OECD Regional Development Papers

A comprehensive approach to understanding urban productivity effects of local governments

Local autonomy, government quality and fragmentation

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This paper advances our understanding of the spatial dimension of productivity by investigating the link between subnational governance arrangements and urban labour productivity. It presents a detailed study of the direct and indirect effects of decentralisation (local autonomy), government quality and fragmentation and empirically demonstrates the need for a comprehensive approach when considering the effects of governance-related characteristics on regional economic outcomes. Multi-level analysis of data for Functional Urban Areas (FUAs) in Europe during 2003-2014 suggests that labour productivity tends to be higher in regions with higher quality of government. Productivity, on average, is lower in more decentralised countries. However, under "the right" conditions (high quality of government and low fragmentation), decentralisation is positively linked to productivity. Overall, cities with high levels of government quality and local autonomy but low horizontal fragmentation tend to be the most productive.

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Keywords: Labour productivity; Local autonomy; Fragmentation; Quality of government, Functional Urban Areas

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Executive summary

Globally, cities above fifty thousand inhabitants account for about half of the world's population and their importance is expected to grow. Due to agglomeration benefits, cities are often the hotbeds of innovation and productivity that can also spill over to other regions. In many European countries, frontier urban regions are the key drivers of national productivity growth.

Effective governance arrangements and high quality of government are important vehicles to enable and boost productivity. However, it is not always clear what constitutes effective arrangements nor how quality of government in general translates into economic growth and higher wellbeing.

Three aspects of governance arrangements have been extensively studied in academic research: quality of government; decentralisation; and administrative fragmentation. While the evidence on a positive link between government quality and regional economic performance is well-established, and the negative impact from administrative fragmentation on economic performance appears reasonably solid, the results for decentralisation appear mixed. One reason for a lack of consensus could be interdependencies in the effects of the three governance-related measures. Our understanding of such interdependencies is very limited, as academic literature rarely pays attention to them.

This paper adopts a comprehensive approach in order to fill this gap and analyses the effects of government quality, decentralisation and fragmentation, including their interactions, on urban labour productivity. To enable robust international comparisons, it considers European Functional Urban Areas (FUAs), which are defined consistently across countries. While the estimation approach cannot establish causal relationships, the results indicate that:

- **Government quality is positively linked to urban labour productivity** but this link depends on the level of decentralisation and fragmentation. Decentralisation serves as a conduit and fragmentation as a barrier in the relationship between quality of government and labour productivity.

- **When local governance is poor, decentralisation (or devolution) is negatively associated with productivity**. This is true for multiple forms of devolution (policy, financial, organisational and non-interference). This result appears to be driven by a lack of quality of many local governments and the fragmentation between them. Poor quality may reflect corruption, inability to deliver, or vested interests. Fragmentation can result in additional co-ordination costs, beggar-thy-neighbour policies and other undesirable externalities.

- **However, with good quality institutions and limited fragmentation across functional economic areas, devolution is positively associated with productivity**. Decentralisation enables local governments to have targeted growth strategies. As a result, in more decentralised countries the positive association of government quality and labour productivity is magnified.

- **But fragmentation works as a barrier**. Co-ordination in public service provision is more challenging in more fragmented FUAs. Therefore, the positive link between government quality and productivity is smaller in these areas, although the negative link between decentralisation and productivity is also smaller.

- The results illustrate a central role of the quality of government. If the quality of government in the region of Radom in Poland (FUA with the lowest predicted productivity) were at the level of Helsinki in Finland (FUA with the highest predicted productivity), predicted labour productivity in Radom increases by 58%. This large effect is made possible by the “right” enabling conditions which combine high local autonomy and low horizontal fragmentation. When, in contrast, local autonomy is low and fragmentation is high, improving quality of government does not translate into sizable increase in urban labour productivity.

- The resulst demonstrate the scope to better leverage on the high quality of government in cities with low governmental autonomy (e.g. FUAs in the UK) or high horizontal fragmentation (e.g. some FUAs in France). Productivity could be boosted by offering more channels for high quality of government to translate into better economic outcomes e.g. by increasing local autonomy (in the UK) or decreasing horizontal fragmentation (in France).

To conclude, this study empirically demonstrates the need for a comprehensive approach when it comes to the link between government-related characteristics and regional economic outcomes. Although the possibility of a reverse causality, particularly between urban productivity and regional government quality, cannot be excluded, the conclusion that multiple and interrelated factors are at play still stands. These interdependencies should be taken into account for an efficient policy design.

1 Introduction

Globally, cities above fifty thousand inhabitants account for about half of the world population and their importance is expected to grow (OECD/European Commission, 2020[1]). Due to agglomeration benefits, cities are often the hotbeds of innovation and productivity that can spill over to other regions lifting aggregate economic performance. In many European countries, frontier urban regions shape national productivity growth (Bachtler et al., 2019[2]).

Frontier or not, proper governance arrangements and high quality of government can help cities to improve their productivity. The task of determining such arrangements, however, is not an easy one. City boundaries are defined by the patterns of economic activity, which do not necessarily coincide with administrative units. As a result, co-ordination is likely to be an issue. Fragmentation and potentially different levels of responsibilities can make governing "at the right scale" hard to achieve. The challenges linked to the spatial organisation of governments in the urban space exist against a backdrop of the processes of decentralisation and multi-level governance reforms, which are themselves complex and multi-faceted (OECD, 2017[3]; OECD, 2019[4]).

Properly designed and implemented decentralisation and governance arrangements can have strong benefits for the regions in terms of democracy, efficiency, accountability and local and regional development (OECD, 2019[4]; Rodríguez-Pose, Tijmstra and Bwire, 2009[5]). Yet, changing such arrangements to improve their design is not straightforward given the need to involve and co-ordinate several layers of government and many stakeholders, often with divergent interests (OECD, 2017[3]). The OECD calls for a comprehensive approach that builds on local needs and capacities to maximise the benefits (OECD, 2017[3]; OECD, 2018[6]; OECD, 2019[4]).

When it comes to policy practice, however, it is not always clear which considerations should be included in a comprehensive approach. Academic research is often limited to considering only one characteristic of regional governance arrangements at a time. For example, the literature finds positive effects of the quality of government on regional economic growth (Rodríguez-Pose and Garcilazo, 2015[7]) and innovation (Rodriguez-Pose and Di Cataldo, 2015[8]). Given that road infrastructure increases market access, which in turn can facilitate GDP, employment and population growth (Adler et al., 2020[9]), the positive link between government quality and returns on transportation investments (Crescenzi, Di Cataldo and Rodríguez-Pose, 2016[10]) is particularly important. There are also explorations of the relationship between decentralisation and, for instance, regional economic growth (Rodríguez-Pose, Tijmstra and Bwire, 2009[5]) or inter-regional disparities (Pike et al., 2012[11]) attesting to the role of decentralisation for specific outcomes and in specific contexts. Finally, horizontal fragmentation is found to be negatively related to urban labour productivity (Ahrend et al., 2017[12]). While extremely useful, such studies are unable to shed light on potential interactions in the effects of governance-related characteristics.

This paper empirically demonstrates that a comprehensive approach is indeed warranted and that policy considerations should go beyond one-on-one relationships. The analysis shows that labour productivity in European Functional Urban Areas (FUAs) is linked to the quality of government, local autonomy and fragmentation but the relationships are not linear – effects of each factor depend on other factors. Given regional variations in all three government-related metrics across Europe, the paper also contributes to the discourse on the spatial dimension of productivity and its subnational determinants (Tsvetkova et al., 2020[13]; Andersson, Eklund and Tsvetkova, 2020[14]).

The main conclusion of this paper is that the positive association between FUA labour productivity and quality of government is the largest when local autonomy is high and horizontal fragmentation is low. This goes in line with previous academic and policy research, which focused on individual elements such as fragmentation and capacity (Ahrend et al., 2017[12]; OECD, 2019[4]).

The paper continues with an overview of the literature on decentralisation (local autonomy), quality of government and horizontal fragmentation presenting the case for a comprehensive approach. Subsequently, the data section describes the sources and structure of the data used. Section 5 discusses estimation strategy with all results described in Sections 6, 7 and 8. Finally, the implications and relevance of this research are discussed.

2 Governance dimensions and regional economic performance

Decentralisation literature

General debates on decentralisation

Decentralisation refers to "the transfer of powers and responsibilities from the central government level to elected authorities at the subnational level (regional governments, municipalities, etc.) … that have some degree of autonomy" (OECD, 2019, p. 11[4]). Over the past decades, many (OECD) countries have delegated more authority and responsibilities to local governments, a process of decentralisation sometimes called a "silent revolution" (OECD, 2019[4]). The general assumption behind this trend is that local governments have a better understanding of the local needs (Tiebout, 1956[15]; Oates, 1999[16]; Klugman, 2013[17]). The same argument underlies the concepts of place-based policies (Barca, 2009[18]; Barca, Mccann and Rodríguez-Pose, 2012[19]) and smart-specialisation (McCann and Ortega-Argilés, 2015[20]; Foray, 2015[21]).

Decentralisation can foster policy innovation through policy competition (Martinez-Vazquez and McNab, 2003[22]; Tiebout, 1956[15]; Rose-Ackerman, 1980[23]; Justman, Thisse and Van Ypersele, 2002[24]) and facilitate benchmarking of local politicians' performance through increased transparency (Belleflamme and Hindriks, 2005[25]; Besley and Case, 1995[26]). As a result, decentralisation may lead to increased participation and accountability (Seabright, 1996[27]; Ebel and Yilmaz, 2002[28]; Putnam, Leonardi and Nanetti, 1993[29]). Literature has pointed to a number of other (potential) positive effects of decentralisation. Lower per capita fees resulting from inter-jurisdictional competition can promote growth-enhancing savings and capital accumulation (Brueckner, 2006[30]; Koethenbuerger and Lockwood, 2010[31]). Shorter supply chains, less inefficient bureaucracies and reduced costs can result from decentralisation and competition (Carniti et al., 2019[32]; Ezcurra and Pascual, 2008[33]; Klugman, 2013[17]). Finally, the literature suggests that regional inequality can be reduced through increased (fiscal) decentralisation (Ezcurra and Pascual, 2008[33]; Carrascal-Incera et al., 2020[34]; Rodriguez-Pose and Ezcurra, 2011[35]).

On the other side of the debate are arguments in favour of more centralised governments. Subnational governments may lack the capacity, resources and expertise to tackle major projects particularly those requiring co-ordination among governments and jurisdictions. Prud'homme (1995[36]) argues that government should only provide basic universal needs which do not differ much across regions, and for which central government would be a more efficient provider. If increased decentralisation contributes to the complexity of the local public system, its understanding by the public would diminish, leading to weaker political participation and accountability mechanisms (Goodman, 2019[37]). Besides, greater (fiscal) decentralisation may actually result in higher regional inequalities when interregional fiscal stabilisers are insufficiently established (Bartolini, Stossberg and Blöchliger, 2016[38]; Blöchliger, Bartolini and Stossberg, 2016[39]). Local elites may also find it easier to capture local governments, seeding corruption or inequalities (Bardhan and Mookherjee, 2000[40]; Bischoff and Krabel, 2017[41]; Jia and Nie, 2017[42]; Storper, 2005[43]).

Finally, subnational governments may be misused to circumvent limits on debt or expenditures (Faulk and Killian, 2017[44]).

In sum, the debate on the economic effects of decentralisation is far from being settled. The specific advantages and disadvantages of more decentralised governance structures often depend on locality-specific circumstances but also on the ways decentralisation is designed and implemented. While the arguments put forth in the literature often refer to decentralisation in general, empirical analyses tend to focus on and estimate the effects of one aspect of decentralisation at a time.

Decentralisation, in fact, is a complex and multi-dimensional concept. The OECD names three salient dimensions, i.e. political, administrative, and fiscal decentralisation. The political dimension sets the legal basis of decentralisation by describing how subnational administrators are selected, by appointment or through elections. The administrative dimension relates to the transfer of planning, financing and management decisions on some public functions to lower levels of government. Lastly, the fiscal dimension describes the taxing and spending responsibilities of subnational tiers of government (OECD, 2019[4]).

Fiscal decentralisation

Probably the most widely used measure of decentralisation in empirical literature is fiscal decentralisation approximated by the share of expenditures/revenues spent/collected at a subnational level. Empirical evidence on the economic effects of fiscal decentralisation is mixed (Baskaran, Feld and Schnellenbach, 2016[45]). The outcomes are shown to be dependent on the empirical specification, sample, decentralisation measure, and level of spatial aggregation (Baskaran, Feld and Schnellenbach, 2016[45]; Iimi, 2005[46]; Martinez-Vazquez, Lago-Peñas and Sacchi, 2017[47]).

Earlier single-country studies also offer divergent results. A US-based analysis focusing on the second half of the last century found no statistically significant relationship between fiscal decentralisation and growth (Xie, Zou and Davoodi, 1999[48]). On the other hand, several studies looking at China establish a positive relationship (Qiao, Martinez-Vazquez and Xu, 2008[49]; Lin and Liu, 2000[50]), although decentralisation can be linked to inflation and decreased stability (Feltenstein and Iwata, 2005[51]). In a cross-country setting, Davoodi and Zou (1998[52]) find insignificant fiscal decentralisation effects on economic growth for developed and developing economies, whereas Iimi (2005[46]) finds positive effects for a sample of 51 countries during 1997-2001.

More recent OECD analyses at the subnational level discover a positive correlation between fiscal decentralisation on the one hand and economic growth, productivity, human capital (Blöchliger and Égert, 2013[53]), and interregional convergence (Blöchliger, Bartolini and Stossberg, 2016[39]) on the other. A greater alignment between the revenues sourced locally and local public expenditures generates greater returns to public investments because of the pressure to design local economic development policies better (Blöchliger, Bartolini and Stossberg, 2016[39]; Bartolini, Stossberg and Blöchliger, 2016[38]).

Another group of empirical papers reports a bell-shaped relationship between fiscal decentralisation and economic growth. These studies argue that there is an optimal level of decentralisation, which is most conducive to economic growth. Neither extreme fiscal decentralisation (Rodriguez-Pose and Ezcurra, 2011[35]), nor extreme centralisation (Thiessen, 2005[54]) are well-suited for this task. Carniti and co-authors (Carniti et al., 2019[32]) suggest that this bell-shaped link stems from the bell-shaped relationship between government size and economic growth, implying that the decentralisation effect on economic growth runs through its effect on government size.

Political and administrative decentralisation

Despite the most research attention paid to fiscal decentralisation, it is only a part of the story. If governmental entities spending money have no authority over these processes, the outcome of decentralisation is unlikely to be optimal. Fiscal decentralisation should be well-balanced and go hand-in-

hand with political and administrative decentralisation (OECD, 2019[4]). After all, when a subnational government is bound by strict rules from the central government resulting in little authority to decide how to use its budget, focusing on fiscal decentralisation only would provide a partial and likely distorted picture of decentralisation.

Surveys are usually used to measure political and administrative decentralisation. They seek to elicit the extent to which subnational governments have power, responsibility and autonomy. Examples of resulting indices include the Regional Authority Index or RAI (Hooghe et al., 2016[55]), the Local Autonomy Index or LAI (Lander, Keuffer and Baldersheim, 2015[56]; Ladner and Keuffer, 2018[57]; Ladner, Keuffer and Baldersheim, 2016[58]) and work by the OECD (Dougherty and Phillips, 2019[59]). These indices capture decentralisation as a matter of how much authority or autonomy a particular subnational level of government has, mostly at the country level.

In terms of empirical evidence, Muringani and co-authors (Muringani, Dahl Fitjar and Rodríguez-Pose, 2019[60]) find that Regional Authority Index and quality of governments together are associated with economic growth in European regions. Another study suggests that tax decentralisation is linked to higher rates of economic growth in a context of high administrative and political decentralisation (Filippetti and Sacchi, 2016[61]).

Quality of Government

Quality of government reflects the extent to which governments act impartially, efficiently and are free from corruption (Charron, Dijkstra and Lapuente, 2014[62]; Charron, Dijkstra and Lapuente, 2015[63]). There is a vast and growing literature on the link between quality of government (more broadly referred to as 'institutions' in the international research) and economic performance at the level of both nations (Acemoglu, Johnson and Robinson, 2005[64]; Barro, 1996[65]; La Porta et al., 1999[66]) and regions (Rodríguez-Pose and Ketterer, 2020[67]; Charron, Dijkstra and Lapuente, 2014[62]). More than a quarter of century ago, Putnam (1993), using the example of Italy, demonstrated that quality of government is a decisive factor for prosperity and growth of regions.

More recent literature shows that higher-quality governments contribute to better economic performance of regions through facilitating regional diversification (Cortinovis et al., 2017[68]), regional competitiveness (Annoni and Dijkstra, 2013[69]) and potential for innovation (Rodriguez-Pose and Di Cataldo, 2015[8]) as well as by alleviating credit constraints for SMEs (Rodríguez-Pose et al., 2020[70]). Higher quality of government can also be associated with lower interregional inequalities (Ezcurra and Rodríguez-Pose, 2014[71]) and less dominance from any particular city or region (OECD, 2015[72]). Quality of government can shape returns on investments from European cohesion funds (Rodríguez-Pose and Garcilazo, 2015[7]) and investments in infrastructure (Crescenzi, Di Cataldo and Rodríguez-Pose, 2016[10]).

The quality of government tends to be determined by history and is path-dependent (Charron and Lapuente, 2013[73]; Rodríguez-Pose and Ketterer, 2020[67]). Yet, improving quality of government is possible. Such improvements, in fact, can be a powerful driver of development, especially in low-income countries (Rodríguez-Pose and Ketterer, 2020[67]).

Fragmentation

A separate but related metric of governance arrangements is fragmentation, which can be horizontal or vertical. Vertical fragmentation is closer to the notion of decentralisation and refers to the multi-level structure of local government and the distribution of responsibilities across its units. Horizontal fragmentation, on the other hand, is the number of units within the same tier of local government (Goodman, 2019[37]). The general trend of decentralisation in the OECD countries was accompanied by a

decrease in horizontal fragmentation driven by policies encouraging or imposing mergers or cooperation among local governmental entities (OECD, 2019[4]).

Commonly, empirical focus is on horizontal fragmentation (Goodman, 2019[37]; Stansel, 2005[74]; Ahrend et al., 2017[12]), which is also referred to as administrative fragmentation. Administrative fragmentation can be measured by the number of local governments within a region, such as a Functional Urban Area or a Metropolitan Statistical Area (MSA). Empirical literature that studies the relation between horizontal fragmentation and regional economic performance so far looked predominantly at the context of US MSAs.

The results are mixed and appear to depend on the period, the outcome of interest and other factors. For example, Stansel (2005[74]) finds that horizontal fragmentation is positively associated with long-run income growth. Similarly, Goodman (2020[75]) reports a positive association between horizontal fragmentation and long-run population growth also demonstrating that an increase in special districts per municipality is associated with larger population growth. These studies may create an impression that fragmentation leads to better outcomes, which is not likely the case. More plausible explanation appears to be reverse causality. If metropolitan growth is the result of incorporating more suburbs, which enter as separate entities, the positive association between growth and fragmentation is mechanical and should not be interpreted as an actual link between the two phenomena. Also, faster growing MSAs may introduce more governing bodies (thus, increasing fragmentation) to tackle the growing demand and increasing complexity of public services provision.

Another body of literature reports that fragmentation is negatively linked to economic outcomes. Grassmueck and Shields (2010[76]) find that this is the case for growth in income and employment. Similarly, Hammond and Tosun (2011[77]) using data on US counties instead of MSAs discover a negative association between horizontal fragmentation on the one hand and population and employment growth on the other. Nelson and Foster (1999[78]), in their analysis of largest US MSAs, empirically study the effects of administrative fragmentation also accounting for vertical fragmentation. The authors show that income growth is highest in the presence of large suburban municipalities, with few elected special service district officials, and an overseeing metropolitan governance structure which may co-ordinate decisions among local governments.

There are so far only few international studies. Ahrend and co-authors (Ahrend et al., 2017[12]) rely on a harmonised definition of urban areas (FUAs) and investigate the link between fragmentation and labour productivity in five OECD countries. The analysis finds a negative relationship which is considerably mitigated by the presence of a governance body, likely due to reduced co-ordination costs. Duque and co-authors (Duque et al., 2020[79]) focus on metropolitan areas of more than 500 000 residents in Latin America and find that fragmentation acts to both increase and decrease productivity in the region. While smaller units can be more responsive to the local needs boosting efficiency, the need to co-ordinate decreases metropolitan productivity.

3 A comprehensive approach

A brief review of the literature above leads to several conclusions. First, quality of government has positive effects on regional economic performance. Second, decentralisation can have positive, negative or a bell-shaped relationship with regional economic outcomes depending on specifics. Finally, the effects of administrative fragmentation of urban regions, at least in the US, are not straightforward, but overall would point to administrative fragmentation affecting economic performance negatively. What many of these studies have in common, however, is the focus on only one dimension of government (its quality, decentralisation/local government autonomy or fragmentation) as an explanatory variable. The dependent variables, on the other hand, are often the same, suggesting that all government-linked characteristics (usually studied separately) are likely to work together. Somewhat limited but growing literature that considers more than one dimension at a time confirms that there is an interplay between various factors related to the governance arrangements and government quality (Muringani, Dahl Fitjar and Rodríguez-Pose, 2019[60]).

In fact, the sometimes inconclusive empirical evidence of the "one-dimensional" studies might result from a failure to account for other government-related attributes. For example, it could be the case that the ability of more decentralised governments to deliver better services to their jurisdictions hinges on the quality of local governments. There might be threshold effects when a certain level of quality is needed for decentralisation to have pronounced economic benefits. Devolution of authority to local governments that are not able to effectively manage increasing responsibilities makes positive effects of decentralisation improbable. Likewise, the effects of fragmentation could be dependent on other governmental characteristics. Decentralisation can make co-ordination easier if local governments have full authority over the subject of co-ordination. Lower quality of government, on the other hand can diminish the willingness to co-ordinate in a good faith, amplifying challenges of co-ordination in public service provision.

A comprehensive view, therefore, is needed in empirical research to better understand the ways different government attributes interact and affect regional economic outcomes. This knowledge is crucial for design of policies that are better tailored to the specific realities within the place-based approach.

This paper focuses on the direct and indirect effects of three government-related dimensions, quality of government, decentralisation (local autonomy) and administrative fragmentation. It establishes how all three dimensions are linked to urban labour productivity in the international context of European FUAs. It further seeks to identify the combination(s) most conducive to urban productivity.

The quality of government is expected to have a positive direct effect on labour productivity, whereas the level of decentralisation is expected to have an insignificant effect (Rodriguez-Pose and Ezcurra, 2011[35]; Muringani, Dahl Fitjar and Rodríguez-Pose, 2019[60]). The interaction between these two factors is expected to be positive, in line with the work by Muringani and colleagues (Muringani, Dahl Fitjar and Rodríguez-Pose, 2019[60]).

The reasons for the expected relationships are the following. First, decentralisation is more likely to promote positive economic outcomes (higher labour productivity) when the quality of government is high. High-quality governments are expected to be more efficient, transparent and accountable. Second, increased decentralisation opens more avenues for these qualities to make actual difference in regional economic performance, i.e. the positive effects of a high-quality government should be stronger when governments have greater autonomy. The opposite should also hold. Greater autonomy entrusted to

governments of lower quality (e.g. corruption-ridden) would result in suppressed economic performance due to misallocations, waste and other undesirable consequences. In other words, decentralisation has the ability to magnify both the positive effects of high-quality government and the negative effects of low-quality government.

In the context of urban areas, which consist of multiple constituencies, the picture gets more complex due to the need of co-ordination in service provision. As shown by previous research (Ahrend et al., 2017[12]), managing bigger projects can be more challenging in more fragmented environments due to the need to co-ordinate among a larger number of stakeholders. This can lead to lower efficiency. This means that the positive effect of higher government quality in more decentralised contexts is likely to diminish as cities become more fragmented. In sum, the largest positive productivity effect is expected to be observed for FUAs characterised by high quality of government in the regions of their location in the context of high decentralisation and low administrative (horizontal) fragmentation.

4 Data

Urban labour productivity (dependent variable)

Labour productivity is measured by GDP per worker in USD (constant prices, constant purchasing power parity (PPP) with 2015 as the base year). The data come from the OECD Regions and Cities database (section Metropolitan areas/Economy) available at https://stats.oecd.org/. The data are aggregated for Functional Urban Areas, a consistently defined urban areas consisting of a city and its commuting zone to reflect the actual extent of each area's economic reach (Dijkstra, Poelman and Veneri, 2019[79]).

After a recent update, the data set contains information for FUAs of 250 000 residents or more (over 600 urban areas in OECD member countries). If values of the dependent variable (labour productivity) are missing in the data, these observations were dropped to ensure a balanced panel. The focus of this analysis is also limited to the EU (mainly due to the lack of comparable data on the quality of government in the non-European regions). The final data set consists of 242 FUAs across 154 regions and 37 LAI areas located in 14 European countries. The study period is 2003-2014.

Decentralisation, quality of government and fragmentation (explanatory variables)

Decentralisation (local autonomy)

Decentralisation in this paper is measured by the Local Autonomy Index (LAI), which has been introduced by the European Commission. The Index provides values (panel data) for EU countries running from 1990 to 2014 (Lander, Keuffer and Baldersheim, 2015[56]; Ladner and Keuffer, 2018[57]; Ladner, Keuffer and Baldersheim, 2016[58]). LAI is created through a network of experts on local government, assessing the autonomy of local governments in their respective countries based on a common codebook. Eleven variables are measured and grouped in seven local autonomy dimensions (political discretion, policy scope, financial autonomy, organisational autonomy, non-interference, access, and legal autonomy).[1] The autonomy dimensions are normalised from zero to 100 and are combined using various weights, which are defined by country group coordinators. The resultant scores of the Local Autonomy Index range from zero (no local autonomy) to 100 (full local autonomy).

The raw "full coding" data (Lander, Keuffer and Baldersheim, 2015[56]) include subnational differences in LAI values for selected countries. For example, the LAI scores differ across German and Austrian States. Similarly, there are differences between Wallonia and Flanders, and between England, Northern Ireland, Scotland, and Wales. Besides differences across regions, some countries also have different LAI values for rural and urban areas (Spain and Poland) or individual scores for the major cities (France).

[1] A detailed description on the measurement and definitions of the LAI, as well as of its dimensions, is provided in the official document (Lander, Keuffer and Baldersheim, 2015[56]).

To the degree possible, the analysis uses the subnational LAI values based on the raw "full coding" data and following the methodology as set out by the creators of the index (Lander, Keuffer and Baldersheim, 2015[56]; Ladner and Keuffer, 2018[57]). The values of the index are normalised from zero to 10 to be in line with the magnitude of other variables of interest. Finally, to mitigate multicollinearity concerns, which routinely arise in interaction models, the LAI data used in the research is mean-centered. As a result, the main estimated coefficients reflect the effects of each predictor at the mean level of other variables (Bauer and Curran, 2005[80]).

Quality of government

The University of Gothenburg (Sweden) compiles the most extensive (subnational) quality of government database for European Regions, bundled together in the European Quality of Government Index or EQI (Charron, Dijkstra and Lapuente, 2014[62]; Charron, Dijkstra and Lapuente, 2015[63]). EQI is created through extensive surveys at the individual level, which results in a measure reflecting the perceived quality of government (how the government is viewed by the respondents). The survey questions ask specifically about the quality of government in the (local) area of an individual, thereby measuring the quality of local government. The individual responses are aggregated to the NUTS2 level. The index, thus, captures the average perceived quality of government within NUTS2 regions.

The EQI data are available for 1996-2017. Aside from the overall EQI index, the data set offers a break down by three pillars of the index, corruption, quality of public services, and impartiality. The three pillars and the overall index are standardised with a standard deviation of one. A detailed description of the survey questions and methodology used may be found in the codebook (Charron, Dijkstra and Lapuente, 2014[62]; Charron, Dijkstra and Lapuente, 2015[63]).

Horizontal fragmentation

Horizontal (or administrative) fragmentation is measured here by the number of local governments within each FUA after factoring out population effects (derivation procedure is described below). The data come from the OECD Regions and Cities database (section Metropolitan areas/Territorial organisation) available at https://stats.oecd.org/. Unlike the dependent variable and the measures of decentralisation and the government quality, the available information on fragmentation does not change over time and refers to the 2001-2011 census.[2]

In the literature, horizontal fragmentation is often measured by the number of governmental entities per capita (Stansel, 2005[74]). This measure, however, may be suboptimal for the purposes of this analysis. First, there are threshold effects. As an increasing number of urban residents leads to an increased demand for services (as well as for the introduction of new services), these new needs, up to a certain point, can be accommodated within the existing governmental architecture. Splitting or establishing governments serving specific needs is justified when the demand cannot be satisfied efficiently any longer and the benefits of more focused service provision are expected to outweigh the increase in co-ordination costs. Second, the co-ordination costs are directly linked to the total number or governments and not so much to the number of governments per capita. The latter measure is relatively low in larger cities with quite fragmented structures, which are likely to face significant co-ordination challenges both due to the complexity of their service provision and the number of players in the public service provision space.

To derive a measure of fragmentation that is not dependent on population, the following procedure is used. The total number of governments in a given FUA is regressed on its population (both measures are used

[2] As a result, the analysis is able to capture only between fragmentation effects (and unable to capture the within ones).

as natural logarithms) as shown in Equation 1.[3] The error term from this regression is used as a measure of population-independent fragmentation (Equation 2).

$$\log(Governments)_{f,2011} = \alpha + \beta_1 \log(Population)_{f,2011} + \varepsilon_{f,2011} \quad \text{Equation 1}$$

where *f* refers to FUAs and the estimation is performed for year 2011 (defined by data availability for the number of governments).

$$\widehat{Fragmentation}_f = \varepsilon_{f,2011} \quad \text{Equation 2}$$

Control variables

The models also include several controls to account for the effects of other factors that can be plausibly linked to productivity performance in European cities. The included variables are measures of agglomeration (population density), the territory served by the governments within a FUA (land area) and demographic composition of the population (elderly and youth dependency ratios). The OECD Regions and Cities database (section Metropolitan areas) is the data source. To account for the macroeconomic fluctuations affecting all cities in the same way and to account for the unchanging national peculiarities (culture, legal and regulatory regimes and others), year and country fixed effects are also used. Table 4.1 shows summary statistics for all continuous variables used in the analysis.

Table 4.1. Summary statistics for the variables

	Variable	Mean	Std. Dev.	Min	Max
Dependent	Urban labour productivity	11.20	0.20	10.23	11.70
Explanatory	Decentralisation (LAI)	0.00	1.04	-3.64	1.49
	LAI dimensions: Legal	0.00	1.39	-3.86	2.81
	LAI dimensions: Discretion	0.00	1.79	-5.84	2.60
	LAI dimensions: Policy	0.00	2.12	-7.24	1.89
	LAI dimensions: Financial	0.00	1.50	-3.48	2.00
	LAI dimensions: Organisational	0.00	2.07	-3.89	3.61
	LAI dimensions: Interference	0.00	1.44	-7.22	1.11
	LAI dimensions: Access	0.00	2.06	-2.63	4.04
	Quality of government (EQI)	0.42	0.67	-2.23	1.81
	EQI pillars: Corruption	-0.46	0.75	-1.86	2.51
	EQI pillars: Quality	0.44	0.64	-2.20	1.90
	EQI pillars: Impartiality	0.46	0.76	-2.37	2.11
	Fragmentation	0.00	1.49	-3.06	2.85
Controls	Population density, log	5.87	0.75	3.85	7.90
	Area, log	7.38	0.82	4.93	9.77
	Elderly dependency ratio	26.37	5.02	14.20	46.50
	Youth dependency ratio	24.13	4.08	14.20	36.70

Note: The number of observations is 2 904.
Source: Sources for each variable are listed in Section 4.

[3] Alternative measures of fragmentation (e.g. the natural log of the number of governments within a FUA or errors from a prediction that uses population density and FUA area size) produce comparable estimation results, which are available upon request.

5 Estimation strategy

A multi-level data structure (FUAs within NUTS2 regions within countries with an added layer of geographical detail stemming from the LAI measurement) calls for a multi-level econometric modelling. Such approach allows to estimate the urban labour productivity effects of governance-related factors under the condition of urban processes being hierarchically nested within realities of increasingly higher levels of geographical aggregation. In other words, productivity of FUAs depends not only on FUA-level factors but factors at the higher levels of aggregation. By default, the model assumes that FUAs within the same context are more similar in productivity performance compared to FUAs in other contexts. The model allows for a three-level estimation with FUAs nested in NUTS2 regions (EQI), nested in regions at which LAI is measured using random intercepts for the LAI areas, EQI regions and FUAs.[4]

Three models are estimated. The first one (Equation 3) explores the direct effects of LAI, EQI and horizontal fragmentation. In the next model, nonlinear effects for the decentralisation and the quality of government are introduced by allowing the effect of one characteristic to depend on the other (Equation 4). Finally, interactions with horizontal fragmentation are introduced to further probe the nonlinearity of the effects and to be able to derive the "optimal" values for the three explanatory variables (Equation 5).

$$LP_{c,a,r,f,t} = \beta_0 + \beta_1 LAI_{c,a,t} + \beta_2 EQI_{c,a,r,t} + \beta_3 \widehat{Fragmentation}_{c,a,r,f} + \beta_k X_{c,a,r,f,t} + u_{0a} + u_{1r} + u_{rf} + \omega_t + \omega_c + \varepsilon_{c,a,r,f,t} \quad \text{Equation 3}$$

where, $LP_{c,a,r,f,t}$ represents labor productivity in FUA *f* located in region *r* and LAI area *a* of country *c* at time *t*. $LAI_{c,a,t}$ is the local autonomy index; $EQI_{c,a,r,t}$ denotes the quality of government and $Fragmentation_{c,a,r,f}$ captures the degree of horizontal fragmentation. The vector $X_{c,a,r,f,t}$ includes *k* control variables; u_{0a}, u_{1r} and u_{2f} are random intercepts for the LAI areas, EQI regions, and FUAs respectively. Finally, time fixed effects and country fixed effects, ω_t and ω_c, are included.

$$LP_{c,a,r,f,t} = \beta_0 + \beta_1 LAI_{c,a,t} + \beta_2 EQI_{c,a,r,t} + \beta_3 \widehat{Fragmentation}_{c,a,r,f} + \beta_4 EQI * LAI_{c,r,t} + \beta_k X_{c,a,r,f,t} + u_{0a} + u_{1r} + u_{rf} + \omega_t + \omega_c + \varepsilon_{c,a,r,f,t} \quad \text{Equation 4}$$

$$LP_{c,a,r,f,t} = \beta_0 + \beta_1 LAI_{c,a,t} + \beta_2 EQI_{c,a,r,t} + \beta_3 \widehat{Fragmentation}_{c,a,r,f} + \beta_4 EQI * LAI_{c,a,r,t} + \beta_5 EQI * \widehat{Fragmentation}_{c,a,r,ft} + \beta_6 LAI * \widehat{Fragmentation}_{c,a,r,f,t} + \beta_7 EQI * LAI * \widehat{Fragmentation}_{c,a,r,f,t} + \beta_k X_{c,a,r,f,t} + u_{0a} + u_{1r} + u_{rf} + \omega_t + \omega_c + \varepsilon_{c,a,r,f,t} \quad \text{Equation 5}$$

[4] This controls for the assumption of independence of observations in grouped data. Not controlling for it may violate the assumption of independence of the residual error terms, resulting in large errors (Barcikowski, 1981[88]).

The Mundlak correction (Mundlak, 1978[81]) helps dealing with the heterogeneity bias by modelling it through adding one additional term in the model for each (FUA level) time-varying covariate, accounting for the between effect (Bell and Jones, 2015[82]).

Multilevel models may be estimated using full maximum-likelihood (FML) or restricted maximum-likelihood (RML). The RML procedure takes into account the uncertainty in the fixed parameters when estimating the random parameters. It offers better estimates of the variance components (Raudenbush and Bryk, 2002[83]) and is used in this paper.

6 Estimation results and discussion

The estimation results are presented in four subsections. First, the direct effects of the explanatory variables are discussed. In the next step, non-linearities in the effects of decentralisation and government quality are explored. The third subsection shows the results for the full model, which allows for interaction in the effects of all three governance-related variables. Finally, the last subsection contains a brief study of optimisation in the urban productivity effects of decentralisation, quality of government and horizontal fragmentation.

Direct effects

The direct effects of the three variables of interest (decentralisation/local autonomy, quality of government and horizontal fragmentation) are estimated from Equation 1 where random intercepts and fixed effects are successively added (Table 6.1). First, a pooled estimation is performed without random or fixed effects (column A). In columns B-D, the random intercepts for the three levels of data (FUA, area and region) along with the Mundlak correction are added. The last two columns also include time fixed effects (column C) or time and country fixed effects (column D).

Table 6.1. Estimation results, direct effects only

Dependent variable: FUA labour productivity (GDP per worker, USD in constant prices and PPP, base year 2015).

Variables	Pooled (A)	Multi-level (B)	Multi-level (C=B + time fixed effects)	Multi-level (D=C + country fixed effects)
Decentralisation (LAI)	0.001	-0.060***	-0.062***	-0.063***
	(0.004)	(0.006)	(0.006)	(0.006)
Quality of government (EQI)	0.100***	0.051***	0.054***	0.054***
	(0.005)	(0.005)	(0.005)	(0.005)
Fragmentation	0.060***	0.014	0.014	0.001
	(0.003)	(0.013)	(0.013)	(0.014)
Population density, log	0.153***	0.211***	-0.003	-0.004
	(0.005)	(0.031)	(0.039)	(0.039)
Area, log	0.046***	0.057***	0.058***	0.058***
	(0.005)	(0.011)	(0.011)	(0.010)
Elderly dependency ratio	0.010***	0.007***	0.001	0.001
	(0.001)	(0.000)	(0.001)	(0.001)
Youth dependency ratio	0.009***	-0.008***	-0.003***	-0.003***
	(0.001)	(0.001)	(0.001)	(0.001)
Constant	9.439***	10.490***	10.440***	10.580***
	(0.065)	(0.192)	(0.192)	(0.195)
Random effects				
FUA-level variance		0.006	0.006	0.006
Area-level variance		0.029	0.029	0.007
Region-level variance		0.005	0.005	0.005

Variables	Pooled (A)	Multi-level (B)	Multi-level (C=B + time fixed effects)	Multi-level (D=C + country fixed effects)
Mundlak correction	No	Yes	Yes	Yes
Time FE	No	No	Yes	Yes
Country FE	No	No	No	Yes
Log restricted-likelihood	1 164	4 693	4 790	4 797

Note: *** p<0.01, ** p<0.05, * p<0.1; standard errors in parentheses; restricted maximum likelihood estimation procedure is used (with identity covariance structure); number of observations is 2 904.

Of the three variables, the direct effects are consistent in all specification only for the quality of government. Table 6.1 suggests that labour productivity tends to be higher in FUAs located in regions with higher quality of government. This result is consistent with previous findings in the literature (Rodríguez-Pose and Ketterer, 2020[67]). The direction of the coefficients or their significance changes between the pooled and multi-level specifications for the other two variables. The measure of decentralisation, Local Autonomy Index, goes from insignificant in the pooled model (in line with the findings by Muringani and co-authors (Muringani, Dahl Fitjar and Rodríguez-Pose, 2019[60])) to negative and significant in the multi-level model indicating, on average, lower labour productivity where local governments enjoy greater autonomy. Finally, there is no statistical relationship between horizontal fragmentation and urban labour productivity (in the multi-level specification).

The evidence presented in Table 6.1 is preliminary. It captures only direct effects and does not account for the possible non-linearities, which, according to the literature, are likely to be present in the investigated relationships between governance-related characteristics and regional economic performance (urban labour productivity in this case). The following subsections explore the direct together with indirect effects to offer a more nuanced and accurate account.

Non-linear effects of decentralisation and government quality

As discussed, the link between the quality of government and economic outcomes is likely to be amplified by increasing local autonomy. Governance arrangements characterised by greater levels of local autonomy and responsibilities open more avenues for various pillars of government quality (such as corruption or impartiality) to be felt by the residents and businesses affecting their economic behavior.

To account for such a possibility, an interaction term between the indices of government quality and local autonomy is added to the empirical specification. It is expected to be positive and statistically significant in line with prior findings (Muringani, Dahl Fitjar and Rodríguez-Pose, 2019[60]). Table 6.2 shows estimation results (the table structure is identical to the one described in the previous subsection).

Table 6.2. Estimation results with non-linear effects of decentralisation and government quality

Dependent variable: FUA labour productivity (GDP per worker, USD in constant prices and PPP, base year 2015).

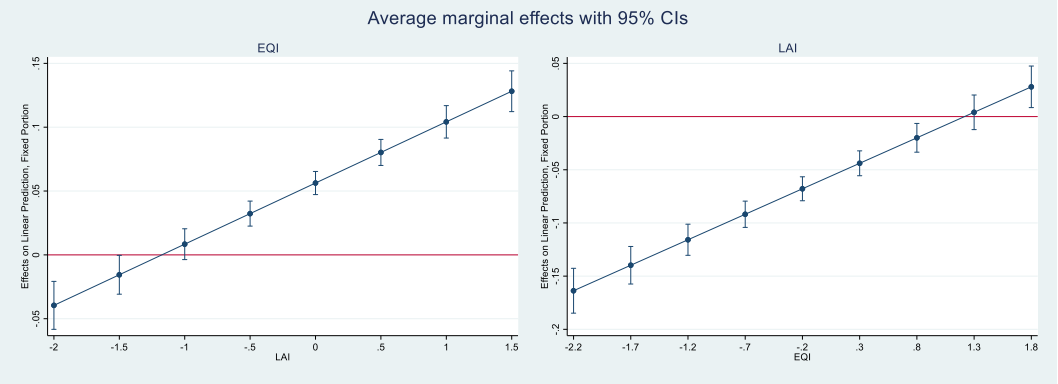
Variables	Pooled (A)	Multi-level (B)	Multi-level (C=B + time fixed effects)	Multi-level (D=C + country fixed effects)
Decentralisation (LAI)	-0.043***	-0.054***	-0.058***	-0.058***
	(0.005)	(0.006)	(0.006)	(0.006)
Quality of government (EQI)	0.074***	0.052***	0.057***	0.056***
	(0.005)	(0.005)	(0.005)	(0.005)
EQI*LAI	0.089***	0.052***	0.048***	0.048***
	(0.006)	(0.004)	(0.004)	(0.004)
Fragmentation	0.041***	0.010	0.011	0.002

Variables	Pooled (A)	Multi-level (B)	Multi-level (C=B + time fixed effects)	Multi-level (D=C + country fixed effects)
	(0.003)	(0.013)	(0.012)	(0.014)
Population density, log	0.141***	0.168***	0.023	0.022
	(0.005)	(0.031)	(0.038)	(0.038)
Area, log	0.045***	0.058***	0.058***	0.057***
	(0.004)	(0.011)	(0.011)	(0.010)
Elderly dependency ratio	0.008***	0.007***	0.003***	0.003***
	(0.001)	(0.000)	(0.001)	(0.001)
Youth dependency ratio	0.012***	-0.005***	-0.001	-0.001
	(0.001)	(0.001)	(0.001)	(0.001)
Constant	9.518***	10.410***	10.380***	10.590***
	(0.062)	(0.191)	(0.190)	(0.195)
Random effects				
FUA-level variance		0.006	0.006	0.006
Area-level variance		0.029	0.029	0.007
Region-level variance		0.005	0.005	0.005
Mundlak correction	No	Yes	Yes	Yes
Time FE	No	No	Yes	Yes
Country FE	No	No	No	Yes
Log restricted-likelihood	1 164	4 693	4 790	4 797

Note: *** p<0.01, ** p<0.05, * p<0.1; standard errors in parentheses; restricted maximum likelihood estimation procedure is used (with identity covariance structure); number of observations is 2 904.

As expected, the interaction term between LAI and EQI is positive and statistically significant indicating that the effects of the local autonomy and government quality are mutually dependent. The estimation suggests that the (consistently positive) effect of the governmental quality on urban labour productivity in Europe is amplified when local governments have greater autonomy. The (consistently negative) effect of local autonomy, on the other hand, tends to be smaller in environments characterised by higher quality of government. To see how the marginal effects of the LAI and EQI on urban labour productivity change as a function of the other variable, Figure 6.1 plots the marginal effects of each variable against values of the other. The vertical axis shows the magnitude of the effect; the zero line passing within the confidence intervals indicates no significant effect.

Figure 6.1. Margins-plots for marginal effects of LAI and EQI



Note: the plots show the marginal effects of EQI (left) and LAI (right), given certain values of LAI and EQI, respectively (estimates derived from the mixed multi-level model shown in Column D of Table 6.2). The horizontal axis displays values that lie between the 1st and the 99th percentiles, thereby excluding the outlier values.
Source: Own calculations.

Figure 6.1 indicates that the positive effect of the quality of government on labour productivity in European FUAs is statistically significant (and increases in magnitude) only at higher values of the Local Autonomy Index (the left panel). This means that the positive effects of EQI are observable mostly in countries (or areas within countries) with medium and high levels of local autonomy. The effects of the LAI, in contrast, are predominantly negative but at higher levels of the quality of government, the negative effect becomes insignificant before turning positive for the regions with very high governmental quality.

Full model

Finally, the full model accounts for non-linearities in the effects of all governance-related characteristics. Table 6.3 shows estimation results for the empirical specification that includes interactions between EQI and LAI; horizontal fragmentation and EQI; horizontal fragmentation and LAI and a three-way interaction term.

Table 6.3. Estimation results for the full model

Dependent variable: FUA labour productivity (GDP per worker, USD in constant prices and PPP, base year 2015).

Variables	Pooled (A)	Multi-level (B)	Multi-level (C=B + time fixed effects)	Multi-level (D=C + country fixed effects)
Decentralisation (LAI)	-0.052***	-0.058***	-0.066***	-0.067***
	(0.006)	(0.006)	(0.006)	(0.006)
Quality of government (EQI)	0.107***	0.061***	0.071***	0.070***
	(0.006)	(0.005)	(0.005)	(0.005)
EQI*LAI	0.053***	0.055***	0.050***	0.050***
	(0.006)	(0.005)	(0.005)	(0.005)
Fragmentation	0.045***	0.022*	0.028**	0.016
	(0.004)	(0.013)	(0.013)	(0.014)
LAI*Fragmentation	0.015***	0.021***	0.023***	0.025***
	(0.006)	(0.005)	(0.005)	(0.005)
EQI*Fragmentation	-0.004	-0.024***	-0.033***	-0.034***
	(0.005)	(0.004)	(0.004)	(0.004)
EQI*LAI*Fragmentation	-0.053***	-0.016***	-0.025***	-0.024***
	(0.006)	(0.003)	(0.003)	(0.003)
Population density, log	0.136***	0.163***	0.009	0.007
	(0.005)	(0.032)	(0.039)	(0.039)
Area, log	0.044***	0.057***	0.056***	0.057***
	(0.004)	(0.010)	(0.010)	(0.010)
Elderly dependency ratio	0.008***	0.007***	0.002***	0.002***
	(0.001)	(0.000)	(0.001)	(0.001)
Youth dependency ratio	0.012***	-0.005***	0.000	-0.001
	(0.001)	(0.001)	(0.001)	(0.001)
Constant	9.587***	10.430***	10.410***	10.600***
	(0.062)	(0.190)	(0.190)	(0.194)
Random effects				
FUA-level variance		0.006	0.006	0.006
Area-level variance		0.025	0.025	0.006
Region-level variance		0.005	0.005	0.005
Mundlak correction	No	Yes	Yes	Yes
Time FE	No	No	Yes	Yes
Country FE	No	No	No	Yes
Log restricted-likelihood	1 334	4 770	4 883	4 889

Note: *** p<0.01, ** p<0.05, * p<0.1; standard errors in parentheses; restricted maximum likelihood estimation procedure is used (with identity covariance structure); number of observations is 2 904.

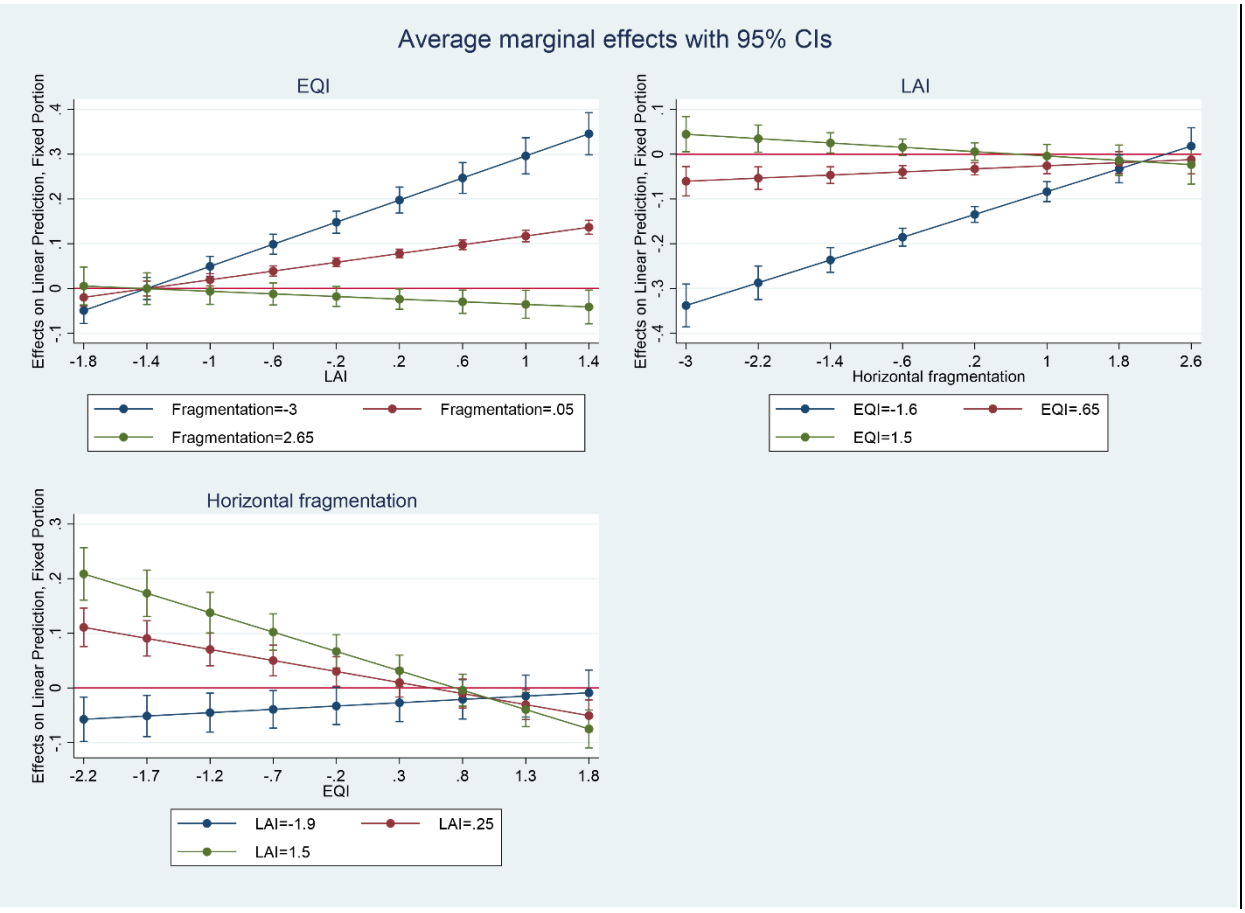
Among the three governance-related characteristics, the effects of the quality of government and decentralisation are interdependent. The direct positive effects of the governmental quality is larger in geographical areas with higher local autonomy. The direct negative effect of decentralisation, on the other hand, is smaller in regions with higher quality of government. At the same time, horizontal fragmentation of FUAs appears to introduce frictions in the mechanisms that link EQI and LAI to urban labour productivity. The estimated effects of both quality of government (positive) and decentralisation (negative) are smaller in more fragmented urban areas.

Figure 6.2 plots marginal effects of each variable against various values of the other two confirming the interdependency in the effects of the governance-related characteristics. The positive effect of the quality of government is the largest where local autonomy is high but horizontal fragmentation is low (the top left panel). The positive and significant estimated coefficient becomes smaller as local autonomy declines; the coefficient also decreases with the degree of horizontal fragmentation becoming statistically insignificant in the most fragmented FUAs regardless of the local autonomy level.

In regions with low quality of government, the negative association between local autonomy and urban labour productivity is the largest (the right panel of Figure 6.2). In the regions with the highest government quality, in contrast, the link between LAI and FUA labour productivity is positive but very small. Fragmentation has a suppressing effect (making the absolute magnitude of the coefficient smaller) for all regions (with both positive and negative LAI effects). The LAI effect is statistically insignificant in the most fragmented urban areas.

Finally, the bottom panel of Figure 6.2 shows the marginal effects of horizontal fragmentation for different levels of EQI and LAI. In the environments with low governmental quality and high local autonomy, fragmentation appears to be positively associated with urban labour productivity likely by limiting the ability of the low-quality government to affect regional economic performance adversely. In countries with low local autonomy, fragmentation is negatively linked to urban productivity regardless of the government quality. In countries with higher levels of local autonomy, the marginal effects of horizontal fragmentation on urban productivity turn negative for higher values of EQI.

Figure 6.2. Margins-plots for the marginal effects of EQI, LAI and fragmentation



Note: the plots show the marginal effects of EQI (left) and LAI (right) and horizontal fragmentation (bottom) given certain values of other two variables (estimates derived from the mixed multi-level model shown in Column D of Table 6.3). The horizontal axis displays values that lie between the 1st and the 99th percentiles, thereby excluding the outlier values. The selected values of the LAI (left and bottom panel) and EQI (right panel) are the 1st, the 50th and the 99th percentiles.
Source: Own calculations.

Maximizing the impact of governance arrangements

The marginal plots empirically show the interplay between quality of government, local autonomy and horizontal fragmentation in shaping urban labour productivity in Europe. They also attest to the importance of a comprehensive approach when considering the effects of governance arrangements particularly in policy design. As the effects of all three governance characteristics are all mutually dependent, all of them should be taken into account. Using Equation 5 (only explanatory variables) and estimation results from column (D) of Table 6.3 while keeping the values of EQI, LAI[5] and fragmentation within their actual limits in the data, Equation 6 allows deriving conditions for the different impacts that the governance characteristics can have on urban productivity. The result of the estimation when the maximising (or minimising) values are plugged in, gives a component of the labour productivity in European FUAs, which is predicted by governance-related characteristics.

[5] The LAI values of Northern Ireland are omitted from the optimisation as they are major outliers on the LAI scale, with a value of more 3.5 standard deviations below the mean and over 1.5 standard deviation from the next lowest value.

$$Maximize: -0.067 * LAI_{c,t} + 0.070 * EQI_{c,r,t} + 0.050 * (EQI * LAI_{c,r,t}) + 0.016 * \widehat{Fragmentation}_{c,r,f} + 0.025 * (LAI * \widehat{Fragmentation}_{c,r,f,t}) - 0.034 * (EQI * \widehat{Fragmentation}_{c,r,ft}) - 0.024 * (EQI * LAI * \widehat{Fragmentation}_{c,r,f,t})$$

Equation 6

Subject to the following constraints:

$$-1.89 =< LAI_{c,t} =< 1.49$$

$$2.23 =< EQI_{c,r,t} =< 1.81$$

$$-3.06 =< \widehat{Fragmentation}_{c,r,f,t} =< 2.85$$

The predicted component of labour productivity is maximised with the following values: EQI = 1.81, LAI = 1.49, and horizontal fragmentation = -3.06 (the value of the component is 0.39). In other words, urban productivity is the highest (omitting the effects of the controls) in environments with the highest levels of government quality and local autonomy and the lowest horizontal fragmentation. The predicted urban labour productivity is minimised (with the predicted component value of -1.06) at the lowest values of the quality of government index (-2.23) and horizontal fragmentation (-3.06) but the highest value of the Local Autonomy Index (1.49).

This suggests that the impact of government quality on urban labour productivity is the largest when local autonomy is high and horizontal fragmentation is low. Labour productivity is decreased when EQI is negative and it is increased when EQI is positive. The FUAs in reality lay somewhere in between the minimum and maximum values as derived from the optimisation.

To further illustrate the role of the government quality for urban labour productivity, a list of the most and the least productive (measured by the average predicted component) FUAs is constructed[6]. During the observation period, the most productive urban areas were Helsinki, Tampere, Turku, Karlsruhe, Halle an der Saale, Saarbrucken, Constance, Pforzheim, Reutlingen, and Heidelberg (the first three FUAs located in Finland and the rest of the list in Germany). The least productive FUAs include Gdansk, Palermo, Czestochowa, Catania, Poznan, Bialystok, Katowice, Bielsko-Biala, Lodz, and Radom (Palermo and Catania located in Italy and the rest in Poland). What is striking, though, is that a comparison of the three governance-related variables shows relatively close values between urban areas with the highest and the lowest predicted productivity component for local autonomy and horizontal fragmentation (LAI for Helsinki is 1.49, for Radom it is 1.29; fragmentation for Helsinki is -1.18, for Radom it is -1). Where the difference lies is the quality of government with Helsinki scoring 1.46 on the EQI and Radom -0.81 (on average over time). If Radom had the same level of government quality as Helsinki (1.46), its predicted productivity increases by 58%. This total is a combination of the 17% direct effect of the quality of government and additional 41% that come through the high local autonomy and low fragmentation.

The large predicted effect of the quality of government improvement in Radom is made possible by the enabling local government structure, i.e. high local autonomy and low fragmentation. In other places, a lack of the “right” enabling conditions appears to hinder the positive link between the quality of government and labour productivity. In Prague, for example, where quality of government is comparable to that of

[6] Given that LAI is mostly captured at the country level, its effects can be hard to distinguish from the country fixed effects. To allow for a more robust estimation, the direct effect of LAI is dropped from Equation 6 in deriving the values of the predicted component for FUAs ranking.

Radom but local autonomy is much lower and fragmentation much higher, increasing quality of government to the level of Helsinki is predicted to have no sizable effect on urban productivity.[7]

In environments where the quality of government is high, improving enabling conditions can be a way to boost urban labour productivity. One such instance is FUAs in UK, which tend to score hign on the EQI index but have low local autonomy. Devolution in this context can improve urban labour productivity.[8] As an example, prediceted labour productivity in Leicester FUA increases by 21% if its local autonomy is equal to that of Helsinki.[9] Another instance is FUAs in France. Many of them have above average quality of government but also high horizontal fragmentation. Here metropolitan consolidation may bring about productivity benefits. Predicted labour productivity in the Rennes FUA increases by 2% if its fragmentation goes down by one standard deviation.[10]

[7] If the quality of government in the Prague region increases to that of Helsinki, Prague labour productivity is predicted to decrease by 1%. The direct link between this hypothetical change in EQI and labour productivity is an increase of 17%. Yet, the existing government structure (low autonomy and high fragmentation) negates the positive effects and the overall expected change is negative, albeit small. On the other hand, decreasing quality of government in Prague by one standard deviation is predicted to have no sizable effect on labour productivity due to a combination of high fragmentation and low autonomy (the overall effect, which is a sum of the direct and indirect parts, is 0.3% while the direct predicted effect is -5%).

[8] This finding is in line with previous OECD work specifically focused on regional productivity in UK (Gal and Egeland, 2018[89]).

[9] The level of local authority of Helsinki is much higher than that of Leicester. In more general terms, increasing LAI by one standard deviation increases predicted labour productivity in Leicester by 6%.

[10] Rennes labour productivity is predicted to go up by 5% if its local autonomy increases by one standard deviation. If LAI of Rennes increases by one standard deviation and horizontal fragmentation decreases by one standard deviation, Rennes labour productivity is expected to go up by 7%.

7 Specification extensions

Unpacking the effects of local autonomy and government quality

The two main measures used in this paper, LAI and EQI, are composite indexes which consist of several components (seven for LAI and three for EQI). The complex nature of the phenomena these two indexes approximate calls for measuring components individually. As a result, the overall results reported in Chapter 6 may conceal certain variations in the effects across components. This subsection explores such a possibility.

Local Autonomy Index (LAI)

When measuring the effects of decentralisation, much of the existing research focuses on financial autonomy and leaves other dimensions (e.g. administrative and political) underexplored. The OECD calls for a comprehensive perspective in order to fully understand decentralisation and its effects in various contexts (OECD, 2019[4]). This subsection separately investigates the effects of the seven LAI dimensions further explained in Box 1.

The seven dimensions of the Local Autonomy Index are generally interlinked. Nevertheless, the mechanisms of the links between every one of them and urban labour productivity are likely to differ. For example, organisational autonomy allows local public organisations to better reflect local preferences based on their understanding of the local needs (Klugman, 2013[17]; Oates, 1999[16]; Tiebout, 1956[15]). This should allow citizens to have more direct control over the organisational structure of local governments via benchmarking the performance of local politicians and voting according to their preferences (Belleflamme and Hindriks, 2005[25]; Besley and Case, 1995[26]) resulting in increased participation and accountability (Ebel and Yilmaz, 2002[28]; Seabright, 1996[27]; Putnam, Leonardi and Nanetti, 1993[29]). At the same time, organisational autonomy can also increase the risk of local elites capturing the local public interest (Bischoff and Krabel, 2017[41]; Storper, 2005[43]; Jia and Nie, 2017[42]; Bardhan and Mookherjee, 2000[40]).

Likewise, financial autonomy and the ability to set local taxes may lead to greater competition among local governments and foster policy innovation (Martinez-Vazquez and McNab, 2003[22]; Rose-Ackerman, 1980[23]; Tiebout, 1956[15]). High legal autonomy may protect local governments from being misused to circumvent limits on debt or expenditures and help them to remain autonomous and effective entities (Faulk and Killian, 2017[44]).

The effects of policy scope, in contrast, can work by allowing the other governance characteristics to have impact on urban economic performance. On the one hand, local governments with more policy scope should be able to tailor service provision to the local needs. On the other, broader policy scope and the increased responsibilities that come with it need enhanced capacity, resources and expertise to successfully take on the projects within a local government's autonomy. If the required attributes are missing or subpar, increased policy scope is not likely to improve urban economic outcomes (Ahrend et al., 2017[12]; Rodríguez-Pose and Gill, 2004[84]; Rodríguez-Pose and Gill, 2005[85]; Prud'homme, 1995[36]).

Box 1. Seven dimensions of the Local Autonomy Index (LAI)

Political discretion is measured through a combination of institutional depth and effective political discretion, which describe "the formal distribution of power and effective decision-making competencies with respect to service delivery" (Ladner and Keuffer, 2018, p. 13[57]). It captures the extent to which local governments are free to take on any new tasks not assigned to other levels of government, and to what extent they have real authoritative decision-making power in functions such as education, social assistance and others (Lander, Keuffer and Baldersheim, 2015[56]).

Policy scope captures "the range of functions or tasks where municipalities are effectively involved in the delivery of services, be it through their own financial resources and/or through their own staff" (Lander, Keuffer and Baldersheim, 2015, p. 64[56]). The range of functions measured are education, social assistance, health, land-use, public transport, housing, police, and caring functions.

Financial autonomy describes the ability of local governments to borrow and raise local public revenues in order to influence their own budget (Lander, Keuffer and Baldersheim, 2015[56]).

Organisational autonomy "measures the extent to which local government is free to decide about its own organisation and electoral system" (Lander, Keuffer and Baldersheim, 2015, p. 22[56]). Mechanisms of organisational autonomy include the mode of filling executive government posts (appointment by higher levels of government or a form of election), the ability of governmental bodies and officials to hire their staff or to create their own legal entities.

Legal autonomy, describes the legal protection given to local governmental entities, in the form of constitutional clauses or through recourse to the judicial system to settle disputes with higher authorities (Lander, Keuffer and Baldersheim, 2015[56]).

Non-interference describes the "extent of liberty allowed by higher levels of government" (Ladner and Keuffer, 2018, p. 13[57]). It is captured through the proportion of unconditional financial transfers and unobtrusive administrative supervision that local governments receive.

Access captures "the degree of influence of local governments over political decisions at higher levels of government" (Ladner and Keuffer, 2018, p. 13[57]).

Source: Ladner, Keuffer and Baldersheim (2015[56]) and Ladner and Keuffer (2018[57]).

Table 7.1 shows estimation results using one dimension of LAI at a time (indicated in the top of each column; estimation results for the control variables are not displayed for brevity). The results clearly show a variation in the importance of different LAI components for urban labour productivity in Europe. Among the four statistically significant dimensions, only two (policy scope and organisational autonomy) display non-linearities in the quality of government, with the negative effect disappearing for higher values of EQI. The effects of three dimensions (financial and organisational autonomy and interference) depend on the level of horizontal fragmentation. The negative effect of financial autonomy and interference tends to be smaller in more fragmented FUAs. The negative effect of organisational autonomy, on the other hand, tends to be larger in urban areas with more governance bodies.

The reported results offer empirical support to the view advocating for a more comprehensive approach when considering local autonomy too (OECD, 2019[4]). Table 7.1 attests to the importance of administrative decentralisation (captured by policy scope) and political decentralisation (captured by organisational autonomy among other dimensions) alongside fiscal decentralisation in explaining urban productivity in Europe.

Table 7.1. Estimation results for the full model using one dimension of LAI at a time

Dependent variable: FUA labour productivity (GDP per worker, USD in constant prices and PPP, base year 2015).

Variables	Discretion	Policy	Financial	Organisational	Legal	Interference	Access
LAI dimension (indicated in top of each column)	0.003	-0.012**	-0.019***	-0.027***	0.045	-0.024***	-0.011
	(0.006)	(0.005)	(0.003)	(0.002)	(0.049)	(0.003)	(0.020)
Quality of government (EQI)	0.056***	0.066***	0.041***	0.018***	0.040***	0.041***	0.043***
	(0.006)	(0.005)	(0.005)	(0.005)	(0.007)	(0.005)	(0.004)
EQI*LAI dimension	0.038***	0.017***	-0.004*	0.047***	-0.006	0.002	0.030***
	(0.004)	(0.003)	(0.002)	(0.003)	(0.011)	(0.002)	(0.002)
Fragmentation	0.017	0.021	-0.005	-0.015	0.001	0.003	0.002
	(0.014)	(0.014)	(0.014)	(0.014)	(0.014)	(0.014)	(0.014)
LAI dimension*Fragmentation	0.009**	0.004	0.015***	-0.006***	0.014	0.011***	-0.003
	(0.004)	(0.003)	(0.003)	(0.002)	(0.010)	(0.002)	(0.007)
EQI*Fragmentation	-0.038***	-0.029***	-0.006	0.026***	0.000	-0.004	-0.003
	(0.004)	(0.004)	(0.004)	(0.004)	(0.005)	(0.004)	(0.004)
EQI*LAI*Fragmentation	-0.009***	-0.015***	-0.004**	-0.012***	-0.002	-0.003**	0.007***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.006)	(0.002)	(0.002)
Constant	10.620***	10.610***	10.580***	10.490***	10.560***	10.600***	10.530***
	(0.194)	(0.197)	(0.194)	(0.195)	(0.195)	(0.195)	(0.235)
Random effects							
FUA-level variance	0.006	0.006	0.005	0.005	0.006	0.006	0.006
Area-level variance	0.006	0.005	0.006	0.005	0.005	0.007	0.006
Region-level variance	0.005	0.005	0.005	0.005	0.005	0.004	0.005
FUA controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Mundlak correction	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Log restricted-likelihood	4 803	4 790	4 748	4 956	4 729	4 777	4 834

Note: *** p<0.01, ** p<0.05, * p<0.1; standard errors in parentheses; restricted maximum likelihood estimation procedure is used (with identity covariance structure); number of observations is 2 904.

The European Quality of Government Index (EQI)

The EQI index consists of three pillars, corruption, quality of public services, and impartiality. While the three pillars are highly interrelated, there may still be differences in outcomes when focusing on a specific pillar. Among the three pillars, corruption appears to be linked to regional economic outcomes in a more direct way as a result of the ability of local (powerful) interest groups in more corrupt environments to capture local government and distort competition in their favour (Bardhan and Mookherjee, 2000[40]; Bischoff and Krabel, 2017[41]; Jia and Nie, 2017[42]; Storper, 2005[43]).

Table 7.2 shows estimation results for each EQI pillar separately followed by a marginal plot for corruption pillar in Figure 6.1. Marginal plots for the other two pillars are shown in Figure A A.2.

Table 7.2. Estimation results for the full model using one pillar of EQI at a time

Dependent variable: FUA labour productivity (GDP per worker, USD in constant prices and PPP, base year 2015).

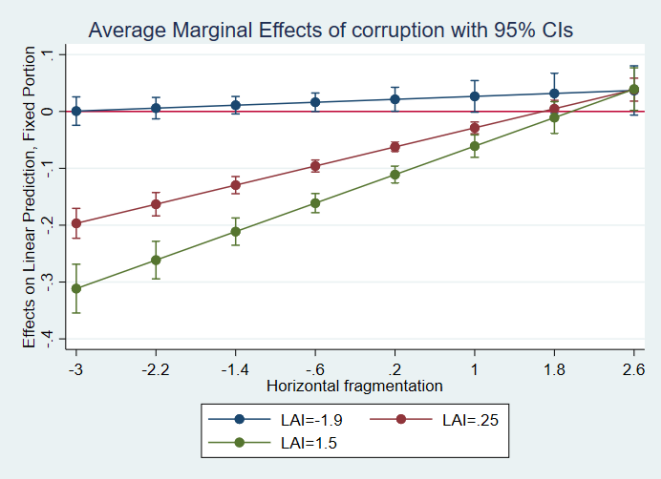
Variables	Corruption	Quality	Impartiality
Decentralisation (LAI)	-0.058***	-0.061***	-0.060***
	(0.006)	(0.006)	(0.006)
EQI pillar (indicated in top of each column)	-0.060***	0.050***	0.043***
	(0.004)	(0.004)	(0.004)
EQI pillar*LAI	-0.042***	0.036***	0.033***
	(0.004)	(0.004)	(0.004)
Fragmentation	0.024*	0.008	0.007
	(0.014)	(0.014)	(0.014)
LAI *Fragmentation	0.020***	0.017***	0.022***
	(0.005)	(0.005)	(0.005)
EQI pillar*Fragmentation	0.038***	-0.022***	-0.017***
	(0.004)	(0.003)	(0.003)
EQI pillar*LAI*Fragmentation	0.017***	-0.015***	-0.017***
	(0.003)	(0.003)	(0.002)
Constant	10.620***	10.630***	10.630***
	(0.194)	(0.193)	(0.197)
Random effects			
FUA-level variance	0.006	0.006	0.005
Area-level variance	0.005	0.006	0.007
Region-level variance	0.005	0.005	0.005
FUA controls	Yes	Yes	Yes
Mundlak correction	Yes	Yes	Yes
Time FE	Yes	Yes	Yes
Country FE	Yes	Yes	Yes
Log restricted-likelihood	4 889	4 843	4 815

Note: *** p<0.01, ** p<0.05, * p<0.1; standard errors in parentheses; restricted maximum likelihood estimation procedure is used (with identity covariance structure); number of observations is 2 904.

As expected, corruption is associated with lower urban labour productivity in Europe. The negative effect is amplified in countries with more autonomous local governments. Fragmentation, in contrast, mitigates the negative effect likely by limiting the reach of the corrupted officials and of local interest groups. The results for the other two pillars, quality of services and impartiality, are consistent with the overall EQI results reported in Table 6.3.

Figure 7.1 visually demonstrates the change in the marginal effects of corruption for various levels of local autonomy and horizontal fragmentation. In countries with low local autonomy, corruption is not statistically linked to urban productivity. The negative effects are considerably larger in environments with high levels of autonomy compared to the environments with median level of autonomy. In both types of environments, however, the negative effect of corruption on urban labour productivity declines as horizontal fragmentation increases. The effect is predominantly insignificant in the most fragmented FUAs.

Figure 7.1. Margins-plots for marginal effects of corruption (a EQI pillar)



Note: the plot shows the marginal effects of EQI given certain values of LAI and horizontal fragmentation (estimates derived from the mixed multi-level model shown Table 7.2). The horizontal axis displays values that lie between the 1st and the 99th percentiles, thereby excluding the outlier values. The selected values of LAI are the 1st, 50th and 99th percentiles.
Source: Own calculations.

Analysis over time

The link between regional governance characteristics and urban productivity can change over time. This might be a particular concern during the periods of major shifts in economic activity, such as the 2008 global recession. Table 7.3 shows estimation results for the 2003-08 and 2008-2014 periods separately.[11]

Table 7.3. Estimation results for the full model before and after the 2008 crisis

Dependent variable: FUA labour productivity (GDP per worker, USD in constant prices and PPP, base year 2015).

Variables	2003-2008	2008-2014
Decentralisation (LAI)	0.077***	-0.039***
	(0.021)	(0.006)
Quality of government (EQI)	0.055***	0.044***
	(0.008)	(0.006)
EQI*LAI	-0.084***	0.038***
	(0.013)	(0.005)
Fragmentation	0.001	0.009
	(0.014)	(0.014)
LAI*Fragmentation	0.037***	0.015***
	(0.013)	(0.005)
EQI*Fragmentation	-0.007	-0.018***

[11] An additional estimation (not reported for brevity) explored changes in the effects of governance-related characteristics over time by estimating cross-sectional models separately for each year. The results suggest a growing importance of the quality of government; its coefficient goes from insignificant to weakly significant and to strongly significant after the recession. A measure of local autonomy is (weakly) significant and positive during the financial crisis (2008-2012) potentially indicating that higher local autonomy allowed faster adaptation and promoted resilience in the times of economic downturn. Fragmentation shows no direct effects but during the recession, the positive effects of higher government quality were smaller in more fragmented FUAs.

Variables	2003-2008	2008-2014
	(0.006)	(0.004)
EQI*LAI*Fragmentation	-0.034***	-0.014***
	(0.008)	(0.003)
Constant	10.570***	10.670***
	(0.195)	(0.195)
Random effects		
FUA-level variance	0.006	0.005
Area-level variance	0.007	0.005
Region-level variance	0.004	0.005
FUA controls	Yes	Yes
Mundlak correction	Yes	Yes
Time FE	Yes	Yes
Country FE	Yes	Yes
Log restricted-likelihood	2 665	3 067
Observations	1 452	1 694

Note: *** p<0.01, ** p<0.05, * p<0.1; standard errors in parentheses; restricted maximum likelihood estimation procedure is used (with identity covariance structure).

Table 7.3 shows that the effect of decentralisation was positive before the recession – FUAs in countries with greater local autonomy tended to be more productive. This has changed after the crisis where autonomy appears to be a drag, although its effects are mitigated or entirely cancelled in more fragmented environments with higher quality of government. Another important observation is that the overall results reported in the main analysis appear to be entirely driven by the post-recession period potentially pointing to increasing significance of governance characteristics for urban economic outcomes.

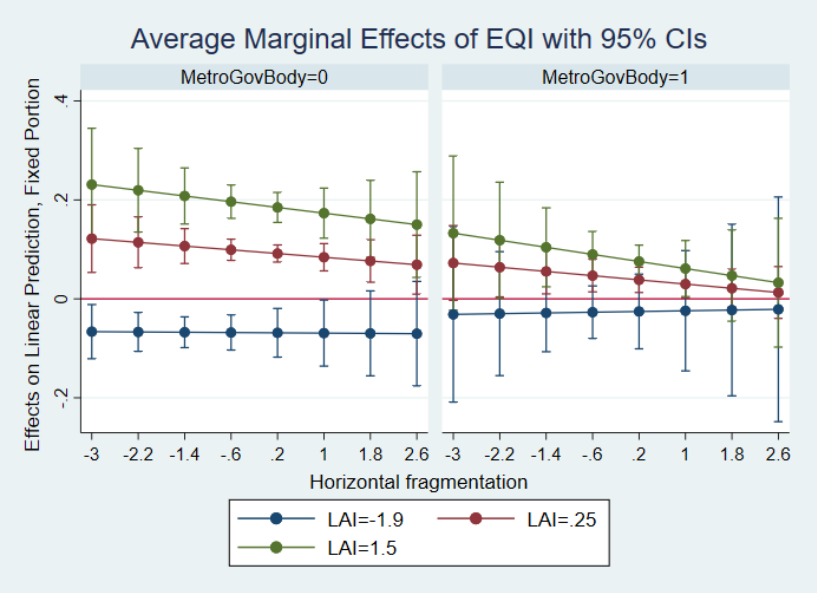
Presence of metropolitan governance bodies

Literature shows that the presence of a governance body in a functional urban area can mitigate the (negative) productivity effects of horizontal fragmentation (Ahrend et al., 2014[86]). To test for the role that a governance body can play in shaping the effects of the other three governance-related characteristics on urban labour productivity, data for five countries (Germany, Mexico, Spain, United Kingdom, and United States) are used.[12]

The results (reported in Table A A.1) show that the negative effect of horizontal fragmentation is somewhat negated when governance bodies are present as has been previously shown. Figure 7.2 plots marginal effects of the quality of government for different levels of LAI and for different values of fragmentation separately for FUAs with and without presence of a governance body. The absolute magnitude of the EQI impact decreases. The importance of the local autonomy (as measured by the distance between the effects plotted for various values of LAI) decreases as well. Government quality becomes insignificant in areas with lower local autonomy regardless of the degree of fragmentation. In areas with higher local autonomy, the EQI effects are (positive and) significant only in FUAs in the middle of the fragmentation value distribution.

[12] The subsample selection is determined by the availability of data on the presence of a governance body in a FUA (available for five countries only). The data include information on when the governance bodies were formed, also introducing within variation in the estimation. There are 521 observations without governance bodies and 391 observations with governance bodies resulting in the total of 912 observations.

Figure 7.2. Margins-plots of EQI marginal effects for FUAs with and without governance body



Note: the plots show the marginal effects of EQI in FUAs without (left) and with (right) metropolitan governing body for certain values of other two variables (estimates derived from the mixed multi-level model shown in Table A A.1). The horizontal axis displays values that lie between the 1st and the 99th percentiles, thereby excluding the outlier values. The selected values of the LAI are the 1st, 50th and 99th percentiles.
Source: Own calculations.

8 Robustness checks

A series of robustness checks help to understand whether results change depending on specification. The specific analyses that were carried out include several modifications. The first one is the use of an alternative dependent variable (GDP per capita to approximate labour productivity in European FUAs). While approximating labour productivity in a less precise manner, this measure can be superior to the one used in this paper (GDP per worker) during the times of recession when productivity would appear to increase as an artefact of decreasing employment levels. The estimation results are reported in Table A B.1 and are generally consistent with those reported in the main analysis. The positive effect of the quality of government is the highest in FUAs located in more decentralised (high LAI) and less fragmented (low horizontal fragmentation) environments.

The next robustness check involves using two alternative measures of fragmentation (one at a time). The first measure is a logarithm of the number of governmental entities in a FUA as reported by the OECD Regions and Cities database in the section Metropolitan areas/Economy. The second one is derived similarly to the measure used in the main analysis but adding land area (same data source) to Equation 1. Table A B.2 reports results for both specifications, which are very consistent with the ones reported in Table 6.3.

Finally, in order to check whether the results are affected by a single country, the full model is estimated leaving out one country at a time. Additional checks of sensitivity to estimation procedure include the jackknife and bootstrap estimations, clustered at the FUA level and at the regional level. The estimation results show little variation (not reported for brevity).

Concluding remarks

Institutions matter. Decades ago, North called institutions the underlying determinant of economic performance and growth prospects (North, 1991[87]). Since then, the appreciation for the role of institutions, and of governance arrangements in particular, in economic performance of nations and regions only grew. Among formal institutions, quality of (subnational) government is now firmly linked by the academic literature to regional economic outcomes in Europe.

Another worldwide trend is decentralisation of the authority from the national government to governments in regions and localities allowing them to better attend to local needs and to leverage local assets. The process of decentralisation (or devolution) is particularly complex due to both the multifaceted nature of government responsibilities, which need to be parsed and assigned to lower levels, but also to the multitude of forms a devolution process can take. Given the objective need to co-ordinate and to reach consensus among numerous players with often contrasting interests, decentralisation requires careful planning and implementation.

The OECD calls for a comprehensive view of decentralisation, which considers its different facets, such as political, administrative and fiscal (OECD, 2019[4]). The existing evidence on the effects of decentralisation often comes from academic studies looking at the impacts of fiscal decentralisation only, which may result in a one-sided view on this multifaceted process from policy makers and undermine the success of decentralisation efforts.

The process of decentralisation happens against a backdrop of urbanisation with cities growing through organic expansion but also by integrating surrounding areas into urban boundaries. This increases the demand for public services (such as transportation, waste management, healthcare and others), which requires enhanced co-ordination among different levels and units of government.

In sum, it is clear that government-related characteristics can influence economic fortunes of places. Such characteristics are (theoretically) entirely within policy scope and can be modified or wholly changed by policy action. Yet, when it comes to defining specific arrangements that would maximise economic returns and enhance wellbeing of people, the evidence is scarce. Research often considers different dimensions of government and governance in isolation. Given the multi-dimensional dynamics linking these dimensions to economic processes, such isolated evidence offers little in terms of practical advice.

Knowing the ways governmental characteristics and governance arrangements affect regional economic performance is a necessary but not sufficient condition for informed policy design in this area. Understanding the interdependence of the effects is another important component.

This paper offers a detailed evaluation of the relationship between government quality, decentralisation (local autonomy) and horizontal fragmentation on the one hand and urban labour productivity on the other. In doing so, it pays thorough attention to both direct and indirect effects. The estimation relies on a multi-level procedure, which is better suited for capturing the multi-level nature of government and governance characteristics in Europe.

The results suggest a strong positive link between government quality and urban productivity in Europe. The direct effect of decentralisation, however, is negative, although decentralisation appears to work more as a conduit for the quality of government to affect economic performance. Horizontal fragmentation also acts as a channel for the other effects to take place. In more decentralised countries, higher quality of government is positively linked with urban productivity only if fragmentation is low. If horizontal fragmentation is high, the association is negative in environments with more autonomous local governments and insignificant where local governments are less autonomous.

To conclude, this study empirically demonstrates the need for a comprehensive approach when it comes to the link between government-related characteristics and regional economic outcomes. There are multiple factors at play and their effects are all interdependent, which should be explicitly taken into account for effective policy design. The study also offers support to the view that government-related characteristics are multidimensional constructs with various components potentially interacting differently in their impact on economic performance.

The main take-away is the following. Recent evidence shows that improving quality of government can be a powerful driver of regional economic success (Rodríguez-Pose and Ketterer, 2020[67]). This paper demonstrates that the ability of governmental quality to impact urban labour productivity, a measure of such success, depends on local autonomy and degree of fragmentation. Cities with high levels of government quality and local autonomy but low horizontal fragmentation tend to be the most productive.

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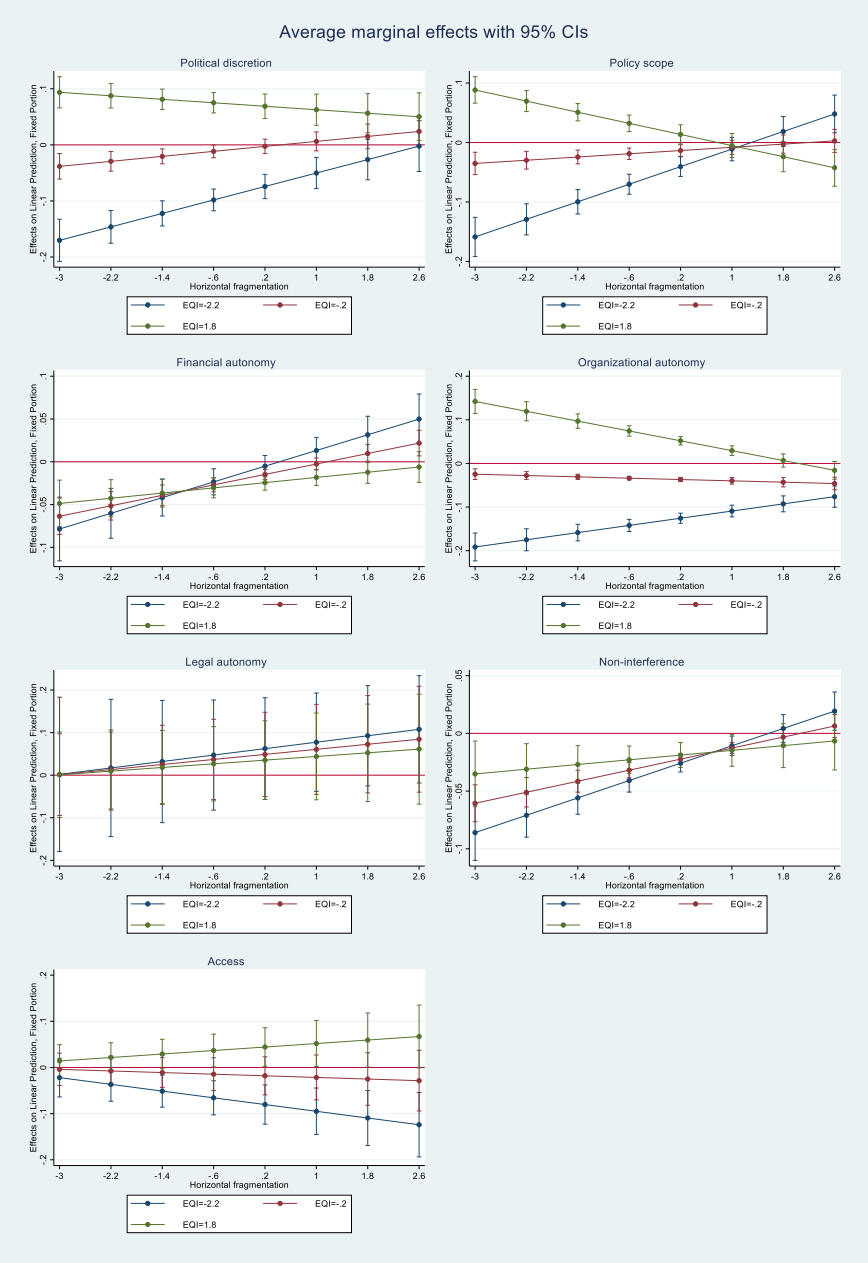
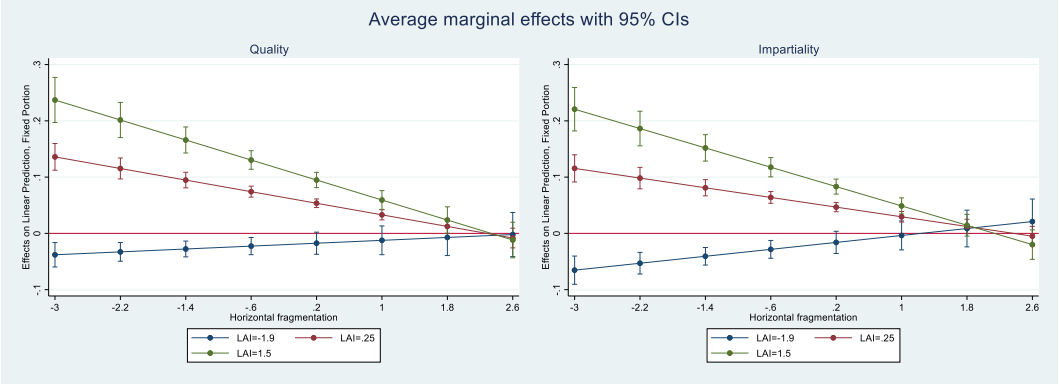
Annex A. Additional specification extensions

Figure A A.1. Margins-plots for marginal effects of LAI dimensions



Note: the plots show the marginal effects of each LAI dimension given certain values of EQI and horizontal fragmentation (estimates derived from the mixed multi-level model shown in Table 7.1). The horizontal axis displays values that lie between the 1st and the 99th percentiles, thereby excluding the outlier values. The selected values of EQI are the 1st, 50th and 99th percentiles.
Source: Own calculations.

Figure A A.2. Margins-plots for marginal effects of EQI pillars (services quality and impartiality)



Note: the plots show the marginal effects of each EQI pillar given certain values of LAI and horizontal fragmentation (estimates derived from the mixed multi-level model shown in Table 7.2). The horizontal axis displays values that lie between the 1st and the 99th percentiles, thereby excluding the outlier values. The selected values of LAI are the 1st, 50th and 99th percentiles.
Source: Own calculations.

Table A A.1. Estimation results for full model including governance body presence and its interactions

Dependent variable: FUA labour productivity (GDP per worker, USD in constant prices and PPP, base year 2015).

Variables	Estimation coefficients
Decentralisation (LAI)	-0.082***
	(0.009)
Quality of government (EQI)	0.075***
	(0.009)
EQI*LAI	0.075***
	(0.010)
Fragmentation	0.021
	(0.037)
LAI*Fragmentation	0.000
	(0.014)
EQI*Fragmentation	-0.008
	(0.010)
EQI*LAI*Fragmentation	-0.004
	(0.008)
Governance body	-0.023**
	(0.011)
Governance body *LAI	0.008
	(0.010)
Governance body *EQI	-0.042***
	(0.016)
Governance body *Fragmentation	0.027***
	(0.009)
Governance body *EQI*LAI	-0.044***
	(0.013)
Governance body *EQI*Fragmentation	-0.001
	(0.013)
Governance body *LAI*Fragmentation	0.011
	(0.013)
Governance body *EQI*LAI*Fragmentation	-0.002
	(0.017)

Variables	Estimation coefficients
Population density, log	-0.110*
	(0.064)
Area, log	0.078***
	(0.025)
Elderly dependency ratio	-0.003**
	(0.001)
Youth dependency ratio	0.005***
	(0.002)
Constant	10.210***
	(0.374)
Random effects	
FUA-level variance	0.010
Area-level variance	0.014
Region-level variance	0.000
Mundlak correction	Yes
Time FE	Yes
Country FE	Yes
Log restricted-likelihood	1 612

Note: *** p<0.01, ** p<0.05, * p<0.1; standard errors in parentheses; restricted maximum likelihood estimation procedure is used (with identity covariance structure); number of observations is 912.

Annex B. Additional robustness tests

Table A B.1. Estimation results for full model, alternative dependent variable

Dependent variable: FUA labour productivity (GDP per capita, USD in constant prices and PPP, base year 2015).

Variables	Pooled (A)	Multi-level (B)	Multi-level (C=B + time fixed effects)	Multi-level (D=C + country fixed effects)
Decentralisation (LAI)	-0.036***	0.030***	0.015**	0.017**
	(0.009)	(0.008)	(0.007)	(0.007)
Quality of government (EQI)	0.226***	0.097***	0.121***	0.119***
	(0.009)	(0.006)	(0.006)	(0.006)
EQI*LAI	0.058***	0.069***	0.062***	0.062***
	(0.010)	(0.006)	(0.006)	(0.006)
Fragmentation	0.060***	0.018	0.030	0.034
	(0.006)	(0.021)	(0.020)	(0.023)
LAI*Fragmentation	0.024***	0.005	0.0132**	0.011*
	(0.008)	(0.007)	(0.006)	(0.006)
EQI*Fragmentation	-0.037***	-0.038***	-0.054***	-0.054***
	(0.007)	(0.005)	(0.005)	(0.005)
EQI*LAI*Fragmentation	-0.049***	-0.021***	-0.031***	-0.031***
	(0.009)	(0.004)	(0.004)	(0.004)
Population density, log	0.200***	-0.407***	-0.843***	-0.838***
	(0.007)	(0.041)	(0.047)	(0.047)
Area, log	0.094***	0.111***	0.111***	0.103***
	(0.007)	(0.018)	(0.018)	(0.018)
Elderly dependency ratio	0.005***	0.012***	-0.000	-0.000
	(0.001)	(0.001)	(0.001)	(0.001)
Youth dependency ratio	-0.004***	-0.014***	-0.002**	-0.002**
	(0.001)	(0.001)	(0.001)	(0.001)
Constant	8.418***	9.552***	9.457***	10.010***
	(0.095)	(0.320)	(0.316)	(0.334)
Random effects				
FUA-level variance		0.015	0.015	0.015
Area-level variance		0.048	0.043	0.015
Region-level variance		0.019	0.018	0.018
Mundlak correction	No	Yes	Yes	Yes
Time FE	No	No	Yes	Yes
Country FE	No	No	No	Yes
Log restricted-likelihood	100	3 982	4 277	4 282

Note: *** p<0.01, ** p<0.05, * p<0.1; standard errors in parentheses; restricted maximum likelihood estimation procedure is used (with identity covariance structure); number of observations is 2 904.

Table A B.2. Estimation results for full model, alternative measures of fragmentation

Dependent variable: FUA labour productivity (GDP per capita, USD in constant prices and PPP, base year 2015).

Variables	Number of governmental entities (log) used to measure fragmentation	Fragmentation measure derived from a regression that accounts for population and area
Decentralisation (LAI)	-0.140***	-0.070***
	(0.015)	(0.006)
Quality of government (EQI)	0.164***	0.068***
	(0.013)	(0.005)
EQI*LAI	0.120***	0.035***
	(0.010)	(0.005)
Fragmentation	0.013	0.009
	(0.014)	(0.014)
LAI*Fragmentation	0.021***	0.007
	(0.004)	(0.006)
EQI*Fragmentation	-0.028***	-0.032***
	(0.004)	(0.004)
EQI*LAI*Fragmentation	-0.020***	-0.033***
	(0.003)	(0.004)
Population density, log	0.006	-0.013
	(0.039)	(0.039)
Area, log	0.054***	0.062***
	(0.016)	(0.011)
Elderly dependency ratio	0.002**	0.002**
	(0.001)	(0.001)
Youth dependency ratio	-0.000	-0.001
	(0.001)	(0.001)
Constant	10.580***	10.620***
	(0.203)	(0.201)
Random effects		
FUA-level variance	0.005	0.006
Area-level variance	0.006	0.008
Region-level variance	0.005	0.005
Mundlak correction	Yes	Yes
Time FE	Yes	Yes
Country FE	Yes	Yes
Log restricted-likelihood	4 886	4 888

Note: *** p<0.01, ** p<0.05, * p<0.1; standard errors in parentheses; restricted maximum likelihood estimation procedure is used (with identity covariance structure); number of observations is 2 904.