Master in Economics

Master's thesis

Institutions and regional development:

An empirical investigation for European regions

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1 Introduction

> "Commerce and manufactures can seldom flourish long in any state which does not enjoy a regular administration of justice, in which the people do not feel themselves secure in the possession of their property, in which the faith of contracts is not supported by law, and in which the authority of the state is not supposed to be regularly employed in enforcing the payment of debts from all those who are able to pay. Commerce and manufactures, in short, can seldom flourish in any state in which there is not a certain degree of confidence in the justice of government."
>
> The Wealth of Nations
> -Adam Smith

Since Adam Smith's *Wealth of Nations* the idea that government's activity would wound economic growth more than it would favor it, has been widely discussed in both economics and politics. While the appealing idea of *lassaiz-faire* has been periodically questioned and even harshly challenged throughout history (presently resulting as a complete utopia), it is now broadly accepted to recognize public institutions to be harmful for economic prosperity when they are corrupted and unable to secure propriety rights. Yet, in the last decades different seminal papers have also posed that good institutional quality would positively affect countries' economic performances (North, 1990; Edquist, 1997).

In this vein, the European Union has engaged quality of institutions as a mean of reduction of regional socioeconomic disparities across the Union. Following the Copenhagen criteria introduced in 2004[1] any European State embracing the values of freedom, democracy, equality, rule of law and respect for human rights, as well as a functioning market economy, may apply to join the EU. As by 2017, the EU Commission even recognized tackling widespread corruption and introducing measures aimed at making government decisions more efficient and transparent,

[1] The criteria was introduced just before allowing for the entrance of Eastern European countries into the EU. At the time such countries were shifting from an authoritarian regime based on a centralized economy to democracy and free market.

to be as important for regional development as physical investments (EU Commission, 2017).

Yet, while programs of public investments such as the Regional Policy allocated almost a third of the total EU Budget, the implementation of institutional reforms aimed at improving institutional quality at both national and regional level, would be arguably relatively less expensive. Accordingly, it is inevitably relevant to determine how much do institutions matter for economic development, in order to conclude whether acting on this factor is a valuable tool for regional development strategies.

In this respect, starting from the theoretical contributions by North (1990), and Edquist (1997), several empirical works have found a positive link between institutional quality and countries economic performance (e.g. Gwartney *et al,* 1999; de Haan and Sturm, 2000; Lundstrom, 2005). Moreover, a subsequent wave of researches particularly highlighted that, among different components of the variable, protection of property rights and rule of law play the most relevant role in generating sustainable growth (Rodrik *et al*, 2004; Acemoglu *et al*, 2005).

Nevertheless, despite the abundance of contributions at the country level, not as much results have been yet delivered addressing regional level analysis on the link between institutional quality and economic development.[2]

In the European regional context, indeed, most of the researchers have approached institutional quality as a channel for factors to impact economic development rather than as a factor *per se*. Crescenzi *et al.* (2016), for instance, found a strong positive relationship between returns of infrastructural investments and quality of regional institutions, while Lasagni *et al.* (2015), explained inter-firms productivity differentials among Italian provinces, through distances in institutional quality scores. More similar to the context of our research, Rodríguez-Pose and Garcilazo (2015) disclose local institutional quality

[2] This lack of contributions was particularly highlighted by Rodríguez-Pose (2013) in a paper in which the author pointed out the importance of inquiring the link between institutional quality and regions' economic performance. That time, contributions were still yet to come on the issue. As by today the number of studies is still moderate.

to be a vital factor determining the rate of returns of Cohesion Policy[3] investments.

While our study is somewhat close to all these three contributions by posing a very much alike empirical question and focusing on quite the same context, it differs in several aspects and tries to fill several gaps in this literature. First, we present a fairly broader and more recent dataset based on regional level observations for the period 2008-2016. Second, we implement the most recent version released of the European Quality of Government index (EQI). Data is plural for a disaggregate analysis of institutional quality components, which entails the chance of delivering more accurate policy implications of the results. Finally, we also implement models which address the potential spatial relationship between institutional quality and economic development.

In accordance with the results from the country-level literature, we found quality of regional institutions to positively affect both regional income per capita and GDP growth rate. Yet, a strong and significant disparity is detected in both economic performances and institutional quality between regions from EU-15[4] countries and New Member States (NMS).[5] The results are robust to different aggregation periods of the dataset. Finally, the analysis of spatial dependence reveals the existence of positive spatial autocorrelation.

The remainder of this work is structured as follows. In Section 2 we briefly discuss the theoretical inspiration for this empirical analysis, as well as present a literature review of the most relevant contributions for our research. The dataset implemented, and its descriptive statistics are presented in Section 3, while the econometric specification of the models considered are posted in Section 4. In Section 5 we discuss the main results of the empirical analysis. Finally, conclusion and policy implications are addressed in Section 6.

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[3] Cohesion Policy is part of Regional Policy that is focused on funding less developed European countries and regions in order to help them to catch up and to reduce the economic, social and territorial disparities that still exist in the EU.

[4] Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, Spain, Sweden, United Kingdom.

[5] Bulgaria, Croatia, Cyprus, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Romania, Slovakia and Slovenia.

2 Institutional quality and economic development

The influence of institutions on economic development was fundamentally neglected by the mainstream of the economic theory. Indeed, the Neoclassical growth models of Solow (1956) and Swan (1956), as well as the endogenous growth approach developed by Romer (1986) and Lucas (1988), tended to merely consider economic growth as the resulting combination of physical capital, labor and technology.[6]

Yet in 1990, economist Douglas North suggested that formal institutions might matter for economic development when transactions among individuals in a society are costly.[7] According to North (1990), institutions shall be thought as the rules of the game in a society or, more formally, as the humanly devised constraints that shape human interaction (North, 1990). Coherently, the major role of institutions would be that of reducing uncertainty by establishing a stable structure for human cooperation. In this prospective, institutions are bound to influence economic performance as they are capable of reducing transaction costs, hence the total costs of production, to different extents in accordance to their quality.[8] Good institutional settings promote economic development by establishing an environment in which transactions occur under trust and order. Property rights are well established, and people do not need to devote a lot of resources to their measurement and enforcement.

Building on North, numerous cross-sectional studies have highlighted that poor institutional quality makes the economic environment less efficient, entailing lower economic standards. States that suffer from high corruption, weak rule of law, and low impartiality are associated with, among other, poorer health (Holmberg and Rothstein, 2012), poorer environmental outcomes (Welsch, 2004), greater income inequality (Gupta *et al*; 2002) and even lower levels of happiness (Veenhoven, 2010). Similarly, and more directly addressing our research question, examples of cross-sectional studies reporting a positive and significant relationship

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[6] To these three factors, Mankiwn *et al.* (1992) add human capital.

[7] The idea however was not purely original. Social scientists such as Tönnies (1887) or Weber (1921), had already stressed the importance of institutions for the effectiveness of public policy and economic development.

[8] A similar mechanism of association between formal institutions and the economy can also be found in Baumol's theory of productive and unproductive entrepreneurship (Baumol, 1996).

between institutional quality scores and per capita income levels, or their growth rates, include Gwartney *et al.* (1999), Haan and Sturm (2000), and Lundstrom (2005).
With respect to panel data analysis, likewise results are presented by researchers Nguyen *et al.* (2018), who embrace a Simulated Generalized Methods of Moments (SGMM)[9] approach in order to inquire the relationship between institutions and economic growth in a sample of 29 emerging economies between 2002 and 2015. They alternatively examine the role of different components of institutional quality (namely control of corruption, government effectiveness and rule of law) on both GDP per capita and GDP growth rate, disclosing positive and statistically significant estimates for each one of these components. Furthermore, and in accordance with the previous contributions by Rodrik (2004), they also find government effectiveness and rule of law to be the most influential features of institutional quality for economic development. Remarkable results are also posted by Khan and Hanif (2018), who analyze the relationship between inflation and economic growth for a dataset of 113 developed and emerging economies over the period 1981–2015. While their contribution is somewhat obliquely related to our investigation, it greatly fits with North's approach, as they find inflation to affect growth only in those economies that have relatively high standards of bureaucratic quality.[10] Their findings hence endorse the argument that sees the institutions as structures aimed at securing transactions among economic agents.

A similar *modus operandi* has been mostly implemented in the European regional context as well. Crescenzi *et al.* (2016) for instance, inquire the link between rates of returns of infrastructural investments and regional quality of institutions, using data from 166 regions between 1995 and 2009. Their research concludes that better institutions lead to higher returns of investments, hence higher economic development, especially when such investments concern brand new public works. Analogously, Lasagni *et al.* (2015) test the relevance of

[9] The Simulated Generalized Methods of Moments gives the researchers the further advantage of estimating the coefficients while controlling for potential endogeneity.

[10] The authors argue that countries with low institutional quality do not observe any significant adverse effects of inflation on output growth. This is because the weak fiscal structure of these countries makes seigniorage tax a feasible choice for meeting their budgetary requirements. By contrast, with improvements on the institutional fronts, the conventional taxes become more feasible and the cost of inflation in terms of output growth loss becomes high.

institutional goodness in explaining firm productivity in 107 Italian provinces between 1998 and 2007. By employing several estimation techniques (OLS, FE, GMM) the authors disclose robust results that ascribe a key role to the local institutional context in determining firms' productivity. Rodríguez-Pose and Di Cataldo (2014), examine the impact of institutional quality on regions' innovative performances, measured as the number of patents application per year. By testing 189 EU regions between 1997 and 2009, they found an 'institutional quality threshold effect' for innovation, according to which policies aimed at improving innovative performance are most likely to be effective in regions with a certain standard of institutional quality. Nistotskaya *et al.* (2015), argue that regions where governments are perceived as impartial and free from corruption, have on average significantly more SMEs, hence a more dynamic economic environment. The effect of institutional quality on entrepreneurship is inquired in their research in a sample of 172 regions from 18 EU countries between 1990 and 2007.
Finally, and more closely related to our study, Rodríguez-Pose and Garcilazo (2015) inquire the relationship between institutional quality and the rates of returns of Cohesion Policy investments in a sample of 169 regions between 1996-2007. The authors argue that both EU investments and institutional quality make a difference for regional economic growth, yet above a certain threshold of expenditure in investments, the institutional standards become the basic factor determining regions' rate of growth.
Lastly, the potential relevance of spatial spillovers in establishing the bond between institutions and economic development has been investigated by Bologna, *et al.* (2016). The authors found improvements in US metropolitan areas institutional quality to produce a total (direct plus indirect) positive effect on economic growth which could be modelled in a Spatial Durbin Model (i.e. spatial dependence in both the dependent and the independent variable). The results of their paper suggest that gains to institutional reforms are not confined to the metropolitan area in which the reforms are enacted.
In conclusion, besides the contributions from purely econometric studies, significant results are also posed by D'agostino and Scarlato (2015), who found a positive link between institutional quality and regional economic performances by constructing a three-sector semi-endogenous growth model with negative externalities related to the social and institutional variables affecting the

innovative capacity of regional economic systems. Particularly, by applying their model on regions from Italy, they find the enhancement of socio-institutional conditions to be more effective for innovation capacity and economic growth in the lowest-ranked regions in terms of institutional and economic development.

3 Empirical framework

3.1 The sample

The sample collected consists of 208 European regions representing the 28 EU member states. The geographical level of disaggregation used for the data is defined in accordance to the Eurostat NUTS 2 regional classification, which broadly corresponds to the first level of administrative subdivision in each country. Two are the main reasons. First, NUTS 2 regions are the geographical level to which the Regional Policy is addressed. Second, these territorial units are particularly meaningful from a policy prospective as they generally have considerable responsibilities in terms of policy implementation. Of course, the NUTS method of classification recognizes a different number of regions within the borders of different countries[11] (i.e. some countries are going to have more observations than others). This feature of the data shall be retained. Throughout the analysis, indeed, particular attention will be devoted to the large heterogeneity that characterizes the EU regional economic development and institutional quality standard. To this purpose, two subgroups of regions will be frequently compared. Following the EU statistical nomenclature, regions belonging to countries that were members of the EU prior to the enlargement of 2004 will be referred to as EU-15, while regions from the newest member states will be labelled as NMS. In our sample, we have 150 regions in the EU-15 group and 58 in the NMS group.

The dataset implemented considers observations from 2008 to 2016, hence entirely capturing the years of the economic crisis as well as the first years of recovery. Such time range was mainly selected due to data constrains for institutional

[11] For instance, because of NUTS 2 classification Belgium has more observations than Hungary even though Belgium geographical surface is about a third of the Hungarian's.

quality in earlier periods that made it impossible to bring in observations prior to 2008. Apart from institutional quality, all the variables considered are drawn from the Eurostat Regional Database[12].

3.2 Dependent variables

Following the existing literature (e.g. Nguyen *et al*; 2018; Osborne, 2006), two dependent variables will be alternatively taken into account: *(i)* regional GDP per capita, and *(ii)* its growth rate. This strategy is embraced with the aim of providing a comprehensive analysis of the effects of institutional quality on both countries' level of development as well as their rate of growth.[13]

Regional income per inhabitant is expressed in Purchasing Power Standards (PPS), i.e. a common currency aimed at eliminating the differences in price levels between countries. This formula has the advantage of allowing for meaningful comparisons of GDP by considering the size of the economy of interest and, avoiding biases due to discrepancies in purchasing power across European countries. Table 1 summarizes some descriptive statistics on the average values of the dependent variables implemented in the model.

The table discloses remarkable differences in the average value of GDP per capita expressed in levels, between and within countries. For instance, a 55 thousand euros gap differentiate Luxemburg's GDP per capita from that of Hungary. Such disparities are also reflected between subgroups when EU-15 and NMS regions averages are compared. Furthermore, several countries also show considerable differences within their territories, as suggested by the remarkably high standard deviations reported for Czech Republic, Slovakia and Ireland. Analogously, significant differences are also encountered when GDP growth rate is considered. In this case, however, the table suggests an inverse trend, with NMS regions growing at a faster rate than EU-15 ones.

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[12] http://ec.europa.eu/eurostat/web/regions/data/database

[13] In this respect, Osborne (2006), particularly suggested that while income levels measure differences between poor and rich countries, the rate of growth operates a distinction between slow- and fast-growing countries. Accordingly, the latter variable would be more suitable to examine changes in the short and medium run.

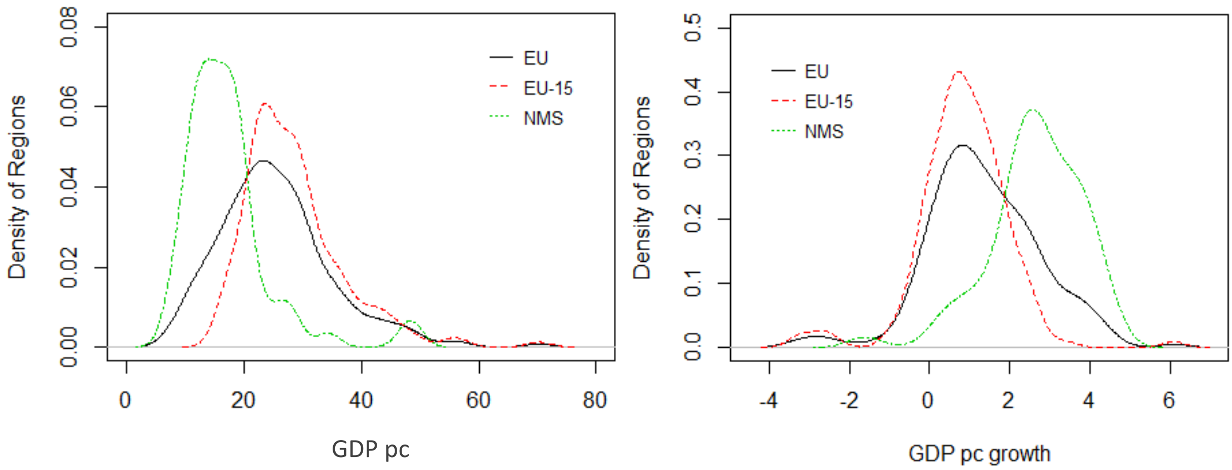
Table 1 Descriptive statistics, 2008-2016

Country (# of NUTS 2 regions)	GDP pc		GDP pc growth		Institutional Quality (EQI)	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Austria (9)	33.66	6.37	1.86	0.56	73.32	2.11
Belgium (10)	27.98	6.24	1.63	0.42	64.17	9.5
Bulgaria (6)	10.90	4.66	2.58	0.69	17.19	10.98
Croatia (2)	15.98	0.65	0.75	0.21	26.15	0.48
Cyprus (1)	24.51		-1.6		54.96	
Czech Republic (8)	22.83	10.21	1.94	0.51	44.46	4.95
Denmark (5)	31.16	7.10	1.44	0.48	84.93	2.41
Estonia (1)	19.21		2.50		54.85	
Finland (6)	31.39	6.93	0.32	0.58	84.68	6.69
France (22)	25.15	5.32	1.03	0.48	63.71	3.83
Germany (16)	31.60	8.85	2.06	0.65	72.05	2.98
Greece (4)	19.85	5.68	-2.75	0.33	30.49	4.06
Hungary (7)	15.54	6.25	2.64	0.88	37.87	3.77
Ireland (2)	33.58	15.56	3.35	3.88	70.96	1.05
Italy (21)	26.65	7.05	0.16	0.61	34.10	14.93
Latvia (1)	16.00		2.6		38.30	
Lithuania (1)	18.39		3.7		40.18	
Luxembourg (1)	70.21		1.2		77.89	
Malta (1)	23.10		3.7		56.00	
Netherlands (12)	33.02	7.36	0.16	1.16	79.18	2.01
Poland (16)	15.77	3.90	3.68	0.58	40.55	2.65
Portugal (5)	20.92	4.71	0.98	0.66	54.72	5.86
Romania (8)	19.96	8.08	2.87	0.51	17.45	5.59
Slovakia (4)	24.42	16.41	2.25	0.31	37.48	1.42
Slovenia (2)	22.68	5.97	0.30	0.14	49.45	0.00
Spain (16)	24.90	5.04	0.03	0.36	54.80	5.40
Sweden (8)	31.67	6.40	0.76	0.32	74.23	23.09
United Kingdom (12)	26.46	7.83	1.13	0.37	70.89	1.74
EU-15 (150)	28.57	8.52	0.84	1.15	62.95	17.63
NMS (58)	17.33	7.89	2.64	1.16	35.48	12.34
Full Sample (208)	25.42	9.75	1.35	1.41	55.29	20.44

GDP pc is expressed in thousands of euros in PPS. GDP pc growth is expressed as a percentage. Institutional quality is expressed in a scale 0-100.

Figure 1 - Kernel density distributions of the dependent variables, 2008-2016

a) GDP pc *b)* GDP pc growth



Nonetheless, differently from what it could have been expected from Table 1, the kernel density plot of GDP per capita is not found to be bimodal. Yet, a more detailed examination of Figure 1*a*, which displays the variable's average distribution between 2008-2016 specified for subgroups, a clear backwardness of NMS regions in terms of income per capita is disclosed. On behalf of that, Figure 1*b* shows instead that these regions have actually been growing at a faster rate during the period examined as it was suggested by the table.

3.3 Institutional quality

Institutional quality is addressed through the European Quality of Government Index (EQI) funded by the European Commission in 2010 and developed by the University of Gothenburg in its redaction of 2010, 2013 and 2017 (Charron *et al*; 2014). Among different indexes measuring institutional goodness, EQI is the only one allowing for analyses at the regional level, that indeed has been only recently addressed among scholars thanks to this database. Furthermore, being specifically designed for EU statistics, EQI has also got the advantage of being naturally referred to the NUTS classification. Accordingly, the index particularly fits the context of this study.

The index identifies institutional quality as a multi-dimensional concept consisting of high impartiality and quality of public service delivery, along with low corruption. Specifically, quality and impartiality of regional institutions are made out of residents' ratings of these two characteristics in the areas of public education and health care system, as well as in law enforcement and in the democratic procedures. Analogously, residents' perception of, and experiences with bribery in those geographical contexts define the index for 'control of corruption'. Then, the three components are aggregated to construct a composite index. All the technical details can be found in the seminal paper by Charron *et al.* (2014). Table 2 shows some descriptive statistics on the institutional quality components. As we expect to find great disparities between NMS and EU-15 regions, the table reports the average value of the variables between 2010 and 2013 specified for subgroups.

Table 2 Institutional quality components, 2010-2013

variable	Full Sample		EU-15		NMS	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Quality	61.057	19.965	65.420	17.944	49.851	20.540
Impartiality	61.134	20.435	65.827	18.561	49.076	20.106
Corruption	59.027	20.787	64.114	18.928	45.960	19.631
Sample size	208		150		58	

The index ranges from -3 to +3, with higher values representing better institutions. Yet, again with the aim of simplifying the interpretation of the estimates, we are going to consider the min-max normalized values of the variable, which are also provided by the dataset, and range from 0 to 100.

Also, because EQI's observations are not as frequent in time as the rest of the variables in the dataset, institutional quality is going to be treated as follows. The data from 2010 will be used for the observations between 2008 and 2013, while the data from 2013 will be used for observations for the period 2014-2016.[14] This

[14] Unfortunately, EQI's data for 2017 cannot be used at this stage, as there is no data available for income after 2016. Yet, the variable will be reported in some of the descriptive statistics.

approach is mainly embraced with the aim of reducing the risk of endogeneity by considering a lagged independent variable into the regression.
Finally, in the cases of Belgium, Sweden and Slovenia, where institutional quality is only reported at NUTS 1 level, the macro areas observations will be repeatedly assigned to the related NUTS 2 units.

Figure 2 – Institutional quality distribution, 2010-2013

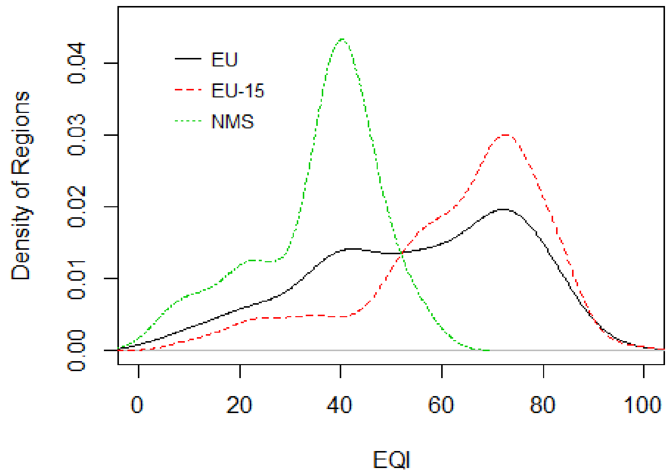
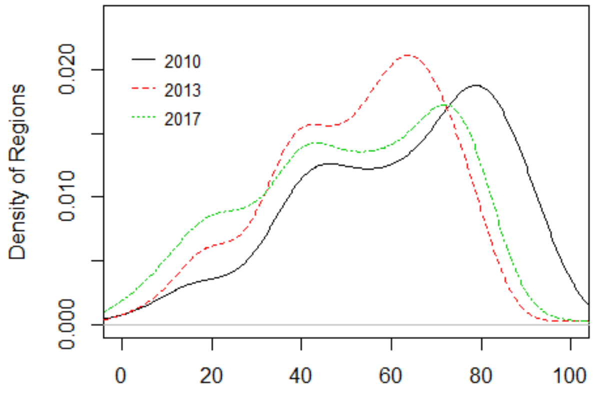


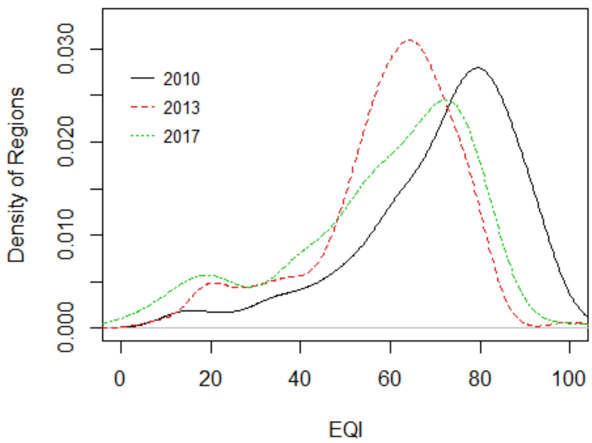
Figure 2 shows the cross-sectional distribution of institutional quality, which takes into account the average score of EQI between 2010 and 2013. The picture displays a bimodal behavior of the variable among European regions. Again, by separating the distributions for subgroups, rather dissimilar patterns for institutional quality in EU-15 and NMS regions are found. While better standards are generally observed among EU-15 observations, it shall also be noticed that there is a slightly higher heterogeneity within such group due to the lower scores recorded in several regions from Italy, Greece and Spain (fat left tail). The overall descriptive statistics specified for each group were presented in Table 1.
With respect to the evolution of the afore mentioned scores, institutional quality emerges as a quite persistent factor over the time. Indeed, by graphically observing the kernel density distribution in Figure 4*a*, which is referred to institutional quality observations from 2010 to 2017, we do not quite point out the attendance of any trend of convergence.

Figure 4 – Institutional quality distribution over time

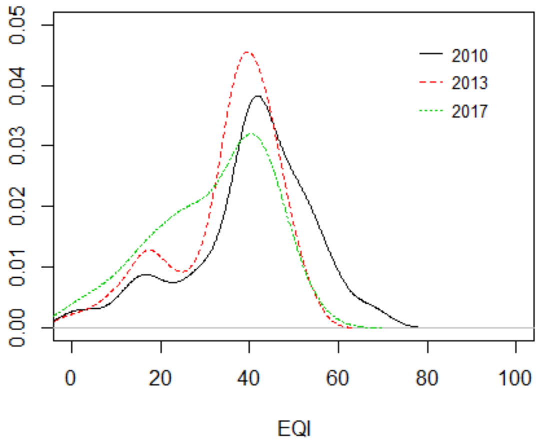
a) Full sample



b) EU-15 sample



c) NMS sample



Uppermost, performing a non-parametric analysis for the equality of the distributions (Li, 1996), we found a significant difference between all the compared densities in most of the cases, which would even suggest the attendance of a slight pattern of worsening of institutional quality. The results of the analysis are presented in Table 3. Still, more convoluted effects arise when splitting the time range into two periods and the full sample into subgroups. Between 2010 and 2013, indeed, a general tendency toward worsening standards among the best performing regions (i.e. EU-15), caused the overall distribution to slightly shift left.

Table 3 Non-parametric tests for the equality of distributions (Li, 1996)

Sample	Null hypothesis	t statistic	p value
Full sample	$f_{2010} = f_{2017}$	9.486	0.000
	$f_{2013} = f_{2017}$	3.446	0.000
EU-15	$f_{2010} = f_{2013}$	4.019	0.000
	$f_{2013} = f_{2017}$	19.195	0.000
NMS	$f_{2010} = f_{2013}$	1.644	0.050
	$f_{2013} = f_{2017}$	0.535	0.296

In all cases the alternative hypothesis is $f_x \neq f_y$ where f_x and f_y are the two distributions under comparison. EU15 and NMS refer to the distributions in figures 4*b*, and 4*c* respectively.

Yet, the same regions have experienced in the following period an inverse tendency of growth towards their offset value. At the time, NMS regions held a fairly stable level of institutional quality from 2010 to 2017[15].

Because the best performing regions in terms of institutional quality are also the ones recording higher levels of GDP per capita, at least a positive correlation between the variables shall be observed. Yet, as it was previously discussed, when observing economic growth, we found an overturned data, with NMS regions growing at a faster rate than EU-15 ones.

In this respect, as we also observe slight changes in institutional quality, a most proper tool for capturing institutional standards could be the variation of institutional quality over time, which would provide a relative measure of the evolution of the variable. Yet embracing this approach coasts the loss of some data: namely, observations from 2008 to 2010 will have to be dropped. The period 2011-2013 will refer to EQI's differential between 2010 and 2013, while from the period 2014 to 2016 the difference between the values of 2013 and 2017 EQI will be applied. Table 4 displays some descriptive statistics of the variable.

[15] In this respect, note that the only case in which we cannot reject the null hypothesis of the Li-test is that of NMS institutional quality distribution between 2013 and 2017, entailing no signifcant differences in the distribution of EQI.

Table 4 Cross sectional EQI differentials over time

ΔEQI	Observations	Mean	Std. Dev	Min	Max
Overall	208	-9.660	6.968	-28.82	7.91
EU-15	150	-11.458	6.232	-28.82	7.91
NMS	58	-5.019	6.661	-18.99	7.34

Observations capture the average change in the value between periods 2010-2013 and 2013-2017.

Remarkably, and in line with the evidences from both Figure 4 and Table 3, Table 4 shows how institutional quality has worsened all over the EU in the period studied. Still, according to the table, the EU-15 regions are those who worsened the most, while the variation has been only half as bad in NMS regions.

Figure 3 – Institutional quality and economic development, 2008-2016

a) GDP pc *b)* GDP pc growth

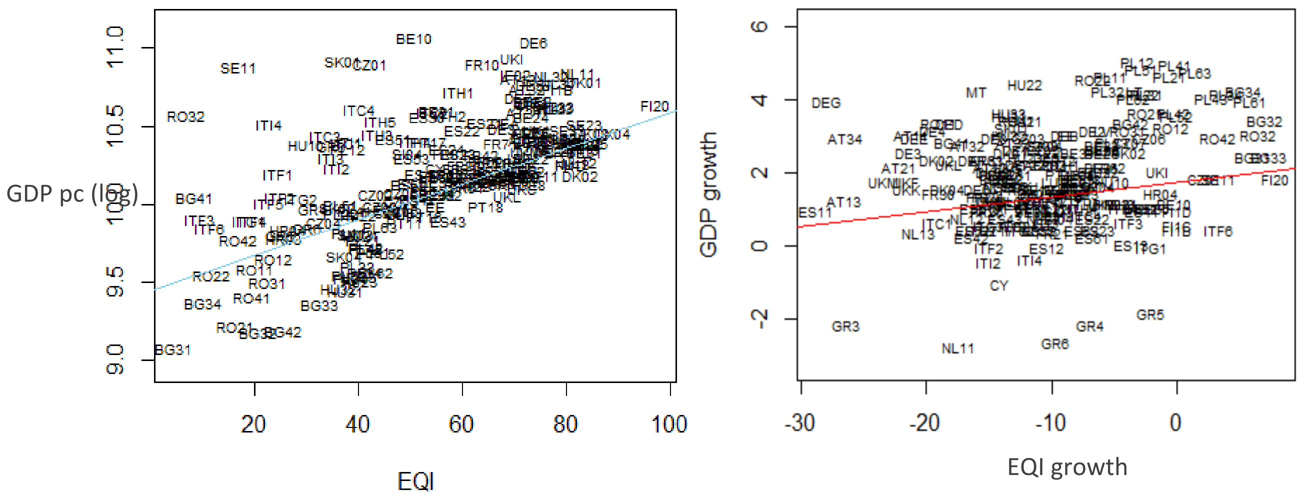


Figure 3 shows a positive correlation for both institutional quality and GDP per capita as well as institutional quality variation and GDP pc growth rate. Coherently with what has been found from the descriptive statistics in Table 3, and in Table 4, the bottom left corner of Figure 3*a* mainly includes NMS regions, with the remarkable exceptions of two regions from southern Italy, (*Campania*

and *Puglia*) while the upper right edge is mostly represented by regions from western European and Scandinavian countries.
Differently, the upper right corner of Figure 3*b* predominantly displays regions from Polonia and Romania (i.e. NMS), leaving Spanish, Austrian but even German and British regions on the left side of the graph.
Unfortunately, the lack of data availability denies the possibility of producing further analysis on potential patterns of convergence for institutional quality in Europe. Indeed, other long-lived indexes reporting institutional quality, such as 'Freedom in the World', 'World Governance' or 'Economic Freedom', do not provide regional data.[16]

3.4 Control variables

The rest of the controls included in the model are selected following the lessons of the neoclassical growth theories and, more properly, of the related empirical contributions from Barro (1991), and Mankiw *et al.* (1992).
This approach was embraced following the wide use of the Solow framework and Barro-type growth equation as a starting point when evaluating other theories in growth empirics (e.g. Durlauf *et al*; 2008; Henderson *et al*; 2012).[17]
The annual rate of R&D investments to GDP is treated as a proxy of technological progress, while labor and physical capital are included into the model through the regional population growth rate and the gross fixed capital accumulation ratio to GDP, respectively. Moreover, as a specification of human capital, the percentage of highly educated workers (i.e. tertiary education) will also be included into the model. The implementation of such variable has become quite common in economic literature at least when developed economies are concerned (e.g. Dettori *et al*; 2012). This strategy, in fact, seems particularly

[16] Nonetheless, the ongoing European political integration process is arguably the most promising political venture in terms of potential perceived quality of government variation in the West. Accordingly, it will deserve further analysis in the near future.
[17] Yet, it is noteworthy to underline that as Durlauf and Quah (1999) argue, the fact that one particular theory could predict economic growth does not discredit other alternative theories as growth drivers. Thus, different baseline models could also have been implemented.

appropriate as *(i)* in most regions the rates of primary and secondary school enrollment would tend to settle on similar levels, and as *(ii)* arguably, tertiary education is most closely related to high value-added economic activities, which characterize the most advanced economies.

Finally, following Crespo-Cuaresma *et al.* (2014), qualitative features are also included into the data through two dummy variables. One specifies whether a region belongs to the NMS subset or not, while the other takes the value of 1 when a region hosts the country's capital city within its borders, and 0 otherwise. As it is partially witnessed by the descriptive statistics reported in Table 1, new and old members states enjoy remarkably different levels of both income and growth. Accordingly, being part of a subset or of the other might play a relevant role in defining the relationship between regions' institutional quality and the level of economic development. Similarly, recalling that countries' capital cities are generally a suitable environment for companies' economic activities because of urban agglomeration, this qualitative characteristic shall also be expected to have a considerable role in explaining regional economic development. Table 5 displays some descriptive statistics referred to the control variables specified for subgroups. The statistics reported refer to the average values of the observations between 2008 and 2016.

Table 5 Control variables descriptive statistics, 2008-2016.

variable	Full Sample		EU-15		NMS	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Population growth	0.207	0.603	0.379	0.473	-0.232	0.677
Education	26.539	8.751	28.441	8.585	21.655	7.191
R&D investment	1.489	1.076	1.761	1.100	0.792	0.598
Physical capital	21.618	3.647	21.086	3.270	22.853	4.874
Sample size	208		150		58	

4 Econometric strategy

The previous sections on the literature framework and variable description suggested that good institutional quality improves economic output levels and growth rates. Mindful of this general research proposition, we are going to examine this relationship by testing the annual panel data for the period 2008-2016 with a series of panel regressions following these general models.

$$\ln(GDP_{it}) = \beta_0 + \beta_1 EQI_{it} + \beta_2\, GR.POP_{it} + \beta_3 EDU_{it} + \beta_4\, KAP_{it} + \beta_5\, R\&D_{it} + \alpha_i NMS + \alpha_i CapCity + u_{it} \quad (1)$$

$$GR.GDP_{it} = \beta_0 + \beta_1 \Delta EQI_{it} + \beta_2\, GR.POP_{it} + \beta_3 EDU_{it} + \beta_4\, KAP_{it} + \beta_5\, R\&D_{it} + \beta_6\, GDP_{it_0} + \alpha_i NMS + \alpha_i CapCity + u_{it} \quad (2)$$

Following the existing literature, Equation 1 considers the dependent variable, GDP, as the logarithmic transformation of the regional income per capita, while the index of institutional quality, EQI, is alternatively modelled as institutional quality itself, or as one of its individual components (i.e. quality, impartiality and control of corruption). The rest of controls as well as the two dummy variables, stick with their description of Section 3.4, and are implemented in both Equation 1 and Equation 2. This latter equation considers instead, the lagged value of regional GDP per capita growth rate as dependent variable, institutional quality variation, or the variation of its components, as main explanatory variable, and the rest of the previously discussed controls plus the logarithmic transformation of the initial level of regional income. This additional variable is included in the equation following the empirical literature on growth models' estimations (e.g. Mankiw *et al*; 1992). Basically, the variable keeps region *i*'s GDP per capita constant at its level of 2008.

In this framework, the following specifications are going to be examined. Model 1 will address the relationship between the dependent and the main independent variable only. The regression will then be integrated with the rest of the controls in Model 2, and the dummies in Model 3.

This latter model in particular will also be addressed for the analysis of spatial dependence between the variables. Previous evidences from the US local context (Bologna *et al*; 2015), indeed, have highlighted the importance of spatial spillovers in the relationship between economic development and institutions. Because the presence of un-attended spatial spillovers in the data might produce non-robust estimates, testing for the existence of spatial dependence in our model is highly advisable. In this respect a spatial panel approach is embraced. The panel version of the LM tests introduced by Anselin *et al.* (1996) assessing the existence of spatial dependence in spatial autoregressive (SAR) and spatial error (SEM) models, will be performed. SAR and SEM models take the form of Equation 3 and Equation 4 respectively.

$$y_{it} = \rho W y_{jt} + X\beta + \varepsilon \tag{3}$$

$$y_{it} = X\beta + u_{it}, \qquad \text{with} \qquad u_{it} = \lambda W u_{jt} + \varepsilon \tag{4}$$

Yet, the specification of these spatial models for their assessment entails the construction of a matrix of spatial weights (W), which describes the neighboring relationship between regions. In particular, we build the matrix following the 'k-nearest-neighbors' criterion, which considers the k closest[18] regions to the geographical unit of interest as the neighbors. Accordingly, such regions will be entered in the W matrix as 1, while the others will take the value of 0. Moreover, following the convention, we 'row normalize' the entries such that the rows of the W matrix will all sum to one. Because EU NUTS 2 regions have generally three to seven contiguous regions, we set k=5 as a rule of neighboring. Finally, because spatial analysis requires balanced panels, observations from Northern Finland and Estonia will have to be dropped for the implementation of this analysis because of the high number of missing values in several variables.

5 Results

5.1 GDP per capita

In this section we consider the regressions ran implementing the logarithmic transformation of regional income per capita as dependent variable (i.e. Equation 1).

[18] Region's geographical position is described by considering the coordinates of the capital city of the region itself or of its major economic center.

According to the hypothesis previously discussed, we shall expect to observe positive estimates for institutional quality (North, 1990) and education (Dettori *et al*; 2012). Following the neoclassical growth theory, the rate of R&D investments to GDP, meant as a proxy of technical innovation, is also expected to positively affect regional income, as it is the 'capital city' dummy variable (Cuaresma *et al*; 2012). Being part of the NMS subgroup is instead expected to exert a negative feedback, while it is more difficult to forecast the estimates for the other controls, namely population growth rate and gross fixed capital accumulation, as the literature has shown that these features are generally more effective in developing countries (e.g. Khan and Hanif, 2018).

Table 6 reports the specification tests for panel models. We find fixed effects to be the best fitting estimator for our regression.

Table 6 Best fitting estimator for GDP per capita

	LM test	F test	Hausman test
Null Hypothesis	$OLS\ vs\ RE$	$OLS\ vs\ FE$	$RE\ vs\ FE$
Test value	71.1***	243.3***	1911.7***

*** significant at 1% level; ** significant at 5% level; * significant at 10% level.

Nonetheless, Table 7 shows the results for both the regressions in pool OLS and random effects, in addition to these attained in fixed effects.

In all but one specification we found positive and statistically significant estimates for institutional quality. When controlling for random effects, indeed, we found a one point percent increase in the quality of institutions to reduce regional income per capita of about 0.1%. Nevertheless, this controversial result is contrasted by the regressions in both pool OLS and fixed effects, which found positive and statistically significant estimates for institutional quality in line with our hypothesis. Moreover, the pool OLS estimation found the rest of the explanatory variables to comply with our expectations as well. Positive estimates are found for population growth rate, investments and education. The levels of physical

Table 7 Estimation results for GDP per capita

	Dependent variable: GDP pc (log)				
	Pool OLS			Random effects	Fixed effects
Variable	Model 1	Model 2	Model 3	Model 3	Model 3
Intercept	9.473***	9.424***	9.515***	9.727***	
	(0.022)	(0.123)	(0.112)	(0.074)	
Institutional quality	0.010***	0.005***	0.005***	-0.001***	0.002***
	(0.0003)	(0.001)	(0.0003)	(0.0005)	(0.0006)
Population growth rate		0.113***	0.898***	0.011***	0.011***
		(0.019)	(0.016)	(0.003)	(0.004)
Education		0.011***	0.005**	0.014***	0.0016
		(0.002)	(0.002)	(0.001)	(0.001)
Physical capital		-0.004	-0.000	0.003***	0.004***
		(0.005)	(0.001)	(0.001)	(0.001)
R&D investment		0.088***	0.073***	0.033***	0.011
		(0.021)	(0.006)	(0.011)	(0.007)
NMS			-0.202***	-0.344***	
			(0.036)	(0.048)	
Capital city			0.307***	0.212***	
			(0.061)	(0.071)	
Fixed effects	no	no	no	no	yes
Time effects	no	no	no	no	yes
R^2	0.304	0.550	0.640	0.420	0.124
F- statistic	812.45***	451.79***	46.80***	190.72***	46.23***
Observations	1863	1850	1850	1850	1850

*** significant at 1% level; ** significant at 5% level; * significant at 10% level. Robust standard errors in parenthesis.

Capital accumulation have no significant effects, while remarkable explanatory power is reserved to the two dummy variables, which are in line with our predictions too. Yet ostensibly, when further controls for individual and time effects are included, less straightforward results appear. The fixed effects specification in fact, shows that, while the estimate for quality of institutions is still significant and exhibits the correct sign, no significant impact is found neither for education nor for the rate R&D investment to GDP.

A similar tendency is observed when institutional quality components are considered into the regression, as it is presented in Table 8. Here again, appealing results are posed by the pool OLS estimation, while none of the components is found to be statistically significant when controlling for two-ways fixed effects. Remarkably, as we increase the number of effects to which we control for, from pool OLS to random effects, and from random effects to fixed effects, the model loses explanatory power, and so it does institutional quality, whose outcome seems to be absorbed by such controls. This behavior might be due to the particular composition of the dataset, which we have forced to considered repeated observations of institutional quality over time.

Because of their structure, institutional quality components are most likely to be correlated within each other. Hence, in order to avoid multicollinearity, the components are modelled into the regression analysis one at the time. The results do not really disclose any component to be more influential than the others. The coefficient for 'quality', 'impartiality' and 'control of corruption', indeed, are quite close to each other's across estimation methods.

With respect to the controls, the estimates present fairly similar results to those from the previous analysis, hence mostly in line with our hypotheses.

Table 8 Disaggregate level analysis of institutional quality for GDP per capita.

	Dependent variable: GDP pc (log)								
	Pool OLS			Random effects			Fixed effects		
variable	Model 3	Model 3	Model 3	Model 3	Model3	Model 3	Model 3	Model 3	Model 3
Intercept	9.447***	9.475***	9.481***	9.563***	9.554***	9.544***			
	(0.109)	(0.113)	(0.110)	(0.055)	(0.057)	(0.059)			
Quality	0.007***			0.0004*			0.0002		
	(0.001)			(0.0002)			(0.0002)		
Impartiality		0.006***			0.0006*			-0.000	
		(0.0008)			(0.0003)			(0.0004)	
C. Corruption			0.006***			0.0008*			-0.0002
			(0.001)			(0.0004)			(0.0004)
Population growth rate	0.078***	0.087***	0.086***	0.013***	0.013***	0.013***	0.010***	0.010***	0.010***
	(0.015)	(0.0016)	(0.015)	(0.004)	(0.004)	(0.004)	(0.003)	(0.003)	(0.003)
Education	0.004*	0.004*	0.003	0.016***	0.016***	0.016***	0.001	0.001	0.001
	(0.002)	(0.002)	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Physical capital	-0.000	0.000	0.001	0.003***	0.003***	0.003***	0.004***	0.004***	0.004***
	(0.004)	(0.003)	(0.004)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
R&D investment	0.071***	0.074***	0.074***	0.031***	0.030***	0.029***	0.011	0.012	0.011
	(0.015)	(0.015)	(0.016)	(0.010)	(0.010)	(0.010)	(0.007)	(0.007)	(0.007)
NMS	-0.214***	-0.212***	-0.205***	-0.302***	-0.300***	-0.296***			
	(0.034)	(0.036)	(0.030)	(0.044)	(0.044)	(0.045)			
Capital city	0.325***	0.308***	0.338	0.220***	0.220***	0.224***			
	(0.061)	(0.062)	(0.060)	(0.068)	(0.068)	(0.068)			
Fixed effects	no	no	no	no	no	no	yes	yes	yes
Time effects	no	no	no	no	no	no	yes	yes	yes
R^2	0.658	0.647	0.650	0.414	0.413	0.413	0.106	0.106	0.106
F- statistic	505.07***	480.45***	486.37***	185.43***	184.55***	184.59***	38.74***	38.48***	38.67***
Observations	1841	1841	1841	1841	1841	1841	1841	1841	1841

*** significant at 1% level; ** significant at 5% level; * significant at 10% level. Robust standard errors in parenthesis.

Finally, as a further control for the goodness of the relationship between institutional quality and GDP per capita, we center the analysis on the potential spatial dependence of the model in the dependent variable as in the error term. To this purpose the panel version of the LM tests introduced by Anselin *et al.* (1996) assessing the existence of spatial dependence in spatial autoregressive (SAR) and spatial error (SEM) models, are performed. The results are presented in Table 9.

Table 9 LM tests GDP per capita models

	LM test in SAR	LM test in SEM
Null hypothesis	$\rho = 0$	$\lambda = 0$
LM value	26.38***	149.26***

*** significant at 1% level; ** significant at 5% level; * significant at 10% level.

In both cases, the null of no spatial effect in the dependent variable, and in the error term respectively, can be rejected.[19] Accordingly, both the SAR and the SEM are preferred to the pool OLS regression, meaning the attendance of spatial dependence both in the dependent variable and in the error term. As a further control, the regressions are also run considering random and fixed effects.

The results are posted in Table 10. In line with the findings previously presented, institutional quality is again positively affecting regional income. Particularly, fixed effects regressions found a point percentage increase in EQI to improve GDP per capita of about a 0.4%, in both the SAR and the SEM. The control variables also keep complying with our predictions despite the estimator implemented.

[19] Spatial autoregressive (SAR) models take the form of $y_{it} = \rho W y_{jt} + X\beta + \varepsilon$, being i the region of interest, j its neighboor and W the matrix of spatial weights. Accordingly, setting $\rho = 0$, means denying the attendence of spatial dependence in the dependent variables. The same happens in SEM models, which take instead the form of $y = X\beta + u$, with $u_{it} = \lambda W u_{jt} + \varepsilon$, when λ is tested equal to 0.

Table 10 Spatial analysis estimation results for GDP per capita

	Dependent variable: GDP pc (log)					
	SEM			SAR		
	Pool OLS	Random effects	Fixed effects	Pool OLS	Random effects	Fixed effects
Variables	Model 3	Model 3	Model 3	Model 3	Model 3	Model 3
Intercept	9.270***	2.022***		4.793***	9.872***	
	(0.038)	(0.028)		(0.031)	(0.098)	
Institutional quality	0.006***	-0.0001	0.004***	0.003***	0.0004	0.004***
	(0.0003)	(0.0001)	(0.0003)	(0.0002)	(0.0002)	(0.0003)
Population growth rate	0.062***	0.007***	0.053***	0.060***	0.009***	0.070***
	(0.006)	(0.001)	(0.005)	(0.006)	(0.001)	(0.006)
Education	0.011***	0.004***	0.013***	0.005***	0.002***	0.008***
	(0.001)	(0.0003)	(0.001)	(0.001)	(0.0005)	(0.001)
Physical capital	0.003***	0.002***	-0.0003	0.001	0.001**	-0.0004
	(0.001)	(0.0003)	(0.001)	(0.001)	(0.0003)	(0.001)
R&D investment	0.028***	0.007*	0.051***	0.048***	0.005	0.055***
	(0.005)	(0.004)	(0.006)	(0.005)	(0.004)	(0.006)
NMS	-0.080***	-0.157***		-0.127***	-0.144***	
	(0.012)	(0.34)		(0.013)	(0.041)	
Capital City	0.384***	0.480***		0.410***	0.500***	
	(0.015)	(0.045)		(0.016)	(0.040)	
Fixed effects	no	no	yes	no	no	yes
Time effects	no	no	yes	no	no	yes
ρ				0.480***	0.549***	0.411***
λ	0.708***	0.783***	0.669***			
Observations	1845	1845	1845	1845	1845	1845

*** significant at 1% level; ** significant at 5% level; * significant at 10% level. Standard errors in parenthesis.

5.2 Growth rate of GDP per capita

In this Section, the analysis is performed considering regional GDP per capita growth rate as dependent variable. As it was previously discussed, regional income growth rate presents a completely different distribution compared to GDP per capita, with the NMS regions growing (on average) at a faster rate than the EU-15 ones. In this respect, as it was motivated in Section 3.2, institutional quality variation over time is addressed as a measure of institutional goodness. Analogously, the disaggregate analysis of institutional quality is also implemented considering the components variation over time.

Table 11 reports the results for the specification tests for panel models, which found again fixed effects to be the best fitting estimator for this regression. Yet again, the results for the pool OLS and random effects estimations are also going to be presented in Table 12.

Table 11 Best fitting estimator for GDP growth rate

	LM test	F test	Hausman test
Null Hypothesis	$OLS\ vs\ RE$	$OLS\ vs\ FE$	$RE\ vs\ FE$
Test value	-0.873	4.482***	224.01***

*** significant at 1% level; ** significant at 5% level; * significant at 10% level

Positive estimates for institutional quality differentials, education and R&D investment shall still be expected. In accordance with the theory of beta convergence[20], the initial level of regional income per capita is awaited to exert a negative impact on the dependent variable, while opposite results shall now be observed for the NMS dummy. In fact, because of the previously discussed data characteristics, the variable might either have no influence on GDP growth, or even be affecting it positively.

[20] It is one of the implication of the Solow Model, suggested by according to which developed economies grow at a slower rate than the developing ones.

Table 12 Estimation results for GDP per capita growth rate

	Dependent variable: GDP pc growth rate					
	Pool OLS			Random effects	Fixed effects	
Variable	Model 1	Model 2	Model 3	Model 3	Model 3	Model3
Intercept	2.435***	5.458***	1.803	1.803		
	(0.105)	(2.084)	(2.524)	(2.335)		
Δ Institutional quality	0.043***	0.050***	0.044***	0.044***	0.047***	-0.014
	(0.011)	(0.011)	(0.010)	(0.012)	(0.018)	(0.015)
Population growth rate		-0.764***	-0.774***	-0.774***	-0.947***	-0.859***
		(0.115)	(0.101)	(0.110)	(0.142)	(0.138)
Education		-0.003	-0.009	-0.009	-0.080*	-0.102*
		(0.014)	(0.012)	(0.012)	(0.042)	(0.059)
Physical capital		0.074***	0.066***	0.066***	-0.026	-0.088
		(0.018)	(0.020)	(0.019)	(0.066)	(0.075)
R&D investment		0.095	0.177*	0.177*	0.687	-0.920*
		(0.111)	(0.096)	(0.099)	(0.662)	(0.516)
Initial GDP pc (log)		-0.443**	-0.099	-0.099		
		(0.373)	(0.246)	(0.224)		
NMS			0.999***	0.999***		
			(0.215)	(0.265)		
Capital City			0.701**	0.701**		
			(0.275)	(0.347)		
Fixed effects	no	no	no	no	yes	yes
Time effects	no	no	no	no	no	yes
R^2	0.013	0.082	0.105	0.105	0.057	0.081
F- statistic	16.10***	18.34***	18.06***	18.06***	10.293 ***	14.97***
Observations	1245	1232	1232	1232	1232	1232

*** significant at 1% level; ** significant at 5% level; * significant at 10% level. Robust standard errors in parenthesis.

The pool OLS estimation, as well as the regression performed with random effects, found most of the control variables to be in line with our expectations. The initial level of income per capita negatively affects GDP growth rate, while the NMS dummy variable, together with physical capital, R&D investments and the other dummy, is now found to be positively affecting economic growth.

The positive bond between institutional quality and the dependent variable is corroborated in five out of six regressions. Yet, as it was discussed in the previous section, once again, by increasing the number of effects to which we control for, institutional quality loses significance. The two-ways fixed effects, indeed, shows institutional quality variation over time to have no significant impact on GDP growth, while when the same regression is performed dropping time effects, we found that a marginal increase in institutional quality improves GDP growth by 0.05 points percentage.

Table 13 shows really similar results in the analysis of institutional quality components, which are found to be not statistically significant when the two-way fixed effects are implemented, yet positively affecting growth when time effects are dropped.[21] Differently from the related results presented in the previous section, we now found component's coefficients to be fairly different between each other. Particularly, 'quality' and 'impartiality' are found to be more influential than 'control of corruption' in determining regional income growth rate, regardless of the estimation methods. Being these two features of the index the closest to the concept of rule of law and government effectiveness, we found this result to be particularly coherent with the existing literature.

Again, most of the estimates for the control variables comply with our predictions.

[21] Due to space constraints Table 13 only shows the results of the estimation with countries fixed effects.

Table 13 Disaggregate level analysis of institutional quality for GDP growth rate

	Dependent variable: GDP pc growth rate								
	Pool OLS			Random effects			Fixed effects		
variable	Model 3	Model 3	Model 3	Model 3	Model 3	Model 3	Model 3	Model 3	Model 3
Intercept	2.255	2.200	1.936	2.255	2.200	1.934			
	(2.372)	(2.419)	(2.403)	(2.363)	(2.410)	(2.540)			
Δ Quality	0.041***			0.041***			0.058***		
	(0.007)			(0.007)			(0.011)		
Δ Impartiality		0.017**			0.017**			0.024*	
		(0.008)			(0.008)			(0.012)	
Δ C. Corruption			0.010			0.001			0.007
			(0.008)			(0.021)			(0.011)
Population growth rate	-0.773***	-0.761***	-0.745***	-0.773***	-0.761***	-0.745***	-0.997***	-0.923***	-0.879***
	(0.111)	(0.113)	(0.112)	(0.111)	(0.113)	(0.247)	(0.141)	(0.141)	(0.140)
Education	-0.016	-0.002	0.006	-0.016	-0.002	-0.166	-0.196***	-0.054	0.039
	(0.013)	(0.012)	(0.012)	(0.013)	(0.012)	(0.012)	(0.041)	(0.038)	(0.031)
Physical capital	0.069***	0.064***	0.065***	0.069***	0.064***	0.065***	0.002	-0.011	0.010
	(0.019)	(0.019)	(0.019)	(0.018)	(0.023)	(0.021)	(0.080)	(0.076)	(0.068)
R&D investment	0.223**	0.182*	0.167	0.223**	0.182*	0.167*	0.812	0.761	0.837
	(0.099)	(0.105)	(0.118)	(0.099)	(0105)	(0.096)	(0.643)	(0.691)	(0.667)
Initial GDP pc (log)	-0.156	-0.179	-0.159	-0.156	-0.179	-0.159			
	(0.231)	(0.236)	(0.235)	(0.230)	(0.235)	(0.247)			
NMS	1.038***	1.082***	1.107***	1.038***	1.082***	1.107***			
	(0.258)	(0.264)	(0.265)	(0.257)	(0.263)	(0.215)			
Capital City	0.825***	0.644*	0.609**	0.825**	0.644*	0.609*			
	(0.351)	(0.358)	(0.360)	(0.349)	(0.357)	(0.276)			
Fixed effects	no	no	no	no	no	no	yes	yes	yes
Time effect	no	no	no	no	no	no	no	no	no
R^2	0.1167	0.097	0.094	0.122	0.097	0.094	0.088	0.053	0.046
F- statistic	21.31***	16.58***	15.92***	21.315***	16.57***	15.92 ***	16.45***	9.54***	8.25***
Observations	1232	1232	1232	1232	1232	1232	1232	1232	1232

*** significant at 1% level; ** significant at 5% level; * significant at 10% level. Robust standard errors in parenthesis.

Finally, the analysis of spatial dependence is again undertaken. The LM test discloses the attendance of spatial dependence in both the error term and the dependent variable. Accordingly, the SEM and SAR are again preferred to the pool OLS estimation.

Table 14 LM tests GDP growth rate models

	LM test in SAR	LM test in SEM
Null hypothesis	$\rho = 0$	$\lambda = 0$
LM value	4.564***	32.759***

*** significant at 1% level; ** significant at 5% level; * significant at 10% level.

Institutional quality rate of variation is still found to improve economic growth in all the regressions posted in Table 15. Furthermore, the magnitude of its effect on the dependent variable is quite in line with the results displayed in Table 12. Analogously, the rest of the expiatory variables also disclose consistent coefficients with the results previously discussed. The SEM model found the initial level of regional GDP per capita, as well as the rate of growth of regional population, to be negatively affecting economic growth regardless of the estimator implemented. Similarly, and again coherently with the results from both Table 12 and 13, the two dummies are exerting a positive effect on the dependent variable as it also happens with physical capital and the rate of R&D investments in the fixed effects SEM model.

Table 15 Spatial analysis estimation results for GDP growth rate

	Dependent variable: GDP growth rate					
	SEM			SAR		
	Pool OLS	Random effects	Fixed effects	Pool OLS	Random effects	Fixed effects
Variables	Model 3	Model 3	Model 3	Model 3	Model 3	Model 3
Intercept	9.112***	8.997***		0.776	0.498	
	(3.134)	(3.358)		(2.443)	(2.670)	
Δ Institutional quality	0.018*	0.018*	0.049***	0.021**	0.020**	0.019*
	(0.010)	(0.010)	(0.011)	(0.008)	(0.008)	(0.008)
Population growth rate	-0.559***	-0.565***	-0.801***	-0.459***	-0.482***	-0.482***
	(0.095)	(0.096)	(0.110)	(0.083)	(0.084)	(0.083)
Education	0.007	0.006	-0.005	-0.002	-0.003	-0.003
	(0.015)	(0.016)	(0.015)	(0.009)	(0.010)	(0.010)
Physical capital	0.032*	0.027	0.070***	0.032**	0.026	0.026
	(0.017)	(0.018)	(0.021)	(0.016)	(0.017)	(0.021)
R&D investment	0.063	0.061	0.315****	0.129*	0.131	0.131
	(0.081)	(0.086)	(0.108)	(0.077)	(0.085)	(0.085)
Initial GDP pc (log)	-0.805**	-0.782**		-0.084	-0.046	
	(0.322)	(0.345)		(0.247)	(0.271)	
NMS	0.663***	0.672***		0.565***	0.577***	
	(0.199)	(0.214)		(0.179)	(0.198)	
Capital City	0.876***	0.872***		0.410*	0.402***	
	(0.260)	(0.278)		(0.224)	(0.247)	
Fixed effects	no	no	yes	No	no	yes
Time effects	no	no	yes	no	no	yes
ρ				0.065***	0.656***	0.655***
λ	0.667***	0.670***	0.056			
Observations	1230	1230	1230	1230	1230	1230

*** significant at 1% level; ** significant at 5% level; * significant at 10% level. Standard errors in parenthesis.

5.5 Robustness checks

Three main techniques are employed to check for the robustness of the estimates. On the one hand, the regressions are run on a reduced panel data attained by merging the original data into three periods (namely 2008-2010, 2011-2013, 2014-2016). On the other, the values of institutional quality from 2010 are kept for all the observations in order to control for the potential attendance of a problem of endogeneity due to reverse causality. The feasibility of such issue has been especially highlighted by Fedderke (2001), who constructed a growth model in which property rights were the institutional feature affecting economic growth. He suggested that an interdependence between institutional and economic development might exist, as according to his study these two features might be mutually determining each other.

In all of these cases, we found the estimates for institutional quality to be positive and statistically significant at the 1% level. Similarly, reproducing the specification from Equation 2 on the reduced panel data, we corroborate the findings presented in Section 5.2 as well. The results are presented in Appendix A.

Finally, with respect to the spatial analysis, the same regressions are performed implementing different neighboring rules, namely setting k=3 and k=7. In both cases we show robust results regardless of the different constructions of the matrix of spatial weights. These latter results are contained in Appendix B.

6 Conclusions and final remarks

Different specification and different variables have been implemented throughout the dissertation with the aim of inquiring how much do institutions matter for regional economic development. The findings presented largely supported North's (1990) proposition according to which institutions drive countries' economic performances, hence resulting as a valuable tool for achieving regional progress and convergence. Particularly, through a fixed effects regression we found one point percentage increase of institutional quality to improve regional GDP per capita of about 0.2% in the European regional context.

To give a sense of the size of this variation it shall be highlighted that, for instance, a point percentage increase in institutional quality in the Valencian Autonomous Community would produce, *ceteris paribus*, an increase in income per capita of about € 442, given its conversion to PPS. This would basically consist of € 2 million increase in the overall region's GDP according to the latest census statistics of the area. Similarly, a one point improvement in the institutional quality variation is estimated to boost economic growth by around 0.06 points percentage *ceteris paribus*.

These results are coherent with the previous findings from Rodriguez-Pose *et al.* (2015) and Crescenzi *et al.* (2016), which pointed out in both cases how regional institutions in Europe are a key shaper of economic performance. As both their works have highlighted that better institutions are corresponded by higher returns of investments for cohesion policy expenditures and infrastructural spending respectively, we now confirm the relevance of institutional quality as an instrument for regional economic development *per se* in a more recent period of time. In any case, it might be concluded that this line of the empirical research is unanimously indicating that "institution-building" needs to be put at the top of the European development agenda. Let's consider, for instance, that according to this study, if the lowest-ranked economy in the EU, that is the Hungarian region of *Severozapaden*, would accomplish to get to the Scandinavian standard of institutional quality, its GDP per capita would increase of € 1.427, hence improving its actual condition about 20%.

Accordingly, policies aimed at improving institutional quality should be especially considered for EU regional development strategies. Furthermore, in accordance with different researchers (e.g. Rodrick, 2004), our study especially reveals that quality and impartiality in public services delivery and in law enforcement, are the most influential feature in citizens' perception of the quality of institutions.

In this respect, starting from our findings, yet following the existing literature, some policy advises aimed at improving regional economic performances through institutional quality, might be presented. For instance, following the seminal paper by Tiebout (1956), Alesina (2003) suggested that subnational administrations exerting their powers in smaller territories, generally have to deal with less heterogeneous individual preferences. This feature would allow local governments to supply public policies that are closer to residents' preferences, hence improving citizens' rates of satisfaction for institutional quality. To this extent, institutional reforms aimed at decentralizing the executive power and at establishing a clearer separation of the duties between central and local governments, should be encouraged. Similarly, Padovano *et al.* (2009) found higher competitiveness in the political market to improve the quality of local institutions. Thus, measures aimed at improving democratic competitiveness and alternation between political forces, such as setting limits to the mandates of regional governors, might be considered as well.

It is important to remark that many improvements in this direction could be accomplished since, as by now, not many countries in the EU, and in the NMS subgroup especially, are complying with measures of this kind.

Furthermore, the results attained with the spatial panel approach reveal the attendance of positive feedback effects, implying the presence of virtuous reciprocals influences within neighborhoods' institutions.

Finally, as a conclusive remark some of the weaknesses of this project shall be highlighted as well. A main concern is that, in spite of the precautions taken, the model might have not overcome the potential problem of endogeneity due to reverse causality in the relationship between institutions and economic development. In this respect an interesting pattern for future contributions would be that of including an instrumental variable into the regressions presented. Nonetheless, because of limited data availability and because of the difficulty of finding an instrument affecting the independent but not the dependent variable in this context, the task has yet not been undertaken. Accordingly, this might be a promising direction for further contributions in this topic.

Still, we consider having contributed to the existing literature with this research, as we provide a comprehensive outlook of the effect of regional quality of institutions on economic development, showing that institutions shall be thought not always as the provider, but also as the object of public policies.

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Appendix A. Alternative panel aggregations and use of lagged value for institutional quality

Table A – Robustness checks for panel models.

Dependent variable:	GDP per capita (log)			GDP growth rate
intercept	9.458***	9.604***	9.591***	-2.327
	(0.113)	(0.074)	(0.075)	(4.181)
Institutional Quality (lagged)	0.006***	0.0036***	0.004***	
	(0.001)	(0.0006)	(0.001)	
Δ Institutional Quality				0.022*
				(0.011)
Population growth rate	0.855***	0.114***	0.112***	-0.337
	(0.016)	(0.018)	(0.022)	(0.212)
Education	0.003	0.003**	0.002	0.010
	(0.002)	(0.0016)	(0.001)	(0.013)
Physical Capital	0.0004	0.005*	0.006	0.042*
	(0.004)	(0.0027)	(0.005)	(0.022)
R&D investments	0.069***	0.05***	0.045***	0.090
	(0.016)	(0.127)	(0.016)	(0.116)
Initial GDP pc (log)				0.290
				(0.432)
NMS	-0.189***	-0.361***	-0.347***	1.834***
	(0.036)	(0.033)	(0.048)	(0.300)
Capital City	0.336***	0.381***	0.368***	-0.479
	(0.062)	(0.374)	(0.066)	(0.342)
Lagged Institutional Quality	yes	no	yes	no
Reduced panel data	no	yes	yes	yes
R^2	0.657	0.670	0.661	0.255
F statistic	504.99***	151.26***	147.76***	14.82***
Observations	1845	537	537	354

*** significant at 1% level; ** significant at 5% level; * significant at 10% level. Robust standard errors in parenthesis

Appendix B. Alternative specifications for the spatial matrix

Table B.1 Robustness check for spatial panel analysis - Regional GDP per capita

	Dependent variable: GDP per capita (log)			
	SAR		SEM	
Variables	*k*=3	*k*=7	*k*=*3*	*k*=7
Intercept	5.558 ***	4.681***	9.258***	9.285***
	(0.031)	(0.031)	(0.037)	(0.039)
Institutional quality	0.004***	0.003***	0.005***	0.006***
	(0.001)	(0.0002)	(0.0003)	(0.0003)
Population growth rate	0.066***	0.059***	0.059***	0.059***
	(0.006)	(0.006)	(0.006)	(0.006)
Education	0.005***	0.004***	0.012***	0.011***
	(0.001)	(0.001)	(0.001)	(0.001)
Physical Capital	0.001	0.001	0.004***	0.003***
	(0.001)	(0.001)	(0.001)	(0.001)
Investments	0.048***	0.051***	0.027***	0.029***
	(0.005)	(0.005)	(0.005)	(0.005)
NMS	-0.150***	-0.135***	-0.091***	-0.088***
	(0.012)	(0.012)	(0.012)	(0.012)
Capital City	0.407***	0.412***	0.358***	0.382***
	(0.016)	(0.016)	(0.015)	(0.016)
ρ	0.401***	0.492***		
λ			0.637***	0.741***
Observations	1845	1845	1845	1845

*** significant at 1% level; ** significant at 5% level; * significant at 10% level. Standard errors in parenthesis.

Table B.2 Robustness check for spatial panel analysis – Regional GDP growth rate

	Dependent variable: GDP growth rate			
	SAR		SEM	
Variables	*k*=3	*k*=7	*k*=3	*k*=3
Intercept	-0.439	0.091	5.190*	6.980**
	(2.571)	(2.542)	(3.154)	(3.154)
Institutional quality variation	0.018**	0.023***	0.22**	0.0164
	(0.008)	(0.008)	(0.010)	(0.010)
Population growth rate	-0.475***	-0.446***	-0.492***	-0.604***
	(0.083)	(0.083)	(0.093)	(0.096)
Education	-0.002	-0.006	-0.002	0.002
	(0.010)	(0.009)	(0.014)	(0.015)
Physical Capital	0.037**	0.039**	0.036**	0.039**
	(0.016)	(0.016)	(0.017)	(0.017)
Investments	0.106	0.111	0.049	0.060
	(0.078)	(0.077)	(0.078)	(0.082)
Initial GDP pc (log)	0.016	-0.001	-0.383	-0.576*
	(0.262)	(0.259)	(0.327)	(0.324)
NMS	0.566***	0.559***	0.636***	0.675***
	(0.178)	(0.176)	(0.194)	(0.194)
Capital City	0.344	0.365	0.644**	0.853***
	(0.227)	(0.224)	(0.253)	(0.257)
ρ	0.691***	0.586***		
λ			0.595***	0.715***
Observations	1230	1230	1230	1230

*** significant at 1% level; ** significant at 5% level; * significant at 10% level. Standard errors in parenthesis.