firms as the results of a complex interactions among managers, stockholders and stakeholders as discussed Bénabou and Tirole (2010) but this is beyond the scope of the present study. Despite our shortcut it is worth underlining that we will not impose *a priori* the strength of these social norms which in the present context are to be understood as civicness. We just assume these "moral costs" are an exponential function of civicness with a power parameter, $\gamma > 0$ for every unit of illegal rent contractors seize. The parameter γ capture the degree of internalization of civicness by firms. As S_k is defined in the interval [0,1] when γ tends to zero firms internalize social norms to a large extent, as γ becomes larger the firm are less and less concerned about the social norms in terms of civicness in the society where they operate. Under the hypothesis that contractors are risk-neutral and separable in the real costs (the fine) and moral costs as in Levitt and List (2007), the contractor problem is the maximization of the net expected rent, $E(\pi)$, for each project, defined as:

$$E(\pi) = (1 - pr)\,\tilde{S}\,b - pr\,\tilde{S}\,F\,b - b\,\tilde{S}\,{S_k}^{\gamma} \quad \text{s.t.}\tilde{S} \in [0,1]\,,\ S_k \in [0,1] \text{ and } pr = \tilde{S}\,S_k; \tag{7}$$

where b is what really accrues to the firm and $1 - b$ is the share that goes to corrupted public officials. Contractor firms transfer the illegally acquired rent as a lump sum, $b\,R$, to the firms' owners. Rendering endogenous how the illegal rent is shared between the contractor firm and the corrupt public official is beyond the scope of the present paper since the focus is on $\tilde{S}$. The solution implies an optimal level of illegal rent $\tilde{S}^*$ that is a piecewise negative function of S_k in the interval [0,1] given F:

$$\tilde{S}^* = \text{Min}(\frac{1 - {S_k}^{\gamma}}{2(1 + F)S_k},\ 1). \tag{8}$$

Since we are interested in what is not "stolen" we define $S = 1 - \tilde{S}^*$ as the flow of public capital expenditure that is going to become actual public capital, a formulation that can be straightforwardly interpreted as an iceberg cost function. As in the iceberg cost metaphor, here one unit of tax is "melted" away due to illegal rents in its way to become public capital. Eq. (8) implies that equilibrium iceberg costs, S, will be a positive and piecewise function of social capital:

$$S = \text{Max}\ (1 - \frac{1 - {S_k}^{\gamma}}{2(1 + F)S_k},\ 0) \tag{9}$$

The fine, F, affects the level of S_k for which the iceberg costs are the maximum — i.e., S is zero. The higher the F, the lower the threshold level of S_k for which we have the maximum inefficiency. The threshold is defined by the S_k that solves:

$$1 - \frac{1 - {S_k}^{\gamma}}{2\,(1 + \text{F})\,S_k} = 0. \tag{10}$$

Although a closed form solution w.r.t. to S_k of Eq. (10) cannot be found, it is trivial to show that in the interval S_k [0,1] a real solution exists and it is unique. An increase in the fine parameter, F, lowers the threshold for which our iceberg cost function is zero and also affects the shape of the S(.) function. Fig. 1 displays several S(.) for given level of γ and F.

It is worth noticing that as γ increases, firms internalize less, the S(.) shifts downward but only for high values of γ the shape of the S(.) displays a flex point. As expected, when the fine F is low and firms internalize very little the social norms their illegal behavior is higher for every

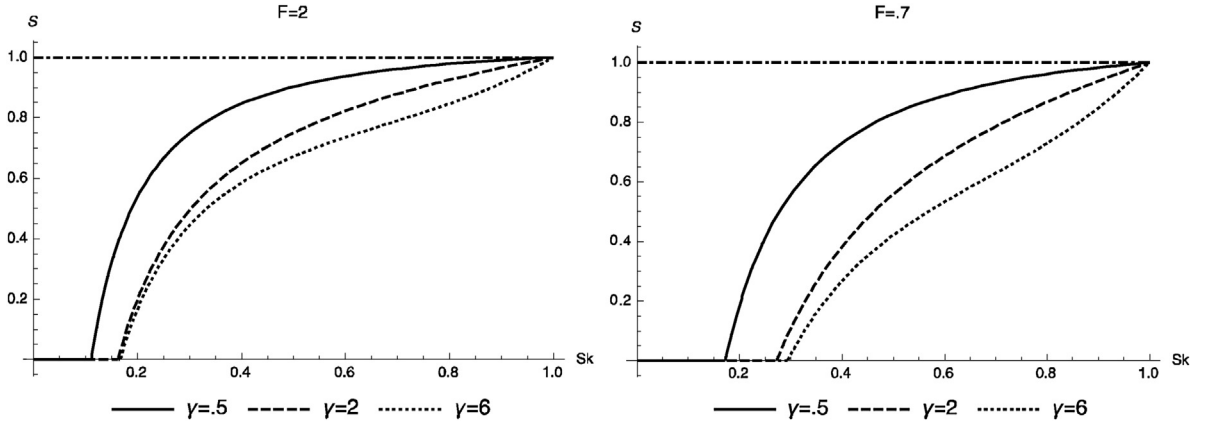
F=2
S
1.0
0.8
0.6
0.4
0.2
0.2
0.4
0.6
0.8
1.0
Sk
γ=.5
γ=2
γ=6
F=.7
S
1.0
0.8
0.6
0.4
0.2
0.2
0.4
0.6
0.8
1.0
Sk
γ=.5
γ=2
γ=6

Fig. 1. S(Sk,.).

level of civicness. The marginal effect of civicness is always positive but: decreasing when firms internalize the social norms; first decreasing and then increasing when they internalize little. In the latter case, the "moral and reputational costs" exert their positive effects on firms' only at very high level of civisms in the society.

The negative relationship between illicit rents and social capital implied by Eq. (9) is empirically supported by Nannicini, Stella, Tabellini, and Troiano (2013),[13] and, in particular, by the inverse relationship between social capital and iceberg costs associated with the accumulation of public capital in Golden and Picci (2005) for the Italian case. In general the negative relationship between social capital and government inefficiency encompassing corruption has been an established regularity across countries (Bjornskov, 2003, 2011; Corrado & Rossetti, 2018; Knack & Keefer, 1997; Knack, 2002; La Porta, Lopez-Silanes, Schleifer, & Vishney, 1997) .We are now going to analyze the dynamic of the regional economy under the assumption of fully immobile factors, an implicit or explicit assumption in many regional growth models. This assumption is reasonable for public capital, clearly less so for labor and capital. We believe this analysis subsumes the other cases we discuss later one: (a) capital mobile and labor fixed, (b) capital and labor fully mobile. Firms operate in a competitive setup and are assumed to equalize marginal factor productivity to their factor cost, taking public capital as given. For the representative firm of a region:

$$\begin{aligned} w &= A(1-\alpha)(\frac{K}{L})^{\alpha} p^{1-\alpha} = (1-\alpha)A(\frac{K}{N})^{\alpha}(1-lp)^{-\alpha}p^{1-\alpha} \\ &= (1-\alpha)A(1-lp)^{-\alpha}k^{\alpha}p^{1-\alpha} = (1-\alpha)A(1-lp)^{-\alpha}(k/p)^{\alpha}p \end{aligned} \tag{11}$$

$$r = \alpha A K^{\alpha-1} L^{1-\alpha} p^{1-\alpha} = \alpha(1-lp)^{1-\alpha} A k^{\alpha-1} p^{1-\alpha}; \tag{12}$$

where the first order conditions have been conveniently rewritten in per capita terms. Each agent who is not employed as public official (indexed with l) in the sub-national economy is assumed to solve a standard inter-temporal maximization problem, where agents' preferences are proxied by an iso-elastic utility function of consumption (c):

$$\begin{aligned} &\text{Max} \int_0^{\infty} \frac{1}{1-\theta} {c_l}^{1-\theta} e^{-\rho t} dt, \\ &\text{subject to}: \quad \dot{a}_l = (1-\tau)(r a_l + w) - c_l + \frac{bR}{1-lp} \quad \text{and} \lim_{t\to\infty} e^{-rt} a_l = 0, \end{aligned} \tag{13}$$

where a is the accumulable asset; τ is the tax rate; R is the expected illegal rents that the contractors as a whole transfer to all households as a lump sum: $R = (1-\epsilon)(\tau+\upsilon)(w+ra)[(1-\tilde{S}^* S_k)\tilde{S}^* - (\tilde{S}^* S_k)\tilde{S}^* F]$. Solving the problem yields the standard Euler condition:

$$\dot{c}_l = \frac{c_l}{\theta}((1-\tau)r - \rho). \tag{14}$$

[13] The reason for this is that un-civic voters reward a corrupt politician as long as they obtain targeted benefits, so that the threat of electoral punishment is weaker for incumbent politicians (and rents, or iceberg costs, higher) when social capital is low (Nannicini et al., 2013).

We need to also consider the flows of resources going to corrupt public officials (indexed by lp) who share the same preferences with the other households. In this case we have the same inter-temporal problem as defined by (13) but where the budget constraint is defined as[14]:

$$\dot{a}_{lp} = (1-\tau)(r\ a_{lp} + w) - c_{lp} + \frac{(1-b)R}{lp} \tag{15}$$

Given the form of the constraint (15), the public officials' Euler equation is, therefore, identical to those of the other households. Clearly, in the aggregate the total private per capita capital of the economy, k, is equal to $a = (1-lp)\,a_l + a_{lp}lp$ and therefore it will also hold: $\dot{k} = \dot{a}_l(1-lp) + \dot{a}_{lp}lp = (1-\tau)(w + a\,r) - c + R$. However, we want to render explicit all illegal and legal incomes. Substituting $\dot{a}_l$ and $\dot{a}_{lp}$ using (15), after some algebra, we obtain the equation of motion of per capita capital of the regional economy:

$$\dot{k} = k^{\alpha} p^{1-\alpha} l^{1-\alpha} A[1-\epsilon(\tau+\upsilon)]^{-1}[(1-\tau) + (1-\varepsilon)(\tau+\upsilon)\tilde{S}^*(1-\tilde{S}^* S_k(1+F))] - c \tag{16}$$

where c is the total per capita consumption of the economy $\left[(1-lp)\,c_l + c_{lp}lp\right]$. In facts, the Eq. (16) is just a modified version of a standard one to account for the flow of illegal rents that goes back to agents. In order to obtain the public capital growth we now consider the regional government total purchase of capital goods net of monitoring costs denoted as I. We assume that punishment does not generate revenue for the local government otherwise we should add a term to account for the revenue coming from the fine[15]:

$$I = (1-\epsilon)(\tau+\upsilon)(w + ar) \tag{17}$$

The total government expenditure in the region is just I plus the monitor costs. The actual increase in the public capital stock is I times the iceberg cost parameter S. Therefore after some algebra we obtain the law of motion of public capital with iceberg costs:

$$\dot{p} = S\ I = SAl^{1-\alpha}k^{\alpha}p^{1-\alpha}(1-\epsilon)(\tau+\upsilon)[1-\epsilon(\tau+\upsilon)]^{-1} \tag{18}$$

where $0 \le \tau \le 1,\ 0 < \varepsilon \le 1,\ -1 \le \upsilon \le 1$.

The whole dynamic of the model is defined by Eqs. (18), (16) and the Euler equations which are equal for the two types of agent. It is quite convenient to express the whole model using the private-to-public capital ratio, $\hat{k}$, and the consumption-to-public- capital ratio ,$\hat{c}$. Using Eq. (12) the entire model is summarized by the usual transversality condition and the following three differential equations:

$$\frac{\dot{p}}{p} = S\hat{k}^{\alpha}\hat{A}(1-\epsilon)(\tau+\upsilon)[1-\epsilon(\tau+\upsilon)]^{-1} \quad \dot{p} \ge 0 \tag{19}$$

$$\frac{\dot{\hat{c}}}{\hat{c}} = \frac{1}{\theta}(\alpha\hat{k}^{\alpha-1}(1-\tau)\hat{A} - \rho) - \frac{\dot{p}}{p} \tag{20}$$

[14] We assume here that public officials are prevented from owning shares of the contractor firms and that financial markets succeed in eliminating the idiosyncratic risk of illegal activity whose returns take the form of lump sum bonuses to stock holders.

[15] The additional term should be $[(\tilde{S}^* S_k)\tilde{S}^* F\tau(w + ra)]$ assuming that all revenue remains in the region. This assumption is clearly a shortcut that avoids us to endogenize F that we leave exogenous as we do for taxation. A full model of government behavior over the taxation and the fine is beyond the scope of the present paper. We see it however not very unrealistic when one considers that, in reality, it is quite difficult and costly for the government to recoup the illicit rents.

$$\frac{\dot{\hat{k}}}{\hat{k}} = \hat{k}^{\alpha-1}\hat{A}[1-\epsilon(\tau+\upsilon)]^{-1}[(1-\tau)+(1-\varepsilon)(\tau+\upsilon)\tilde{S}^*(1-\tilde{S}^*S_k(1+F))] - \frac{\hat{c}}{\hat{k}} - \frac{\dot{p}}{p} \tag{21}$$

where $\hat{A} = Al^{1-\alpha}$. Although the system appears quite complicate it simplifies to a more familiar one, once one consider no inefficiency, zero fiscal residuals and zero monitoring costs (so no public employees). After substituting the growth rate of public capital, p, in (20) and (21) it is possible to analyze the dynamic system qualitatively using the phase diagram in the plane $\hat{k}$ and $\hat{c}$.

$$\frac{\dot{\hat{c}}}{\hat{c}} = \frac{1}{\theta}(\alpha\hat{k}^{\alpha-1}(1-\tau)\hat{A} - \rho) - \hat{k}^{\alpha}\mathrm{S}\Psi_2 \tag{22}$$

$$\frac{\dot{\hat{k}}}{\hat{k}} = \hat{k}^{\alpha-1}\Psi_1 - \frac{\hat{c}}{\hat{k}} - \hat{k}^{\alpha}S\Psi_2 \tag{23}$$

where: $\Psi_2 = \hat{A}(1-\epsilon)(\tau+\upsilon)[1-\epsilon(\tau+\upsilon)]^{-1}$ and $\Psi_1 = \hat{A}[1-\epsilon(\tau+\upsilon)]^{-1}[(1-\tau)+(1-\varepsilon)(\tau+\upsilon)\tilde{S}^*(1-\tilde{S}^*S_k(1+F))]$ which are both positive. Given the restrictions on parameters and the form of the production function, the system is saddle path stable with steady-state values $\hat{k}^*$ and $\hat{c}^*$. In Futagami et al. (1993), the authors, following Barro (1990), analyze the normative implications of their model with respect to tax policy. In the present model, instead, we adopt a more positive approach since we are interested mainly in the growth effects of changes in S induced by decentralization and, thus, focus on the balanced growth path of this economy. In steady state c, k and p grow at the same rate since $\hat{k}^*$and $\hat{c}^*$are constant, so that the long-run growth rate of the economy can be analyzed using the equation of motion of public capital only. Therefore, the long-run growth of the regional economy is:

$$g = \hat{k}^{*\alpha}S\hat{A}(1-\epsilon)(\tau+\upsilon)[1-\epsilon(\tau+\upsilon)]^{-1} = \hat{k}^{*\alpha}S\Psi_2. \tag{24}$$

The effects of the changes in τ, F and S_k on the balanced growth path depend on both the direct effects and the indirect effects they induce on $\hat{k}^*$. From (24), g is clearly increasing with respect to S($\mathrm{S_k}$) and, thus, to $\mathrm{S_k}$ and τ, whereas it is clearly positive and concave with respect to $\hat{k}^*$. Therefore, it is crucial to analyze the relationship among $\hat{k}^*$, $\mathrm{S_k}$, F and τ to the right of the threshold point. In fact to the left of it, S and thus g will be zero. It appears convenient to rewrite the zero locus for the c/p ratio that determines $\hat{k}^*$ in implicit form in order to assess the derivative sign of g with respect to $\mathrm{S_k}$, F and τ:

$$\Gamma(\hat{k}^*, S_k, \tau, F, .) = \alpha\hat{k}^{*\alpha-1}\hat{A}(1-\tau) - \rho - \hat{k}^{*\alpha}\theta S\ \ \Psi_2 = 0 \tag{25}$$

Also, from Eq. (25), given the assumptions on parameters and the form of the production function it is straightforward to prove a real solution exists. We consider $\partial g/\partial\tau$ from Eq. (24) first:

$$\frac{\partial g}{\partial\tau} = \hat{k}^{*\alpha}S\hat{A}(1-\epsilon)[1-\epsilon(\tau+\upsilon)]^{-1} + S\hat{A}(1-\epsilon)[1-\epsilon(\tau+\upsilon)]^{-1}\alpha\hat{k}^{*\alpha-1}\frac{\partial\hat{k}^*}{\partial\tau}. \tag{26}$$

The derivative $\partial g/\partial\tau$ depends on a positive term plus the term $\partial k^*/\partial\tau$ whose sign can be derived by the implicit function. As both $\Gamma_\tau\Gamma_{\hat{k}^*}$ can be shown to be negative, we can conclude that $\partial\hat{k}^*/\partial\tau$ is negative by the implicit function theorem. Therefore, the sign of the derivative of g with respect to τ has two components opposite in sign. An inverted U relationship is expected between growth and the tax rate, as in the models of Barro (1990) and Futagami et al. (1993). In favor of this

proposition, setting υ equal zero, we found that as tax rates tends to zero, the second term vanishes therefore $\partial g/\partial\tau$ is positive. For tax rates that tends to one, $\partial g/\partial\tau$ turns out to be negative[16]:

$$\begin{cases} \lim_{\tau\to 0}\dfrac{\partial g}{\partial\tau} = (1-\varepsilon)S\hat{A}\hat{k}^{*\alpha} > 0 \\ \lim_{\tau\to 1}\dfrac{\partial g}{\partial\tau} = \hat{A}S\hat{k}^{*\alpha}(\varepsilon - \dfrac{\alpha\hat{k}^{*\alpha-1}+\hat{k}^{*\alpha}\hat{A}S}{\rho+\alpha\hat{k}^{*\alpha}\theta\hat{A}S}) < 0 \;\; if \;\; \varepsilon\rho < \alpha\hat{k}^{*\alpha}+\hat{k}^{*\alpha}\theta\hat{A}S(1-\alpha\varepsilon) \end{cases} \tag{27}$$

We are also interested in the impact of tougher punishment for corruption on long-run growth. In this case the total derivative is:

$$\frac{\partial g}{\partial F} = \hat{k}^{*\alpha}\Psi_2\frac{\partial S}{\partial F} + S\Psi_2\alpha\hat{k}^{*\alpha-1}\frac{\partial\hat{k}^*}{\partial F}. \tag{28}$$

Regarding the first term of Eq. (28), from Eq. (9) the higher the fine F, the lower the share of illegal rent ($\partial S/\partial F > 0$). Therefore the first term is positive. Since $\Gamma_{\hat{k}^*} < 0$ and $\Gamma_F < 0$, we can establish that $\partial\hat{k}^*/\partial F < 0$, thus the second term is negative. However after some algebra we can get that growth is, as expected, always increasing in F:

$$\frac{\partial g}{\partial F} = \Psi_2\frac{\partial S}{\partial F}\hat{k}^{*\alpha}[1 - \frac{\alpha\theta\Psi_2}{(1-\alpha)(1-\tau)\hat{k}^{*-1}+\rho+\alpha\theta\Psi_2}] > 0 \tag{29}$$

What about $\partial g/\partial S_k$? From Eq. (24) we can write:

$$\frac{\partial g}{\partial Sk} = (\tau+\upsilon)(1-\epsilon)\hat{A}\hat{k}^{*\alpha}\frac{\partial S}{\partial Sk} + (\tau+\upsilon)(1-\tilde{\varepsilon})\hat{A}S\alpha\hat{k}^{*\alpha-1}\frac{\partial\hat{k}^*}{\partial Sk}. \tag{30}$$

Since $\Gamma_{\hat{k}^*} < 0$ and $\Gamma_{S_k} < 0$ by the implicit function theorem, we obtain that $\partial\hat{k}^*/\partial S_k < 0$. Again we have a positive and negative term. However after some algebra we get:

$$\frac{\partial g}{\partial Sk} = (\tau+\upsilon)(1-\epsilon)\hat{A}\hat{k}^{*\alpha}[\frac{\frac{\partial S}{\partial Sk}\alpha(1-\alpha)\hat{k}^{*\alpha-1}}{\alpha(1-\alpha)\hat{k}^{*\alpha-1}+\alpha(1-\alpha)\hat{k}^{*\alpha}\theta S\Psi_2}] > 0 \tag{31}$$

3. Regional convergence, national growth and decentralization

We are now going to analyze the issue of decentralization that takes the form of a full devolution of responsibility upon public (capital) expenditure on sub-national government, later on we will deal with partial decentralization. In our model, the iceberg costs associated with public investment are a function of a territory's social capital when decision-making is attributed to the local government. When, instead, the decision-making is centralized, iceberg costs are function of the national social capital, that is, some *weighted average* level of social capital. It is natural to think these weights to be regions' population shares of total population.[17] The rationale for this hinges on two considerations. The first concerns the accountability of a central government.

[16] When transfers υ are negative, the benefits of taxation due to public investments are decreased; thus, the optimum level of taxation in terms of maximum growth is lower. In others words, the inverted U relationship shifts its maximum for a lower level of taxation in the interval. When transfers are positive, the opposite takes place. In fact, the transfers can be so generous as to set the maximum growth for the tax rate equal to one if $1-2(\alpha+S)/\hat{k}^* < 0$.

[17] Assuming the weights to be the population shares is not crucial for the main qualitative results of the paper provided the national social capital it is a convex combination of regional ones.

Since the resources are pooled and then partially redistributed, it is expected that all regions and their political representatives have the incentive to monitor the government's activities, or at least each region according to its internal accountability, which is a function of its own social capital. Again, the natural way to capture this mechanism is to consider the determining social capital to be the average national, and not the local, social capital. The second consideration involves the bureaucrats. Since central-government officials are typically hired through national public competition, officials' cultural legacy, values and beliefs matter even when they move from their original regions (Fisman & Miguel, 2007; Ichino & Maggi, 2000). In their famous experiment based on the unpaid parking fines of UN diplomats in New York City, Fisman and Miguel (2007) show the importance of public officials' cultural legacy in accounting for their behavior. Therefore, when one considers the central bureaucracy, a blend of regional cultural traits and beliefs of the nation is expected. This blend is naturally approximated by the national average of regional $\bar{S}_k$.

We are now able to describe the growth of region jth. From Eqs. (24), (25), (9) and under the assumption of both capital and labor perfectly immobile, the long run growth rate of region j when the regime is centralized is:

$$\begin{cases} g_j = \hat{k}_j^{*\alpha} S(\overline{S_k}, F)\hat{A}_j(1-\epsilon)(\tau+\upsilon_j)[1-\epsilon(\tau+\upsilon_j)]^{-1} \\ \Gamma(\hat{k}_j{}^*, \overline{S_k}, \tau, F, \upsilon_j, \epsilon) = 0 \end{cases} \tag{32}$$

whereas under decentralized regime is:

$$\begin{cases} g_j = \hat{k}_j^{*\alpha} S(S_{kj}, F)\hat{A}_j(1-\epsilon)(\tau+\upsilon_j)[1-\epsilon(\tau+\upsilon_j)]^{-1} \\ \Gamma(\hat{k}_j{}^*, S_{kj}, \tau, F, \upsilon_j, \epsilon) = 0 \end{cases} \tag{33}$$

When capital is fully mobile and labor immobile the rate of returns on capital is equalized among regions:

$$r = \alpha\hat{A}_j\hat{k}_j^{*\alpha-1} \rightarrow \hat{k}_j{}^* = \left(\frac{\alpha\hat{A}_j}{r}\right)^{\frac{1}{1-\alpha}} \tag{34}$$

where the interest equalizes supply and demand of capital in the nation if the economy is closed or it is given if the economy is a small open economy. Moreover, we can express each region's $\hat{k}_j$ as a linear function of national average capital ratio, $\bar{\hat{k}}$[18]:

$$\hat{k}_j{}^* = \frac{\hat{A}_j{}^{\frac{1}{1-\alpha}}}{\sum_1^H n_j\hat{A}_j{}^{\frac{1}{1-\alpha}}}\bar{\hat{k}}^* = \tilde{A}_j\ \bar{\hat{k}}^* \tag{35}$$

We are now able to define the steady state growth rate under centralized regimes assuming each region is sufficiently small to not affect the national equilibrium interest rate (alternatively we could consider an open small national economy):

$$\begin{cases} g_j = \left(\frac{\alpha\hat{A}_j}{r}\right)^{\frac{\alpha}{1-\alpha}} S(\overline{S_k}, F)\hat{A}_j(1-\epsilon)(\tau+\upsilon_j)[1-\epsilon(\tau+\upsilon_j)]^{-1} \end{cases} \tag{36}$$

[18] Since : $r^{\frac{1}{\alpha-1}}\alpha^{\frac{1}{1-\alpha}}(\hat{A}_j)^{\frac{1}{1-\alpha}} = \hat{k}_j{}^*$ and $r^{\frac{1}{\alpha-1}}\alpha^{\frac{1}{1-\alpha}}\sum_1^H n_j\hat{A}_j{}^{\frac{1}{1-\alpha}} = \bar{\hat{k}}^*$.

whereas when the regime is decentralized the growth rate of region jth is:

$$\begin{cases} g_j = (\frac{\alpha \hat{A}_j}{r})^{\frac{\alpha}{1-\alpha}} S(S_{kj}, F)\hat{A}_j(1-\epsilon)(\tau+\upsilon_j)[1-\epsilon(\tau+\upsilon_j)]^{-1} \end{cases} \tag{37}$$

Still the wage rate is different and remains so even if we had set the TFPs equal and the fiscal residual parameters equal to zero. This is because the regions differ by p_j due to population immobility:

$$w_j = (1-\alpha)\hat{A}_j \hat{k}_j{}^{\alpha} \; p_j \tag{38}$$

In the case of labor perfectly mobile as capital, wages also equalize, and the per capita public capital will adjust to be equal to:

$$\frac{p_j}{p_i} = (\frac{\hat{A}_i}{\hat{A}_j})^{\frac{1}{1-\alpha}} \quad \vee i, j \tag{39}$$

In case TFP are equal among regions and fiscal residuals parameters equal to zero we would have the same per capita capital, both private and public, and equal income. We regard this last case as uninteresting since not empirically relevant. The reasons are threefold. In general, we observe regional per capita GDP dispersion coupled with wage dispersion (and little unemployment) or large unemployment dispersion (and a common national wage, as in the case of Italy e.g.). Moreover we do observe regional dispersion in per capita public capital but certainly not negatively correlated with the TFP of the regions.[19] In addition, since the regional growth rates are larger for the more efficient regions (both in terms of TFP as well as iceberg costs) we would observe a never-ending population emptying of the least efficient ones. This is not observed. Instead we observe that migration flows stabilize when the regional GDP gaps are sufficiently small. This is in line with some heterogeneous real and/or psychological costs of migration as in Gennaioli, LaPorta, Lopez-de-Silanes, and Shleifer (2014) such that labor migration flows eventually write off. We will therefore focus only on the cases of fully immobile factors and the one when only capital is mobile. The two cases, however, yield the same qualitative results since the two implied growth functions share the same properties for similar parameters values. In Fig. 2 we report the values of growth implied by the Eqs. (33) and (37) as S_k varies for two different values of γ.[20] The growth-S_k relationships we numerically obtained are increasing in S_k, are piecewise concave for a small value of γ and piecewise concave first then convex when γ is large.

Given the similarities of the growth functions, the major implications of our model as far as the growth effects of decentralization can be carried on using either the capital immobile or capital mobile case.

Whatever it is the value of γ, small or large, the form of the growth function in both cases implies that when we decentralize the growth of regions endowed with more civicness increases and the growth of poorly endowed regions decreases. We can conclude that decentralization will foster regional economic divergence, the more so the larger is the dispersion of regional social capital distribution within the country. We will test this mechanism through calibration later in the paper. As for the national long-run growth — that is, the average of the regions' growth rates

[19] Assuming $\alpha = 0.5$ and $\hat{A}_j = 2$, $\hat{A}_i = 1$ the p_j/p_i would be 1/4.

[20] Assuming $\alpha = 0.6$; $\theta = 4$; $\rho = 0.02$; $\tau = 0.4$; $\varepsilon = 0.1$; $\upsilon = 0.1$; $A = 0.1$; $F = 1$; $r = 0.05$

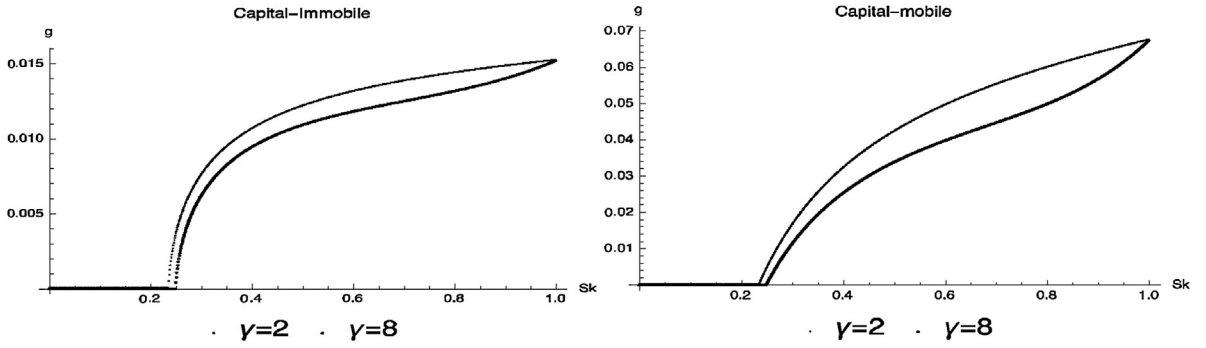

Fig. 2. Growth as a function of S_k.

Table 1
Social capital (trust), social capital dispersion, favoritism of government officials, independence of judicial system and efficiency of settling disputes (ranking over 144 countries).

Country	Social capital average	St. dev. of S_k	Favoritism of gov. officials		Independence of judicial system		Efficiency of legal sys. settling disputes	
			Score	Rank	Score	Rank	Score	Rank
Turkey	5.7	0.09	3	66	3.5	83	3.8	61
Portugal	17.86	0.06	3	67	3.9	67	2.9	129
France	22.25	0.14	3.7	39	4.9	37	4.4	37
Greece	22.36	0.23	2.5	114	3.1	98	2.5	135
Hungary	22.38	0.12	2.6	107	3.7	72	3	117
Poland	26.94	0.16	3.3	50	4.2	58	3.1	111
Spain	33.03	0.17	3.3	54	4	60	3.7	69
Austria	33.55	0.24	3.8	37	5	30	4.8	25
Italy	33.65	0.22	2.5	115	3.8	68	2.5	139
Germany	35.06	0.14	4.5	15	6.2	7	4.9	20
UK	38.2	0.16	4.2	22	6.2	11	5.4	11
Switzerland	41.62	0.19	4.9	9	6.6	6	5.7	4
Australia	42.3	0.12	4.2	24	6	14	5	18
USA	45.38	0.18	3.2	59	4.9	38	4.5	35
Canada	47.32	0.29	4.2	23	6.3	5	5.4	9
Netherland	53.1	0.18	5.2	4	6.4	3	5.6	8
Sweden	67.34	0.1	5.3	3	6.2	9	5.6	5

Source: Global Competitiveness Report 2012–2013.

weighted by their populations the implications of the model are far from trivial and will depend by the non-linear interplay of the rule-of-law and the distribution of S_k. In order to shed some light on the complex links between the distribution of regional social capital, the rule of law and the growth effects of decentralization we performed some Monte Carlo simulations under some additional assumptions. We assumed that initially the government is centralized, capital is mobile and interest rate given. The size of each region is equal and regions' number is large. In order to parameterize the simulations and in particular the distribution of civicness, it is useful to look at cross-country data on social capital. Here, social capital is measured by the percentage of people who reply, "Most people can be trusted," in the World Value Survey or the European Value Survey. In order to obtain the distribution, we consider regional population to weight trust and then average it in the period 1975–2005. As is well known, countries differ widely by mean and deviance (see Table 1). A second crucial element is the threshold effect and the concavity, which is a function of the parameter F, the expected punishment of corruption. In fact, countries can differ in their effective sanctions because of the efficiency of their legal system, and economic agents, including contractor firms, internalize this when forming expectations about punishment. Table 1 reports the ranking and score that measure the efficiency of the judicial system in the Global Competitiveness Report 2012–2013. Assuming that these OECD countries have a sufficient rule of law to set all their regions above the threshold as it is likely to be since are relatively developed market economies, which countries are at risk of displaying the most negative post-reform growth? Typically, those countries that present low average social capital, high heterogeneity of S_k and low efficiency of the judicial system. At least six countries in our sample are at risk, according to the data in Table 1: Greece, Italy, Poland, Portugal, Turkey and Hungary. Nevertheless it is not clear a priori since, as we showed, this conclusion depends on the entire distribution of regional civicness as well on the threshold and the flex points. We therefore perform some simulation of the

devolution impact on growth using a Monte Carlo experiment in which a given set of parameters of the model and of the social-capital distribution (mean and standard deviation) generates a distribution of the regional growth rate.

Fig. 3 displays a graphical example of our Monte Carlo exercise. We built two identical distributions of S_k, obtained by a normal distributions with mean 0.4 and deviance 0.06 truncated in the interval [0, 1]).[21] These are the mean and the deviance of the middle cluster of the three we built from the sample of our 23 OECD countries (see chapter 4). We report different distributions of post-reform regional growth for different values of F. In particular, a value of F equal to 0.4 generates distribution in panel (A). A much more efficient judicial system, F set to 2, implies a completely different distribution of regional growth rates (panel B). It is clearly possible to have positive effect of decentralization reforms given these parameters but only with a very high value of social capital. In fact setting $F = 2$ as in the panel (B), but with a distribution of S_k centered around 0.69 (Denmark, Norway, Sweden) the net effect would be positive (+0.013%).

From Fig. 3 one could be tempted to conclude that the effect of devolution reform is positive and higher for the country in panel B) but the opposite is true. In fact when one correctly calculates the net effect of devolution as $E(g(Sk,.)) - g(E(Sk))$, the reverse is true with values of +0.085% for country in panel (A) and −0.01% for country in panel (B). This is perfectly in line with the former discussion and clearly depends on the combined effect of change in concavity and the threshold effect as F changes.

We ran some simulations of that type with different combinations of parameter values. We consider a full decentralization reform applied to countries with low, medium, high and very high average social capital corresponding to the values of the three clusters we made from the OECD countries in our sample plus a group of Nordic countries (Sweden, Norway and Denmark). When average S_k is low (0.28) and regional S_k dispersion is 0.07 we could have positive net effect of decentralization on growth only for a value of F equal to 1. In this case only, the net decentralization growth effect $(E(g) - g(E(Sk))$ is positive. As we move toward countries with higher social capital (0.33 and 0.53), we observe negative effects. It is worth noticing that as we increase the rule of law parameter the negative effects of decentralization dampens, this is due to the effect of F on concavity. Finally, we consider extremely high values of civicness such as those one find only in Nordic European countries (greater or equal to 0.69). For such high values of social capital we get a positive effect of full decentralization.[22] All in all, the Monte Carlo simulations seems in line with the former analysis. When a country presents a lousy level of rule of law and it is very poorly endowed with social capital on average but with some regions with sufficiently high social capital to be above the threshold, decentralizing could be beneficial. In this case decentralization is beneficial because it means letting the richly S_k endowed regions to growth faster whereas the poorly endowed ones are not worse off so that the national growth increases. When the combination of F and S_k are such that regions lie above the threshold but below the flex point, the decentralization reforms have a negative effect. The lower growth of the regions that are poor in social capital more than compensate the higher growth of the rich ones. In this case the lower the regional dispersion of civicness the lower is the negative effects of decentralization. When the social capital is very high and the regions of the country lie on the left of the flex point in the

[21] $\alpha = 0.6$; $\gamma = 8$; $\theta = 4$; $\rho = 0.02$; $\tau = 0.4$; $\varepsilon = 0$; $\upsilon = 0$; $A = 0.2$; $r = 0.05$.

[22] The main results are that countries with a low Sk of 0.28 and a regional s.d. of Sk of 0.076 display a post reform growth differential ranging from +0.645 to −1.026 with rule of law parameter F of 1 or 2 respectively. When average Sk increases to 0.33 and s.d. Sk is 0.061 the figures are −0.474 and 0.4 for F equal to 1 or 3. Finally setting Sk to 0.53 and s.d. to 0.03 we observe post reform growth differential of −0.39 and −0.019.

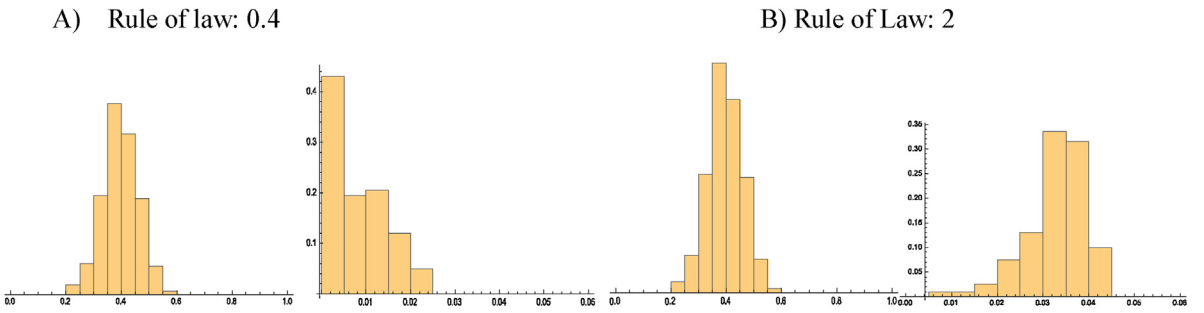

Fig. 3. The distribution S_k (left) and post-decentralization growth rates distribution of sub-national economies (right).

region where the growth relationship is convex, the effects of decentralization on growth turn out to be positive. Since high level of civicness are typically associated with very high levels of rule of law and that flattens the curve, these positive effects of decentralization are expected to be low. In this case, as far as the effects of regional S_k dispersion are concerned, the higher the dispersion the higher will be the positive effect of decentralization. However since we were able to obtain positive effects only considering values of S_k to the extreme values of our sample belonging to the few European Nordic countries our prior is a negative effect of full decentralization reforms for most of the countries. Anecdotal discussions of the model implications might consider the cases of countries which united or disintegrated or countries that made profound institutional changes in terms of devolution to sub-national governments functions. In fact what we analyzed above was a full decentralization exercise whereas in the data we observe partial decentralization reforms (more on this point later on). Therefore one should derive from the theory a more empirically testable model and test it on a long run data set of countries. We followed this avenue in the next chapter also to connect our contribution to the empirical literature of decentralization and growth.

4. Testing the model predictions on a panel of 23 OECD countries, 1975–2010

The implications found by the former Monte Carlo calculations are hereby tested using a panel data set of 23 OECD countries during the period 1975–2010. This is the sample of countries where data on social capital, in particular the one most used by researcher, that is trust, are available for a sufficient long time period (Values Surveys (EVS, 2011; WVS, 2009)).

In order to obtain an empirical relationship to estimate it appears convenient to approximate the function $g(S_k,.)$ using a Taylor's approximation around the national average of S_k. This growth is to be interpreted as the regional growth of region i-th under centralized regime where it is the national social-capital level that matters. Taylor's expansion is:

$$g = g(\overline{S}_k, .) + g_{S_k}(\overline{S}_k, .)(S_k - \overline{S}_k) + \frac{1}{2} g_{S_k S_k}(\overline{S}_k, .)(S_k - \overline{S}_k)^2. \tag{40}$$

Eq. (40) should be interpreted as the approximation of the ith-region's long-run growth after the devolution reform, *ceteris paribus*. Its post-reform growth rate is lower (higher) the lower (higher) its S_k is with respect to national social capital, but being poorly endowed is more costly because of the quadratic term. From (40), the average national long-run growth under the new decentralized government can, therefore, be written as:

$$g_{National} = \int_0^1 g(S_k, .) f(S_k) dS_k \cong$$

$$\int_0^1 [g(\overline{S}_k, .) + g_{S_k}(\overline{S}_k, .)(S_k - \overline{S}_k) + \frac{1}{2} g_{S_k S_k}(\overline{S}_k, .)(S_k - \overline{S}_k)^2] f(S_k) dS_k, \tag{41}$$

where $f(S_k)$ is the p.d.f. of social capital,[23] and $\bar{S}_k = \int_0^1 S_k f(S_k) dS_k$.

[23] We conduct the analysis assuming Sk to be a continuous random variable, and we rationalize the assumption considering a very large number of sub-national economies.

The second term of (41) clearly disappears, and the equation enables us to derive that the new average national growth rate is a function of the dispersion of the social-capital distribution of the economy:

$$g_{National} \cong g(\overline{S}_k, .) + \frac{1}{2} g_{S_k S_k}(\overline{S}_k, .)\sigma^2, \text{ where } \sigma^2 = \int_0^1 (S_k - \overline{S}_k)^2 f(S_k) dS_k. \tag{42}$$

Eq. (42) is in line with the former findings concerning divergence and clearly hinges on the form of g(S_k,.), that is the sign of $g_{S_k S_k}$. It implies a negative relationship between post reform growth and regional civicness dispersion when both the growth-S_k relationship is piece wise concave and all regions lie above the threshold. This negative impact of decentralization in the presence of large social-capital dispersion is a clear-cut result that is independent of the statistical distribution as implied by Jensen's inequality. When the growth-S_k function presents also a convex region this link can be positive if the country's S_k and that of its regions is sufficiently high as suggested by our simulation.

In summary, Eq. (42) suggests adding further two dimensions to control for when assessing empirically the decentralization effects on growth: the average social capital of the country and its within-country heterogeneity. In addition the former theoretical analysis and the Monte Carlo analysis suggests that these two variables interact with decentralization in a nonlinear way changing its sign and magnitude. The implications suggests a precise empirical strategy to follow when testing our theory, as we will show shortly. Nevertheless before turning on the empirics one has to realize that in the OECD sample we have countries which have already realized the devolution reforms and, above all, the devolution has been partial and not full. Moreover we would like to link our discussion to the former empirical analysis in the literature that typically has used the index of decentralization constructed by the OECD: the share of sub-national government over the total of government expenditure. This decentralization index is a continuous variable changing across countries and in time. However so far we have considered the decentralization as a dichotomous variable d taking on the values $d = 1$ for a decentralized country and $d = 0$ for a centralized one.

Therefore in this section we will extend the analysis taking account of this possibility by assuming that $d \in [0, 1]$, where d is the degree of decentralization of the country. One way a partial devolution can be thought in the present model is that now the contractor firm is facing a different probability of being caught since the responsibility of the public tender is both in the hands of local authorities and the central government. Therefore the civicness that matters is expected to be mix of the local and the national one.

We thus modify the probability of being caught as follows:

$$pr = P(Being\ \ Caught \mid \tilde{S}, S_{kmix}) = \tilde{S} \cdot S_{kmix} \tag{43}$$

where: $S_{kmix} = d \cdot S_{kr} + (1 - d) \cdot \bar{S}_k$; and S_{kr} and $\bar{S}_k$ are the regional and national average social capital respectively. Under this assumption all results previously presented concerning the long-run regional growth after decentralization continue to hold, but in term of S_{kmix} taking the place of S_k. It can be easily shown that the approximation we presented in Eq. (40) of the regional growth

as a function of its regional social capital, has to be modified as follows[24]:

$$g(S_{kr},.) = g(\overline{S}_k,.) + g_{S_{kmix}}(\overline{S}_k,.)\cdot d\cdot(S_{kr}-\overline{S}_k) + \frac{1}{2}g_{S_{kmix}S_{kmix}}(\overline{S}_k,.)\cdot d^2\cdot(S_{kr}-\overline{S}_k)^2 \tag{44}$$

Consequently, the long-run average national growth, $g_{National} = \int_0^1 g(S_{kr},.)f(S_{kr})dS_{kr}$, is now approximated as follows:

$$g_{National} \cong g(\overline{S}_k,.) + \frac{1}{2}g_{S_{kmix}S_{kmix}}(\overline{S}_k,.)\cdot d^2\cdot\sigma^2, \tag{45}$$

Notice that $d=1$ implies $S_{kmix}=S_{kr}$ so that in this case Eq. (32) corresponds exactly to Eq. (27). For $0<d<1$, we can see that the average national growth rate of a partially decentralized country is a function of the interaction between the dispersion of the social-capital distribution of the economy and the square of its degree of decentralization. This last link is expected to be negative in our OECD sample as our former Monte Carlo analysis has shown. Before starting to test our model empirically, one more issue has to be taken into account: in this type of endogenous growth model, growth is driven by the ratio of two cumulative inputs (private and public capital). Since they can be accumulated, these two inputs can generate transitional dynamics with unbalanced growth effects out of steady state (Barro & Sala-i-Martin, 2004). The presence of unbalanced growth effects justifies the initial level of income in the empirical growth relationship, which leads to a dynamic relationship in the log-level of income. Therefore, without imposing the condition that the economy is always along its steady-state growth, we empirically test the following general dynamic panel model:

$$\ln\, y_{it} = a_{0i} + e_t + a_1 \ \ln\, y_{it-1} + X'_{it}b + \varepsilon_{it} \quad i=1,..N\ t=1,...,T_i, \tag{46}$$

where y_{it} is the real per capita GDP; a_{0i} and e_t are country and time fixed effects, respectively; ε_{it} is an idiosyncratic disturbance term; and X_{it} is a vector of covariates.

As far as the measurement of the degree of decentralization is concerned, we consider the standard quantitative measure used in the literature: the ratio of local government expenditures over total government expenditures, denoted here as Local_G, obtained from the OECD Decentralization Database (2013).[25] To measure the country *rule of law*, we use The Legal System and Property Rights index, proposed by Gwartney, Lawson, and Hall (2013), from the World Economic Freedom network of the Fraser institute (RoL), which has been available since 1970. In addition, since our model implies that the sign of the relationship between growth and decentralized government expenditures is conditional upon the *rule of law*, we build an interaction variable between the two variables. With regard to social capital, our calculations are carried out on the micro data from the Integrated Values Surveys (EVS, 2011; WVS, 2009), including all available waves and attributing them to the nearest five-year period of our analysis. Most researchers consider our social-capital proxy, *trust*, the standard way to measure social capital, and it was

[24] Notice that, holding constant $\bar{S}_k$ and d, S_{kmix} is a function of S_{kr} only. Moreover, for $S_{kr}=\bar{S}_k$ we have $S_{kmix}=\bar{S}_k$. Therefore in Eq. (46), $g_{S_{kmix}}(\bar{S}_k,.)$ and $g_{S_{kmix}S_{kmix}}(\bar{S}_k,.)$ have, respectively, the same values of $g_{S_k}(\bar{S}_k,.)$ and $g_{S_kS_k}(\bar{S}_k,.)$ in Eq. (42).

[25] It would be natural to use Local Capital Expenditure over the total, but its time series is not available for the necessary length of time. Besides, using the standard measure allows us to compare our results with former results in the literature.

already used in the previous section. As said above, our regional measure of trust corresponds to the percentage of respondents who answered, "Most people can be trusted,"[26] to question *a165* of Integrated Values Surveys. Note that the national average of the social-capital endowment, Skpop, is obtained by weighting the regional measures of S_k with the average regional share of the population in the period considered.[27] The intra-country dispersion of S_k, Skdev, is calculated as the standard deviation of the regional S_k endowments using, again, the regional population weights. Finally, our theory predicts that, all other things constant, the relationship between national growth and decentralized governments expenditures will be quadratic, where from the Monte Carlo calculations reported above a negative quadratic term is expected. Moreover, the national average social-capital as well as the regional social-capital dispersion should affect the shape of the quadratic relationship between growth and decentralization: the former variable in a positive way, whereas the latter variable negatively. Therefore, we include other two interaction variables in the analysis: the interaction between decentralized government expenditures and the product of the social-capital average and social-capital dispersion, and the interaction between the square of decentralized government expenditures and the former product. We utilize an unbalanced panel of quinquennial data, which includes 23 countries[28] observed in the time period 1975-2010. In order to estimate the model, we apply the system GMM estimator proposed by Arellano and Bover (1995) and Blundell and Bond (1998), which has come to represent the standard approach to estimating dynamic growth models on five-year averaged cross-country data. With a suitable choice of instruments, this approach permits us not only to get rid of country fixed effects, but also to take into account the potential endogeneity of some of the covariates. The system GMM estimator allows us to efficiently combine information from the equations in levels with the set of orthogonality conditions holding for the equations in first differences. In so doing, it is possible to retain part of the between-countries variation while also controlling for country heterogeneity.[29] Following the logic of system GMM, we use the second and third lags of the endogenous regressors and the dependent variable in levels as instruments for the equations in first differences to be estimated; and we use the first lag of the same variables in first differences as instruments for the equations in levels. As for the weakly exogenous covariates, their first and second lags of levels are used for the equation in first differences, and their first differences for the level equations. Time fixed effects are included in all models but not reported in the tables. We apply the one-step system GMM estimator, which is robust to heteroskedasticity.[30] The main results of the analysis are reported in Table 2. In column (1), we first report the estimates of an empirical model not driven by our theory, corresponding to the specification generally encountered in the empirical literature regarding the growth effects of devolving fiscal responsibility

[26] The data are attributed to regions on the base of the crossing variable X048-Region, where the interview was conducted. Every region is then associated to the corresponding one in the standard international classifications: NUTS for Europe and OECD TL for non-European nations.

[27] The way we calculated the national average, Skpop, has the side effect of increasing the time variability of trust, which is quite stable over time, as it is supposed to be.

[28] The countries are: Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece , Hungary, Ireland, Italy, Japan, Netherlands, New Zealand, Norway, Poland, Portugal, Spain, Sweden, Switzerland, the United Kingdom and the United States.

[29] Due to persistence of the variables over time, Bond, Hoeffler, and Temple (2001) show that the first-differenced GMM estimator performs poorly, whereas the system GMM estimator gives more reasonable results when applied to an empirical growth model.

[30] It is well known that the two-step GMM estimates present asymptotic standard errors that are severely downward-biased in small samples.

Table 2
Dependent variable log per capita GDP.

	(1)	(2)	(3)
ln y_1	0.942*** (0.0257) [0.000]	0.887*** (0.0310) [0.000]	0.894*** (0.0284) [0.000]
ln Openness	0.0457** (0.0215) [0.033]	0.0101 (0.0136) [0.457]	
ln Invest	0.00440 (0.0643) [0.945]	0.0126 (0.0317) [0.692]	
ln Local_G	0.0189 (0.0161) [0.242]	−0.283 (0.191) [0.139]	−0.378*** (0.124) [0.002]
ln RoI * ln Local_G		0.152* (0.0899) [0.091]	0.195*** (0.0602) [0.001]
ln RoL		−0.445 (0.337) [0.187]	−0.589*** (0.212) [0.005]
ln Skpop		0.0202 (0.0393) [0.608]	
ln Skdev		−0.105 (0.103) [0.305]	−0.145*** (0.0527) [0.006]
ln Skpop * ln Skdev * ln Local_G		0.0242* (0.0147) [0.098]	0.0288*** (0.00706) [0.000]
ln Skpop * ln Skdev * (ln Local_G)$\hat{2}$		−0.00465** (0.00206) [0.024]	−0.00517*** (0.00106) [0.000]
ln Tax_tot		2.886*** (0.973) [0.003]	3.250*** (0.922) [0.000]
(ln Tax_tot)$\hat{2}$		−0.415*** (0.136) [0.002]	−0.464***(0.130) [0.000]
Const	0.393 (0.285) [0.169]	−3.133* (1.843) [0.089]	−3.397** (1.607) [0.035]
Obs	138	134	134
Groups	23	23	23
AR(1)	−2.59**	−2.46**	−2.43**
AR(2)	−0.11	0.44	0.36
Sargan–Hansen[a]	13.21	3.41	5.24
Wald's test[b]: $\chi^2(3)$		0.73	

Notes: standard errors in parentheses and p-values in brackets.

[a] Computed from two-step system GMM estimates.

[b] The null hypothesis is that ln Openness, ln Invest and ln Skpop are jointly not relevant.

* $p<0.10$.

** $p<0.05$.

*** $p<0.01$.

to local governments (see e.g. Rodriguez-Pose & Ezcurra, 2011). The vector of covariates X_{it} for this model contains, all in logs, standard conditioning variables in growth regressions, such as the investment share (Invest) and the degree of openness (Openness),[31] and, in addition, the fiscal decentralization proxy (Local_G).[32] In line with much of the literature, we find that the fiscal decentralization parameter is not significantly different from zero. In column (2) of Table 2 we report the estimation results of our model, which, consistent with the theoretical implications presented in the previous sections, also controls for the average social capital (Skpop) and its standard deviation (SKdev), the *rule of law* measure (RoL), as well as the average tax rate in level (Tax_tot) and squared. Moreover, as described above, three interaction terms are included in the model: the interaction between the fiscal decentralization proxy and the *rule of law* measure; the interaction between the fiscal decentralization proxy and the product of the social-capital average and social-capital standard deviation; and the interaction between the square of the fiscal decentralization proxy and the former product.[33] Finally, in column (3), the investment shares, the degree of openness and the national average social-capital were dropped from the model since the Wald's test confirmed their high joint insignificance: $W(3) = 0.73$ with p-value $= 0.87$. Looking at the results shown in column (3), we notice that all estimated coefficients are highly significant and the quadratic interaction term is in line with the theory and the simulation results presented above, since it enters the model with a negative sign. Moreover, the coefficients of both the log of the national average tax rate and its square appear to be in line with the inverted U hypothesis.

It is worth noting that the marginal elasticity of growth with respect to fiscal decentralization implied by our model is not constant, but it depends on the starting values of fiscal decentralization (ln Local_G), of *rule of law* (ln RoL), of the national average social-capital (ln Skpop) and of the regional social-capital dispersion (ln Skdev). Therefore, in order to shed light on the potential different patterns of the estimated growth elasticity function for various starting values of these variables, we have clustered the 23 OECD countries into three homogeneous groups. To obtain the clusters we have used ln Skpop, ln Skdev and ln RoL as joint clustering variables and their long-run country means as input data.[34] In Table 3 we report the three groups of countries together with the cluster means of the variables in their original scale. The cluster named Low (High) contains the countries with the lowest (highest) long-run values of both national average social-capital and rule of law as well as the highest (lowest) long-run values of regional social-capital dispersion in the sample.

Using these cluster means as starting values, we report in Fig. 4 the implied marginal elasticity of growth with respect to fiscal decentralization, together with its 90% confidence bands, for the three groups of OECD countries. In all graphs, the growth elasticity is plotted as a function of the starting value of the fiscal decentralization level in the range 2%–100%. Looking at the graphs, we see that the growth elasticity is a decreasing continuous function of fiscal decentralization in all clusters. Moreover, the elasticity is significant and positive (negative) for low (high) starting

[31] Investment in secondary education and population growth were never significant in all models, so to save space, we do not report them. This result is far from unexpected since the data set is composed of advanced OECD countries.

[32] All covariates are treated as endogenous regressors.

[33] All variables enter the model at logs. Regressors ln Local_G, ln Openness, ln Invest, Ln Tax_tot and squared, as well as the three interaction terms ln RoL * ln Local_G, (ln Skpop*ln Skdev) * ln Local_G and (ln Skpop*ln Skdev) * (ln Local_G)$\hat{2}$ are treated as endogenous regressors. The remaining regressors are treated as weakly exogenous.

[34] For each country we computed the average of these variables over the time period 1975–2010 for the available quinquennial observations. Clusters were obtained by using the k means clustering algorithm implemented in Stata 12.

[35] Starting values for the (log) rule-of-law, the (log) average social capital and the (log) social capital standard deviation are set equal to their cluster means.

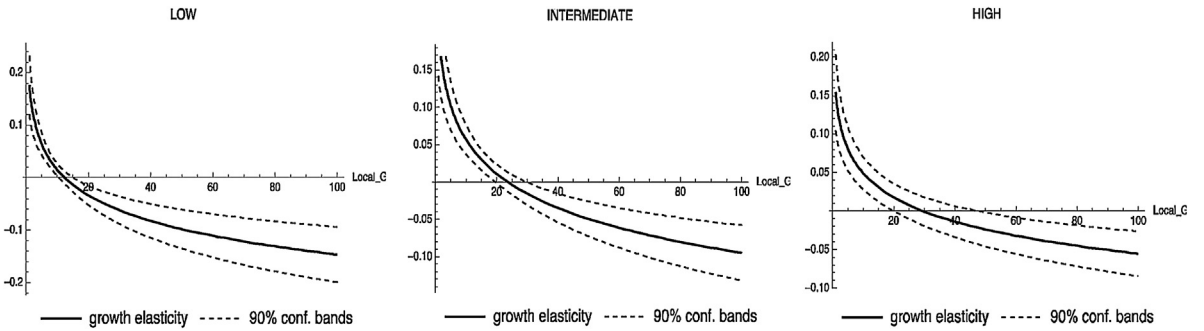

Fig. 4. Estimated marginal elasticity and 90% confidence bands as a function of Fiscal Decentralization (Local_G) for the three OECD clusters.[35].

Table 3
OECD clusters and cluster means of the variables. Clusters based on the long-run values of (log) national average social capital, (log) regional social capital dispersion and (log) rule of law.

Clusters	National average social capital, % (Sk_pop)	Regional social capital dispersion (Skdev)	Rule of law (RoL)
Low: Greece, Italy, Poland, Spain	28.45	7.59	6.26
Intermediate: Austria, Belgium, Canada, France, Germany, Hungary, Netherlands, Portugal, Switzerland, United Kingdom, United States	33.43	6.16	7.84
High: Australia, Denmark, Finland, Ireland, Japan, New Zealand, Sweden	53.05	3.03	7.94

levels of fiscal decentralization. However, we see that in the three groups of OECD countries the growth elasticity becomes null (and then negative) for a different level of fiscal decentralization, i.e. around 10%–12%, 25% and 30% in the cluster Low, Intermediate and High, respectively. Moreover, we notice that further increasing fiscal decentralization in OECD countries with high starting decentralization levels has a much more negative effect on growth for those countries belonging to cluster Low than to cluster High. On whole therefore, these results imply that countries with both high social capital and rule of law, as well as low social capital dispersion can afford a level of fiscal decentralization much higher than countries where the rule of law and social capital is poor and the distribution of civicness across regions is highly dispersed.

It's worth noting that the marginal growth elasticities reported in Fig. 4 can be used to answer to questions of the following type: what is the average effect of increasing fiscal decentralization of expenditures by 1% on a country's quinquennial growth? However normally, fiscal decentralization reforms are the result of political decisions that determines a permanent variation in the share of government expenditures that is controlled by Sub-National Governments. Moreover, typically the magnitude of this permanent variation is not marginal. Therefore, in the following, we consider the case of a permanent variation from 10% to 65% of the fiscal decentralization level and we measure its growth effect in 35 years. This corresponds to the case of a country which had experienced a large devolution in 1975, starting from a level comparable to that of Belgium or Portugal in 1975 and made it as decentralized as Canada. We did this exercise for all three clusters of OECD countries. More specifically, we computed the cluster growth differential between a decentralization level of 65% and one of 10%, both kept constant over the time-period 1975–2010 for the average country of the cluster starting from the same per-capita output in the year 1975.

For each cluster the long run growth effect of decentralization (d) can be obtained considering the area under our estimated elasticity functions once adjusted to account for the long run dynamics. Since the five-year periods are seven, this is accomplished by the term $\Sigma_{i=0}^{6} {a_1}^i$ obtained solving the dynamic model where a_1 is the estimated autoregressive coefficient equal to 0.894. Therefore, we can write that:

$$g(lnd_1) - g(lnd_0) = lny(lnd_1) - lny(lnd_0) = \int_{lnd_0}^{lnd_1} dlny = \int_{lnd_0}^{lnd_1} (\Sigma_{i=0}^{6} a_1^i) f(lnd) dlnd \tag{47}$$

Table 4
Cluster growth differential over the time-period 1975–2010 between a fiscal decentralization level of 65% and 10%, respectively.

	Low	Intermediate	High
Cluster growth differential (%)	−49.00	−4.84	6.42

where d_1 is equal to 65%, d_0 is 10% and $f\,(lnd)$ is our estimated income elasticity function, which is different for each cluster.[36] In line with the remarks we made above about Fig. 4, the growth differentials of the three groups of countries reported in Table 4 present remarkable differences. The growth differential is negative both for the cluster Low and Intermediate, while it is positive for the cluster High. Moreover, looking at the magnitude of the growth differentials the group of countries characterized by low levels of rule of law and social capital and high levels of social capital dispersion appear to be highly penalized by the fiscal decentralization reform.

Given our estimates and the implied form of marginal elasticity function, decentralization reforms of a magnitude above 55% would yield only negative effects. Clearly, the kind of fiscal decentralization reform just considered is only hypothetical, since in our 1975–2010 OECD sample the ratio of local over total government expenditures for cluster Low, Intermediate and High is equal to 11.60%, 29.16% and 33.52% in the quinquennium 1975–1979 and to 18.20%, 33.91% and 34.61% in quinquennium 2005–2009, respectively.[37] When one considers these historical values of decentralization to compute the cluster growth differentials, the results are different and a negative growth differential resulted for all groups of countries (respectively, −2.23%, −1.46% and −0.11% for the cluster Low, Intermediate and High).

Finally, in order to verify the robustness of our results to other measures of social capital, we extract three other proxies of social capital from the Integrated Values Surveys (EVS, 2011; WVS, 2009): one for political action/participation (named *petition*), and two capturing the social aversion against bribe and against free rider behavior (named *bribe* and *fare*). In our sample, the correlation between trust and petition (for the variables in logs) is equal to 0.61, whereas between trust and bribe and between trust and fare, it is 0.50 and 0.45, respectively. Unfortunately, their variability in the sample is quite different: the standard deviation of trust is 0.38, whereas for petition, bribe and fare it is just 0.17, 0.040 and 0.05, respectively. This low variability may clearly be an issue for the precision in estimating the growth effects. We estimated the general model implied by our theory using these alternative proxies for both the national average social capital and regional social capital dispersion. Results are totally confirmed for the proxy petition and only partly for the proxies fare and bribe. In the estimated model containing the proxy fare, the quadratic interaction term, ln Skpop * ln Skdev * (ln Local_G)$\hat{2}$, turns out to be insignificant while the other statistics are in line. In the model containing the proxy bribe, both the average social capital and the social capital dispersion result to be insignificant while the quadratic interaction term is highly significant but has a positive coefficient. The statistics about the rule of law instead are in line.

[36] We used the cluster means reported in Table 3 for the values of the other variables on which the growth elasticity also depends.

[37] Notice that in line with our previous remark on the fiscal decentralization sustainability, countries belonging to cluster low show on average the lowest values of decentralization too.

5. Conclusions

We believe that our theoretical and empirical results have relevant implications for the debate on growth and decentralization policy. As for the theoretical implications, our results suggest that persistent informal institutions, such as cultural traits, values and beliefs that affect rent-seeking behavior, play a great role in the success or failure of decentralization reforms. However, the links we found are not linear. The final result of decentralization reform policy for the long run growth of the national economy depends on the complex interplay between the distribution of within country civicness, the country's level of rule of law and the degree of devolution implied by the reform.

Our empirics seem to indicate that the exclusion from previous empirical analyses of some measures of the *rule of law*, as well as of social capital understood as civicness and its regional dispersion, could account for the ambiguous results reported in the literature thus far. Our results also seem to dismiss the assumption of a constant income elasticity of decentralization in favor of a nonlinear one that interacts with measures of social capital and its regional dispersion. In our OECD sample, a positive (negative) effect of a decentralization reform of government expenditures on output is found the lower (higher) the initial decentralization level of the country and the smaller (higher) the size of the reform. We obtain a negative (positive) marginal effect of further devolution policy of expenditures above (below) a threshold level of decentralization, ranging from 20% to 40% depending on formal and informal institutions. Higher levels of social capital and rule of law and lower level of regional social capital dispersion imply higher thresholds levels of decentralization.

The policy recommendation stemming from our long run growth elasticity analysis is that countries presenting low and dispersed civicness and whose rule of law is insufficient should not undertake large devolution reforms to their sub national governments or face the prospect of lower national growth rates.

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