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**DO HIGH-QUALITY LOCAL
INSTITUTIONS SHAPE LABOUR
PRODUCTIVITY IN WESTERN
EUROPEAN MANUFACTURING FIRMS?**

Roberto Ganau and Andrés Rodríguez-Pose

**INTERNATIONAL TRADE AND
REGIONAL ECONOMICS**

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JEL Classification: C23, D24, H41, R12

Keywords: Regional Institutions, Manufacturing firms, labour productivity, Western Europe, Cross-Country Analysis

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Do High-Quality Local Institutions Shape Labour Productivity in Western European Manufacturing Firms?

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Abstract: We investigate the extent to which regional institutional quality shapes firm labour productivity in western Europe, using a sample of manufacturing firms from Austria, Belgium, France, Germany, Italy, Portugal and Spain, observed over the period 2009-2014. The results indicate that regional institutional quality positively affects firms' labour productivity and that government effectiveness is the most important institutional determinant of productivity levels. However, how institutions shape labour productivity depends on the type of firm considered. Smaller, less capital endowed and high-tech sectors are three of the types of firms whose productivity is most favourably affected by good and effective institutions at the regional level.

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1. INTRODUCTION

The local environment where firms are located and operate influences their day-by-day activity. Factors such as physical proximity between economic actors and historical heritage (Boschma, 2005; Martin and Sunley, 2006), as well as institutions represent key local-level dimensions affecting the success – or failure – of firms. The quality of institutions affects firms' entry, survival chances, overall performance, and growth by, for example, guaranteeing competition, reducing criminality, or lowering transaction costs (e.g. Bjørnskov and Foss, 2008; Sobel, 2008; Percoco, 2012; Lasagni et al., 2015; Che et al., 2017; Ganau and Rodríguez-Pose, 2018).

This sway of institutions on different economic dimensions, such as entrepreneurship (e.g. Sobel, 2008), aggregate efficiency (e.g. Méon and Weill, 2005), economic growth (e.g. Acemoglu et al., 2005), and economic development (e.g. Acemoglu et al., 2001) has been frequently researched. Most of these analyses, however, have taken place at the national level. Indeed, there is scarce evidence on how local and/or sub-national institutions affect economic outcomes at a micro level. This paper contributes to fill this gap in the literature by investigating the role that local institutions play in shaping firms' economic performance – defined in terms of labour productivity – and, particularly, by identifying which type of economic actors are more likely to be affected by the quality of local institutions. In this respect, the key contribution of this paper is twofold. First, we assess, by means of microdata, how differences in economic productivity of firms are connected to within-country variations in institutional quality, from a cross-country perspective. Second, we identify a number of sources of firm-level heterogeneity which can drive the institutions-productivity relationship.

The main hypothesis behind the paper is that a high-quality institutional environment can, overall, enhance the performance of individual firms. Institutions that guarantee property rights, a fair juridical system and the enforcement of contracts, together with efficient and transparent governments that warrant fair market competition and the provision of high-quality public services, contribute to create a favourable business environment, based on certainty and stability (Sobel, 2015). In such a context, individual economic actors – namely, entrepreneurs – can thrive (Baumol, 1990; Sobel, 2008; McCaffrey, 2018). Hence, local institutions can influence the efficiency and productivity levels of individual firms (e.g. Black and Lynch, 1996; Chaudhuri et al., 2010; Backam, 2014).

Two different sources of heterogeneity are likely to drive the returns of institutions on firm-level performance. The first one is related to the local environment where firms are located and operate. As regional governments gain autonomy and political power to implement different types of local policies (Rodríguez-Pose, 2013), local-level differences in institutional quality – often historically rooted (Tabellini, 2010) – may explain differences in firm-level performance, not only across, but also within countries. The second factor refers to the idea that, under the assumption of the presence of rational agents and complete information, all economic actors within a locality are exposed to a particular institutional setting in a homogeneous way (Aparicio et al., 2016), i.e. they benefit from (are harmed by) "good" ("bad") institutions in the same way. However, heterogeneity across economic actors within a territory is likely to emerge with respect to the effect of institutions, as individual actors – i.e. entrepreneurs and firms – interact differently with the local context.

Thus, the empirical analysis investigates the effects of regional institutional quality on firm-level labour productivity, as well as the kinds of firms which benefit more from local institutions. It uses a large sample of manufacturing firms, observed over the short-run, post-crisis period 2009-2014 from seven western European countries – Austria, Belgium, France, Germany, Italy, Portugal and Spain. These countries are characterised by both a strong level of economic and political integration within the European Union (EU) and by high heterogeneity at sub-national level. It employs dynamic panel data models to assess the role played by both institutional quality as a whole, and by four different institutional dimensions – government effectiveness, control of

corruption, rule of law, and government accountability. In particular, the analysis explicitly accounts for firm-level sources of heterogeneity in terms of size, capital endowment and technological level which may affect the institutional quality-productivity relationship.

The results suggest that firm-level labour productivity benefits from high-quality institutions, in particular in terms of government effectiveness. This positive effect is higher in magnitude for smaller than for larger firms, for firms with low capital endowment than for highly-endowed firms, as well as for high-tech than for low-tech firms.

The rest of the paper is organised as follows. The second Section discusses the relationship between institutions and firms' performance, and derives the research hypothesis. The third Section presents the data and the econometric methodology. The fourth Section presents and discusses the empirical results. The fifth Section concludes the paper.

2. INSTITUTIONS AND FIRM PRODUCTIVITY

The economic effects of institutions have been the object of great scrutiny since, at least, the contribution of North (1990). Over the last two decades, a large body of empirical studies has confirmed the theoretical claim that institutions matter for economic development and growth (e.g. Acemoglu et al., 2001; Acemoglu et al., 2005). The main intuition driving this institutional perspective in the economics literature is that institutions shape the structure of a society, thus influencing the behaviour and performance of individual economic actors, and, consequently, the development and growth paths of territories (North, 1990; Putnam, 1993).

A first attempt to theorise the economic role of institutions and, in particular, the link between institutions and firm performance, can be traced back to Baumol's (1990) contribution about productive vs. unproductive entrepreneurship. Baumol (1990) recognises the fundamental role of institutions in shaping entrepreneurial activity. According to him, "good" institutions stimulate a "positive" entrepreneurial behaviour, leading to greater overall wealth, as a consequence of more investments and better innovative capacity. A "good" institutional environment, by promoting and guaranteeing economic freedom, can stimulate productive entrepreneurship (Sobel, 2015). This, in turn, improves productivity by increasing the returns of the two basic factors behind firm-level – and aggregate – productivity: human and physical capital (Gwartney et al., 2006; Hall et al., 2010). In contrast, "bad" institutions can create uncertainty and lower the economic impact of productive investments. Excessive regulation and taxation, unnecessary red-tape and corruption may induce entrepreneurs to conduct their activities elsewhere or devote more time, efforts, and resources into less productive activities, such as lobbying (Sobel, 2008; McCaffrey, 2018).

Hence, the institutional environment where firms operate influences the allocation and use of resources and production inputs (Sobel, 2008). A high-quality institutional setting – all else being equal – will promote greater economic freedom, increase the rule of law, facilitate the fight against corruption, and supply a greater protection of property rights. In these environments, efficient market regulation and transparent and well-functioning governments and judiciary will facilitate the emergence and preservation of a socio-economic and business environment characterised by stability and clarity. In this type of environment it is easier for efficient and dynamic entrepreneurial activity to take hold (Streeck, 1991; Acemoglu et al., 2005; Storper, 2005; Rodríguez-Pose, 2013), as local institutional conditions induce entrepreneurs to invest resources in more productive activities. This, in turn, fuels economic exchanges and leads to increases in firm-level efficiency and productivity. In addition, the existence of a solid and stable institutional environment stimulates trust and reciprocity among economic actors, promoting a reduction in transaction costs and the development and spread of positive externalities among local firms (North, 2005).

Therefore, "good" local institutions will foster a degree of economic freedom that will encourage entrepreneurs to adopt a more "productive" behaviour (Sobel, 2008). Under these circumstances, the likelihood of increasing capital investments, technological transfer, knowledge

creation and diffusion, and of spurring innovation is far greater (Rodríguez-Pose, 2013; Sobel, 2015). The benefits of good local institutions are thus felt both at the micro- and the macro-economic level. It is not only that individual firms in specific environments become more productive, but good institutions are an important source of aggregate productivity and productivity growth (Putnam, 2000). The heterogeneity in institutional quality and economic freedom are, thus, capable of explaining cross-country differences in entrepreneurship and entrepreneurial activity (Johnson et al., 2000; Davidsson and Henrekson, 2002; Aidis, 2005; Bjørnskov and Foss, 2008; Nyström, 2008; Sobel, 2008; Anokhin and Schulze, 2009; Douhan and Henrekson, 2010; Aidis et al., 2012; Estrin et al., 2012; Dreher and Gassebner, 2013; Powell and Weber, 2013; Dutta and Sobel, 2016) as well as in productivity and economic performance (Hall and Jones, 1999; La Porta et al., 1999; Acemoglu et al., 2001; Easterly and Levine, 2003; Glaeser et al., 2004; Méon and Weill, 2005; Acemoglu and Robinson, 2006; Aparicio et al., 2016).

However, it is not until more recently that the territorial dimension of the economic impact of institutions has attracted more attention (e.g. Rupasingha et al., 2002; Akçomak and ter Weel, 2009; Rodríguez-Pose and Di Cataldo, 2015; Crescenzi et al., 2016; Di Vita, 2018; Ketterer and Rodríguez-Pose, 2018). Sub-national research on institutions has been used as a means to provide an alternative explanation to the persistence of regional inequalities both across and within countries (Farole et al., 2011). It has accounted explicitly for the spatially-bounded and historically-embedded nature of institutions, which very often differ considerably not only across countries, but also within them (Tabellini, 2010; Rodríguez-Pose, 2013). It is often argued that local institutions may play a greater role than national ones in influencing the performance of economic actors, due to both historical heritage and geographic proximity. Recent waves of decentralisation have further accentuated this interest in the sub-national dimension as more powerful regional governments have a greater capacity to design and implement policies which, in theory, should respond better to the interests and needs of local communities (Rodríguez-Pose and Gill, 2003). From this perspective, the local dimension represents, perhaps, a more adequate level – than the traditional national level approach – to analyse and understand the role of institutions (Rodríguez-Pose, 2013).

The regional institutional dimension has also been examined empirically using more micro perspectives. By and large, these studies have confirmed previous evidence of a positive role of national institutions on firms' performance (e.g. Dollar et al., 2005; Bowen and De Clercq, 2008). High-quality local and regional institutions – and, in particular, effective regional governments – help reduce transaction costs and facilitate competition in the local market by, for example, wrestling down organised criminality and ensuring legality in public tenders (e.g. Albanese and Marinelli, 2013; Ganau and Rodríguez-Pose, 2018). Similarly, "good" local institutions may promote bureaucratic efficiency and transparency, contributing to the creation of a favourable business ecosystem for both local firms and foreign investors (e.g. Aiello et al., 2014; Choi et al., 2015; Ascani et al., 2016; Chakraborty, 2016). Moreover, a high-quality, formal institutional setting is likely to generate positive spillover effects – particularly in areas highly endowed with informal institutions (Rodríguez-Pose, 2013) – favouring interactions and knowledge flows among local firms thanks to increased trust and reduced transaction costs. Consequently, firms operating in a crime-free, efficient, highly competitive local environment, characterised by the presence of long-lasting inter-firm networks, are freer to engage in more innovative activities and adopt new technologies. Consequently, firms become more efficient and can converge towards the productivity levels of leading firms (Lasagni et al., 2015).

The empirical evidence of a positive relationship between regional institutions and firm-level performance remains, however, based on a single-country analysis – i.e. Lasagni et al. (2015) on the Italian case, Choi et al. (2015) on China and Chakraborty (2016) on India. To the extent of our knowledge, only Ricotta (2016) provides a cross-country analysis involving European countries.

This paper argues that the regional institutional setting characterising the business environment where firms operate represents a key dimension able to influence their performance. It hypothesises, therefore, that local institutions affect firm-level labour productivity, meaning that any

improvements in institutional quality can push up firms' performance and, conversely, weak institutions undermine firm-level productivity. This relationship is likely to be particularly relevant across European countries, in light of the growing emphasis by EU policy-makers on institutional quality in terms of regional development and growth (Farole et al., 2011; Charron et al., 2014).

EMPIRICAL FRAMEWORK

3.1. The dataset

The firm-level data used in the empirical analysis are drawn from the Amadeus database (Bureau van Dijk), which provides balance sheet data and personal information of European firms. The original sample has been cleaned considering only active manufacturing firms reporting unconsolidated financial statements and located in the EU area. Firms without information on year of incorporation and geographic location have been removed.¹ Finally, only firms reporting strictly positive values of value added, tangible fixed assets, and employment for at least three consecutive years during the period 2009-2014 have been considered.

The cleaning procedure of the firm-level data left us with a sample of 30,801 manufacturing firms operating in seven western European countries – Austria, Belgium, France, Germany, Italy, Portugal, and Spain. The data cover the 2009-2014 short-run, post-crisis period. The choice of focusing on these seven countries is driven by three main reasons. First, concentrating on developed west European nation-states guarantees a certain degree of similarity among countries – and their regions – with respect to their more recent historical, political, and institutional paths (Filippetti and Cerulli, 2018; Ketterer and Rodríguez-Pose, 2018). This is particularly relevant, as the analysis focuses on the role of regional institutions on firms' performance. Second, the cleaning procedure performed on the Amadeus database left us with usable information on representative samples of firms located only in the above-mentioned seven countries. In many of the excluded countries, weak availability of institutional, economic, and demographic data at a regional level, frequently left us (after the cleaning procedure) with only few dozens of firms to analyse. This meant that the specific sub-samples of firms for these countries were poorly representative with respect to the true population of manufacturing firms, according to official figures.²

Appendix Table A1 compares the 2009 population of manufacturing firms and the final sample. The sample is highly representative of the firms in all the countries analysed. 93.81% of the regions in the seven countries considered is included in the sample – see Appendix Table A2 –, and all manufacturing two-digit sectors defined according to the NACE Rev. 2 classification of economic activities are covered in the sample – see Appendix Table A3.

3.2. Empirical model

The relationship between regional institutional quality and firms' labour productivity is analysed by means of the following empirical dynamic equation:

¹ Cyprus, Estonia, Latvia, Lithuania, Luxembourg and Malta have been excluded *à priori* due to the absence of sub-national administrative regions, while Croatia is missing from the analysis because it only joined the EU in 2013. The level 1 of the *Nomenclature des Unités Territoriales Statistiques* (NUTS) adopted by the EU has been considered for Belgium and Germany, while the NUTS-2 level has been considered for the other EU countries. This choice is driven by the geographic level of disaggregation characterising the available data on regional institutional quality. The geographic division used in the analysis matches that of previous empirical research on EU regions. This research mainly focuses on regions with effective devolved power to influence the economic performance of local firms in each specific country (e.g. Rodríguez-Pose and Di Cataldo, 2015; Crescenzi et al., 2016; Ketterer and Rodríguez-Pose, 2018).

² We are conscious that the final sample of firms used in the analysis does not allow us to generalise the empirical results to all firms located in the EU. However, its representativeness guarantees the generalisation of the findings at least to manufacturing firms located in the territories covered in the empirical exercise

$$\log(\text{Labour Productivity}_{isrct}) = \alpha + \beta \log(\text{Labour Productivity}_{isrct-1}) + \sum_{k=1}^K \gamma_k F_{isrct}^k + \gamma \text{Institutional Quality}_{rct} + \sum_{p=1}^P \delta_p R_{rct}^p + \varepsilon_{irct}$$

$$\varepsilon_{isrct} = \nu_i + \nu_t + \nu_s + \nu_c + \nu_{isrct} \quad (1)$$

where $\text{Labour Productivity}_{isrct}$ denotes the labour productivity of firm i operating in sector s and located in region r of country c at time $t = 2009, \dots, 2014$, with labour productivity defined as deflated value added over employment.³

Besides the first-order, time-lagged labour productivity variable, the right-hand side of Equation (1) includes the vector F_{isrct}^k of firm-specific, log-transformed variables. This vector includes: a size measure, defined as number of employees; the capital-to-employment ratio, defined as tangible fixed assets per employee; and an age measure, defined as year of observation minus the year of incorporation of a firm.

The term $\text{Institutional Quality}_{rct}$ denotes the explanatory variable of interest, capturing the level of institutional quality in region r of country c at time t . Regional institutional data are drawn from the European Quality of Government Index dataset provided by the Quality of Government Institute (University of Gothenburg). The dataset provides region-level information derived from citizen-based surveys conducted in 2009 and 2013, and focusing on the perception and experience of individuals with respect to corruption, quality and impartiality in terms of education, public health care and law enforcement – see Charron et al. (2013) and Charron et al. (2014) for details.

Following Charron et al. (2014, p. 83), the survey questions have been adapted to, and interpolated with, four of the six components making up the country-specific World Bank's Worldwide Governance Indicators (WGI) project, which covers the period 1996-2015 – see Kaufmann et al. (2010) for details. Specifically, the four dimensions considered are (i) government effectiveness, (ii) control of corruption, (iii) rule of law, and (iv) government accountability.⁴ The interpolation of the region- and country-specific indicators presents three main advantages. First, it allows us to extend the temporal dimension of the region-level institutional data over the period 2009-2014. Second, it allows us to capture country-specific dimensions – e.g. legal system, immigration, trade, security – which are not captured in the regional indicator. Third, it helps to overcome potential biases affecting the regional indicator induced by the limited number of respondents per region (Charron et al., 2014).

Let \overline{WGI}_{ct} denote the average of the four considered institutional dimensions from the WGI in country c at time t , and let IQS_{rc} be the region-specific score derived from the corresponding four

³ Value added data have been deflated using a country-specific, one-digit, industry-level deflator provided by Eurostat.

⁴ The other two dimensions accounted for in the WGI dataset are (i) regulatory quality and (ii) political stability and absence of violence. Unfortunately, these two dimensions cannot be accounted for in the regional institutional quality index, due to the lack of information in the survey-based, regional data. The exclusion of these two dimensions from the regional institutional quality index represents a shortcoming. In particular, regulatory quality is key for individual firms' behaviour. Often, entrepreneurial activity and the performance of firms depend on the regulatory quality in a given place. Labour market regulations (Kannianen and Vesala, 2005; Van Stel et al., 2007) and regulation on market entrance and new firm formation (e.g. Ciccone and Papaioannou, 2006; Klapper et al., 2006; Van Stel et al., 2007) condition, for example, the capacity and efficiency of firms to operate. Similarly, political stability affects economic performance by increasing the security of property rights, encouraging long-term investments in physical capital and productive assets, promoting the formation of new businesses, and favouring a productive – rather than unproductive and rent-seeking – entrepreneurial activity (Haber and Razo, 1998; Dutta et al., 2013).

survey-based components. Then, the region-specific, time-varying institutional quality index (IQI_{rct}) is defined as follows (Charron et al., 2014):

$$IQI_{rct} = \overline{WGI}_{ct} + (IQS_{rc} - \overline{IQS}_c^w) \quad (2)$$

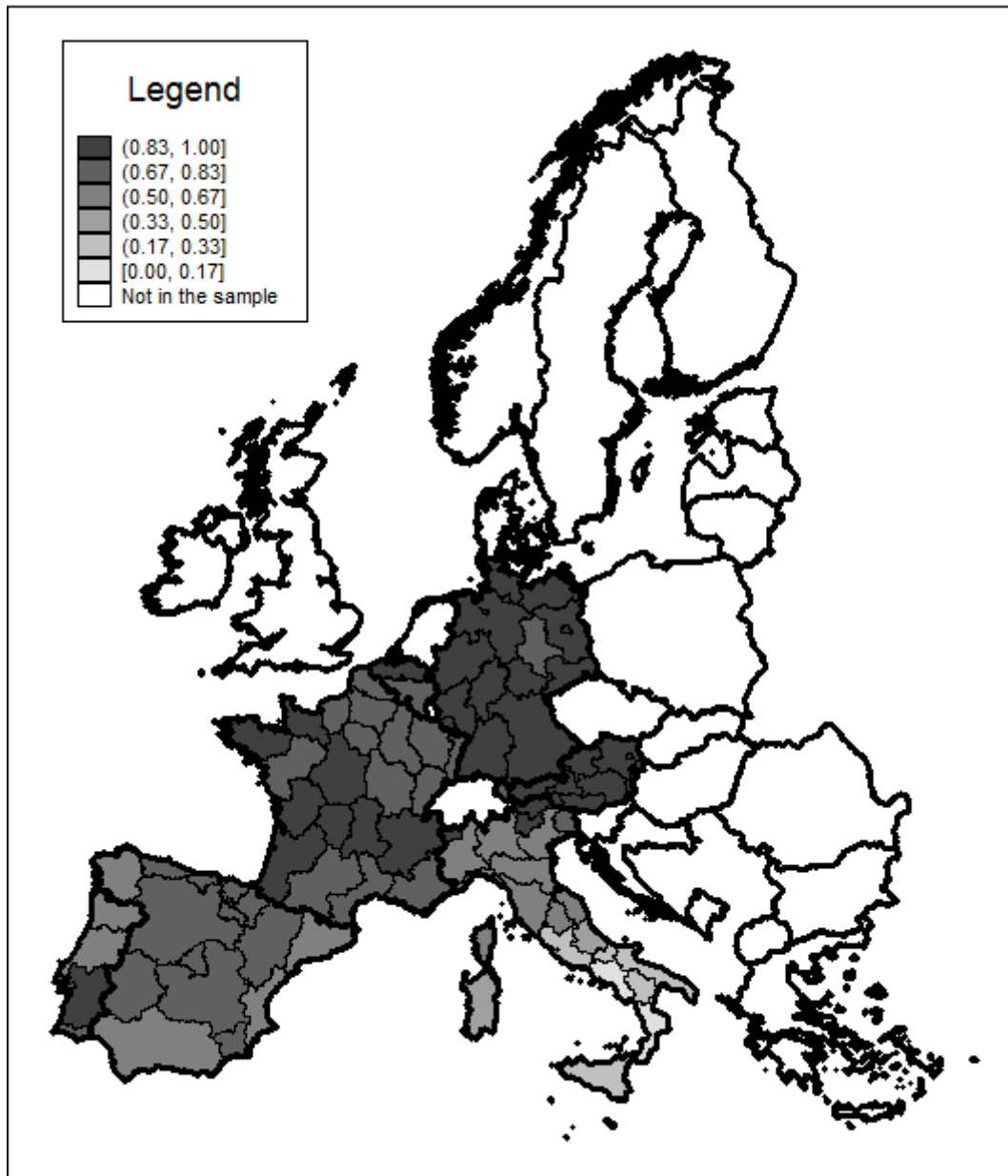
where \overline{IQS}_c^w denotes the country-specific, population-weighted average of the survey-based regional score. The institutional quality variable is then obtained by standardising the index defined in Equation (2) in the interval $[0, 1]$.⁵

The interpretation of the institutional quality variable is straightforward: the level of institutional quality in a region increases with the value of the variable from zero to one. It is hypothesised that a high regional institutional quality will create a favourable socio-economic ecosystem for firms to operate. Better institutions promote competition and incentive mechanisms, favour interactions among local workers and firms, and increase the security of the local business environment. They encourage the productive form of entrepreneurship discussed by Baumol (1990), with the end result being better firm-level performance.

Figure 1 maps the spatial distribution of the institutional quality index at regional level in the countries considered in the analysis. There are considerable differences in institutional quality both within and across countries. Germany and Italy represent the two extremes. On one hand, Germany has the best institutional quality of the countries considered in the analysis, and presents a relatively homogeneous structure across its regions. On the other, Italy has the lowest overall quality and internal heterogeneity is rather marked. The quality of institutions in the northern regions of Trentino and Alto-Adige is similar to – if not above – that of regions in Austria and Germany, while Calabria and Campania in the South have the lowest institutional quality in the sample.

⁵ The same approach for extending the regional institutional quality index has been employed by Rodríguez-Pose and Di Cataldo (2015), Crescenzi et al. (2016) and Ketterer and Rodríguez-Pose (2018) to analyse the impact of institutions on regional performance.

Figure 1. Spatial distribution of the institutional quality index.

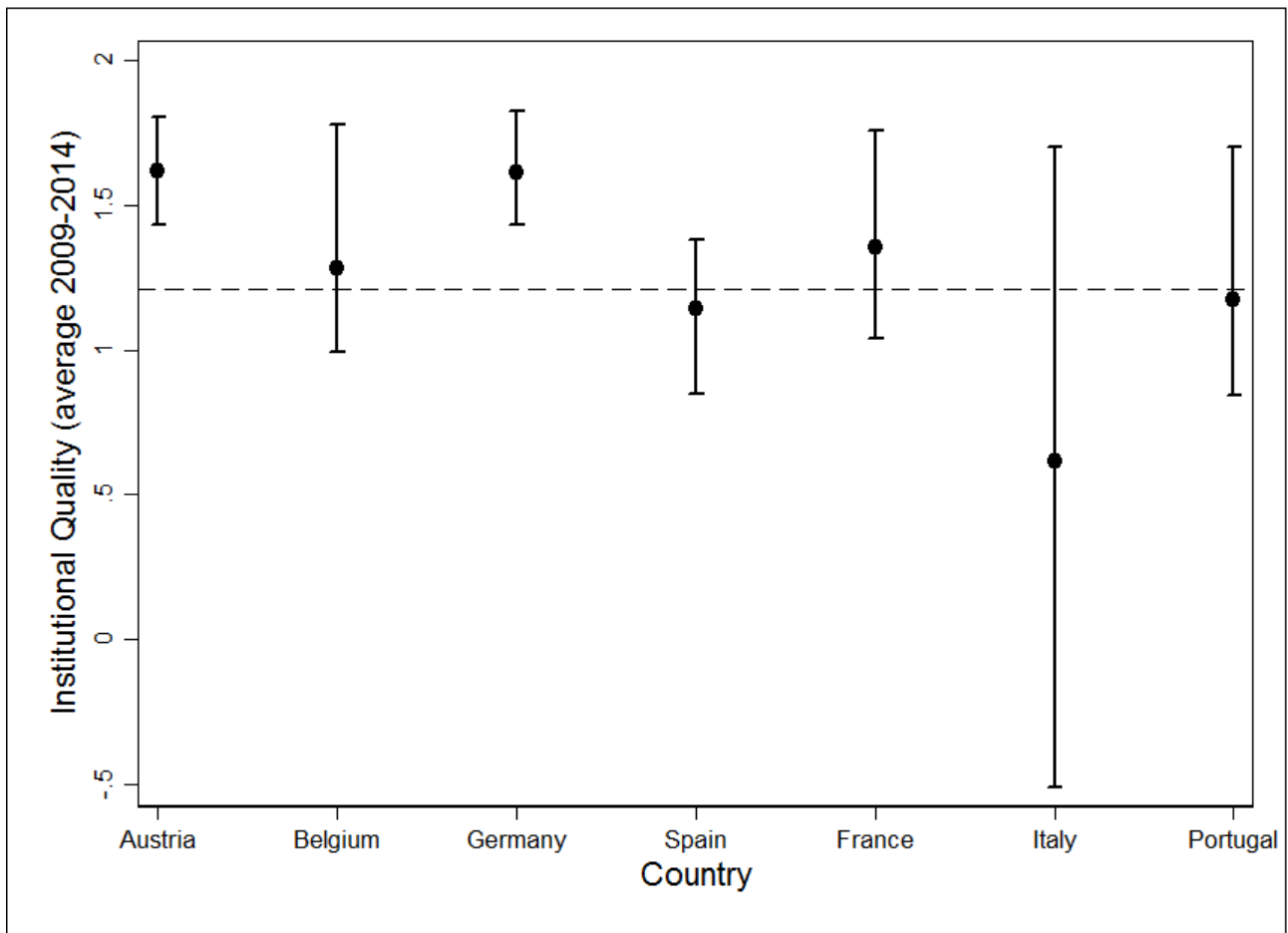


Notes: The non-standardised yearly institutional quality index (IQI_{rct}) is averaged over the period 2009-2014, and then standardised in the interval [0,1]. The higher the value of the index, i.e. the better the institutional quality in a region, the darker the shade.

Figure 2 complements Figure 1 by plotting the within-country variations of the (non-standardised) institutional quality index. Austria and Germany display the best overall institutional quality in the sample. Belgium, France, Portugal, and Spain hover around the mean, while Italy is the only country clearly below it. Looking at the within-country distribution of institutional quality, the gap between the regions with the best institutions and those with the worst is low in Austria, Germany, France, and Spain, moderate in Belgium and Portugal, and high in Italy. 44% of Austrian regions are above the country average. This percentage is 33 for Belgium; 56 for Germany; 45 for France; 53 for Spain; 57 for Italy; and 40 for Portugal. The best (worst) institutional quality at a regional level within each country is found in Tyrol (Vorarlberg) for Austria; Flanders (Brussels) for Belgium; Schleswig-Holstein (Saxony-Anhalt) for Germany; Basque Community (Catalonia) for Spain; Brittany (Corsica) in France; Alto-Adige (Campania) for Italy; and Alentejo (Norte) in Portugal. The German region of Schleswig-Holstein has the highest institutional quality index score

in the sample; Campania in Italy the lowest.

Figure 2. Within-country variations of the institutional quality index.



Notes: The non-standardised yearly institutional quality index (IQI_{rct}) is averaged over the period 2009-2014. The dashed line refers to the sample average, while the dots refer to country-level mean values.

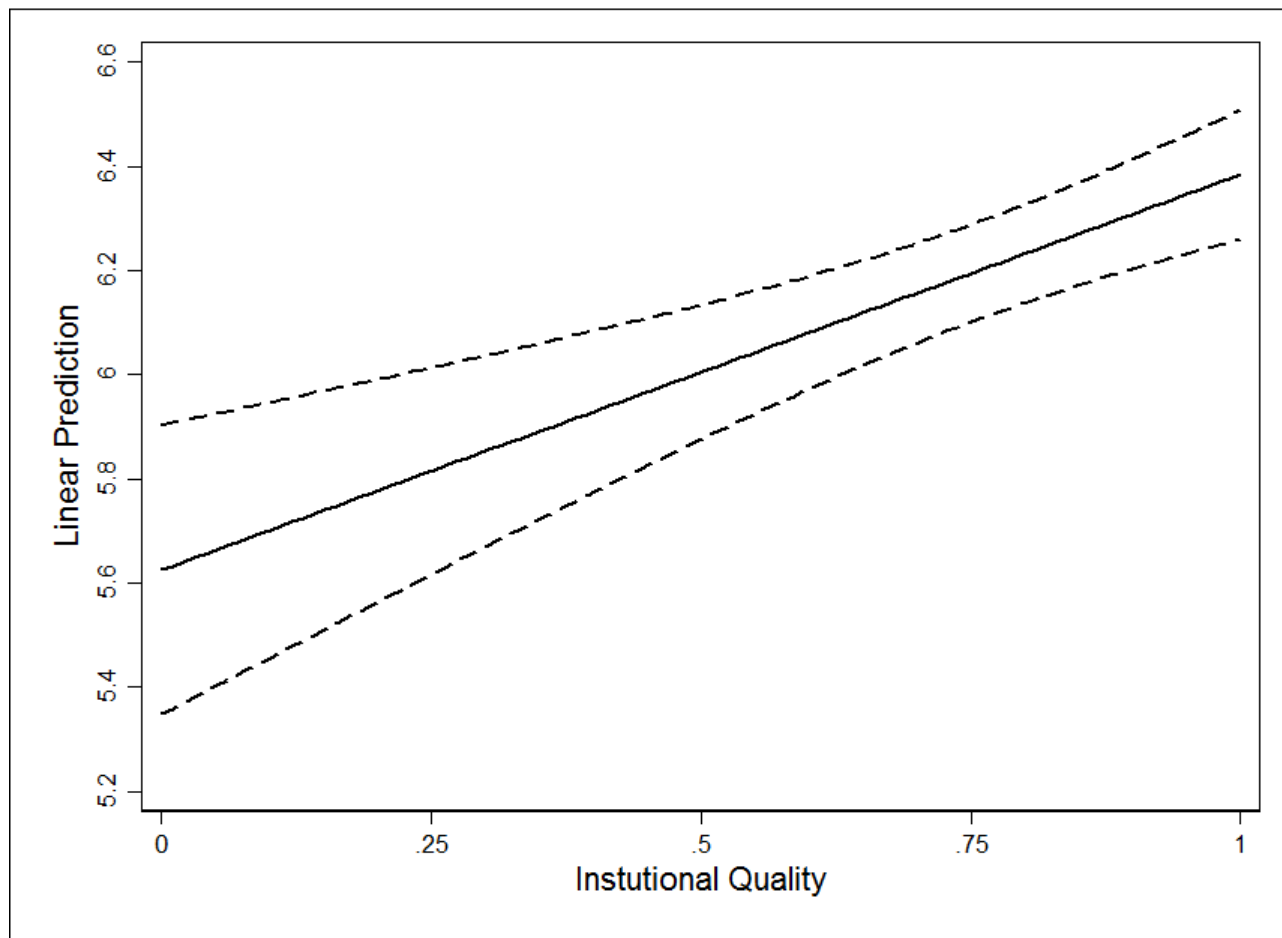
The vector R_{rct}^p of time-varying, region-specific controls includes: a measure of population density – defined as population per square kilometre – aimed at capturing spatial agglomeration forces; a measure of per capita Gross Domestic Product (GDP) – defined as GDP over population – as a proxy for a region's overall economic condition; the unemployment rate and a measure of human capital – defined as share of population with tertiary education – aimed at capturing conditions of the regional labour market. Finally, the composite error term, ε_{isrct} , is defined as the sum of five components: ν_i captures firm-specific effects; ν_t captures time fixed effects; ν_s captures industry-specific effects defined at the two-digit sector level; ν_c captures country-specific effects; and ν_{isrct} denotes the error term.

Table 1. Descriptive statistics of the main variables

		Mean	Std. Dev.	Min.	Max.
log(Labour Productivity _{isrct})	Overall	6.117	0.671	-2.852	11.972
	Between		0.631	1.010	11.845
	Within		0.257	1.838	9.978
Institutional Quality _{rct}	Overall	0.647	0.206	0	1
	Between		0.206	0	1
	Within		0.040	0.414	0.948
Government Effectiveness _{rct}	Overall	0.611	0.190	0	1
	Between		0.185	0	1
	Within		0.050	0.380	0.863
Control of Corruption _{rct}	Overall	0.639	0.236	0	1
	Between		0.236	0	1
	Within		0.046	0.437	0.860
Rule of Law _{rct}	Overall	0.564	0.219	0	1
	Between		0.216	0	1
	Within		0.056	0.251	0.937
Government Accountability _{rct}	Overall	0.581	0.172	0	1
	Between		0.159	0	1
	Within		0.075	0.215	1.094
log(Labour Productivity _{isrct-1})	Overall	6.110	0.663	-2.158	11.718
	Between		0.617	0.575	10.927
	Within		0.269	0.522	8.756
log(Employment _{isrct})	Overall	2.922	1.475	0.000	10.423
	Between		1.450	0.000	10.216
	Within		0.175	-0.007	5.417
log(Capital _{isrct} /Employment _{isrct})	Overall	10.192	1.465	-3.932	17.977
	Between		1.450	1.633	17.944
	Within		0.341	4.627	13.912
log(Age _{isrct})	Overall	2.838	0.784	0.693	5.700
	Between		0.807	0.896	5.694
	Within		0.112	2.215	3.314
log(Population Density _{rct})	Overall	5.310	0.801	3.158	8.903
	Between		0.808	3.161	8.899
	Within		0.008	5.257	5.363
log(GDP Per Capita _{rct})	Overall	-5.067	0.705	-6.360	-1.255
	Between		0.706	-6.337	-1.264
	Within		0.022	-5.161	-4.978
Unemployment Rate _{rct}	Overall	11.077	6.621	2.700	36.200
	Between		6.330	2.750	35.500
	Within		1.377	4.027	17.111
Human Capital _{rct}	Overall	24.021	8.488	11.000	47.200
	Between		8.354	11.600	46.900
	Within		1.238	18.271	33.581

Table 1 reports some descriptive statistics of the dependent and the explanatory variables, while Appendix Table A4 reports the correlation matrix of the firm- and region-level explanatory variables. As a preliminary insight of the relationship between firm-level labour productivity and regional institutional quality, Figure 3 plots the estimated linear fit between these two variables. Firms located in regions characterised by a better institutional environment show higher levels of labour productivity.

Figure 3. The association between firm-level labour productivity and regional institutional quality.



Notes: The solid line refers to the estimated linear fit, while the dashed lines refer to the associated confidence intervals. The estimation uses clustered standard errors at the regional level. The firm-level labour productivity variable is log-transformed, while the regional institutional quality variable is defined in the interval $[0,1]$.

3.3. Estimation strategy

Two main econometric issues concern the estimation of Equation (1): unobserved heterogeneity and endogeneity of the explanatory variables. In particular, endogeneity is likely to emerge in the context of Equation (1) for several reasons. First, a structural endogeneity problem characterises the estimation of the time-lagged dependent variable. Second, simultaneity between the dependent variable and the set of firm- and region-specific control variables may lead to spurious results. Third, endogeneity may affect the capacity of the key explanatory variable to capture regional institutional quality for at least three reasons: (i) reverse causality could emerge if regions endowed with high-performing firms have better institutions as a consequence of a more efficient economic and productive environment; (ii) spatial sorting may bias the estimation of the casual effect of institutional quality on firm performance if the most efficient firms locate in – or relocate towards – areas with a better institutional environment; (iii) measurement errors could occur, as the institutional variable defined in Equation (2) can only be considered a poor proxy for what is a more complex phenomenon, difficult to capture using exclusively survey-based data.

The widely-employed two-step system Generalised Method of Moments (GMM) estimator is used to deal simultaneously with both unobserved heterogeneity and endogeneity of the explanatory variables, given the complexity characterising the estimation of Equation (1) and the difficulty of

correctly identifying a causal effect of institutional quality on firm performance.⁶ In particular, system GMM allows to adequately estimate the coefficient of the time-lagged dependent variable in the context of a dynamic model, while a simple instrumental variable estimator would produce a biased estimate of it (Wooldridge, 2002). The system GMM estimator combines a system of first-differenced variables – which remove unobserved heterogeneity – instrumented with lagged levels, and a system of variables in level instrumented with lags of their first differences (Arellano and Bover, 1995; Blundell and Bond, 1998). Furthermore, it allows to enrich the set of internally-generated instruments with a set of external instrumental variables, if available, which can be both time-varying and time-invariant.

In the context of Equation (1), the variable capturing firm age, as well as industry, geographic and time dummy variables, are treated as exogenous and are used as instruments for themselves only in level. The other firm-specific explanatory variables, as well as the region-specific controls for population density, per capita GDP, unemployment rate and human capital, are instrumented using their lagged values in both levels and first differences.

Following Ketterer and Rodríguez-Pose (2018), the institutional quality variable is instrumented using both internally-generated instruments and a set of historical, region-specific, external instrumental variables. The set of historical variables includes: (i) a dummy variable capturing whether a region belonged to the Roman Empire at the time of Julius Caesar (49 BC), to proxy for a strong exposure to the Roman state, legal and military system; (ii) a dummy variable capturing whether a region belonged to Charlemagne's Empire and/or was a tributary territory to it at the time of the Charlemagne's death, to proxy for early exposure to what could be regarded as a "modern" governance; (iii) a dummy variable capturing whether a region was Christianised in 600 AD, to account for the early proliferation of Christianity-related moral and social norms; (iv) a variable capturing the number of times a region changed kingdom between 500 AD and 1000 AD, to proxy for early political (in)stability.⁷

The rationale underlying the use of such historical variables as instruments for current institutional quality relies on North's (1990) new institutionalist idea of path dependency, according to which current (region-specific) institutional settings keep traces – and, thus, are partially the result – of past institutions, formal norms and informal social norms (Sokoloff and Engerman, 2000; Acemoglu et al., 2001; Acemoglu et al., 2002; Duranton et al., 2009; and Di Liberto and Sideri, 2015, among others).

Turning on the chosen set of external instrumental variables, there is a strong possibility that current regional variability in institutional quality may have been shaped by historical variability in terms of governance (e.g. exposure to the Roman Empire and/or Charlemagne Empire), political (in)stability (e.g. number of times a region changed dominance), and religious beliefs (e.g. early diffusion of Christianity). Moreover, these variables could reasonably be considered exogenous with respect to the current performance of firms, as well as uncorrelated with other omitted determinants of firms' performance, given their deep historical nature (Ketterer and Rodríguez-Pose, 2018).

The validity of the estimation methodology is assessed through Arellano and Bond's (1991) test of serial correlation for dynamic panel data, and Hansen's (1982) J statistic of over-identifying restrictions aimed at assessing the null hypothesis of instruments' exogeneity. The variance inflation factor (VIF) is used to assess potential multicollinearity problems.

⁶ Equation (1) is estimated using the "xtabond2" Stata routine written by Roodman (2009).

⁷ The historical, region-specific variables were collected by Gilles Duranton, Giordano Mion and Andrés Rodríguez-Pose, and they were built by geo-coding historical maps provided by Kishlansky et al. (2003) and the online source www.euratlas.com. The variable capturing the number of kingdom changes was constructed using different maps, including the boundaries of European kingdoms in 100 year intervals.

4. EMPIRICAL RESULTS

4.1. Main results

Table 2 reports the results of the two-step system GMM estimation of Equation (1). There is an absence of third-order serial correlation in the first-differenced residuals, as indicated by the results of Arellano and Bond's (1991) test, and the null hypothesis of instruments' exogeneity is never rejected – the p-values of Hansen's (1982) J statistic are not significant in all the estimated specifications. The mean VIF is lower than the conservative cut-off value of 10, discarding the possibility of multicollinearity. The baseline specification (1) excludes the variable capturing regional institutional quality from the right-hand side of Equation (1), as it evaluates the relationship between the control variables and firms' labour productivity. The specification of the firm-level productivity equation in a dynamic fashion is justified: the coefficient of the first-order, time-lagged dependent variable is highly significant and relatively high in magnitude. In addition, the results underline that a firm's labour productivity is positively associated with its size, capital intensity, and negatively connected to its age. The region-specific variables for population density and per capita GDP show negligible estimated effects. By contrast, the region-level control for unemployment displays a negative and statistically significant coefficient, while the regional human capital variable shows a positive and significant coefficient.

Table 2. Institutional quality and firms' labour productivity

Dependent Variable	log(Labour Productivity _{isrct})			
	(1)	(2)	(3)	(4)
Institutional Quality _{rct}	...	0.468*** (0.116)	0.151* (0.088)	0.223** (0.103)
log(Labour Productivity _{isrct-1})	0.449*** (0.035)	0.737*** (0.030)	0.368*** (0.037)	0.399*** (0.043)
log(Employment _{isrct})	0.152*** (0.024)	...	0.153*** (0.025)	0.152*** (0.023)
log(Capital _{isrct} /Employment _{isrct})	0.037*** (0.012)	...	0.049*** (0.012)	0.048*** (0.014)
log(Age _{isrct})	-0.029** (0.012)	...	-0.025** (0.012)	-0.025** (0.012)
log(Population Density _{rct})	0.013 (0.026)	...	0.006 (0.022)	0.010 (0.031)
log(GDP Per Capita _{rct})	-0.014 (0.038)	...	-0.043 (0.032)	-0.062*** (0.023)
Unemployment Rate _{rct}	-0.004* (0.002)	...	-0.006** (0.002)	-0.005* (0.003)
Human Capital _{rct}	0.007** (0.003)	...	0.005** (0.002)	0.005** (0.003)
Industry Dummies	Yes	Yes	Yes	Yes
Country Dummies	Yes	Yes	Yes	Yes
Year Dummies	Yes	Yes	Yes	Yes
Number of Observations	111,480	111,480	111,480	111,480
Number of Firms	30,801	30,801	30,801	30,801
Model F Statistic [p-value]	284.33 [0.000]	2,022.71 [0.000]	352.36 [0.000]	404.25 [0.000]
Mean VIF	3.15	2.57	3.36	3.36
AR (1) {p-value}	0.000	0.000	0.000	0.000
AR (2) {p-value}	0.003	0.000	0.012	0.004
AR (3) {p-value}	0.975	0.600	0.783	0.842
Internal Instruments	Yes	Yes	Yes	Yes
External Instruments	No	No	No	Yes
Hansen J Statistic {p-value}	0.405	0.315	0.222	0.699
Number of Instruments	109	53	120	124

Notes: * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$. Standard errors are clustered at the regional level, and they are reported in parentheses. The dynamic labour productivity equations are estimated using a two-step system GMM estimator, and they include a constant term. The dummy and age variables are used as instruments for themselves only in level. The other variables are treated as endogenous and instrumented using their values lagged 3 to 4 both in level and first difference. Historical variables capturing dominance by Roman Empire, dominance by Charlemagne's Empire, early Christianisation and number of changes in kingdom are included as external instruments to instrument the institutional variable in specification (4).

Specification (2) excludes the firm- and region-specific control variables from the right-hand side of Equation (1), as it assesses the potential presence of a direct effect of regional institutional quality. Regional institutional quality has a positive and highly significant coefficient, as is also the case of the time-lagged dependent variable.

This last key result is confirmed looking at specification (3), which represents the full firm-level dynamic labour productivity Equation (1). All variables which are treated as endogenous are instrumented using only internally-generated instruments. The time-lagged dependent variable and the firm- and region-specific controls show the same sign, as well as similar significance level and magnitude, than in specification (1). The key explanatory variable capturing regional institutional quality shows a positive and significant coefficient: specifically, a unit increase in the level of institutional quality leads to a 15.1% increase of firm-level labour productivity.

Table 3. Institutional quality and firms' labour productivity: the effect of institutional components

Dependent Variable	log(Labour Productivity _{isrct})				
	(1)	(2)	(3)	(4)	(5)
Government Effectiveness _{rct}	0.159** (0.076)	...	...	...	0.166* (0.095)
Control of Corruption _{rct}	...	0.128* (0.077)	...	...	0.105 (0.092)
Rule of Law _{rct}	...	...	0.060 (0.080)	...	0.006 (0.114)
Government Accountability _{rct}	...	...	...	-0.018 (0.053)	-0.031 (0.045)
log(Labour Productivity _{isrct-1})	0.459*** (0.031)	0.487*** (0.035)	0.482*** (0.031)	0.481*** (0.034)	0.402*** (0.038)
log(Employment _{isrct})	0.137*** (0.023)	0.150*** (0.025)	0.140*** (0.024)	0.150*** (0.024)	0.139*** (0.019)
log(Capital _{isrct-1} /Employment _{isrct})	0.038*** (0.013)	0.035*** (0.012)	0.032** (0.013)	0.033** (0.013)	0.034*** (0.013)
log(Age _{isrct})	-0.020* (0.011)	-0.025** (0.011)	-0.020* (0.010)	-0.026** (0.011)	-0.024** (0.010)
log(Population Density _{rct})	-0.021 (0.035)	-0.015 (0.029)	-0.025 (0.037)	-0.006 (0.028)	-0.017 (0.021)
log(GDP Per Capita _{rct})	-0.036** (0.018)	-0.045* (0.025)	-0.041** (0.017)	-0.041** (0.019)	-0.062*** (0.020)
Unemployment Rate _{rct}	-0.003 (0.002)	-0.004* (0.002)	-0.006** (0.002)	-0.007*** (0.003)	-0.005* (0.002)
Human Capital _{rct}	0.007** (0.003)	0.008** (0.003)	0.008** (0.004)	0.007** (0.003)	0.004* (0.002)
Industry Dummies	Yes	Yes	Yes	Yes	Yes
Country Dummies	Yes	Yes	Yes	Yes	Yes
Year Dummies	Yes	Yes	Yes	Yes	Yes
Number of Observations	111,480	111,480	111,480	111,480	111,480
Number of Firms	30,801	30,801	30,801	30,801	30,801
Model F Statistic [p-value]	416.78 [0.000]	393.26 [0.000]	309.28 [0.000]	343.74 [0.000]	543.53 [0.000]
Mean VIF	3.25	3.48	3.35	3.19	4.04
AR (1) {p-value}	0.000	0.000	0.000	0.000	0.000
AR (2) {p-value}	0.001	0.001	0.001	0.001	0.003
AR (3) {p-value}	0.999	0.952	0.963	0.969	0.859
Internal Instruments	Yes	Yes	Yes	Yes	Yes
External Instruments	Yes	Yes	Yes	Yes	Yes
Hansen J Statistic {p-value}	0.664	0.901	0.672	0.695	0.976
Number of Instruments	124	124	124	124	157

Notes: * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$. Standard errors are clustered at the regional level, and they are reported in parentheses. The dynamic labour productivity equations are estimated using a two-step system GMM estimator, and they include a constant term. The dummy and age variables are used as instruments for themselves only in level. The other variables are treated as endogenous and instrumented using their values lagged 3 to 4 both in level and first difference. Historical variables capturing dominance by Roman Empire, dominance by Charlemagne's Empire, early Christianisation and number of changes in kingdom are included as external instruments to instrument the different institutional components.

This effect grows significantly in specification (4), which adds the set of external historical instrumental variables to the set of internally-generated ones to deal with the endogeneity of the institutional quality variable. In particular, a unit increase in the level of institutional quality leads to a lofty 22.3% increase of firm-level labour productivity. The coefficients of the firm- and region-specific control variables almost replicate those reported in specification (3), with the only exception of the variable for regional per capita GDP, which shows a negative and statistically significant coefficient.

As a further step, the effect of institutional quality is evaluated considering each of the individual components forming the institutional quality index separately. The same approach used with the aggregate institutional quality variable defined in Equation (2) is employed to derive the variables for (i) government effectiveness, (ii) control of corruption, (iii) rule of law, and (iv) government accountability. Each variable is further standardised in the interval [0, 1].

Table 3 reports the results of the two-step system GMM estimation of the modified Equation (1) considering the effect of each component separately – specifications (1) to (4) – and together – specification (5). All specifications are estimated adding the set of external historical instruments to the internally-generated ones to deal with the potential endogeneity of the institutional components. The diagnostic tests support the estimation strategy. Although the results in specifications (1) to (4) suggest that both government effectiveness and control of corruption have a positive effect on firms' labour productivity when considered individually in the empirical model, only government effectiveness remains positive and significant – see specification (5) – when all institutional dimensions are regressed simultaneously. In fact, the variables for control of corruption, rule of law, and government accountability show non-significant coefficients. Hence, firm-level labour productivity mostly benefits from a highly effective, regional government able to identify key domains of intervention, formulate related strategies and, in particular, implement policies and strategies that make interventions more helpful and efficient (Farole et al., 2011; Rodríguez-Pose and Di Cataldo, 2015). The firm- and region-specific controls show the same sign and similar significance levels as in specification (4) of Table (2).

Interesting insights emerge when firm-level heterogeneity in terms of size, capital endowment, and technological level are accounted for. First, the firms in the sample are split around the median value of the (log-)employment distribution.⁸ As Table 4 shows, institutional quality is positively and significantly connected to firm-level productivity in both sub-samples of firms – see specifications (1) and (3). Nevertheless, the impact is marginally greater for productivity in smaller firms than in larger ones. It is as though smaller firms compensate for their internal disadvantages to generate productivity relative to larger ones by reaping the advantages of good government. Firm size-related differences in the productivity returns of institutional quality appear to be even larger when considering the individual institutional components. First, only government effectiveness seems to matter for the overall firm-level labour productivity. Second, its positive effect on labour productivity is about 1.3 times larger for smaller than for larger firms – see specifications (2) and (4).

⁸ The median value equals 2.72. It is chosen because the skewness test rejects the log-normality hypothesis with p-value equal to 0.000.

Table 4. Institutional quality and labour productivity by firm size classes

Dependent Variable	log(Labour Productivity _{isrct})			
	Small		Large	
Firm Size Class	(1)	(2)	(3)	(4)
Institutional Quality _{rct}	0.188* (0.112)	...	0.187* (0.107)	...
Government Effectiveness _{rct}	...	0.226* (0.126)	...	0.174* (0.092)
Control of Corruption _{rct}	...	-0.076 (0.128)	...	0.020 (0.097)
Rule of Law _{rct}	...	-0.150 (0.130)	...	-0.089 (0.139)
Government Accountability _{rct}	...	0.084 (0.068)	...	-0.004 (0.092)
log(Labour Productivity _{isrct-1})	0.511*** (0.039)	0.483*** (0.049)	0.595*** (0.055)	0.537*** (0.070)
log(Employment _{isrct})	0.255*** (0.029)	0.221*** (0.036)	0.120*** (0.026)	0.139*** (0.026)
log(Capital _{isrct} /Employment _{isrct})	0.057*** (0.012)	0.058*** (0.015)	-0.003 (0.013)	-0.007 (0.016)
log(Age _{isrct})	-0.033*** (0.009)	-0.022** (0.010)	0.004 (0.005)	0.004 (0.005)
log(Population Density _{rct})	0.001 (0.024)	0.006 (0.032)	-0.005 (0.015)	-0.010 (0.018)
log(GDP Per Capita _{rct})	-0.040 (0.024)	-0.041 (0.026)	-0.033** (0.015)	-0.028* (0.015)
Unemployment Rate _{rct}	-0.003 (0.003)	-0.005 (0.004)	-0.001 (0.002)	-0.003 (0.003)
Human Capital _{rct}	0.003 (0.003)	0.003 (0.004)	0.002 (0.001)	0.002 (0.002)
Industry Dummies	Yes	Yes	Yes	Yes
Country Dummies	Yes	Yes	Yes	Yes
Year Dummies	Yes	Yes	Yes	Yes
Number of Observations	55,646	55,646	55,834	55,834
Number of Firms	15,875	15,875	14,926	14,926
Model F Statistic [p-value]	473.97 [0.000]	404.95 [0.000]	401.76 [0.000]	497.47 [0.000]
Mean VIF	1.50	2.11	2.78	3.44
AR (1) {p-value}	0.000	0.000	0.000	0.000
AR (2) {p-value}	0.007	0.004	0.014	0.006
AR (3) {p-value}	0.241	0.262	0.153	0.149
Internal Instruments	Yes	Yes	Yes	Yes
External Instruments	Yes	Yes	Yes	Yes
Hansen J Statistic {p-value}	0.841	0.922	0.655	0.791
Number of Instruments	123	156	124	157

Notes: * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$. Standard errors are clustered at the regional level, and they are reported in parentheses. The dynamic labour productivity equations are estimated using a two-step system GMM estimator, and they include a constant term. The dummy and age variables are used as instruments for themselves only in level. The other variables are treated as endogenous and instrumented using their values lagged 3 to 4 both in level and first difference. Historical variables capturing dominance by Roman Empire, dominance by Charlemagne's Empire, early Christianisation and number of changes in kingdom are included as external instruments to instrument the institutional variables.

Second, firms are split around the median value of the distribution of the log-transformed capital-to-employment ratio.⁹ As Table 5 shows, the institutional quality variable displays a positive and significant coefficient for both lowly- and highly-endowed firms – see specifications (1) and (3). Nevertheless, high local government quality leads to higher increases in productivity in firms with a low capital-to-employment ratio than in those with a higher ratio. Once again, of the four government quality dimensions, only government effectiveness matters for both sub-samples of firms – see specifications (2) and (4).

⁹ The median value equals 10.27. It is chosen because the skewness test rejects the log-normality hypothesis with p-value equal to 0.000.

Table 5. Institutional quality and labour productivity by firm capital endowment classes

Dependent Variable	log(Labour Productivity _{isrct})			
	Low		High	
Firm Capital Endowment Class	(1)	(2)	(3)	(4)
Institutional Quality _{rct}	0.409** (0.175)	...	0.261** (0.123)	...
Government Effectiveness _{rct}	...	0.195* (0.115)	...	0.172* (0.097)
Control of Corruption _{rct}	...	0.062 (0.124)	...	0.068 (0.126)
Rule of Law _{rct}	...	-0.114 (0.140)	...	0.068 (0.123)
Government Accountability _{rct}	...	0.070 (0.061)	...	-0.067 (0.054)
log(Labour Productivity _{isrct-1})	0.419*** (0.041)	0.458*** (0.038)	0.460*** (0.051)	0.456*** (0.055)
log(Employment _{isrct})	0.124*** (0.025)	0.106*** (0.018)	0.125*** (0.027)	0.110*** (0.023)
log(Capital _{isrct} /Employment _{isrct})	0.023** (0.010)	0.023** (0.011)	0.049 (0.044)	0.041 (0.046)
log(Age _{isrct})	-0.016 (0.012)	-0.005 (0.009)	-0.040** (0.016)	-0.034** (0.013)
log(Population Density _{rct})	-0.022 (0.044)	0.016 (0.040)	0.007 (0.024)	-0.001 (0.021)
log(GDP Per Capita _{rct})	-0.085** (0.034)	-0.058* (0.032)	-0.042*** (0.016)	-0.034** (0.016)
Unemployment Rate _{rct}	-0.004 (0.004)	-0.005 (0.004)	-0.003 (0.003)	-0.004 (0.003)
Human Capital _{rct}	0.004 (0.003)	0.001 (0.004)	0.001 (0.003)	0.002 (0.002)
Industry Dummies	Yes	Yes	Yes	Yes
Country Dummies	Yes	Yes	Yes	Yes
Year Dummies	Yes	Yes	Yes	Yes
Number of Observations	55,759	55,759	55,721	55,721
Number of Firms	15,960	15,960	14,841	14,841
Model F Statistic [p-value]	361.03 [0.000]	712.34 [0.000]	457.39 [0.000]	399.98 [0.000]
Mean VIF	4.20	4.85	3.01	3.71
AR (1) {p-value}	0.000	0.000	0.000	0.000
AR (2) {p-value}	0.040	0.020	0.027	0.029
AR (3) {p-value}	0.993	0.900	0.904	0.904
Internal Instruments	Yes	Yes	Yes	Yes
External Instruments	Yes	Yes	Yes	Yes
Hansen J Statistic {p-value}	0.531	0.985	0.482	0.975
Number of Instruments	124	157	124	157

Notes: * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$. Standard errors are clustered at the regional level, and they are reported in parentheses. The dynamic labour productivity equations are estimated using a two-step system GMM estimator, and they include a constant term. The dummy and age variables are used as instruments for themselves only in level. The other variables are treated as endogenous and instrumented using their values lagged 3 to 4 both in level and first difference. Historical variables capturing dominance by Roman Empire, dominance by Charlemagne's Empire, early Christianisation and number of changes in kingdom are included as external instruments to instrument the institutional variables.

Table 6 reports the results of the estimation of the Equation (1) and its modified version controlling for the four institutional components, accounting for firm heterogeneity in technological sector.¹⁰ High-tech firms profit more from institutional quality than low-tech firms. In particular, both low- and high-tech firms reap productivity gains from government effectiveness only. However, the productivity returns of government effectiveness is about 1.7 times larger for high-tech than for low-tech firms.

¹⁰ Low- and high-tech sectors are defined at the three-digit level of the NACE Rev. 2 classification following the methodology proposed by the Organisation for Economic Cooperation and Development (OECD).

Table 6. Institutional quality and labour productivity by firm technological classes

Dependent Variable Firm Technological Class	log(Labour Productivity _{isrct})			
	Low-Tech		High-Tech	
	(1)	(2)	(3)	(4)
Institutional Quality _{rct}	0.195* (0.102)	...	0.354** (0.147)	...
Government Effectiveness _{rct}	...	0.184* (0.100)	...	0.314*** (0.108)
Control of Corruption _{rct}	...	0.085 (0.103)	...	0.072 (0.125)
Rule of Law _{rct}	...	-0.047 (0.106)	...	-0.223 (0.160)
Government Accountability _{rct}	...	-0.023 (0.057)	...	-0.079 (0.123)
log(Labour Productivity _{isrct-1})	0.485*** (0.038)	0.483*** (0.034)	0.335*** (0.038)	0.351*** (0.038)
log(Employment _{isrct})	0.154*** (0.028)	0.146*** (0.022)	0.121*** (0.024)	0.121*** (0.024)
log(Capital _{isrct} /Employment _{isrct})	0.037** (0.016)	0.033** (0.014)	0.025 (0.016)	0.016 (0.016)
log(Age _{isrct})	-0.033** (0.013)	-0.025** (0.011)	-0.016 (0.012)	-0.016 (0.013)
log(Population Density _{rct})	-0.019 (0.028)	-0.024 (0.027)	0.012 (0.034)	0.028 (0.027)
log(GDP Per Capita _{rct})	-0.060** (0.025)	-0.053** (0.024)	-0.062 (0.040)	-0.042 (0.026)
Unemployment Rate _{rct}	-0.004 (0.003)	-0.003 (0.003)	-0.001 (0.005)	-0.004 (0.003)
Human Capital _{rct}	0.004 (0.003)	0.004 (0.003)	0.004 (0.004)	0.008** (0.004)
Industry Dummies	Yes	Yes	Yes	Yes
Country Dummies	Yes	Yes	Yes	Yes
Year Dummies	Yes	Yes	Yes	Yes
Number of Observations	84,469	84,469	27,011	27,011
Number of Firms	23,526	23,526	7,275	7,275
Model F Statistic [p-value]	420.74 [0.000]	422.48 [0.000]	224.88 [0.000]	548.29 [0.000]
Mean VIF	3.87	4.61	5.01	6.34
AR (1) {p-value}	0.000	0.000	0.000	0.000
AR (2) {p-value}	0.001	0.001	0.977	0.989
AR (3) {p-value}	0.835	0.853	0.859	0.794
Internal Instruments	Yes	Yes	Yes	Yes
External Instruments	Yes	Yes	Yes	Yes
Hansen J Statistic {p-value}	0.141	0.907	0.288	0.951
Number of Instruments	118	151	89	113

Notes: * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$. Standard errors are clustered at the regional level, and they are reported in parentheses. The dynamic labour productivity equations are estimated using a two-step system GMM estimator, and they include a constant term. The dummy and age variables are used as instruments for themselves only in level. The other variables are treated as endogenous and instrumented using their values lagged 3 to 4 in specifications (1) and (2), and values lagged 2 to 3 in specifications (3) and (4) both in level and first difference. Historical variables capturing dominance by Roman Empire, dominance by Charlemagne's Empire, early Christianisation and number of changes in kingdom are included as external instruments to instrument the institutional variables.

4.2. Robustness test

The robustness of the main results on the institutional quality variable is tested using an alternative identification strategy, which exploits exogenous regional variations in the 1870s literacy rate – included in the econometric model as an external instrumental variable – in order to identify the casual effect of current regional institutional quality on firms' labour productivity. The validity of this alternative external historical instrument relies on previous empirical evidence suggesting that historical educational levels are highly correlated with subsequent changes in institutional conditions (Glaeser et al., 2004; Rodríguez-Pose and Di Cataldo, 2015). Similarly to the previously employed set of historical instrumental variables, literacy rates in the 1870s represent

a past phenomenon which is improbable to have any bearing on the current performance of individual firms. Following Akçomak and ter Weel (2009) and Tabellini (2010), the variable capturing historical literacy rate is defined as percentage of population able to read and write.¹¹

Table 7 reports the results of the estimation of Equation (1) adding the historical literacy rate as an external instrument to the set of internally-generated instrumental variables. Overall, the main findings are confirmed. The effect of institutional quality on labour productivity at firm level remains positive and significant. Once again, the results highlight that smaller firms benefit from regional institutional quality to a larger extent than larger firms, that firms with low capital endowment benefit more than highly-endowed firms, and that high-tech firms benefit more than low-tech ones.

A series of further tests has been performed to confirm the robustness of the main findings, and all the tables reporting these results are included in the Appendix. First, Appendix Table A5 reports the results obtained by estimating an augmented version of Equation (1), which includes also a region-level control variable used to proxy for the size of the shadow economy (*Shadow Economy_{rect}*). Following Tafenau et al. (2010) and Herwartz et al. (2015), this variable has been estimated by adopting a multiple indicators multiple causes (MIMIC) approach in the context of a structural equation model estimated via Maximum Likelihood (ML). The aim of this exercise is to mitigate concerns related to the fact that the institutional quality variable does not account for dimensions such as regulatory quality and political stability, as previously discussed in Footnote 4. The rationale is that individuals and firms may prefer to operate in the informal – rather than in the formal – economy in the presence of regulatory burdens and political instability.¹² The results presented in Appendix Table A5 confirm a positive and statistically significant effect of institutional quality on firm-level labour productivity, while the shadow economy variable shows negative but non-significant coefficients.

¹¹ Data on Austrian and Belgian regions are drawn from Flora (1983) and refer to the year 1880. Data on French regions are drawn from Tabellini (2010) and refer to the year 1872. Data on German regions are drawn from Cipolla (1969) and refer to the year 1871. Data on Italian regions are drawn from Flora (1983) and refer to the year 1871 – population able to read only. Data on Portuguese regions are drawn from Nunes (1993) and refer to the year 1878. Data on Spanish regions are drawn from Núñez (1990) and refer to the year 1877.

¹² We are grateful to an anonymous reviewer for having suggested this robustness test.

Table 7. Institutional quality and labour productivity using an alternative external instrument

Dependent Variable Firm Class	log(Labour Productivity _{isrct})						
	Whole Sample	Size		Capital Endowment		Technology	
			Small	Large	Low	High	Low-Tech	High-Tech
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Institutional Quality _{rct}	0.158* (0.088)	0.206* (0.116)	0.162* (0.087)	0.282** (0.109)	0.185** (0.093)	0.215** (0.098)	0.292** (0.144)
log(Labour Productivity _{isrct-1})	0.372*** (0.043)	0.539*** (0.036)	0.564*** (0.073)	0.402*** (0.043)	0.445*** (0.049)	0.479*** (0.039)	0.338*** (0.037)
log(Employment _{isrct})	0.152*** (0.022)	0.295*** (0.032)	0.129*** (0.030)	0.135*** (0.025)	0.119*** (0.028)	0.154*** (0.024)	0.121*** (0.027)
log(Capital _{isrct-1} /Employment _{isrct})	0.051*** (0.013)	0.043*** (0.013)	-0.009 (0.013)	0.017* (0.010)	0.063 (0.040)	0.046*** (0.014)	0.021 (0.016)
log(Age _{isrct})	-0.024** (0.010)	-0.035*** (0.009)	0.005 (0.005)	-0.020 (0.013)	-0.040** (0.017)	-0.033*** (0.012)	-0.016 (0.013)
log(Population Density _{rct})	0.012 (0.022)	0.009 (0.024)	0.001 (0.013)	-0.004 (0.032)	0.013 (0.020)	-0.000 (0.018)	0.031 (0.027)
log(GDP Per Capita _{rct})	-0.063 (0.038)	-0.015 (0.028)	-0.027 (0.023)	-0.048 (0.048)	-0.026 (0.030)	-0.047* (0.025)	-0.068* (0.040)
Unemployment Rate _{rct}	-0.006** (0.002)	-0.000 (0.003)	-0.001 (0.003)	-0.003 (0.004)	-0.005** (0.002)	-0.003 (0.003)	-0.003 (0.004)
Human Capital _{rct}	0.003* (0.002)	0.004 (0.003)	0.002 (0.001)	0.006 (0.004)	0.001 (0.003)	0.002 (0.002)	0.002 (0.003)
Industry Dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country Dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of Observations	111,480	55,646	55,834	55,759	55,721	84,469	27,011
Number of Firms	30,801	15,875	14,926	15,960	14,841	23,526	7,275
Model F Statistic [p-value]	351.20 [0.000]	1,000.97 [0.000]	403.23 [0.000]	702.26 [0.000]	474.66 [0.000]	449.44 [0.000]	201.38 [0.000]
Mean VIF	3.36	1.50	2.78	4.20	3.01	3.87	5.01
AR (1) {p-value}	0.000	0.000	0.000	0.000	0.000	0.000	0.000
AR (2) {p-value}	0.016	0.005	0.004	0.060	0.029	0.001	0.964
AR (3) {p-value}	0.786	0.230	0.164	0.998	0.881	0.820	0.850
Internal Instruments	Yes	Yes	Yes	Yes	Yes	Yes	Yes
External Instrument	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Hansen J Statistic {p-value}	0.793	0.122	0.435	0.680	0.592	0.409	0.339
Number of Instruments	121	120	121	121	121	115	86

Notes: * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$. Standard errors are clustered at the regional level, and they are reported in parentheses. The dynamic labour productivity equations are estimated using a two-step system GMM estimator, and they include a constant term. The dummy and age variables are used as instruments for themselves only in level. The other variables are treated as endogenous and instrumented using their values lagged 3 to 4 in specifications (1) to (6), and values lagged 2 to 3 in specification (7) both in level and first difference. The historical variable capturing the regional literacy rate in the 1870s is included as external instrument to instrument the institutional variable.

In the second robustness exercise, the right-hand side of Equation (1) has been further augmented by including, in addition to the shadow economy variable, two extra regional controls for R&D – defined as total intramural R&D expenditure as a percentage of GDP – and motorway density – defined as kilometres of motorways per thousand square kilometres. Due to the presence of missing values in the data series for R&D expenditure and motorways density available from Eurostat, this exercise is based on a reduced sample of firms and firm-year observations. In any case, the results reported in Appendix Table A6 confirm the key finding: regional institutional quality enhances firm-level labour productivity, with an estimated effect of one unit increase in institutional quality accounting for a range of 19.9 to 29.6% of any increase in firm-level labour productivity.

As a further robustness exercise, Equation (1) has been modified to test for the regional vs. national dimension of institutional quality, given that the regional institutional quality variable used in the empirical analysis is defined by interpolating the region-specific institutional dimensions with the country-level ones. Therefore, different region- and country-level variables for institutional quality have been compared in order to evaluate whether the estimated effect of institutions on firm-level labour productivity is effectively driven by the regional dimension of institutional quality. Specifically, Appendix Table A7 compares the estimated coefficients of: (i) the regional institutional quality variable, defined in Equation (2) as *Institutional Quality*_{rct}; (ii) a purely region-specific, time-invariant variable (*Institutional Quality*_{rc}²⁰¹³), defined using only regional information drawn from the 2013 wave of the European Quality of Government Index dataset, i.e. defined without interpolation with the country-level institutional data drawn from the WBI dataset; (iii) a purely country-level variable, defined using the WBI data series, and based on the four institutional dimensions of government effectiveness, control of corruption, voice and accountability, and rule of law (*Institutional Quality*_{ct}^{fp}); and (iv) a purely country-level variable depicting also the two institutional dimensions of regulatory quality and political stability (*Institutional Quality*_{ct}^{sp}). The results suggest that the regional institutional dimension matters, while there is no such evidence for the national one. In addition, the "purely" regional dimension – captured by the variable *Institutional Quality*_{rc}²⁰¹³ – seems to matter even more.¹³

The final robustness test involves expanding Equation (1) by including two country-level institutional variables for regulatory quality and political stability derived from the WBI dataset. Additionally, the regional dimension of institutional quality is captured by either the time-varying regional variable *Institutional Quality*_{rct}, or the purely region-specific, time-invariant variable *Institutional Quality*_{rc}²⁰¹³. The results reported in Appendix Table A8 suggest that neither regulatory quality nor political stability at the country level matter for firm-level labour productivity. Overall, the main result concerning regional institutional quality is confirmed.

¹³ Please, note that specification (1) in Appendix Table A7 corresponds to specification (3) in Table 2, and is included only for the sake of completeness.

5. CONCLUSIONS

This paper has investigated the empirical relationship between regional institutional quality and the labour productivity of firms, using a large sample of manufacturing firms from seven western European countries – Austria, Belgium, France, Germany, Italy, Portugal and Spain – for the period between 2009 and 2014.

The results reveal that regional institutional quality is an important driver behind levels and changes in firm-level productivity. However, how institutions shape labour productivity depends highly on the type of firm considered. Smaller, less capital endowed and high-tech sectors are three of the types of firms whose productivity is most favourably affected by the presence of good and effective institutions at the local and regional level. In particular, government effectiveness is the main driver of the positive institutions-firm productivity relationship. This result suggests that the design, implementation, and monitoring of (local) policies play a crucial role in firm-level economic performance. Efficient governments and policy makers in appropriate regional ecosystems can make a considerable difference for the productivity and, thus, the dynamism of firms.

The results here presented both confirm previous academic evidence on the importance of regional institutions for local economic development and growth, and provide further support for local-level policies aimed at pushing firm-level performance – as the firm is the bulk of any (regional) economic system. They also emphasise how national and supranational governments can further promote economic development indirectly by paying greater attention to the role, capacities and potentialities of regional authorities for designing efficient and effective public policies, especially for those smaller firms with low levels of capital endowment – as well as for high-tech firms – that often do not have the internal capacities to continue developing labour productivity.

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Table A1. A comparison between the population of manufacturing firms and the sample

Country	Manufacturing Industry		Sample	
	No.	%	No.	%
Austria	25,319	2.18	668	2.17
Belgium	37,981	3.27	1,005	3.26
France	207,040	17.85	5,516	17.91
Germany	179,834	15.50	4,742	15.40
Italy	439,112	37.85	11,795	38.29
Portugal	78,940	6.80	2,081	6.76
Spain	191,972	16.55	4,994	16.21
Total	1,160,198	100.00	30,801	100.00

Notes: Percentage values are defined on column totals. Official country-level data are drawn from Eurostat, and refer to the year 2009.

Table A2. Geographic coverage of the sample

Country	Regions			
	NUTS Level	In the Country	In the Sample	Percentage Covered
Austria	2	9	9	100.00
Belgium	1	3	3	100.00
France	2	22	22	100.00
Germany	1	16	16	100.00
Italy	2	21	21	100.00
Portugal	2	7	5	71.43
Spain	2	19	15	78.95
Total Sample		97	91	93.81

Notes: The five French Overseas Departments are excluded *à priori* from the analysis. The sample does not include the Portuguese regions of Azores and Madeira, and the Spanish autonomous cities of Ceuta and Melilla, the Balearic Islands and the Canary Islands due to data availability problems.

Table A3. Sample distribution by industrial sector

NACE Rev. 2 Classification at two-digit level	Firms	
	No.	%
10 - Food products	3,291	10.68
11 - Beverages	481	1.56
12 - Tobacco products	11	0.04
13 - Textiles	956	3.10
14 - Wearing apparel	951	3.09
15 - Leather and related products	766	2.49
16 - Wood, wood and cork's products, except furniture; articles of straw and plaiting materials	1,246	4.05
17 - Paper and paper products	631	2.05
18 - Printing and reproduction of recorded media	1,397	4.54
19 - Coke and refined petroleum products	50	0.16
20 - Chemicals and chemical products	1,093	3.55
21 - Basic pharmaceutical products and pharmaceutical preparations	201	0.65
22 - Rubber and plastic products	1,662	5.40
23 - Other non-metallic mineral products	1,636	5.31
24 - Basic metals	597	1.94
25 - Fabricated metal products, except machinery and equipment	6,164	20.01
26 - Computer, electronic and optical products	1,065	3.46
27 - Electrical equipment	1,054	3.42
28 - Machinery and equipment N.E.C.	3,122	10.14
29 - Motor vehicles, trailers and semi-trailers	592	1.92
30 - Other transport equipment	289	0.94
31 - Furniture	1,038	3.37
32 - Other manufacturing	1,023	3.32
33 - Repair and installation of machinery and equipment	1,485	4.82
Total	30,801	100.00

Table A4. Correlation matrix of explanatory variables

		[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]	[13]
Institutional Quality _{rct}	[1]	1												
Government Effectiveness _{rct}	[2]	0.93	1											
Control of Corruption _{rct}	[3]	0.95	0.82	1										
Rule of Law _{rct}	[4]	0.95	0.85	0.92	1									
Government Accountability _{rct}	[5]	0.70	0.64	0.54	0.53	1								
log(Labour Productivity _{isrct-1})	[6]	0.23	0.22	0.21	0.20	0.21	1							
log(Employment _{isrct})	[7]	0.41	0.35	0.42	0.39	0.25	0.28	1						
log(Capital _{isrct} /Employment _{isrct})	[8]	0.00	0.01	-0.03	-0.02	0.05	0.38	0.12	1					
log(Age _{isrct})	[9]	0.18	0.17	0.17	0.17	0.12	0.20	0.33	0.16	1				
log(Population Density _{rct})	[10]	-0.12	-0.08	-0.09	-0.17	-0.09	0.16	0.11	0.01	0.06	1			
log(GDP Per Capita _{rct})	[11]	0.17	0.18	0.09	0.15	0.22	-0.02	-0.04	0.05	-0.04	-0.48	1		
Unemployment Rate _{rct}	[12]	-0.37	-0.36	-0.30	-0.29	-0.46	-0.31	-0.33	-0.02	-0.13	-0.23	-0.04	1	
Human Capital _{rct}	[13]	0.53	0.50	0.60	0.51	0.15	0.14	0.16	0.02	0.11	0.08	0.01	0.20	1

Table A5. The effect of institutional quality controlling for the size of the shadow economy

Dependent Variable	log(Labour Productivity _{isrct})		
	(1)	(2)	(3)
Institutional Quality _{rct}	0.193* (0.111)	0.327** (0.161)	0.165* (0.095)
Shadow Economy _{rct}	-0.019 (0.036)	-0.002 (0.044)	-0.038 (0.031)
log(Labour Productivity _{isrct-1})	0.349*** (0.041)	0.371*** (0.043)	0.386*** (0.041)
Firm-level Controls	Yes	Yes	Yes
Region-level Controls	Yes	Yes	Yes
Industry Dummies	Yes	Yes	Yes
Country Dummies	Yes	Yes	Yes
Year Dummies	Yes	Yes	Yes
Number of Observations	111,480	111,480	111,480
Number of Firms	30,801	30,801	30,801
Model F Statistic [p-value]	414.47 [0.000]	410.98 [0.000]	399.32 [0.000]
Mean VIF	8.56	8.56	8.56
AR (1) {p-value}	0.000	0.000	0.000
AR (2) {p-value}	0.025	0.013	0.008
AR (3) {p-value}	0.734	0.743	0.804
Internal Instruments	Yes	Yes	Yes
External Instruments	No	Yes	Yes
Hansen J Statistic {p-value}	0.460	0.131	0.115
Number of Instruments	131	135	132

Notes: * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$. Standard errors are clustered at the regional level, and they are reported in parentheses. The dynamic labour productivity equations are estimated using a two-step system GMM estimator, and they include a constant term. The dummy and age variables are used as instruments for themselves only in level. The other variables are treated as endogenous and instrumented using their values lagged 3 to 4 both in level and first difference. Historical variables capturing dominance by Roman Empire, dominance by Charlemagne's Empire, early Christianisation and number of changes in kingdom are included as external instruments to instrument the institutional variable in specification (2), while the historical variable capturing the regional literacy rate in the 1870s is included as external instrument to instrument the institutional variable in specification (3).

Table A6. The effect of institutional quality controlling for size of the shadow economy, R&D expenditure and motorways density

Dependent Variable	log(Labour Productivity _{isrct})		
	(1)	(2)	(3)
Institutional Quality _{rct}	0.199* (0.118)	0.296* (0.160)	0.235** (0.116)
Shadow Economy _{rct}	-0.040 (0.032)	-0.001 (0.042)	-0.028 (0.038)
log(Labour Productivity _{isrct-1})	0.376*** (0.043)	0.377*** (0.051)	0.375*** (0.045)
Firm-level Controls	Yes	Yes	Yes
Region-level Controls			
R_{rct}^p	Yes	Yes	Yes
R&D _{rct}	Yes	Yes	Yes
log(Motorways Density _{rct})	Yes	Yes	Yes
Industry Dummies	Yes	Yes	Yes
Country Dummies	Yes	Yes	Yes
Year Dummies	Yes	Yes	Yes
Number of Observations	89,333	89,333	89,333
Number of Firms	28,494	28,494	28,494
Model F Statistic [p-value]	312.06 [0.000]	400.47 [0.000]	361.50 [0.000]
Mean VIF	9.72	9.72	9.72
AR (1) {p-value}	0.000	0.000	0.000
AR (2) {p-value}	0.036	0.045	0.035
AR (3) {p-value}	0.927	0.923	0.927
Internal Instruments	Yes	Yes	Yes
External Instruments	No	Yes	Yes
Hansen J Statistic {p-value}	0.486	0.655	0.576
Number of Instruments	152	156	153

Notes: * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$. Standard errors are clustered at the regional level, and they are reported in parentheses. The dynamic labour productivity equations are estimated using a two-step system GMM estimator, and they include a constant term. The dummy and age variables are used as instruments for themselves only in level. The other variables are treated as endogenous and instrumented using their values lagged 3 to 4 both in level and first difference. Historical variables capturing dominance by Roman Empire, dominance by Charlemagne's Empire, early Christianisation and number of changes in kingdom are included as external instruments to instrument the institutional variable in specification (2), while the historical variable capturing the regional literacy rate in the 1870s is included as external instrument to instrument the institutional variable in specification (3). The vector R_{rct}^p includes the region-level control variables for population density, GDP per capita, unemployment rate and human capital. The additional region-level control variables are the total intramural R&D expenditure as a percentage of GDP, and the (logarithm of) the motorways network expressed in kilometres per thousand square kilometres. Due to the presence of missing values in the Eurostat series for R&D expenditure and motorways density, the estimation sample used here covers the 92.5% of the full sample of firms, corresponding to the 80.1% of the full set of observations. Specifically, data on motorways density are missing for all Portuguese regions, and for two (out of 21) Italian regions for the entire period 2009-2014; data on R&D expenditure are missing for all Austrian and German regions for the entire period 2009-2014, for all French regions in the year 2014, and for all regions in the sample for the years 2011 and 2013.

Table A7. Regional vs. national institutional quality and firms' labour productivity

Dependent Variable	log(Labour Productivity _{isrct})							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Institutional Quality _{rct}	0.151*	...	0.208**	...	0.198**	...	...	...
	(0.088)		(0.094)		(0.097)			
Institutional Quality _{rc} ²⁰¹³	...	...	...	...	...	0.159**	0.202***	0.199***
						(0.072)	(0.073)	(0.073)
Institutional Quality _{ct} ^{fp}	...	-0.111	-0.135	...	...	...	-0.005	...
		(0.098)	(0.116)				(0.101)	
Institutional Quality _{ct} ^{sp}	...	...	...	-0.078	-0.119	...	...	-0.008
				(0.104)	(0.120)			(0.100)
log(Labour Productivity _{isrct-1})	0.368***	0.474***	0.360***	0.465***	0.357***	0.359***	0.348***	0.348***
	(0.037)	(0.034)	(0.037)	(0.034)	(0.039)	(0.046)	(0.040)	(0.041)
Firm-level Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Region-level Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry Dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country Dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of Observations	111,480	111,480	111,480	111,480	111,480	111,480	111,480	111,480
Number of Firms	30,801	30,801	30,801	30,801	30,801	30,801	30,801	30,801
Model F Statistic [p-value]	352.36 [0.000]	495.98 [0.000]	348.72 [0.000]	467.99 [0.000]	326.67 [0.000]	382.48 [0.000]	361.98 [0.000]	367.63 [0.000]
Mean VIF	3.36	14.95	14.91	17.23	17.17	3.43	14.90	17.12
AR (1) {p-value}	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
AR (2) {p-value}	0.012	0.001	0.016	0.002	0.019	0.026	0.028	0.030
AR (3) {p-value}	0.783	0.976	0.762	0.991	0.765	0.779	0.762	0.761
Internal Instruments	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Hansen J Statistic {p-value}	0.222	0.275	0.680	0.358	0.679	0.138	0.491	0.467
Number of Instruments	120	120	131	120	131	110	121	121

Notes: * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$. Standard errors are clustered at the regional level, and they are reported in parentheses. The dynamic labour productivity equations are estimated using a two-step system GMM estimator, and they include a constant term. The variable *Institutional Quality_{rct}* is the one used in the empirical analysis throughout the paper, i.e. the one based on the four pillars for government effectiveness, control of corruption, rule of law, and voice and accountability as in Charron et al. (2014). The variable *Institutional Quality_{rc}²⁰¹³* is a region-specific, time-invariant institutional variable defined using the 2013 wave of the European Quality of Government Index dataset without any interpolation with the country-specific World Bank's Worldwide Governance Indicators. The variable *Institutional Quality_{ct}^{fp}* is a country-level, time-varying institutional variable defined using the World Bank's Worldwide Governance Indicators, and based on the four pillars for government effectiveness, control of corruption, rule of law, and voice and accountability. The variable *Institutional Quality_{ct}^{sp}* is a country-level, time-varying institutional variable defined using the World Bank's Worldwide Governance Indicators, and based on all available six pillars for government effectiveness, control of corruption, rule of law, voice and accountability, regulatory quality, and political stability. The dummy and age variables are used as instruments for themselves only in level. The other variables are treated as endogenous and instrumented using their values lagged 3 to 4 both in level and first difference. The variable *Institutional Quality_{rc}²⁰¹³* uses instruments only in level.

Table A8. Regional institutional quality controlling for country-level regulatory quality and political stability

Dependent Variable	log(Labour Productivity _{isrct})					
	(1)	(2)	(3)	(4)	(5)	(6)
Institutional Quality _{rct}	0.186** (0.080)	0.178** (0.073)	0.141* (0.073)	...	...	...
Institutional Quality _{rc} ²⁰¹³	...	...	...	0.200** (0.099)	0.173** (0.082)	0.234** (0.108)
Regulatory Quality _{ct}	-0.092 (0.068)	-0.053 (0.060)	...	-0.038 (0.060)	-0.006 (0.059)	...
Political Stability _{ct}	0.008 (0.035)	...	0.011 (0.039)	0.022 (0.023)	...	0.030 (0.023)
log(Labour Productivity _{isrct-1})	0.382*** (0.041)	0.384*** (0.035)	0.374*** (0.038)	0.369*** (0.037)	0.376*** (0.038)	0.366*** (0.039)
Firm-level Controls	Yes	Yes	Yes	Yes	Yes	Yes
Region-level Controls	Yes	Yes	Yes	Yes	Yes	Yes
Industry Dummies	Yes	Yes	Yes	Yes	Yes	Yes
Country Dummies	Yes	Yes	Yes	Yes	Yes	Yes
Year Dummies	Yes	Yes	Yes	Yes	Yes	Yes
Number of Observations	111,480	111,480	111,480	111,480	111,480	111,480
Number of Firms	30,801	30,801	30,801	30,801	30,801	30,801
Model F Statistic [p-value]	356.62 [0.000]	389.99 [0.000]	326.70 [0.000]	329.13 [0.000]	363.42 [0.000]	340.08 [0.000]
Mean VIF	8.83	6.58	5.43	8.85	6.60	5.50
AR (1) {p-value}	0.000	0.000	0.000	0.000	0.000	0.000
AR (2) {p-value}	0.008	0.006	0.011	0.015	0.012	0.017
AR (3) {p-value}	0.816	0.829	0.787	0.805	0.826	0.783
Internal Instruments	Yes	Yes	Yes	Yes	Yes	Yes
Hansen J Statistic {p-value}	0.919	0.662	0.736	0.699	0.331	0.432
Number of Instruments	142	131	131	132	121	121

Notes: * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$. Standard errors are clustered at the regional level, and they are reported in parentheses. The dynamic labour productivity equations are estimated using a two-step system GMM estimator, and they include a constant term. The variable *Institutional Quality_{rct}* is the one used in the empirical analysis throughout the paper, i.e. the one based on the four pillars for government effectiveness, control of corruption, rule of law, and voice and accountability as in Charron et al. (2014). The variable *Institutional Quality_{rc}²⁰¹³* is a region-specific, time-invariant institutional variable defined using the 2013 wave of the European Quality of Government Index dataset without any interpolation with the country-specific World Bank's Worldwide Governance Indicators. The variables *Regulatory Quality_{ct}* and *Political Stability_{ct}* are country-level, time-varying variables defined using the World Bank's Worldwide Governance Indicators, and, specifically, correspond to the individual pillars for regulatory quality and political stability, respectively. The dummy and age variables are used as instruments for themselves only in level. The other variables are treated as endogenous and instrumented using their values lagged 3 to 4 both in level and first difference. The variable *Institutional Quality_{rc}²⁰¹³* uses instruments only in level.