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THE QUALITY OF REGIONAL GOVERNMENT AND FIRM PERFORMANCE

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The Quality of Regional Government and Firm Performance.•

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Abstract This paper examines the effect of the quality of regional government (QoG) on firm Total Factor Productivity (TFP) in a multi-country context. The analysis is based on comparable cross-country data of manufacturing firms operating in seven European countries (Austria, France, Germany, Hungary, Italy, Spain and the United Kingdom). The measure of the 'quality of government' is the European quality of government index (EQI), calculated at regional level over twenty-seven EU members. To disentangle internal from external productivity drivers, the multilevel approach is employed. Results refer to 2008 and show, as expected, the importance of firm-specific determinants of TFP. As far as the specific scope of this paper is concerned, firms located in regions with high quality regional government show higher levels of TFP. When considering the QoG components, corruption and the quality of services positively affect TFP, while the evidence is inconclusive for impartiality.

Keywords: Institutions, firm performance, European regions, multilevel model
JEL classification: O43, D24, C30

1. Introduction

The performance of a firm is influenced by decisions made by the firm itself as well as factors external to it. Firm competencies are important but also competencies that pertain to territories (Mariani, 2004). External factors encompass different aspects of the environmental context in which firms operate, such as physical infrastructures, innovative capacity and efficiency of the public administration.

The attention in this paper is on the effect of the quality of regional government (QoG) on the Total Factor Productivity (TFP) of firms in a multi-country context.

Scholars have demonstrated that the institutional environment affects macro variables such as growth (see Jütting 2003 and Aron 2000, for a critical review), income level, productivity,

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innovation activity, investment and trade at the country (Acemoglu, Johnson and Robinson, 2001; Hall and Jones, 1999; Barbarosa and Faria 2011; Aron 2000; Levchenko 2007) as well as at the regional level (Tabellini 2010; Rodríguez-Pose and Di Cataldo 2015; Ketterer and Rodríguez-Pose 2016). The quality of institutions also influences micro variables such as firm performance (Dollar, Hallward-Driemeier, and Mengistae, 2005; Lasagni, Nifo and Vecchione, 2015; Aiello, Pupo and Ricotta, 2014; Manzocchi, Quintieri and Santoni, 2014). Recent studies indicate that there might be a significant difference in the macro- and micro-impacts of institutional quality: better institutional quality that may have beneficial macro-implications, may not necessarily have positive implications for firm performance (Bhaumik and Dimova 2014). Consider, for instance, an indicator of weak institutional quality such as corruption. For firms, corruption increases the cost of doing business as well as the transaction costs, since implicit contracts based on bribes can be renegotiated ex post (Bhaumik and Dimova 2014). For society as a whole, however, the incidence and the impact of corruption depends on the institutional environment prevailing in a given country, as represented by other public governance indicators (Aidt 2009; OECD 2015). Thus, the proper level of analysis to test whether the regional institutional environment affects productivity is to focus on firms. This is also an important issue from the statistical point of view since the results could be affected by the fallacy of "the wrong level" that occurs when the relations obtained at one level are translated to another. This fallacy could be committed upwards or downwards (Jones 1991).[1] Multilevel models operate at more than one level so that a single model can handle simultaneously the micro-scale of individuals and the macro-scale of places, thereby overcoming the fallacy of "the wrong level". By distinguishing different levels, in this paper multilevel procedures allow relationships to vary according to context and to determine the portion of the total variance in firm-level performance due to within-region variation in firm-level characteristics and the proportion due to differences in the regional context by testing the different aspects of the environmental context that may influence firm performance. Moreover, the multilevel approach takes the hierarchical structure of data into account and models the variability at each level, so that individuals that belong to a given group are more alike than a random sample. This represents a methodological advantage with respect to single-equation models since, with hierarchical data, errors for firms belonging to the same region may be correlated, thereby the assumption of independence may be violated, making Ordinary Least Squares (OLS) tests of significance misleading. All these arguments support the choice of the

[1] When a result obtained at an aggregate level is not confirmed after replicating the analysis on an individual basis there is ecological fallacy. In this sense, micro-founded analysis is preferable since it controls for any potential aggregation bias. On the other hand, working with micro-data leads to the opposite problem related to the absence of any link between individual-level and group-level relationships, i.e. the atomistic fallacy.

multilevel approach for analysing the correlation between the regional quality of government and firm performance, measured by TFP.[2]

In this paper, the effect on productivity of the quality of regional government is investigated by using firm-level data in a multi-country context. The analysis is, indeed, based on comparable cross-country data of manufacturing firms operating in seven EU countries, Austria, France, Germany, Hungary, Italy, Spain and the United Kingdom.

Improved institutional quality has recently been emphasized as one of the principal objectives of the EU under the general framework of sustainable development and in the regional policy framework (Farole, Rodríguez-Pose and Storper, 2011). Researchers have demonstrated that while integration in the EU to date has promoted inter-national convergence, sub-national inter-regional inequalities have tended to increase (Farole, Rodríguez-Pose and Storper, 2011). One of the reasons could be the persistence of institutional differences between regions despite integration (Farole, Rodríguez-Pose and Storper, 2011; Charron and Lapuente, 2013).[3] The so-called Europe 2020 growth strategy (European Commission, 2010) recognises that countries with a better quality of government also have a better performance and considers high quality institutions as complementary to a process of economic growth driven by innovation. Regions with a poor institutional environment are ineffective in supporting innovative activity or assimilating knowledge and innovation. Institutions are a central argument in the current discussion on policies for enhancing economic growth in the EU to recover from the ongoing economic and financial crises (Barbosa and Faria, 2011). Previous studies have demonstrated how institutions shape the return of economic policy at the regional level in Europe and, also, the importance of government quality as a moderator of the efficiency of the spending of Structural and Cohesion Funds: in many of the regions receiving these resources, further improvements in economic growth would require massive amounts of additional investment, unless the quality of government is significantly enhanced (Rodríguez-Pose and Garcilazo, 2015). The problem of regional disparities in term of productivity and institutional quality has become more pressing with the Eurozone crisis. Fingleton, Garretsen and Martin (2015) show how a common contractionary shock across the Eurozone has its biggest impact on the most geographically isolated regions, which are precisely those areas that are suffering the most acute sovereign debt crisis, as well as being the regions with the lowest productivity in the EU. Those economies are trapped in two key problems: high debt and low

[2]The multilevel approach has already been applied to firm productivity by Raspe and van Oort (2011) for the Netherlands; Mahlberg et al. (2013) for Austria; Fazio and Piacentino (2010), Aiello, Pupo, and Ricotta (2014), Aiello, Pupo, and Ricotta (2015) for Italy; Aiello and Ricotta (2016) for the EU countries.

[3] McGuiness (2007) has shown how the rate of the catch-up of poorer countries with wealthier ones is influenced by the quality of the country's institutions.

competitiveness. Understanding regional disparities in productivity is, thus, of the greatest importance in the ongoing debate about the Euro and its future.

Firm data used in this paper come from the "European Firms in a Global Economy: internal policies for external competitiveness" (EFIGE) project (Altomonte and Aquilante, 2012). Data for the regional 'quality of government' refer to the European Quality of Government Index (EQI). This indicator provided by Charron, Dijkstra and Lapuente (2014) makes use of a wide survey of respondents, living in 18 EU states, to measure the perception of the quality of regional and local governments across Europe.

To the best of the author's knowledge, this is the first paper that analyses in a multi-country context, the effect on firm TFP of the within-county quality of government.

In the econometric specification, the 2008-value of TFP depends on key-characteristics of firm performance (size, family-management, group membership, innovation, human capital and export status), on the variable of interest, the indicator of the quality of government, and on control variables at the regional level that, according to the theoretical and empirical literature, may affect firms' economic performance. As expected, the results show the importance of firm-specific determinants of TFP. However, they also indicate that the context in which firms operate plays a role in determining individual TFP: being located in a region with high level of R&D and good infrastructure is correlated positively to the firm's TFP. As far as the specific scope of the paper is concerned, the results provide evidence to show that the quality of regional government has a positive effect on a firm's TFP. This is in line with previous research on the role of institutions at regional level that underlines their importance for economic growth (Tabellini, 2010; Ketterer and Rodríguez-Pose 2016), the capacity of regions to innovate (Rodríguez-Pose and Di Cataldo, 2015) and productivity (Lasagni, Nifo and Vecchione, 2015; Aiello, Pupo and Ricotta, 2014; Manzocchi, Quintieri and Santoni, 2014). On the contrary, the finding contradicts the hypothesis that within country institutional differences do not matter for economic performance (Gennaioli et al., 2013). As far as the EQI components are concerned, corruption and the quality of services appear to be positively correlated to TFP, while the evidence is inconclusive for the impartiality indicator. Efficient and non-bureaucratic provision of public services as well as a low level of local corruption seem to be important factors for good firm performance.

The rest of the paper is organised into five sections. Next section briefly reviews the literature on quality of institutions and economic performance. Section 3 presents the EFIGE dataset and the EQI indicator in the regions of the EU-7EFIGE countries. Section 4 describes the multilevel approach and the empirical strategy. Section 5 discusses the results and section 6 concludes.

2. Quality of institutions and economic performance: a brief overview

Institutions are the rules of the game in a society, i.e. the set of fundamental political, social, and legal rules that shape the strategic behaviours and outcomes of firms (North, 1990). Efficient institutions reduce transaction costs and the cost of enforcing contracts and they facilitate transactions with a positive effect on economic performance. Moreover, with high quality institutions one would expect to find agents faced with incentives for productive effort rather than socially costly rent-seeking activities or predation.

A substantial body of cross-country literature documents a close correlation between institutions and development (see Jütting 2003, for a review). Acemoglu and Robinson (2008) argue that the main determinant of differences in prosperity across countries are differences in economic institutions. On the other hand, Aron (2000) critically reviews the literature that tries to link quantitative measures of institutions with growth of gross domestic product across countries and over time. The evidence suggests a link between the quality of institutions and investment and growth, but the evidence is by no means robust. He suggests that the quality of institutions has a robust and significant indirect relationship to growth via its effect on the volume of investment, while the evidence for a direct relationship between institutions and growth is weak. Better-performing institutions may increase the volume of investment, e.g. by eliminating excessive bureaucratic formalities and rent seeking costs, and improve the efficiency of investment by enforcing well-defined property rights. Acemoglu, Johnson and Robinson (2001) set out to estimate the impact of institutions on income per capita and not just their correlation and, thus, to cope with the endogeneity problem. They decide to use the mortality rates of European colonizers as an instrument for broad institutional differences across countries in an instrumental-variables estimation strategy. They argue that Europeans between the seventeenth and nineteenth centuries adopted very different policies in different colonies, with different associated institutions. In places where Europeans faced high mortality rates, they could not settle and were more likely to set up "extractive institutions". Their objective in this case was to have a highly centralized state apparatus, and other associated institutions, to oppress the native population and facilitate the extraction of resources in the short run. On the contrary, in places where the environment was favorable as regards health and Europeans settled in large numbers, the settlers tried to replicate European institutions, with strong emphasis on private property and checks and balances against government power. These institutions persisted to the present. The mortality rates in colonies should not influence output today directly, but by affecting the settlement patterns of Europeans,

they may have had a first-order effect on institutional development. Exploiting differences in mortality rates of European colonizers between the seventeenth and nineteenth centuries as an instrument for current institutions, they estimate large effects of institutions on income per capita.

Hall and Jones (1999) focus on differences in "social infrastructure" across a sample of 127 countries as the cause of wide differences in capital accumulation, educational attainment, and productivity, and, therefore, large differences in income across countries. They call "social infrastructure" the institutions and government policies that provide the incentives for individuals and firms in an economy. The indicator they use is a combination of two indexes: one is an index of government policies for supporting policies[4] and the other captures the extent to which a country is open to international trade.[5] Hall and Jones treat social infrastructures as endogenous and provide evidence that they help to explain the differences in capital accumulation, productivity, and therefore output per worker.[6] However, Chanda and Dalgaard (2008) highlight the fact that the results in Hall and Jones (1999) can be explained by the impact of institutions, geography and trade, on the efficiency of the economy through the dual economy channel, i.e the relative efficiency. In their paper they found, indeed, that these three factors affect only relative efficiency across sectors, i.e. average labor productivity in the economy relative to labor productivity outside agriculture.[7] On the contrary, none of these determinants influences absolute efficiency, measured by the level of TFP in the non-agricultural sector. Inside the debate on the role of institutions, trade and geography, Rodrik, Subramanian and Trebbi (2004) demonstrate how the quality of institutions trumps geography and integration. Once institutions are controlled for, trade has no direct effect on income, while geography has at best weak direct effects. By contrast, the institutional quality measure always has a positive and significant coefficient.[8]

According to McGuiness (2007), one channel through which institutions are likely to affect TFP growth is through their influence on a country's ability to learn or absorb new technology from the more advanced leader. Considering a group of 57 countries, the author finds some evidence of a tendency for poorer countries to catch-up with wealthier ones and that the rate of this catch-up can be influenced by the quality of the country's institutions, but the most influential variables appear to

[4] This index, created by Political Risk Services, is an average of five indices capturing the quality of government: rule of law; bureaucratic quality; risk of expropriation by the government; government repudiation of contracts, and corruption.

[5] A country is open if it satisfies all of the following criteria: nontariff barriers cover less than 40 percent of trade; average tariff rates are less than 40 percent; any black market premium was less than 20 percent during the 1970s and 1980s; the country is not classified as socialist, and the government does not monopolize major exports.

[6] Hall and Jones consider social infrastructures determined historically by geographical factors such as distance from the equator, and other factors in part captured by language.

[7] A development accounting analysis suggests that as much as 85% of the international variation in aggregate TFP can be attributed to variation in relative efficiency across sectors.

[8] As a measure of institutional quality, they use a composite indicator of different elements that capture the protection afforded to property rights as well as the strength of the rule of law.

be the country-specific effects. The focus of Barbarosa and Faria (2011), on the other hand, is on innovation at the industry level. They investigate the relative importance of institutional variation across European countries in explaining differences in their innovation intensity. The study focuses on three types of country-level market regulation, namely product, labor and financial markets regulation, as well as on the stringency of intellectual property rights, and explore their relationship with industries' innovation intensity. Their findings highlight the fact that stringent product and labor market regulation and the protection of property rights affect innovation intensity negatively. On the contrary, more developed credit markets foster innovation. Finally, some researchers focus on the interaction of institutions and trade flows. For example, Levchenko (2007) finds a positive and statistically significant relationship between institutional quality and trade shares using data on U.S. imports disaggregated by country and industry.[9]

Most research on institutions and economic performance has country-level indicators while few focus on within-country institutional differences and economic performance. The use of national-level data assumes that the quality of institutions is the same across locations within a given country. Yet, in the case of EU, Charron, Dijkstra and Lapuente (2014) demonstrate that there is notable within-country variations based on local governance. For instance, high-performing regions in Italy and Spain, e.g. Bolzano and País Vasco, rank amongst the best EU regions while others perform well below the EU average. Several studies demonstrate the importance of the quality of the local institutional environment, differently measured, on economic performance. In his seminal work, Putnam (1993) focuses on the importance of "civic community" in developing successful institutions. He applies his theoretical framework to the South of Italy, by underling how the pronounced differences in civic, social and economic behavior, i.e. social capital, between Northern and Southern Italy contribute to explaining the economic backwardness of Southern Italy and the convergence of the per capita incomes of the Italian regions during the 1960s and 1970s which was faster in regions with more social capital (Helliwell and Putnam, 1995). Tabellini (2010) concentrates on the effect of culture, measured by indicators of individual values and beliefs, such as trust and respect for others, and confidence in individual self-determination, on economic development in 68 regions of eight European countries. He finds that less trust and respect for others and less confidence in the individual are associated with lower per capita output and slower growth rates, after controlling for country fixed effects, regional education and past urbanization rates. Ketterer and Rodríguez-Pose (2016) and Rodríguez-Pose and Di Cataldo (2015) both use the same indicator as this paper, the EQI. Referring to the debate on whether institutions or geography

[9] To measure the quality or contracting institutions he uses the index of rule of law, but results are robust with alternative measures of institutional quality, such as those from the International Country Risk Guide, World Bank's Doing Business Indicators and the Heritage Foundation.

prevail in driving economic growth, Ketterer and Rodríguez-Pose (2016) analyse their role in the case of the economic growth of EU-15 regions.[10] The regional quality of government, especially, government effectiveness and the fight against corruption, emerges as a fundamental driver of economic performance across EU while geographical factors exert a much weaker influence on economic growth. Rodríguez-Pose and Di Cataldo (2015) provide evidence of a link between the quality of government and the capacity of regions to innovate. Control of corruption and government effectiveness exhibit a significant and positive correlation with innovation. In contrast, rule of law and government accountability have a limited impact on regional patenting. Gennaioli et al. (2013) extend the analysis by exploring not only the influences of geography and institutions but also human capital, natural resource endowments and culture on per capita income in the case of more than 1500 regions in 110 countries.[11] They find that regional education, geography as well as higher natural resource endowments influence per capita income positively, but regional education account for a large share of within-country variation in per capita income. On the contrary, institutions as measured by assessments of the business environment as well as culture do not help to explain regional differences in per capita income. According to the authors, while some institutions and culture may matter at the national level, they do not help to explain the large income differences within countries.

A number of firm-level studies have been carried out in the past few years, assessing the effects of the institutional environment on firm performance. Some use, as measure of the quality of institutions, the individual evaluation of the constraints for business as reported by the top managers of the interviewed firms. For example, using firm-level data of the garment sector on mostly Asian developing economies, Dollar, Hallward-Driemeier, and Mengistae (2005) find that cross-country differences in investment climate as perceived by managers do affect firm performance[12], even after controlling for country fixed effects; on the contrary, Commander and Svejnar (2011) show that in the case of transition economies of Central and Eastern Europe, country fixed effects matter for firm performance, but that differences in the business environment observed by top managers do not.[13]

[10]Amongst the geographical variables considered, are terrain, climate and weather characteristics, distance from the equator, access to the sea and soil characteristics.

[11] Variables for geography include average temperature and proximity to the ocean; for natural resource endowment, oil production; for institutions, survey assessments of the business environment in the World Bank Enterprise Survey, and for culture, trust and ethnic heterogeneity.

[12] The investment climate measures and the enterprise variables come from World Bank surveys of firms in the garment sector in four countries: Bangladesh, China, India and Pakistan. The authors consider aspects of the investment climate such as how long it takes to get goods through customs or to get a phone line or the frequency and duration of power cuts.

[13] Commander and Svejnar use the Business Environment and Enterprises Performance Survey (BEEPS) collected by the European Bank for Reconstruction and Development (EBRD) and the World Bank and consider 26 transition countries. As measure of institutional quality they relate to each firm's top manager's perception of the business environment that his or her firm faces. Considering that this measure may produce biased estimates if a manager's

On the other hand, Bhaumik and Dimova (2014) pool firm-level data of the textile industry from nine developing countries with indicators of institutional quality at the country level.[14] They demonstrate that certain institutions, like restrictive labour market regulations, that are considered bad for economic growth might be beneficial for production efficiency, whereas a good business environment, which is considered beneficial for economic growth, might have an adverse impact on production efficiency. These results suggest that there might be significant differences in the macro- and micro-impacts of institutional quality, such that the classification of institutions into "good" and "bad" might depends on the level of analysis.

Few studies have pooled together firm-level data and measures of sub-national quality of institutions and the one that have focus on one country only (Lasagni, Nifo and Vecchione 2014; Aiello, Pupo and Ricotta 2014; Manzocchi, Quintieri and Santoni 2014). Lasagni, Nifo and Vecchione (2015) evaluate the impact of the institutional quality, measured by the Institutional Quality Index for Italian provinces (NUTS 3) built by Nifo and Vecchione (2014), on TFP. They find that institutional quality at a local level does matter, as it proves to be one of the main drivers of productivity differentials. Similar results have been found by Manzocchi, Quintieri and Santoni (2014) and Aiello, Pupo and Ricotta (2014). Both studies aim to disentangle internal from external productivity drivers but they use different methodologies and, also, different indicators. Manzocchi, Quintieri and Santoni (2014) use a two-step procedure for extracting fixed effects for home counties of the firms (stage one) and regressing them upon a number of external factors that could affect productivity dynamics (stage two). They focus on Italian provinces using an indicator of social capital (newspaper per inhabitant) and of criminal incidence (the principal component that include the number of beds in penal institution, the number of convicts per 100 beds and the number of reported crimes). Aiello, Pupo and Ricotta (2014) use a multilevel approach and consider the Italian regions and an indicator of public administration efficiency built by Golden and Picci.[15]

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perception of the severity of constraint is, for instance, influenced by the performance of his or her firm, they have used an average value of each constraint reported by other firms in a given industry in each country and year or in a given size in a given industry in each country and year. Moreover, they replicate the analysis with Heritage Foundation indices and World Bank's Doing Business indicators both at the country-level.

[14] The source of firms data is World Bank Enterprise Survey of nine developing countries: Brazil, China, Egypt, India, Indonesia, Malawi, Pakistan, South Africa and Zambia. The measures of institutional quality are based on indices that capture both the flexibility of institution that affect the recruitment of labor by the firms and the performance of the recruited workers for each country. Moreover, they also consider, as a measure of the quality of the business environment, the indices of institutional quality provided by the Heritage Foundation.

[15] Golden-Picci Index measures the corruption level on the basis of the difference between the amounts of physically existing infrastructure and the amounts of money cumulatively allocated by government to create these public works.

3. Empirical Setting

3.1 Firm-level data

The empirical analysis is based on the EU-EFIGE/Bruegel-UniCredit dataset (EFIGE dataset in short), which is a by-product of the EU project "European Firms in a Global Economy: internal policies for external competitiveness". The dataset contains data from a survey and from balance-sheets. The survey, carried out in 2010, provides comparable cross-country data of manufacturing firms in seven European countries (Austria, France, Germany, Hungary, Italy, Spain and the United Kingdom) and covers quantitative as well qualitative information.[16] While the survey refers to the 3-year-period 2007-2009, much information is averaged over the years under scrutiny, or relates only to 2008.

The survey data have been integrated with firms' balance sheets of Amadeus database managed by Bureau van Dijk.[17] These data have been used to calculate the TFP by the researchers involved in the EFIGE project by applying the Levinsohn and Petrin (2003) approach and considering sectoral production functions.[18] The estimated TFP for 2008 is used as measure of firm performance in this paper.[19]

Table 1 reports firms distribution by country. The EFIGE project surveys around 15 thousand European firms, many of which are in Germany, France, Italy and Spain (about 3000 firms in each country), followed by the United Kingdom (slightly more than 2000 firms) and Austria and Hungary (less than 500 in each country). When matching the EFIGE survey with the Amadeus archive, the sample decreases by about 50% because of the many missing-values in Amadeus related to the variables needed to estimate the production function from which the TFP is retrieved (for details, see Altomonte and Aquilante, 2012). From the sample with TFP, the outliers, i.e. firms with a TFP below the first or above the ninety-ninth percentile of the distribution, have been eliminated.

In what follows we refer to the sample EFIGE-AMEDEUS formed by 7239 European firms, the majority of which (more than 84% of the sample) are in France (1568), Spain (2336) and Italy

[16] The sampling design has been structured following a three dimension stratification: industry (11 NACE-CLIO industry codes), region (at the NUTS-1 level of aggregation) and size class (10-19; 20-49; 50-250; more than 250 employees). Given their importance in aggregate competitiveness dynamics, but their relatively light weight in standard stratification of the population of firms, large firms have been oversampled.

[17] In computing the correlation over time (2001-2009) between some variables in EFIGE dataset (aggregated with proper weighs) and the national statistics provided by EUROSTAT, Altomonte and Aquilante (2012) show that the correlations are 0.82 for labor productivity, 0.71 for labor cost, 0.52 for revenues and 0.61 for workers. Correlations increase to 90% when considering the countries (France, Italy and Spain) with a good quality of balance sheet data.

[18] Estimates also control for country and year fixed-effects over the 2001-2009 period.

[19] The estimated values of labour and capital elasticities by sector of Bruegel researchers are available in Aiello and Ricotta (2015), table A1.

(2212). Indeed, the number of German and British firms drops dramatically when survey data are merged with the Amadeus database. In what follows, the results have to be understood as referring to this sample of firms.

Table 1 Distribution of firms by country: EFIGE and EFIGE-Amadeus sample

Country	EFIGE Survey	%	EFIGE-AMADEUS	%
Austria	443	3.0	24	0.3
France	2973	20.1	1568	21.7
Germany	2935	19.9	550	7.6
Hungary	488	3.3	162	2.2
Italy	3021	20.5	2212	30.6
Spain	2832	19.2	2336	32.3
UK	2067	14	387	5.3
Total	14759	100	7239	100

Source: Author's calculations on EU-EFIGE-Bruegel-UniCredit dataset

3.2 The Quality of Regional Government in the EU7-EFIGE countries

The European "quality of government" indicator (EQI) at regional level derives from a new dataset developed by Charron, Lapuente and Rothstein (2010). This study makes use of a wide survey of 34000 respondents, living in 18 EU states in order to measure the perception of the quality of regional and local governments across Europe. The services in question are education, public health care and law enforcement, services often provided by local authorities in Europe. In Charron, Lapuente and Rothstein (2010), the definition of QoG, as proposed by Rothstein and Teorell (2008), is linked to the concept of impartial government institutions, that is *"when public officials who implement policies do not take anything about the citizen/case into consideration that is not beforehand stipulated in the policy or the law" (p. 9)*. The questions of the survey are, thus, aimed at capturing average citizens' perceptions and experiences of corruption, and the extent to which they rate their public services as impartial and of good quality. The answers led to the construction, based on factor analysis, of three composite indices of government quality, reflecting the residents' perception of the three 'pillars' of the regional QoG index: corruption, impartiality and quality.[20]

[20] Sixteen questions were included in the survey focusing on four aspects of the quality of government: the rule of law, the government effectiveness, the voice and accountability and corruption. In order to discover which of the 16 indicators are to be considered appropriate to be placed in a single indicator, the authors use the Principle Component Analysis. This analysis revealed three independent factors. The first component is the block of six impartiality variables (Impartiality) which explains roughly 42% of the total variance. The second is the set of corruption questions (Corruption), which together explain approximately 31.5% of the total variance while the third group (Quality) has a combined total variance of about 21.5%. These three factors are the three 'pillars' of the regional QoG index (see Charron, Lapuente and Rothstein, 2010, pp. 31-32).

These three pillars are averaged together to form the final figure for each region. After each stage of aggregation, each indicator is standardized to provide a regional distance to the national score, expressed in standard deviations. The World Bank Governance Indicator (WGI) (Kaufmann, Kraay and Mastruzzi 2009) has been selected as the most suitable source to compare and assess QoG for EU countries.[21] The country-level WGI and the regional-level data are used to explain the within-country variance. In particular, the regional QoG score for each country is aggregated by weighting each region's score by their share of the national population. This mean score is subtracted from each region's individual QoG score and the obtained value shows if the region is above or below the national average and to what extent. This figure is then added to the national level of WGI, so each region has an adjusted score, centered on the WGI. The formula employed for the calculation of the QoG Index combined with the WGI is as follows:

$$QoG_{jc} = WGI_C + \left(RQoG_{jc} - \overline{RQoG_c}\right)$$

where QoG_{jc} is the final *QoG* Index for region *j* in country *c* obtained as the distance from the country average (weighted by regional population) of all regions within the country ($\overline{RQoG}$) of the regional score ($RQoG_{jc}$), added to the WGI score for country *c* (WGI_C).[22] The QoG is standardized for the EU-27 sample so that the mean is zero with a standard deviation of one, obtaining the European Quality Index *(EQI)*. Details on the survey as well as on the construction of the indicator can be found in Charron, Dijkstra and Lapuente (2014).

In this study the *EQI* indicator and its components for the 93 regions of the 7EU-EFIGE countries are considered. In figure 1 the values of the regional *EQI* indicator are reported separating the regions into two groups: the group with a value of *EQI* below the median (0.4705) of the regions of the EFIGE sample (Low EQI) and the group with a value higher than the median (High EQI). It is worth noting that, considering how *EQI* has been calculated, positive and negative values reflect favourable and less favourable institutional environment in comparison to the EU-27 sample. To sum up, Figure 1, thus, shows the position of each region both in comparison to the EU7-EFIGE countries, and whether the value is positive or negative, with respect to the EU-27 countries. Figure

[21] See Charron, Dijkstra and Lapuente (2014; p. 71) for the reasons of this choice.
[22] In Charron, Dijkstra and Lapuente (2014), the reference year of WGI is 2008 while the survey was carried out in December 2009.

1 displays a picture of quality of government in EU7-EFIGE countries that reveals the notable differences across these countries as well as the within-country variation.[23]

Italian regions have the worst quality of government and represent the most extreme case. 18 regions out of the 20 Italian regions present level of QoG under the median and for all, except one (Friuli-Venezia Giulia), the value is negative. The worst scores for all are found in the South of Italy, in Calabria, Campania, Sicily and Puglia. Only two Italian regions, Valle d'Aosta and Trentino Alto-Adige[24], perform well; however in the ranking of the 47 "High EQI" regions they only come 37 and 38, respectively.

All the Hungarian regions exhibit level of QoG under the median and all are negative. However, the worst score for Hungarian regions, i.e. Közép-Magyarország (-1.04), is less than the half of the worst score for Italy (Campania -2.41) while the scores for the other two Hungarian regions, Észak és Alföld (-0.46) and Dunántúl (-0.34), are below the value of Lombardia (-0.71), one of the most developed region of Italy.

The majority of Spanish regions are in the "low EQI" group (14 out of 17); however only 4 show negative values (Cataluña, Andalucía, Comunidad de Madrid and Castilla y León). Spanish regions, such as Asturias, Galicia and the Basque Country score relatively higher than the median.

For the UK only one region is under the median value, the region of London, but its value (0.469) is almost equal to the median.

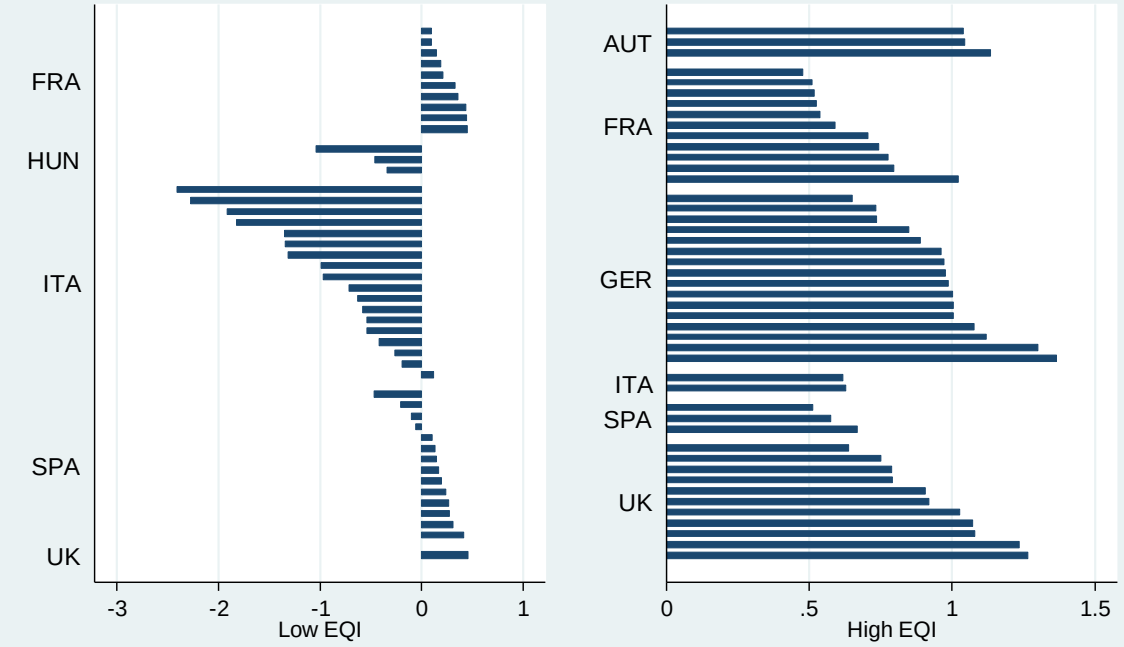
Half of the number of French regions (21) are in "Low EQI" group (11) and the other half in the "High EQI" group. The regions of the "Low EQI" group, however, all show a positive value. Among the French regions, Bretagne (1.023), Aquitaine (0.798) and Rhône-Alpes (0.778) exhibit the highest scores.

[23] In the report by Charron, Lapuente and Rothstein (2010) the countries are classified according to the levels of within-country QoG variation. Focusing on the countries of EFIGE sample, Spain and Italy are classified in the group of countries with high within-country QoG variation, Germany, France, UK and Hungary in the group with moderate variation and Austria in the group of low variation (p. 36).

[24] For Trentino Alto-Adige, in Charron, Dijkstra and Lapuente (2014) the two provinces (NUTS 3) of the region are presented separately. Since the EFIGE data base, considers the Italian NUTS 2 regions, the value of QoG indicator is obtained by using the simple mean of the two provinces.

Figure 1 Quality of gouvernment for EU7-EFIGE regions

(Under/Upper Median)



AUT: Austria; FRA: France; GER: Germany; HUN: Hungary; ITA: Italy; SPA: Spain; UK: United Kingdom

Source: Author's calculations on the EQI dataset (Charron et al, 2014)

Regions in Germany, UK and Austria rank among those with the best government quality in Europe, as is the case of Scotland and East Midlands in the UK, Thuringia and Schleswig-Holstein in Germany and the Eastern area of Austria.[25]

Figure 2 displays the scatterplot between TFP (ln) at the regional level[26] and EQI index (fig 2a) and its components. Figure 2a shows a positive relationship between EQI and the TFP: the simple relationship is 0.107, significant at the 1% level. Figures 2b-2d indicate that, on the contrary, there is no relation between TFP and index for quality, impartiality and corruption, separately.[27]

These results obtained at the regional level could be not confirmed after replicating the analysis on an individual basis (ecological fallacy). Indeed, in order to control for potential aggregation bias micro-founded analysis is needed. However, working with micro-data leads to the opposite problem related to the absence of any link between individual-level and group-level

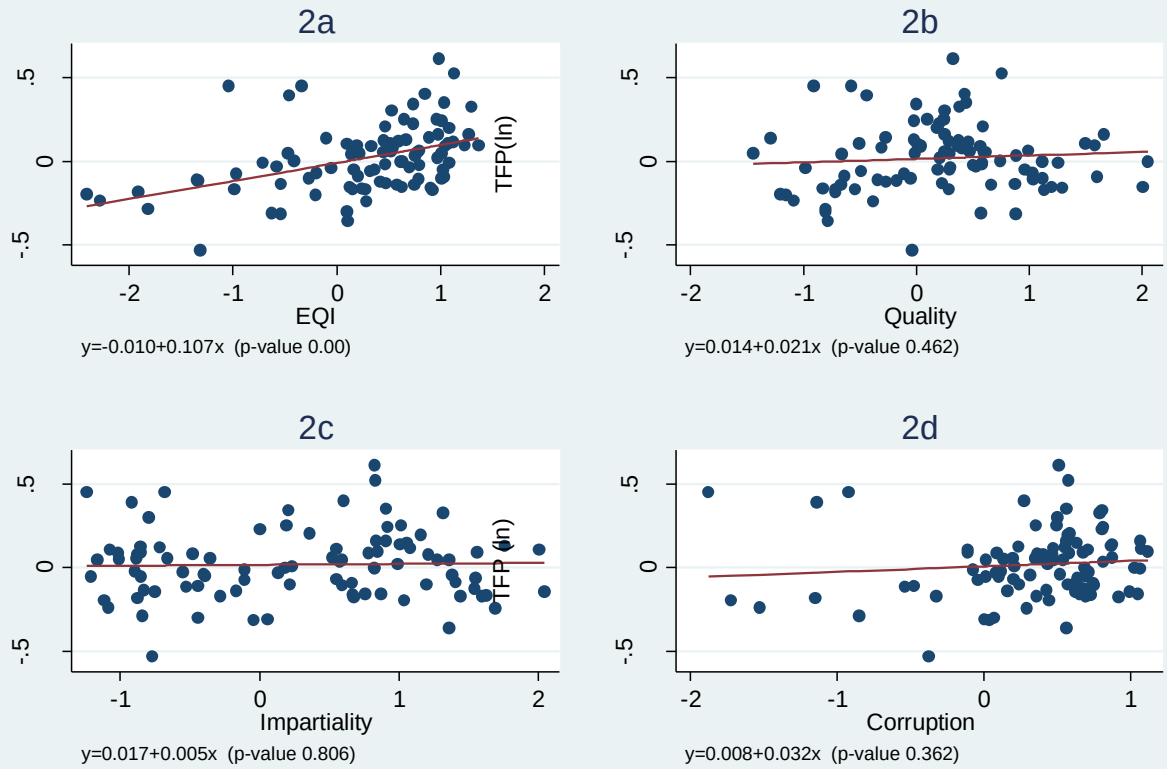
[25] For Austria since the number of observations in the EFIGE database are few (see table 1), the data of QoG indicators available at NUTS 2 are aggregated at NUTS 1, using the simple mean. Considering the NUTS 2 regions, the highest EQI is registered by one of the regions in Eastern Austria, Burgenland (1.32).

[26] Regional average value calculated using TFP at the firm-level.

[27] Results are confirmed when equations in figure 2 are augmented by two other regional variables, R&D expenditure and infrastructures (see §3.4.2 for definitions): only EQI shows a positive and significant coefficient while for the three sub-categories the coefficient is not significant (results are available upon request).

relationships (atomistic fallacy). The multilevel approach combines the individual with the ecological and obviates the fallacy of "the wrong level". For this reason, in order to analyse the correlation between firms TFP and the regional QoG indicators, the multilevel methodology is applied. The next section presents this methodological approach.

Figure 2 Regional TFP and QoG Indicators



3.3 Methodology: multilevel models

The objective of the paper is to analyse in a multi-country context, the effect on firm TFP of the quality of government at the regional level. To achieve this objective microdata are used and the firm represents the unit of analysis. However, firms can be nested within regions and regions within countries, so the data are inherently clustered. With such a structure, it is likely that the firms which operate within a particular geographic area are more similar to each other than a randomly selected group of firms would be. Such similarity may be due to the circumstance that they share the same external environment but also to reciprocal influence. This can result in correlated error terms among the individuals within a particular group and, thus, the assumption of independence of OLS estimation is violated, resulting in downwardly biased standard error estimates and large test

statistics. By relaxing this assumption, multilevel modeling provides more statistically reliable estimates than those ignoring the hierarchical nature of the data.[28] This technique explicitly models the within-group homogeneity of errors by allowing the estimation of error terms for both the individual and the group. In addition to providing more appropriate significance tests, multilevel models have the ability to simultaneously examine the effects of variables at both individual and group levels, as well as possible cross-level interaction effects. Indeed, in the multilevel analysis, variables at different levels are not simply add-ons to the same single-level equation, but are linked together in ways that make the simultaneous existence of distinct level-one and level-two equations explicit. In such a way, level-two factors are used not just as independent variables to explain variability in a level-one dependent variable, but also to explain variability in random intercept and random slopes (Bickel, 2007).[29]

In detail, an econometric specification of a multilevel model may be expressed as follows:

$$y_{ij} = \beta_{0j} + \beta_{1j} X_{ij} + e_{ij} \qquad [1]$$

where the y_{ij} is the TFP of firm *i* in region *j*, X comprises a set of variables measured at firm level, β_{0j} is the intercept, β_{1j} are the slope coefficients and e_{ij} is the random error term with zero mean and variance σ_e^2; *j* stays for regions (*j=1…r*) and *i* for firms (*i=1…N*$_j$). In eq. [1], the regression parameters β_{0j} vary across level-2 units. The specification used here is a random intercept model, that is :

$$\beta_{0j} = \gamma_{00} + \gamma_{01} R_j + u_{0j} \qquad [2]$$

$$\beta_{1j} = \gamma_{10} \qquad [3]$$

In so doing, β_{0j} differs across groups, i.e. regions, and depends on R_j, a set of variables defined at regional level, while u_{0j} is the random error term defined at the group level with zero mean and assumed to be independent of e_{ij}. The random component u_{0j} captures variability in the intercept across clusters, while the fixed component γ_{00} is a weighted average of the intercept across all clusters. γ denotes the fixed level-two parameters.

The combining of micro (eq. 1) and macro models (eq. 2 and 3) produces a two-level mixed equation:

[28] One possibility to relax the assumption of independence is to use OLS with the cluster option. Compared with the OLS without clustering, this option increases the error term to accommodate the lack of independence of firms within regions, However, it leaves both the noise associated with differences between firms and noise associated with differences between regions in the error term while the multilevel model allows the researcher to separate these two errors (see eq. 5)

[29] The possibility to employ contextual factors to explain variability in random components is the main difference between the multilevel model and random coefficient regression.

$$y_{ij} = \gamma_{00} + \gamma_{10} X_{ij} + \gamma_{01} R_j + (u_{0j} + e_{ij}) \qquad [4]$$

The deterministic part of the model, $\gamma_{00} + \gamma_{10} X_{ij} + \gamma_{01} R_j$ contains all the fixed coefficients, while the stochastic component is in brackets. The error term captures the residual variance, in the same way as OLS regression does, and the group-to-group variability of the random intercepts. It is clear that the error term displayed in eq. [4] is not independently distributed. Indeed, as data are nested at different levels of analysis, firms belonging to the same group tend to have correlated residuals, so violating the assumption of independence.

For the identification of the errors resulting from differences across firms or clusters, it is necessary to use an "empty" model, i.e. a model without any explanatory variables:

$$y_{ij} = \gamma_{00} + u_{0j} + e_{ij} \qquad [5]$$

From eq. [5] is possible to decompose the variance of y_{ij} into two independent components, i.e. the variance of e_{ij} (σ_e^2), the so-called within-group variance, and the variance of u_{0j} (σ_{u0}^2), also known as between-group variance. A useful way to interpret the relative magnitude of the variance components is to compute the Variance Partition Coefficients (VPCs) which are the proportion of the variance that lies at each level of the model hierarchy.[30] The VPC at regional level is calculated as the ratio of the regional variance to the total variance, that is:

$$VPC_{u0} = \frac{\sigma_{u0}^2}{\sigma_{u0}^2 + \sigma_e^2} \qquad [6]$$

The firm VPC is written as the ratio of the firm variance to the total variance:

$$VPC_e = \frac{\sigma_e^2}{\sigma_{u0}^2 + \sigma_e^2} \qquad [7]$$

The specification adopted in this paper is a random intercept model (eq. [4]). In particular, the final model is:

$$y_{ij} = \beta_0 + \sum_{v=1}^{k} \beta_v X_{vij} + \psi QoG + \sum_{q=1}^{2} \omega_q R_{qi} + \sum_{p=1}^{10} \lambda_p S_{pi} + \sum_{c=1}^{6} \eta_c C_{ci} + u_{0j} + e_{ij} \qquad [8]$$

where y_{it} is the 2008-value of TFP (in logarithm) of the *i-th* firm operating in region *j*, *X* is a vector of firm-level variables, *QoG* is our variable of interest, the indicator of the quality of government, *R* are a number of control variables at the regional level that, according to the theoretical and empirical literature, may affect firms economic performance, *S* are sectoral dummies and *C* country dummies.

[30] For equation [5] VPC coincides with the intra-class correlation (ICC) that measures the expected degree of similarity between responses within a given cluster (e.g. region). This equivalence will not hold in more complex models, such as those including random coefficients (Leckie 2013).

3.4.Variables and Measurement

In detail, the variables included in the model are described as follows, distinguishing between first and second level variables.

3.4.1 Firm level variables

The empirical model expressed by eq. [8] relates TFP to certain firm characteristics. The choice of these variables has been made in accordance with previous literature and their expected effects are briefly outlined.

First, *Human Capital* proxied by a dummy variable taking the value of one if, at firm level, the share of graduate workers is higher than the national average for the labor force overall. Qualified employees are expected to influence TFP positively since they provide a firm with the ability not only to innovate, but also to absorb knowledge from other firms (Cohen and Levinthal 1990; Griliches 2000). The second dummy, *Innovator*, is unity if the firm has introduced at least one innovation (product, process or organisational innovation) during the period surveyed and zero otherwise with the expectation that a firm's performance improves as a result of its propensity for innovation (see, e.g., Mohnen and Hall, 2013; Hall, 2011). Another firm characteristic considered is whether the firm is part of a group, as membership can provide access to more resources and knowledge that ultimately affect the individual firm's ability to innovate, thereby impacting on TFP (Beugelsdijk 2007). In particular, two dummy variables are considered to distinguish between national (*National group*) and foreign (*Foreign group*) groups. The latter is expected to be more productive since they can capitalize on knowledge accumulated by parent companies abroad and from the advantages of vertical and/or horizontal integration (see, Griffith 1999; Benfratello and Sembenelli 2006; Weche Gelübcke 2013).

The model includes the dummy *Family* which is unity if the proportion of managers related to the controlling family is higher than the national average, in order to take into account the possibility that TFP differs between family-managed firms and non-family managed firms (see Schulze and Gedajlovich 2010). The effect of family management is not certain, as the evidence is mixed (Rutherford, Kuratko, and Holt 2008). Furthermore, one of the regularities relating to productivity is the positive link between productivity and exports (Melitz 2003; ISGEP 2008; Altomonte,

Aquilante, and Ottaviano 2012).[31] Hence, a dummy taking the value of one if the firm is an exporter in 2008 or before 2008 is included. Regressions also include two dummy variables to control for size effect, one referring to medium-sized (*Medium*) firms (50-250 employees) and the other to large-sized (*Large*) firms (more than 250 employees), while small firms represent the control group. Finally, countries (*C*) and sectors (*S*) are treated as fixed effects instead of source of randomness in intercepts since the number of groups (7 and 11, respectively) are too few.[32,]

Due to the cross-sectional nature of the data, it is not possible to establish causality between firm TFP and the firm-specific characteristics; thus, one should not interpret eq. [8] as showing the direction of causality. Consequently, the models in table 3 and 4 should be viewed as a convenient way of summarizing statistical regularities among variables and the results should be read as associations rather than causality.

3.4.2 Regional variables

The variable of interest is the QoG indicator, EQI, and its components already described in section 2.2.

In order to take into account the role played by the characteristics of the regional economic system, two regional variables are included. They are total intramural R&D expenditure (Euro per inhabitant) and infrastructure density defined by motorway kilometers standardized by total regional area (Kilometers per 1000 km^2). The first indicator is meant to capture the ability of a region to create innovation and convert knowledge spillovers into innovative capacity, thus increasing productivity. Therefore, a positive effect of this variable on TFP is expected. The second indicator is a proxy for infrastructure considered by economic theory at the root of differences in productivity. Regions with higher stock of infrastructure are expected to show higher levels of TFP. Eurostat's region database is the source for the regional control variables and the value refers to 2007.

[31] Two hypotheses about the positive correlation between export activity and productivity have been extensively investigated. The first hypothesis is that the most productive firms self-select into foreign markets because they can overcome sunk costs associated with foreign sales (ISGEP 2008; Melitz 2003). The second hypothesis raises the possibility of "learning by exporting". Firms participating in international markets acquire knowledge and technology with positive feedback as regards knowledge and technology. Furthermore, firms which are active in world markets are exposed to more intensive competition than firms which only sell their products domestically.

[32] In the multilevel approach a key issue to be addressed concerns the sample size at any level of analysis. Indeed, the requirements of precise measurement of between-group variance impose a "sufficient" number of clusters. Although there are some, albeit very different from each other, rules of thumb, a clear indication does not exist in this respect (Richter 2006). Some authors suggest that 20 is a sufficient number of groups (Heck and Thomas 2000; Rabe-Hasketh and Skondal 2008), others 30 (Hox, 2002) or 50 (Mass and Hox 2004). In addition, it is worth noting that in random-effects models the clusters must be sized with at least two observations. The alternative is a fixed-effects approach in which the number of groups is not important, although their dimension then becomes crucial as the estimated group-effect is unreliable for small-sized groups.

Table 2 synthesises the list of variables in the final model with their description, summary statistics and the sign of the expected correlation.

Table 2 Descriptive statistics of variables and expected effect

	Description	Obs	Mean	SD	Min	Max	Source	Expected sign
Firm level variables								
Dependent variable								
TFP (ln)	Total factor productivity 2008	7239	-0.09	0.44	-1.4	1.4	EFIGE dataset	
Independent variables								
Medium firms	Dummy for medium firms (50-249 employees)	7239	0.23	0.42	0	1	EFIGE dataset	+
Large firms	Dummy for large firms (over 250 employees)	7239	0.08	0.27	0	1	EFIGE dataset	+
Family management	Dummy for firm with the proportion of managers related to the controlling family higher than the national average	7239	0.25	0.43	0	1	EFIGE dataset	??
Innovator	Dummy for firms that carried out at least one innovation (product, process, organizational) in years 2007-2009	7239	0.67	0.47	0	1	EFIGE dataset	+
Human capital	Dummy for Human capital: firm has a higher share of graduate employees with respect to the national average share of graduates	7239	0.30	0.46	0	1	EFIGE dataset	+
National group	Dummy for national group: firm belongs to a national group	7239	0.15	0.36	0	1	EFIGE dataset	+
Foreign Group	Dummy for foreign group: firm belongs to a foreign group	7239	0.10	0.30	0	1	EFIGE dataset	+
Exporter	Dummy for exporter - wide definition: firm is direct exporter in 2008 or has been actively exporting in years before 2008.	7239	0.70	0.46	0	1	EFIGE dataset	+
Regional level variables								
EQI	QoG index costructed combining the following three indicators:	93	0.27	0.81	-2.4	1.4	Charron et al. (2014)	+
Quality	Index evaluating the quality of education, public health care and law enforcement.	93	0.22	0.75	-1.4	2.1	Charron et al. (2014)	+
Impartiality	Index evaluating the impartiality in education, public health care and legal protection.	93	0.28	0.92	-1.2	2.0	Charron et a.l (2014)	+
Corruption	Index evaluating the level of corruption in education, public health care and legal system.	93	0.33	0.59	-1.9	1.1	Charron et al. (2014)	+
R&D 2007 (ln)	Total intramural R&D expenditure (Euro per inhabitant)	93	6.68	1.40	2.8	9.7	Eurostat	+
Motorway 2007 (ln)	Motorway kilometers standardized by total regional area (Km per 1000 km^2).	93	3.11	0.85	0	5.2	Eurostat	+
Federalism	Dummy for regions located in federal and semifederal States	93	0.60	0.49	0	1	Nistotskaya et al. (2015)	+

4 Results of the analysis
4.1 Main results

The results are in table 3. Column 1 refers to the empty model. The likelihood-ratio test gives support to the use of multilevel methodology. This test compares the empty model with the standard OLS regression: under H_0 $\sigma_{u0}^2 = 0$, hence there is no random intercept in the model. If the null hypothesis is true, OLS can be used instead of a variance-components model. The test is highly significant and indicates that the intercept should be considered as a group-by-group variant coefficient. The evidence in favor of the multilevel approach holds for each model considered in table 3.

As can be seen from column 1 of the table 2, VPC values show that region-specific factors capture 14% of the total TFP variance, while the remaining (86%) is explained by firms. Column 2 reveals that the first result varies dramatically when country-dummy variables are introduced: the role of regions drops to 5%.[33] Comparing the "empty model" with an extended specification of the model (Rabe-Hesketh and Skrondal 2008), it is possible to quantify the proportion of TFP variability at the second-level of the model (regions) which is due to country-effect. [34] This proportion is equal to 66%, i.e. two-thirds of the variance assigned to the region-effect is a between-country effect. The proportion of regional variance explained increases to 72% from 66% when dummies for sectors are introduced. Sector membership only explains a limited proportion of heterogeneity due to regions (table 3 column 3). Firm-level variables absorb 20% of the variance estimated at the first-level of the hierarchy while the proportion of regional variance explained increases slightly from 72% to 78% (table 3, column 4). [35]

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[33] The country-dummies are highly significant, except for Austria, which is similar to the controlling group (Germany). The estimated parameters of country-dummies confirm the considerable differences in productivity across European countries. Italy, Spain are at the lower bound, followed by UK and France. Germany, Austria and Hungary lead the group.

[34] The coefficient of determination for the two-level model is given by:

$$R^2 = \frac{(\sigma^2_{\mu 0N} + \sigma^2_{eN}) - (\sigma^2_{\mu 0M} + \sigma^2_{eM})}{\sigma^2_{\mu 0N} + \sigma^2_{eN}}$$

where N stands for the null model and M for the model of interest.
The proportional reduction in each of the variance components can be calculated separately. The proportion of the level-2 variance explained by the covariates is:

$$R_2^2 = \frac{(\sigma^2_{\mu 0N} - \sigma^2_{\mu 0M})}{\sigma^2_{\mu 0N}}$$

and the proportion of the level-1 variance explained is:

$$R_1^2 = \frac{(\sigma^2_{eN} - \sigma^2_{eM})}{\sigma^2_{eN}}$$

[35] Using the same dataset and methodology, these results have already been obtained by Aiello and Ricotta (2016). Indeed, they have measured how much TFP heterogeneity is due to firm-specificities or sector membership and how

As far as the role of firm characteristics in explaining TFP, except for exporter, all other variables have a significant coefficient. In line with expectations and the results of previous literature, a firm that uses more human capital, that innovates or belongs to a group shows a higher productivity. Moreover, consistent with previous evidence, the TFP is higher for medium-sized firms and even higher for large enterprises. As regards the variable *Family Management*, family involvement in firm management seems to be negatively related to TFP for the sample of 7EU-EFIGE firms. Finally, no significant association between internationalization and TFP has been found, in contrast with the literature showing that exporters self-select and over-perform (Wagner, 2007; ISGEP, 2008; Altomonte, Aquilante, and Ottaviano 2012). On the contrary, this result seems to support the argument that the export *premium* may be the result of an omitted variables bias such as membership in a foreign group (Crozet, Méjan, and Zignago 2011) [36] and being an innovator (Cassiman, Goloso, and Martinez-Ros 2010).[37]

The relationship between the control variables at the regional level and TFP is as expected: firms located in a region with high level of R&D and good infrastructure show higher level of TFP. The first result is consistent with Crescenzi and Rodríguez-Pose (2012) but not the second one. Crescenzi and Rodríguez-Pose (2012), considering 120 regions in the EU during the period 1990-2004, evidence that transport infrastructure endowment is a relatively poor predictor of regional economic growth while, by contrast, local R&D, social conditions, and migration are much better predictors of economic performance.

As far as the specific scope of this paper is concerned, model 5 shows that the regional quality of government has a positive connection with firm TFP. Focusing on the studies that analyse the role of institutions at the regional level, this finding is in line with previous research which underlines their importance for economic growth (Tabellini, 2010; Ketterer and Rodríguez-Pose 2016), the capacity of regions to innovate (Rodríguez-Pose and Di Cataldo, 2015) and productivity (Lasagni, Nifo and Vecchione 2015; Aiello, Pupo and Ricotta, 2014; Manzocchi, Quintieri and Santoni, 2014). On the contrary, the result contradicts the hypothesis that within country

much depends on localization. They demonstrate that TFP heterogeneity is largely due to firm-specific features and that country-effect is more influential than region-effect in explaining individual productivity.

[36] Crozet, Méjan, and Zignago (2011) argue that the exporter productivity premium could be due to omitted variables, correlated to the probability to export as, for example, belonging to a foreign group. Barba Navaretti et al. (2011) show that firms belonging to a foreign group are more likely to be exporters and this finding may suggest a cost reduction effect stemming from belonging to a foreign group.

[37] Cassiman, Goloso, and Martinez-Ros (2010) suggest that one potential underlying mechanism for the selection of more productive firms in the export market could be the fact that successful innovation improves the firm's productivity and, hence, these more productive firms became exporters. As a result, the omission of an innovation variable from the analysis may lead to the overestimation of the productivity-export association. Using a panel of Spanish manufacturing firms for the period 1990-1998 they find support for their hypothesis. However, as far as French firms are concerned, Bellone, Guillou, and Nesta (2009) show that the introduction of innovation does not significantly alter the size of the export premium.

institutional differences do not matter for economic performance (Gennaioli et al., 2013). The result is also consistent with the findings of country-level studies such as, among others, Acemoglu and Robinson (2008), Acemoglu, Johnson and Robinson (2001), Chanda and Dalgaardi (2008), Rodrik, Subramanian and Trebbi (2004), Barbarosa and Faria (2011), that provide evidence of the importance of QoG on economic performance.

The regional variables help to explain the TFP variability at the regional level: the proportion of regional variance explained increases from 78% to 87%.

Considering the individual components of EQI, it is possible to assess which aspects of the quality of government are important for TFP. The results show that corruption and the quality of services is positively correlated to TFP, while the evidence is inconclusive for the impartiality index. An efficient and non-bureaucratic provision of public services as well as a low level of local corruption seem to be important factors also for good firm performance as already evidenced by Ketterer and Rodríguez-Pose (2016) for economic growth and Rodríguez-Pose and Di Cataldo (2015) for European regions' capacity to innovate.

For reference, Model 5 in table 3 and all the models in table 4 have been estimated by running a standard OLS regression, with clustered standard errors at regional level. The results are displayed in column 6 of table 3 and last three columns of table 4. The significance of firm-specific factors, control variable at the regional level and the corruption indicator does not differ qualitatively. On the contrary, for the EQI the significance decreases to 10% while for quality it disappears.

Table 3 TFP and the European Quality of Governement

			Multilevel			*OLS*
	(1)	(2)	(3)	(4)	(5)	(6)
Constant	-0.0750***	0.136***	0.142***	-0.120***	-0.570***	-0.6367***
	(-3.95)	(4.02)	(4.28)	(-3.76)	(-7.24)	(0.079)
Fixed effects						
Level 1: Firms						
Medium				0.194***	0.194***	0.1937***
				(15.81)	(15.79)	(0.017)
Large				0.426***	0.426***	0.4302***
				(22.93)	(22.97)	(0.026)
Family management				-0.0612***	-0.0629***	-0.0667***
				(-5.49)	(-5.64)	(0.009)
National group				0.0849***	0.0847***	0.0867***
				(6.51)	(6.50)	(0.015)
Foreign group				0.196***	0.197***	0.2023***
				(11.94)	(11.97)	(0.023)
Innovator				0.0225**	0.0216**	0.0195**
				(2.35)	(2.25)	(0.009)
Human capital				0.0472***	0.0485***	0.0518***
				(4.76)	(4.90)	(0.009)
Exporter				0.0140	0.0114	0.0127
				(1.37)	(1.12)	(0.010)
Country dummies	NO	YES	YES	YES	YES	YES
Sector dummies	NO	NO	YES	YES	YES	YES
Level 2: Regions						
EQI					0.0531***	0.0448*
					(2.58)	(0.026)
R&D 2007 (ln)					0.0318***	0.0395***
					(3.68)	(0.009)
Motorway 2007 (ln)					0.0408***	0.0451***
					(2.76)	(0.017)
Random-Effects						
Variance						
Regions	0.028	0.009	0.008	0.006	0.004	
Firms	0.170	0.170	0.162	0.136	0.136	
Total	0.198	0.179	0.170	0.142	0.140	
VPC						
Regions	0.14	0.05	0.05	0.04	0.03	
Firms	0.86	0.95	0.95	0.96	0.97	
R^2 *level 2*		0.66	0.72	0.78	0.87	
R^2 *level 1*		0.00	0.05	0.20	0.20	
R		0.09	0.14	0.28	0.29	0.281
LR test	741.0	324.5	254.4	235.1	115.4	
Log restricted-likelihood	-3968.1	-3938.7	-3769.2	-3171.9	-3165.6	
Number of observations	7239	7239	7239	7239	7239	7239

In parentheses, t-values. Level of significance: *** 1%, ** 5%, *10%. OLS: robust standard errors in parentheses. Standard errors are clustered at regional level.

Table 4 TFP and the Quality, Impartiality and Corruption Indicators

	Multilevel			*OLS*		
	(1)	(2)	(3)	(4)	(5)	(6)
Constant	-0.530***	-0.545***	-0.547***	-0.6052***	-0.5961***	-0.6152***
	(-7.12)	(-6.59)	(-7.36)	(0.078)	(0.084)	(0.071)
Fixed effects						
Level 1: Firms						
Medium	0.192***	0.192***	0.192***	0.1938***	0.1943***	0.1932***
	(15.63)	(15.65)	(15.61)	(0.017)	(0.017)	(0.017)
Large	0.423***	0.423***	0.422***	0.4310***	0.4307***	0.4281***
	(22.82)	(22.80)	(22.78)	(0.026)	(0.026)	(0.025)
Family management	-0.0627***	-0.0626***	-0.0627***	-0.0668***	-0.0669***	-0.0665***
	(-5.63)	(-5.62)	(-5.63)	(0.009)	(0.009)	(0.009)
National group	0.0842***	0.0844***	0.0844***	0.0869***	0.0874***	0.0869***
	(6.47)	(6.48)	(6.49)	(0.015)	(0.015)	(0.016)
Foreign group	0.196***	0.196***	0.197***	0.2020***	0.2021***	0.2025***
	(11.97)	(11.97)	(12.00)	(0.023)	(0.023)	(0.023)
Innovator	0.0377***	0.0378***	0.0378***	0.0196**	0.0200**	0.0195**
	(4.23)	(4.24)	(4.24)	(0.009)	(0.009)	(0.009)
Human capital	0.0480***	0.0473***	0.0479***	0.0522***	0.0509***	0.0524***
	(4.87)	(4.79)	(4.86)	(0.009)	(0.009)	(0.010)
Exporter	0.0117	0.0126	0.0119	0.0124	0.0142	0.0121
	(1.16)	(1.25)	(1.18)	(0.010)	(0.010)	(0.010)
Level 2: Regions						
Quality	0.0502***			0.0388		
	(2.72)			(0.024)		
Impartiality		0.0298			0.0151	
		(1.27)			(0.030)	
Fight to Corruption			0.0683***			0.0786***
			(2.96)			(0.022)
R&D 2007 (ln)	0.0327***	0.0318***	0.0283***	0.0405***	0.0381***	0.0346***
	(3.77)	(3.54)	(3.33)	(0.009)	(0.009)	(0.009)
Motorway 2007 (ln)	0.0387***	0.0406***	0.0440***	0.0435**	0.0453**	0.0475***
	(2.62)	(2.67)	(3.00)	(0.017)	(0.017)	(0.016)
Random-Effects						
Variance						
Regions	0.004	0.004	0.003			
Firms	0.136	0.136	0.136			
VPC						
Regions	0.03	0.03	0.02			
Firms	0.97	0.97	0.98			
R^2 *level 2*	0.87	0.86	0.88			
R^2 *level 1*	0.20	0.20	0.20			
R	0.29	0.29	0.30	0.28	0.28	0.28
LR test	117.19	123.91	100.01			
Number of observations	7239	7239	7239	7239	7239	7239

In parentheses, t-values. Level of significance: *** 1%, ** 5%. Sector and country dummies included. OLS: robust standard errors in parentheses.

4.2 Robustness checks

The aim of this section is to test the robustness of the results. First, the possibility that QoG indicator may capture aspects related to the nature of state governance is investigated. In fact, the supporters of federalism stress that devolving resources and authority from national to subnational government levels may stimulate more efficient and better targeted public policies. The positive coefficients for QoG indicators could, thus, reflect the effect of greater regional autonomy and not the quality of government *per se*. For this reason eq. [8] is augmented by a dummy variable for federal and semi-federal states, *Federalism*.[38] The coefficient of this variable always appears positive and significant (columns 1-3), but the results on our variable of interest, the EQI and its sub-categories, do not change significantly.

One shortcoming of the dataset used in this paper is the loss of observations related to the matching procedure of the EFIGE survey with balance-sheet data. As a second robustness test, only countries that, due to more comprehensive balance sheet data, have a larger number of TFP-observations at the firm level, i.e. France, Italy, and Spain (see table 1), are considered. The results of the QoG indicators are confirmed but, for this sample, also the impartiality index appears to be significant.

Finally, in the last four columns of table 5 the models with the different indicators of QoG are controlled for the level two endogeneity problem. Indeed, this endogeneity may occur when the random effects at level-two are correlated with level-one covariates. As shown by Snidjders and Berkhof (2007), the correlation between the lower level predictor variables and higher level error terms can be removed by including the group-level means of the lower level variables, a procedure known as the Mundlak (1978) correction. The results for the indicators of QoG are confirmed even if the significance level is lower (5% instead than 1%).

[38] Federal states in the sample are Belgium, Austria, and Germany. Spain and Italy are coded as semifederal, and the rest are coded as unitary (see, Nistotskaya et al 2015).

Table 5: Robustness checks

	With dummy for Federalism				Sample: France-Italy-Spain				Mundlack correction			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Constant	-0.761***	-0.773***	-0.728***	-0.751***	-0.497***	-0.450***	-0.567***	-0.522***	-0.523***	-0.486***	-0.570***	-0.485***
	(-10.19)	(-10.21)	(-9.42)	(-10.48)	(-7.22)	(-6.48)	(-6.75)	(-7.59)	(-3.62)	(-3.28)	(-3.92)	(-3.34)
Fixed effects												
Level 1: Firms												
Firms characteristics	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Level 2: Regions												
Federalism (1/0)	0.190***	0.246***	0.187***	0.208***								
	(5.06)	(5.81)	(4.83)	(5.54)								
EQI	0.0531***				0.0598***			0.0560***	0.0456**			
	(2.58)				(2.72)			(2.69)	(1.96)			
Quality		0.0503***				0.0491**				0.0446**		
		(2.73)				(2.46)				(2.15)		
Impartiality			0.0293				0.0554**				0.0140	
			(1.26)				(2.05)				(0.56)	
Corruption				0.0680***				0.0766***				0.0618**
				(2.94)				(3.10)				(2.47)
R&D 2007 (ln)	0.0318***	0.0326***	0.0318***	0.0283***	0.0263***	0.0274***	0.0261**	0.0234**	0.0314***	0.0322***	0.0275***	0.0285***
	(3.68)	(3.77)	(3.54)	(3.33)	(2.58)	(2.65)	(2.48)	(2.35)	(3.33)	(3.40)	(2.80)	(3.21)
Motorway 2007 (ln)	0.0408***	0.0382***	0.0400***	0.0435***	0.0263***	0.0420**	0.0453**	0.0467***	0.0453***	0.0443***	0.0431***	0.0474***
	(2.76)	(2.58)	(2.64)	(2.96)	(2.58)	(2.41)	(2.55)	(2.75)	(2.87)	(2.82)	(2.67)	(3.04)
Random-Effects												
R^2 level 2	*0.87*	*0.87*	*0.86*	*0.88*	*0.86*	*0.85*	*0.84*	*0.87*	*0.89*	*0.89*	*0.88*	*0.90*
R^2 level 1	*0.20*	*0.20*	*0.20*	*0.20*	*0.23*	*0.23*	*0.23*	*0.23*	*0.20*	*0.20*	*0.20*	*0.20*
R	*0.29*	*0.29*	*0.29*	*0.30*	*0.32*	*0.32*	*0.32*	*0.32*	*0.30*	*0.30*	*0.30*	*0.30*
LR test	115.6	117.4	124.2	100.3	122.4	124.6	133.5	104.28	73.9	75.2	76.2	63.4
Log restricted-likelihood	-3171.9	-3171.7	-3174.3	-3170.9	-2563.2	-2563.9	-2564.5	-2562.2	-3173.1	-3172.9	-3174.8	-3172.1
Number of observations	7239	7239	7239	7239	6116	6116	6116	6116	7239	7239	7239	7239

In parentheses, t-values. Level of significance: *** 1%, ** 5%. Sector and country dummies included.

5 Concluding remarks

Institutional quality has gained a particularly important role in the EU general framework of sustainable development and regional policy (Farole, Rodriguez-Pose and Storper, 2011). This paper aims to analyse the effect of regional quality of government (QoG) on firm TFP in a multi-country context, considering a group of EU countries. The study is based on EFIGE database, a comparable cross-country data of manufacturing firms operating in seven European countries (Austria, France, Germany, Hungary, Italy, Spain and the United Kingdom). The measure of the 'quality of government' is the European QoG Index (EQI), as provided by Charron, Dijkstra and Lapuente (2014).

The unit of analysis is the firm; this represents the most appropriate level to test whether the regional institutional environment affects productivity since it overcomes the fallacy of "the wrong level" and can also account for the difference in the macro- and micro-impacts of institutional quality. In order to disentangle internal from external productivity drivers, the multilevel approach is employed. This more sophisticated approach specifically takes into account the fact that firms are clustered into regions and handle simultaneously the micro-scale of firms and the macro-scale of regions. In so doing, it guarantees a better standard error estimation and allows the researcher to assess the heterogeneity in firm-level performance due to within-region variation in firm characteristics and the proportion due to differences in the regional context.

Results refer to 2008 and show, as expected, the importance of firm-specific determinants of TFP. However, the context in which firms operate plays a role in determining individual TFP. Results show that the regional endowment of infrastructure and the investments in R&D exert a positive effect on firm performance: firms located in a region with high level of R&D and good infrastructure show higher level of TFP.

As far as the specific scope of this paper is concerned, the quality of regional government is positively correlated with firm TFP. This is in line with previous research which underlines the importance of the quality of institutions at the regional level and it refutes the hypothesis that within country institutional differences do not matter for economic performance. When considering the QoG components, the quality of services and the fight against corruption seem to be important for good firm performance in the EFIGE-7 countries. The evidence is, however, inconclusive as regards impartiality. The results are robust to several robustness checks.

The policy implications arising from the findings of this research are limited by data constraints. In particular, given the cross-sectional nature of the data it is impossible to establish the direction of causality and to claim that the quality of regional government is an exogenous cause of

TFP. However, on the basis of correlational evidence arising from this research, a region with low QoG is likely to be characterized by low productivity, but, as already evidenced by Rodríguez-Pose and Garcilazo (2015), this type of region may also be unable to use cohesion and other funds effectively. So the risk is that regions with low QoG may be trapped in low competitiveness and low growth. This is an important issue because existing regional inequalities already pose a threat to the cohesion of the European Union. In the current context of slow growth, high unemployment and fiscal stringency in EU countries, efforts aimed at improving the quality of local government and, eradicating favoritism and corruption in the exercise of the public administration, may thus represent a means to help less-favoured regions to overcome low competitiveness.

References

Acemoglu D. and J.A. Robinson. 2008. The Role of Institution in Growth and Development, Commission on Growth and Development, Working Paper No. 10.

Acemoglu D., S. Johnson and J. A. Robinson 2001. "The Colonial Origins of Comparative Development: An Empirical Investigation." *The American Economic Review* 91 (5): 1369-1401.

Aidt T. S. 2009. "Corruption, Institutions, and economic development". *Oxford Review of Economic Policy* 25 (2): 271-291.

Aiello, F., V. Pupo, and F. Ricotta. 2014. "Explaining Total Factor Productivity at Firm Level in Italy: Does Location Matter?" *Spatial Economic Analysis* 9 (1): 1–20.

Aiello, F., V. Pupo, and F. Ricotta. 2015. "Firm Heterogeneity in TFP, sectoral innovation and location. Evidence from Italy." *International Review of Applied Economics* 29 (5): 546-571.

Aiello, F., and F. Ricotta. 2016. "Firm heterogeneity in productivity across Europe. Evidence from multilevel models". *Economics of Innovation and New Technology*, 25 (1), 57-89.

Altomonte, C., and T. Aquilante. 2012. "The EU-EFIGE/Bruegel-Unicredit dataset." *Bruegel Working paper 13*, Brussels.

Altomonte, C., T. Aquilante, and G. Ottaviano. 2012. "The triggers of competitiveness: The EFIGE cross-country report." *Brugel Blueprint Series 17*, Brussels.

Aron J. 2000. Growth and Institutions: A Review of the Evidence. The World Bank Research Observer 15 (1): 1203-1228.

Barba Navaretti, G. M. Bugamelli, F. Schivardi, C. Altomonte, D. Horgos, and D. Maggioni. 2011. "The Global Operations of European Firms." *Bruegel Blueprint 12*, Brussels.

Barbosa, N. and A.P. Faria (2011). "Innovation across Europe: How Important Are Institutional Differences?" *Research Policy* 40(9): 1157-1169.

Bellone, F., S. Guillou, and L. Nesta. 2009. "Are export premia robust to innovation statistics?" *Document de travail, 15.* Observatoir Français des Conjuctures Economiques, Paris.

Benfratello, L., and A. Sembenelli. 2006. "Foreign Ownership and Productivity. Is the direction of causality so obvious?" *International Journal of Industrial Organization* 24 (4): 733–751.

Beugelsdijk, S. 2007. "The regional environment and a firm's innovative performance: a plea for a multilevel interactionist approach." *Economic Geography* 83: 181-199.

Bhaumik, S. K. and R. Dimova. 2014. "Good and bad institutions: is the debate over? Cross-country firm-level evidence from the textile industry". *Cambridge Journal of Economics*, 38: 109–126. doi:10.1093/cje/bes089.

Bickel R. 2007. *Multilevel Analysis for Applied Research, It's Just Regression!* The Guilford Press, New York.

Cassiman, B, E. Goloso, and E. Martinez-Ros. 2010. "Innovation, export and productivity." *International Journal of Industrial Organization* 28: 372-376.

Chanda A. and C.J Dalgaard. 2008. "Dual Economies and International Total Factor Productivity Differences: Channelling the Impact from Institutions, Trade, and Geography". *Economica*, 75 (300): 629-661.

Charron, N., V. Lapuente and B. Rothstein. 2010. Measuring the quality of government and subnational variation. Report for European Commission, Directorate-General for Regional Policy. http://ec.europa.eu/regional_policy/information/studies/index_en.cfm#2

Charron N. and V. Lapuente. 2013. "Why Do Some Regions in Europe Have a Higher Quality of Government?." *The Journal of Politics* 75(3): 567-582. DOI: 10.1017/S0022381613000510

Charron N., L. Dijkstra and V. Lapuente. 2014. "Regional Governance Matters: Quality of Government within European Union Member States." *Regional Studies* 48(1): 68-90, DOI: 10.1080/00343404.2013.770141.

Cohen, W.M., and D.A. Levinthal. 1990. "Absorptive capacity: a new perspective of learning and innovation." *Administrative Science Quarterly* 35: 128-152.

Commander, S. and J. Svejnar. 2011. Business environment, exports, ownership, and firm performance. *Review of Economics and Statistics* 93: 309-337.

Crescenzi R. and A. Rodríguez-Pose. 2012. "Infrastructure and regional growth in the European Union." *Papers in Regional Science* 91(3): 487-513.

Crozet M, I. Méjan, and S. Zignago. 2011. "Plus grandes, plus fortes plus loin…Les performances des firmes exportatrices françaises." *Revue économique* 62 (4): 717-736.

Dollar, D., Hallward-Driemeier, M. and T. Mengistae, 2005. "Investment climate and firm performance in developing countries." *Economic Development and Cultural Chang*e 54: 1-31.

European Commission. 2010. EUROPE 2020 A strategy for smart, sustainable and inclusive growth. European Commission.

Farole, T., A. Rodrguez-Pose and M. Storper. 2011. "Cohesion Policy in the European Union: Growth, Geography, Institutions." *Journal of Common Market Studies* 49(5): 1089-1111.

Fazio G., and D. Piacentino. 2010. "A Spatial Multilevel Analysis of Italian SMEs' Productivity." *Spatial Economic Analysis*, 5(3): 299-316.

Fingleton B., H. Garretsen and R. Martin. 2015. "Shocking aspects of monetary union: the vulnerability of regions in Euroland." *Journal of Economic Geography* doi:10.1093/jeg/lbu055.

Gennaioli, N., R.. La Porta, F. López-de-Silanes and A. Shleifer. 2013. "Human capital and regional development." *The Quarterly Journal of Economics* 128(1): 105-164.

Griffith, R. 1999. "Using the ARD establishment data to looking at foreign ownership and productivity in the United Kingdom." *Economic Journal* 109: 416– 442.

Griliches, Z. 2000. "*R&D, Education and Productivity A Retrospective.*". Cambridge, MA: Harvard University Press.

Hall, B. H. 2011. "Innovation and productivity." *Nordic Economic Policy Review* 2: 167-195.

Hall, R.E. and C.I. Jones. 1999. "Why do some countries produce so much more output per worker than others?" *Quarterly Journal of Economics*, 114 (1): 83-116.

Heck, R.H., and S.L. Thomas. 2000. *An introduction to multilevel modelling techniques*. Mahwah, NJ: Lawrence Erlbaum Associates .

Helliwell J.F. and R. Putnam. 1995. "Economic Growth and Social Capital in Italy." *Eastern Economic Journal*, 21, 3: 295-307.

Hox, J.J. 2002. *Multilevel analysis: techniques and applications*. Mahwah, NJ: Lawrence Erlbaum Associates. http://dx.doi.org/10.1787/9789264230781-en

ISGEP, International Study Group on Exports and Productivity. 2008. "Understanding Cross-Country Differences in Exporter Premia: Comparable Evidence for 14 Countries." *Review of World Economics*, 144 (4): 596 – 635.

Jones, K. 1991. Multi-Level Models for geographical research, Concepts and techniques in modern Geography, Department of Geography , Portsmouth Polytechnic.

Jütting, J., 2003, Institutions and development: a critical review. OECD Development Centre, WP n. 210.

Kaufmann D., A. Kraay and M. Mastruzzi. 2009. Governance Matters VIII: Aggregate and Individual Governance Indicators for 1996–2008. World Bank Policy Research Working Paper Number 4978. The World Bank, Washington, DC.

Ketterer T. D. and A. Rodríguez-Pose. 2016. Institutions vs. 'first-nature' geography – What drives economic growth in Europe's regions? Papers in Regional Science, DOI: 10.1111/pirs.12237.

Lasagni A., A. Nifo and G. Vecchione. 2015. "Firm productivity and institutional quality: evidence from Italian industry*." Journal of Regional Science* 00(0): 1–27.

Leckie, G. 2013. Cross-Classified Multilevel Models - Concepts. LEMMA VLE Module 12, 1-60. http://www.bristol.ac.uk/cmm/learning/course.html.

Levinsohn, J., and A. Petrin. 2003. “Estimating production functions using inputs to control for unobservables.” *Review of Economic Studies*, 7: 317–341.

Levchenko A.A. 2007.“Institutional Quality and International Trade.” Review of Economic Studies 74, 791–819.

Mahlberg B., I. Freund, J. Crespo Cuaresma, and A. Prskawetz. 2013. “The age-productivity pattern: Do location and sector affiliation matter?” *Journal of the Economics of Ageing*, http://dx.doi.org/10.1016/j.jeoa.2013.08.002.

Manzocchi S., B. Quintieri and G. Santoni. 2014. Internal vs. External Firm Productivity Drivers. A Study of the Italian Counties. In: LUISS Lab Working Papers, Roma: LLEE Luiss. ISBN: 978-88-6856-014-0.

Mariani M. 2004. “What determines technological hits? Geography versus firm competencies.” *Research Policy*, 33: 1565-1582.

Mass, J.M, and J.J. Hox. 2004. ”Robustness issues in multilevel regression analysis.” *Statistica Neederlandica* 58: 127-137.

McGuinness A. 2007. Institutions and Total Factor Productivity Convergence, Research Technical Paper, Central Bank and Financial Services Authority of Ireland.

Melitz, M. J. 2003. “The Impact of Trade on Intra-Industry Reallocations and Aggregate Industry Productivity.” *Econometrica* 71 (6): 1695–1725.

Mohnen P. and B.H. Hall. 2013. “Innovation and productivity: an update.” *Eurasian Business Review*, 3(1): 47-65.

Mundlack, Y. 1978. “On the pooling of time series and cross-sectional data” *Econometrica* 46:69-86.

Nistotskaya M., N. Charron, and V. Lapuente (2015), The wealth of regions: quality of government and SMEs in 172 European regions, Environment and Planning C: Government and Policy, ; vol. 33, 5: pp. 1125-1155.

Nifo A. and G. Vecchione. 2014. “Do Institutions Play a Role in Skilled Migration? The Case of Italy.” *Regional Studies*, 48 (10): 1628-1649.

North, D. C. 1990. Institutions, institutional change and economic performance. Cambridge: Harvard University Press.

OECD. 2015. Consequences of Corruption at the Sector Level and Implications for Economic Growth and Development, OECD Publishing, Paris.

Putnam R. D., with Leonardi R. and Nanetti R. Y. 1993. *Making Democracy Work. Civic Traditions in Modern Italy*. Princeton University Press, Princeton, NJ.

Rabe-Hesketh, S., and A. Skrondal. 2008. *Multilevel and Longitudinal Modeling Using Stata*. Stata Press, 2nd edition. College Station, TX: Stata Press.

Raspe, O., and F. van Oort. 2011. “Firm Heterogeneity, Productivity, and Spatially Bounded Knowledge Externalities.” *Socio-Economic Planning Sciences* 45:38-47

Richter, T. 2006. “What is wrong with ANOVA and multiple regression? Analyzing sentence reading times with hierarchical linear models.” *Discourse Processes*, 41 (3): 221-250.

Rodríguez-Pose A. and E. Garcilazo. 2015. “Quality of Government and the Returns of Investment: Examining the Impact of Cohesion Expenditure in European Regions.” *Regional Studies*, 49 (8): 1274-1290.

Rodríguez-Pose A. and M. Di Cataldo. 2015. “Quality of government and innovative performance in the regions of Europe.” *Journal of Economic Geography*, 15: 673–706.

Rodrik D., A. Subramanian and F. Trebbi. 2004. “Institutions rule: The primacy of Institutions over geography and integration in economic development.” *Journal of Economic Growth*, 9: 131-165.

Rothstein B. and J. Teorell. 2008. “What is quality of government? A theory of impartial government institutions.” *Governance: International Journal of Policy, Administration and Institutions* 21: 165–190.

Rutherford, M., D. Kuratko, and D. Holt. 2008. “Examining the link between “familiness“ and performance: can the F-PEC untangle the family business theory jungle?” *Entrepreneurship Theory and Practice* 32 (6): 1089–1109.

Schulze, W. S., and E.R. Gedajlovic. 2010. “Guest editors’ introduction. Whither family business?” *Journal of Management Studies* 47: 191-204.

Snijders, T.A.B. and R.J. Bosker. 2008. “Diagnostic checks for multilevel models” in *Handbook of multilevel Analysis,* edited by Jan de Leeuw, New York: Springer.

Tabellini, G. 2010. “Culture and Institutions: Economic Development in the Regions of Europe.” *Journal of the European Economic Association* 8(4): 677-716.

Wagner, J. 2007. “Exports and productivity: a survey of the evidence from firm-level data.” *The World Economy* 30 (1): 60-82.

Weche Gelübcke, J.P. 2013. “The performance of foreign affiliates in German manufacturing: Evidence from a new database.” *Review of World Economics* 149 (1): 151-182.