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Marinela-Daniela Filip, Ralph Setzer

The impact of regional institutional quality on economic growth and resilience in the EU

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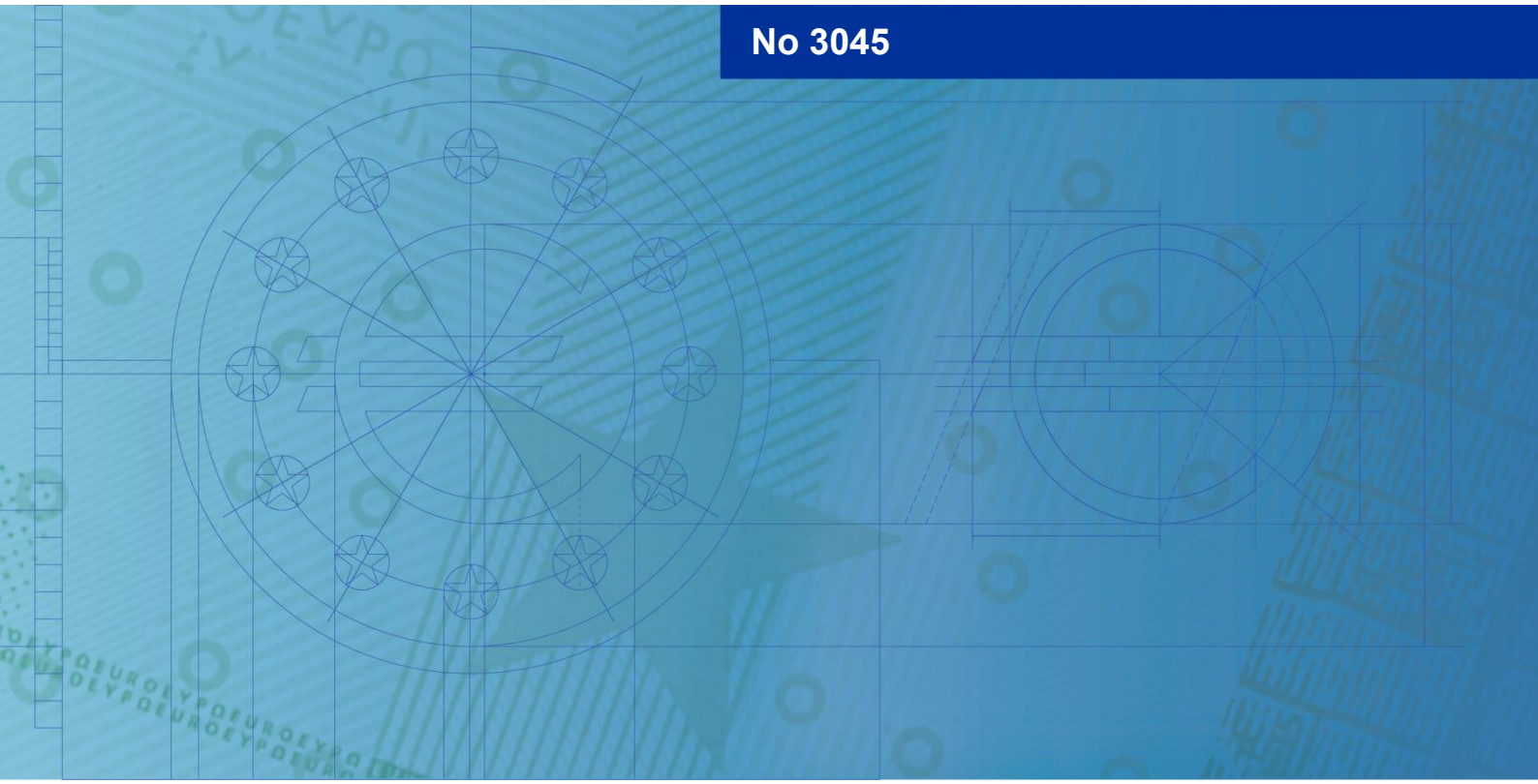


Abstract

This paper investigates the impact of regional institutional quality on economic growth and economic resilience. Using data collected by the Quality of Government Institute, we conduct a two-way fixed effect panel regression model for around 200 European regions during the period 2010 to 2021. Our findings establish a positive relationship between institutional quality and medium-term GDP growth. This effect is more pronounced in regions with low-income per capita, highlighting the importance of asymmetries across European regions. A convergence of regions with low institutional quality to the EU median would increase annual GDP per capita growth by 0.5 percentage points over the medium-term. Additionally, regions with high quality institutions are more resilient to adverse shocks and have a lower incidence of crisis. Our results suggest that regional institutional reforms, such as increasing public sector efficiency or reducing corruption, would spur growth, resilience, and convergence in the European economy.

***Keywords**: Regional Institutional Quality, Economic Growth, Resilience, EU, Reforms*
***JEL codes**: O43, E02, R11, R50, C23*

Non-technical summary

Growth disparities across regions in the European Union (EU) are significant. While some European regions have been experiencing strong growth, economic performance in other regions has been persistently sluggish. The various adverse shocks hitting the EU economy over recent years have also exposed significant differences in economic resilience. While the COVID pandemic, the energy crisis, or the geoeconomic fragmentation hit all EU regions almost simultaneously, their economic impacts across regions have been far from uniform. Significant growth asymmetries exist also within individual European countries, resulting in overall mixed evidence of real convergence at the regional level in the EU (Diaz del Hoyo et al. (2017), European Commission (2024)).

This paper investigates to which extent such large regional growth disparities relate to differences in institutional quality. Our empirical analysis relies on data by the Quality of Government Institute, which is based on a large citizen survey about perceptions and experiences with corruption, impartiality of services and quality of public services. We estimate a two-way fixed effect panel regression model for around 200 European regions during the period 2010 to 2021.

Our empirical findings provide strong evidence that better regional institutional governance is associated with higher per capita GDP growth. We also find important non-linearities in the institution-growth relationship. The growth impact of good governance is more pronounced in low-income regions, highlighting the importance of good institutions for real economic convergence. In addition, the information content of institutional quality for growth increases over longer horizons (four years), suggesting that the impact of improved governance on innovation, investment and the provision of public goods needs time to materialise. Our results suggest that if regions with low institutional quality were to converge to the EU median, their annual GDP per capita growth would increase by 0.5 percentage points over the medium-term. This effect is even more pronounced if the estimation considers only low-income regions, where annual growth could rise by 0.8 percentage points.

We also assess to which extent better quality of government enhances economic resilience. Following Sondermann (2018), we gauge economic resilience in two different ways. First, we estimate correlations between a region's output change and a common shock, while conditioning on the quality of the region's institutions. Second, we look at the incidence of crises, measured as a pronounced fall in GDP, in dependence of institutional quality. Our results suggest that

regions with higher quality of government better withstand the negative effect of shocks on income per capita growth and have a three times lower probability of experiencing a severe crisis than those with lower quality of institutions. A mechanical application of our results to the COVID-19 pandemic suggests that, ceteris paribus, the regions with lower institutional quality had an additional GDP per capita decline of around 4 percentage points compared to the top 10 regions in terms of quality of government.

Our benchmark model is changed in several ways to check the robustness of the results. Apart from alternative computations of our institutional quality index, we address possible issues of reverse causality, using instrumental variables and two-stage least squares method following La Porta et al. (1999), Masuch et al. (2016), and Augusztin et al. (2025).

Our findings have significant policy implications. First, our results highlight the importance of the quality of regional institutions in promoting economic growth. Institutional reforms aimed at increasing the efficiency of public administration, strengthening law enforcement, and combating corruption, would create a more favourable environment for sustainable economic growth. A significant part of these institutional policies responsibilities lie also at regional level. Second, our results indicate that institutional convergence would support regional economic convergence. This would promote the smooth functioning of the European economy and facilitate the single monetary policy in the euro area. Third, sound institutions are particularly conducive towards efficient economic policy reactions to major adverse shocks such as the COVID-19 pandemic or the energy crisis, but also region-specific shocks.

1 Introduction

Long-term growth divergences across European regions have been large and persistent. Some European regions have been experiencing strong growth, while in others growth has remained anaemic for decades. Moreover, despite mostly national policy responses, European regions have shown different degrees of economic resilience in the presence of the large adverse shocks over recent years, such as the COVID-19 pandemic or the energy crisis (Cartone et al. (2021), European Commission (2024)).

One of the reasons for the heterogeneity in regional growth dynamics could be that the quality of institutions differs across regions. The quality of institutions generally refers to how well economic institutions are able to deliver a level-playing field for all economic actors. High quality institutions are defined by efficient public administration, transparency about political and administrative decisions, low levels of corruption, and the rule of law. All these attributes construct the foundations for an environment favourable to investment, innovation and employment, and should thereby also support growth (Acemoglu et al. (2005)).

The link between institutional quality and economic growth and resilience has been extensively analysed at the national level, with evidence suggesting that economies with better institutions experience higher economic growth (Masuch et al. (2016), Siyakiya (2017), Glawe and Wagner (2019), Radulović (2020) or Minović et al. (2021)) and stronger economic resilience, defined as the capacity to withstand significant adverse shocks by minimising the impact on economic activity (Sondermann (2018)).

One concern about these studies is that institutional variation across time is limited and the exploration of dynamic aspects has to rely on fairly short temporal variation. By contrast, using regional data allows for the exploration of diverse institutional setups and therefore provides a more granular analysis on the importance of institutional quality for the macroeconomy than analyses using national data. This enables highlighting non-linearities in the institution-growth nexus or better distinguishing between short- and medium-term effects.

Another key problem that arises when assessing the link between institutional quality and economic growth is that causality can run both ways. It is difficult to determine whether strength of institutions promotes growth, or whether growth contributes to strengthening institutions. We carefully address these endogeneity concerns in this paper by the use of instrumental variables to highlight the effects of competing endogenous variables.

Our results, corroborated by a number of robustness tests, reveal a positive relationship between the quality of government and GDP per capita growth at the regional level. Institutional quality matters for growth in particular in poorer regions and in particular over the medium-term. If regions with low institutional quality were to converge to the EU median, their annual GDP per capita growth would increase by 0.5 percentage points on average over four years. This effect is even stronger if the estimation considers only low-income regions, where growth could rise by 0.8 percentage points, highlighting the role of non-linearities.

Regions with better quality of government also exert higher resilience. That is, they are better equipped to withstand adverse shocks, by minimising their impact on economic activity. Specifically, regions with weaker institutions experienced stronger declines in GDP per capita when common shocks occur compared to the regions with high quality of governance. Moreover, the probability of experiencing a crisis is three times higher in regions with relatively low quality of institutions compared to regions with relatively high quality of institutions.

Our findings have significant policy implications. First, our results highlight the importance of the quality of regional institutional governance in promoting economic growth. Institutional reforms aimed at strengthening governance frameworks would create a more favourable environment for sustainable economic growth. Second, our results indicate that institutional convergence would support regional economic convergence. This would promote the smooth functioning of the European economy and support, for instance, the effective implementation of monetary policy. Third, sound institutions may be particularly conducive towards efficient economic policy reactions to major adverse shocks such as the COVID-19 pandemic or the energy crisis, but also to sudden region-specific shocks.

The remainder of the paper is organised as follows: Section 2 presents a review of the literature on institutions, growth and economic resilience, Section 3 describes our dataset and presents some descriptive statistics. Section 4 outlines the econometric approach and results of the link between regional institutional quality and economic growth. The relationship of institutional quality with economic resilience is empirically analysed in Section 5. Section 6 contains robustness tests, including an instrumental variable approach. Section 7 concludes.

2 Literature review

The effect of institutions on economic development started to be analysed after 1990 building on the seminal work of North (1990). In his paper, North (1990) suggested that formal institutions, understood as the rules of the game in a society, are relevant for economic development, particularly in contexts where transactions among individuals in a society incur costs. Institutions are bound to influence economic performance as they provide an incentive structure that reduces uncertainty and promotes efficiency. Thus, good institutional settings promote economic development by establishing an environment of trust and order which reduces transaction costs.

Building on the work by North (1990) and more related with our research question, many studies analysed the relationship between institutional quality and economic growth in Europe. Some examples of recent studies reporting a significant and positive relationship between institutional quality and income per capita or income growth are Masuch et al. (2016), Siyakiya (2017), Sondermann (2018), Glawe and Wagner (2019), Radulović (2020) or Minović et al. (2021).

Recent research has also shed light on the nexus between government quality and economic development at the regional level. Ezcurra and Rios (2019) found evidence of a positive relationship between higher government quality and labor market performance during the Great Recession. This phenomenon was partly attributable to spatial spillovers emanating from the quality of government in neighbouring regions. Peiró-Palomino (2019) document that the positive growth effects of sound institutional governance were more pronounced in regions of the old EU Member States than in those from countries joining the EU post-2004.

Delving deeper into the dynamics of regional development, Rodríguez-Pose and Ketterer (2019) conduct an empirical analysis encompassing 249 NUTS2 regions from 1999 to 2013. Their study corroborates the role of improvements in government quality as a catalyst for development of lagging regions in Europe. Regions characterized by slower growth, particularly in Southern Europe, stand to benefit the most from improvements in the quality of governance. Echoing these findings, Barbero et al. (2023) quantify the general equilibrium effects on economic growth of improving the quality of institutions at the regional level in the context of the implementation of the European Cohesion Policy. Their research suggest that a 5% increase in government quality across European Union regions increases the impact of Cohesion investment by up to 7% in the short run and 3% in the long run.

As a measure of regional institutional quality, the above studies all relied on the European

Quality of Government Index. This indicator has been constructed with the objective of having a comparable and homogeneous measure of governance at the regional level in Europe (Charron et al. (2014, 2015, 2019, 2022, 2024)). This indicator is also used in our paper. In contrast to previous literature, we use, however, a longer time span of the European Quality of Government Index.

Our paper contributes to the existing literature in several ways: First, our study has a closer look at the time dimension of the link between regional institutional quality and economic growth. While most previous analyses at the regional level have focused on the link between institutions and annual growth, this study emphasises the medium-term perspective in the institution-growth nexus. Specifically, this study attributes an impact of institutions on multi-year growth (growth of up to four years). An advantage of this concept is that short-term growth fluctuations, generated for instance by the business cycle, are largely eliminated. Second, we provide scenario analyses to illustrate the potential economic gains of improvements in institutional quality. Third, we are interested not only in economic growth but also in economic resilience. In recent years, EU countries and regions have faced various shocks, such as the COVID-19 pandemic, the energy crisis, or increased geoeconomic fragmentation. As a result, economic resilience, defined as the ability of a country or region to withstand shocks and reduce their costs, has gained prominence both in the public debate and in the policymaking agenda.

3 Data

The data used in the study is compiled from publicly available databases of the European Commission (ARDECO and Eurostat), the ECB, and Charron et al. (2014, 2015, 2019, 2022). The sample consists of annual realised and projected data from 2010 to 2025 and includes regional data for 27 EU countries. The countries in the sample and the number of regions considered for each country are listed in the Appendix Table A.1.

3.1 Variables and sources

The European Quality of Government Index (EQI) is a comprehensive index at regional level that measures government quality across all 27 EU member states for the years 2010, 2013, 2017, 2021 and 2024 (Charron et al. (2014, 2015, 2019, 2022, 2024)). The EQI is based on a large citizen survey that asks respondents about their perceptions and experiences in their area

(region) with i) corruption, ii) impartiality of services and iii) quality of public services.[1] All three pillars range from -3 to +3, with higher values representing better government quality. For the purpose of this study, we rescaled the indicators from 0 to 1 to facilitate the readability of the coefficients in the econometric estimates.

To obtain an annual time variant EQI indicator, we apply linear interpolation for the missing years (e.g., the years 2011 and 2012 are filled with the linear interpolation between 2010 and 2013 for which data are available).

The sub-national regions considered are based on the availability of the EQI indicator. NUTS 2 level data is available for 20 EU countries (see Table A.1 in the Appendix) summing up to a total of 184 regions. NUTS 1 level is included for Belgium and Germany with a total of 19 regions. Data is only available at the country level for Cyprus, Estonia, Luxembourg, Latvia and Malta. In the four waves of the EQI survey from 2010 to 2021[2], the number of respondents in total were roughly 330.000 (Charron et al., 2014, 2015, 2019, 2022). Table A.1 in the Appendix provides details on the regions considered per country and NUTS level.

Following the literature on regional growth (for instance, Rodríguez-Pose and Garcilazo (2015) and Barbero et al. (2023)), we control for a standard set of indicators at the regional level, such as GDP per capita (to account for catching-up), the employment rate, the education level, the provision of EU funds, and infrastructure density. Moreover, to account for the fiscal impulse, and in the absence of regional fiscal data, we include the general government fiscal balance. Some specifications incorporate further control variables, such as long-term interest rates and trade openness (both available at the national level) and the share of specific sectors in gross value added (available at the regional level).

For the macroeconomic indicators at regional level, the ARDECO[3] and Eurostat databases from the European Commission have been used. A complete list of variables and their level of availability (regional or country) can be found in the Appendix Table A.2.

[1] The survey questions focus on citizens' perceptions within their region regarding various topics, such as public education or the public healthcare system. For details on the specific questions and the construction of the index see Charron et al. (2021).

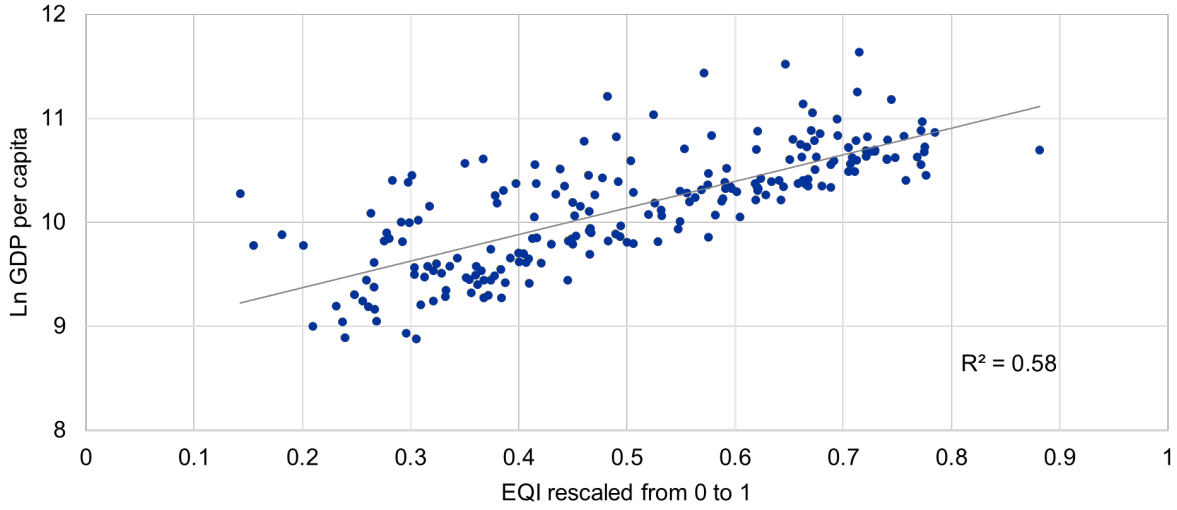
[2] The 2024 wave of EQI is included in the descriptive statistics, but not in the regressions, due to lack of data for the rest of the control variables.

[3] The series GDP per capita, which for some specifications are used until 2025, includes the short-term forecasts at the regional level based on the European Commission spring 2024 forecast (version updated on 09/06/2024) provided by AMECO at the national level.

3.2 Descriptive statistics on regional institutional quality

A visualization of the data illustrates that institutional quality disparities across European regions are strongly correlated with GDP per capita (Figure 1).

Figure 1: Institutional quality and GDP per capita in EU regions in 2021



Source: Charron et al. (2022), ARDECO and authors' calculations.

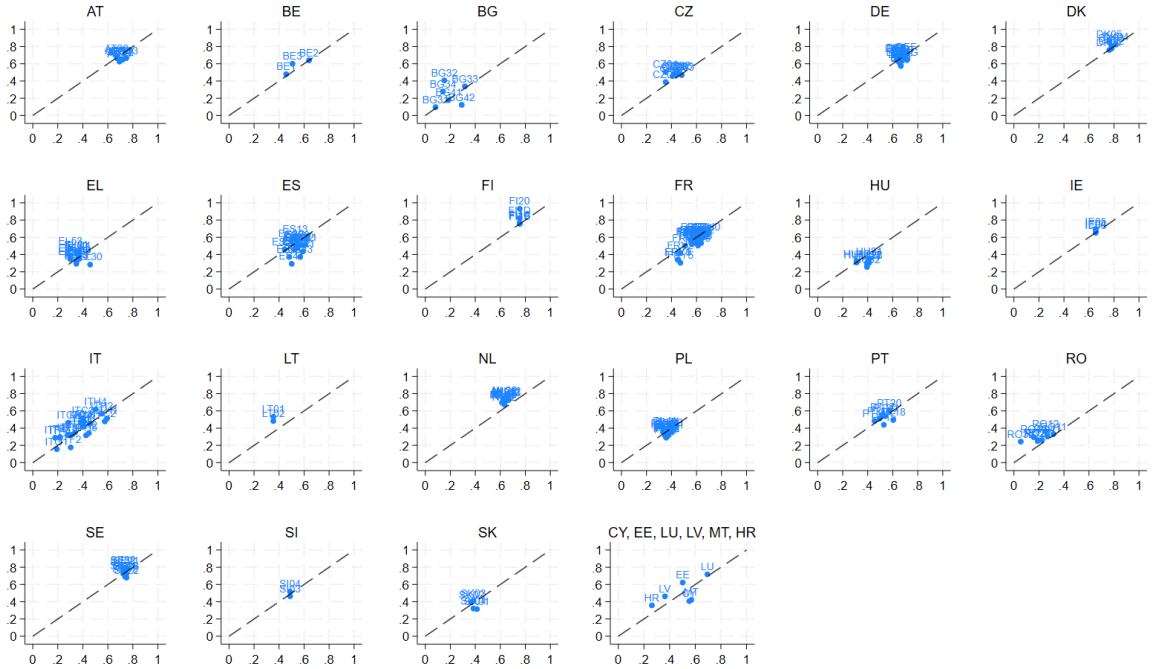
Tracking regional data over time highlights trends of convergence or divergence in the quality of governance. When comparing institutional quality in 2010 with 2024 across regions, the most significant improvements were recorded in the Baltics and in some regions in Romania and Bulgaria. At the same time, institutional quality has deteriorated most markedly in several regions of Spain, France and Portugal (see Figure 2). As documented by Fernández-Villaverde et al. (2013), Challe et al. (2019) and Eurofound (2022), the deterioration of institutional governance in many Southern European countries could be explained by cheap external funding and large capital inflows that reduced incentives for sound institutional policies and led to a strong deterioration in the rule of law and the control of corruption.[4]

Examining regional data on the quality of government reveals significant disparities often hidden by national averages, as different regions within a country experience varying levels of

[4]Figure A.1 in the Appendix highlights evidence for beta-convergence at the EU level. While the institutional quality of the top 5% regions has remained broadly unchanged between 2010 and 2024, the bottom 5% regions have improved on average and therefore converged towards regions with higher institutional quality. Similar conclusions can also be extracted from analysing the developments of the EQI sub-components (see Figure A.2 in the Appendix).

governance quality due to historical, economic, and socio-political factors. Figure 3 reveals that intra-country disparities are more pronounced in certain countries, such as Italy or France, compared to others like the Netherlands or Poland, where values are more clustered. Moreover, Figure 3 highlights that the heterogeneity in regional quality of government is high. In particular, there is a significant gap between the top performers in the index, notably the Nordic countries, and the lower-ranked regions, such as those in Romania and Bulgaria.

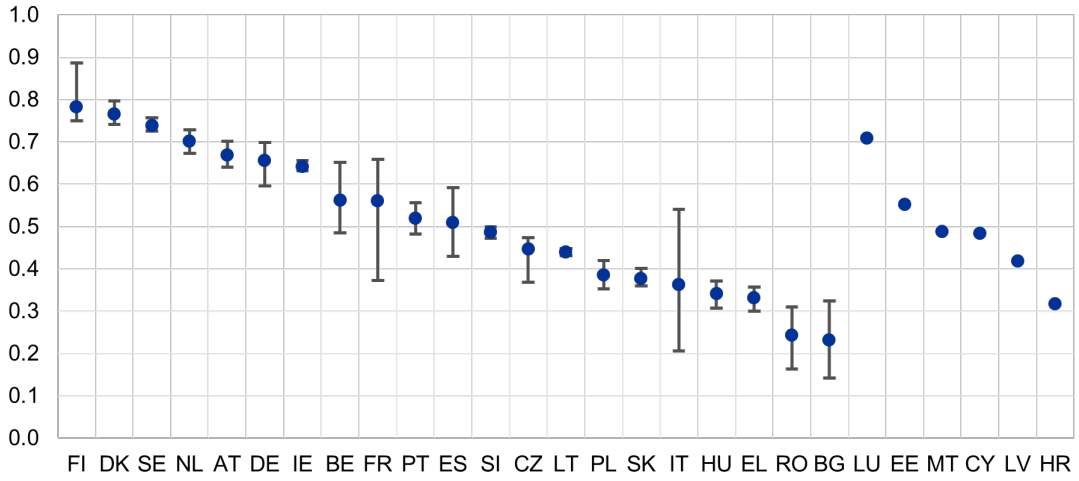
Figure 2: EQI comparison 2010 (x-axis) versus 2024 (y-axis) for all regions



Source: Charron et al. (2014, 2024), and authors' calculations.

Notes: The EQI is rescaled from 0 to 1, with 0 representing the lowest quality of government and 1 the highest. The x-axis is the 2010 data and y-axis represents the 2024 data.

Figure 3: Within-country variability in regional institutional quality



Source: Charron et al. (2014, 2015, 2019, 2022, 2024), and authors' calculations.

Notes: EQI is rescaled from 0 (lowest quality of government) to 1 (highest quality of government). The dots are the average quality of institutions across regions in each country for the years 2010, 2013, 2017, 2021 and 2024. The intervals refer to the minimum and maximum values of regions within the respective country. When intervals are not displayed, it is because regional data for those countries is unavailable.

4 Results on institutional quality and economic growth

This section first describes the econometric approach and then presents the empirical results for all regions, as well as for low versus high-income regions. Finally, it illustrates the potential GDP per capita growth in a scenario where regions with low institutional quality improve their governance to the EU median.

4.1 Econometric approach

The empirical specification consists of a two-way panel fixed effects model which covers region and time fixed effects. This approach follows Rodríguez-Pose and Garcilazo (2015) and Barbero et al. (2023). We estimate the panel model of equation 1:

$$(\frac{1}{h})(lnGDPpc_{i,t+h} - lnGDPpc_{i,t}) = \beta_1 lnGDPpc_{i,t} + \beta_2 eqi_{i,t} + \beta_3 control_{i,t} + \\ + \theta_i + \alpha_t + \epsilon_{i,t} \quad (1)$$

where the dependent variable is the average growth rate over h years (with h varying from 1 to 4 years) of ln nominal GDP per capita in purchasing power standards (pps) for region i;

$lnGDPpc_{i,t}$ represents the level of GDP per capita for region i in year t; $eqi_{i,t}$ denotes the regional quality of government indicator; $control_{i,t}$ contains a vector of variables controlling for additional factors that may influence regional GDP per capita, namely EU funds per capita,[5] employment rate, share of population with low education, infrastructure density, fiscal balance per capita, long term interest rates, and trade openness;[6] θ_i is a fixed effect for each region i while α_t is a fixed effect for time t. To mitigate endogeneity concerns, we introduce all independent variable with a lag.[7] Our panel fixed effects also controls for unobserved heterogeneity that is constant over time within regions. The key estimated parameter is $(\hat{\beta}_2)$ which captures the impact of government quality on ln GDP per capita growth.

4.2 Empirical results

This section first presents results when considering all regions. Subsequently, we show the results when dividing the sample between low-income and high-income regions.

Table 1 presents our benchmark results which consider as dependent variable the 4-year growth of GDP per capita (logarithmic transformation). The institutional quality indicator (EQI) is significant and positive, suggesting that stronger quality of institutions is associated with higher per capita GDP growth. In terms of additional variables, the results confirm the importance of the catching-up effect, i.e. the negative impact of GDP per capita on growth. Columns (2) to (6) add additional control variables which do not change considerably the size of the EQI coefficient. Higher EU funds, better educated population and better infrastructure are associated with higher growth.

These findings are also economically significant. For instance, the coefficients in column (4) suggest that an improvement in institutional quality of 0.1 (corresponding to about two thirds of the standard deviation of the EQI index) leads to an increase in annual GDP per capita growth of 0.4 percentage points (0.1*3.868) on average over four years, holding all other variables constant.

[5] We also examined the results when controlling for the natural logarithm of gross domestic expenditure on R&D per capita, instead of EU funds per capita. The coefficient of EQI was similar (see Table A.3 in the Appendix, so we did not include this variable in the baseline equation to avoid overfitting.

[6] The fiscal balance per capita, long term interest rates and the trade openness have been included at country level since data is not available at regional level. This also allows us to control for country effects.

[7] The robustness section also presents an instrumental variable approach to address endogeneity concerns.

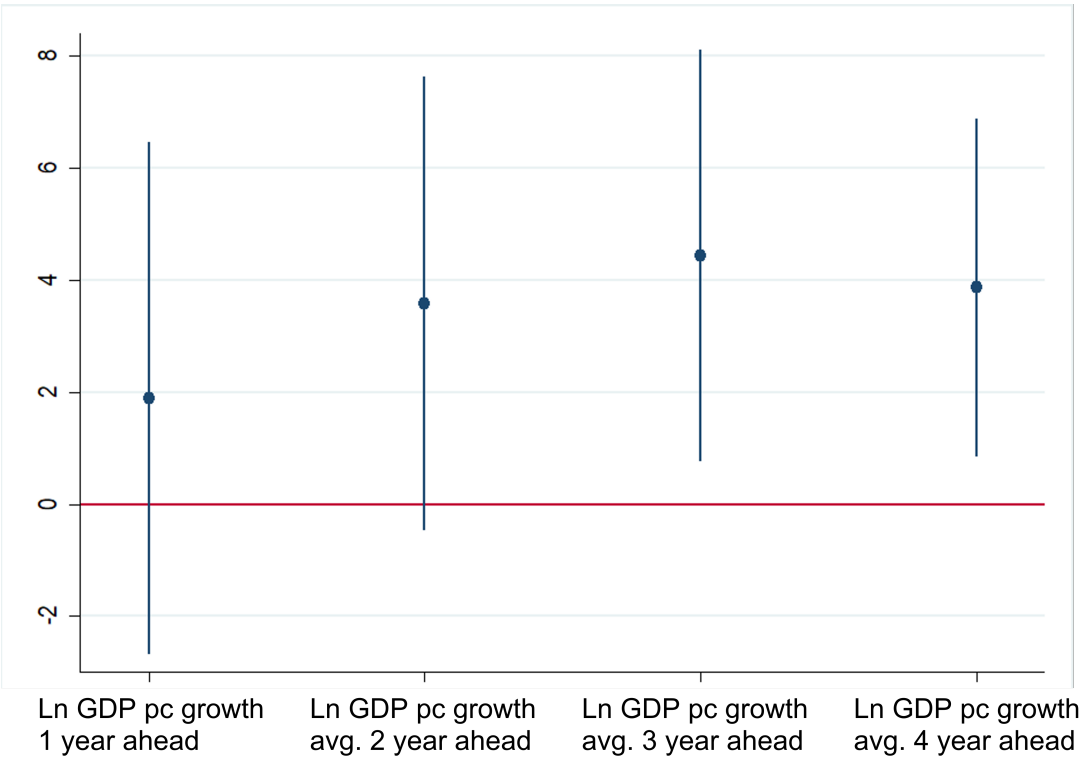
Table 1: Baseline regression results - 4-year average annual growth in GDP per capita

	(1)	(2)	(3)	(4)	(5)	(6)
Ln GDP per capita pps	-12.860***	-11.329***	-11.493***	-10.716***	-9.752***	-10.181***
	(1.016)	(1.080)	(1.263)	(1.206)	(1.464)	(1.208)
EQI	4.288**	3.530*	3.572*	3.868**	4.275**	3.675*
	(1.755)	(1.807)	(1.822)	(1.823)	(1.924)	(1.891)
EU funds per capita		0.001**	0.001**	0.001***	0.001**	0.001***
		(0.000)	(0.000)	(0.000)	(0.001)	(0.000)
Employment rate			0.020	0.002	0.001	-0.021
			(0.053)	(0.053)	(0.063)	(0.056)
Share of population with low education				-0.075***	-0.079***	-0.063***
				(0.020)	(0.025)	(0.022)
Infrastructure density					7.610**	
					(3.841)	
Fiscal balance per capita growth						-0.000
						(0.000)
Trade openness						0.030
						(0.018)
Long term interest rate						-0.006
						(0.024)
Constant	127.608***	112.562***	113.303***	108.307***	97.453***	101.334***
	(10.094)	(10.767)	(11.444)	(10.851)	(12.970)	(11.071)
Countries	27	25	25	25	23	24
Regions	207	197	197	197	175	196
N	2484	2330	2330	2314	2030	2288
R^2	0.73	0.74	0.74	0.74	0.71	0.75

Notes: Fixed effects (time and regions) estimates of the 4-year average annual growth in GDP per capita (dependent variable). Government quality and control variables are lagged by one year. *** significant at 1% level, ** significant at 5%, * significant at 10%. Robust standard errors in parentheses. The fiscal balance per capita growth, trade openness and long term interest rates have been included at country level since data is not available at regional level.

Figure 4 presents the estimated coefficients (and the 90% confidence bands) of the EQI indicator when considering different time windows for the dependent variable (growth of GDP per capita in PPS). While the coefficients are not significant over one and two years ahead, they become significant over three and four years ahead. This confirms the long-term nature in the relationship between institutional quality and growth (Masuch et al. (2016)). The information content of institutional quality for growth increases over longer horizons as the impact of improved governance on innovation, investment and the provision of public goods needs time to materialise (Acemoglu et al. (2005)).

Figure 4: Quality of government impact on growth over different periods

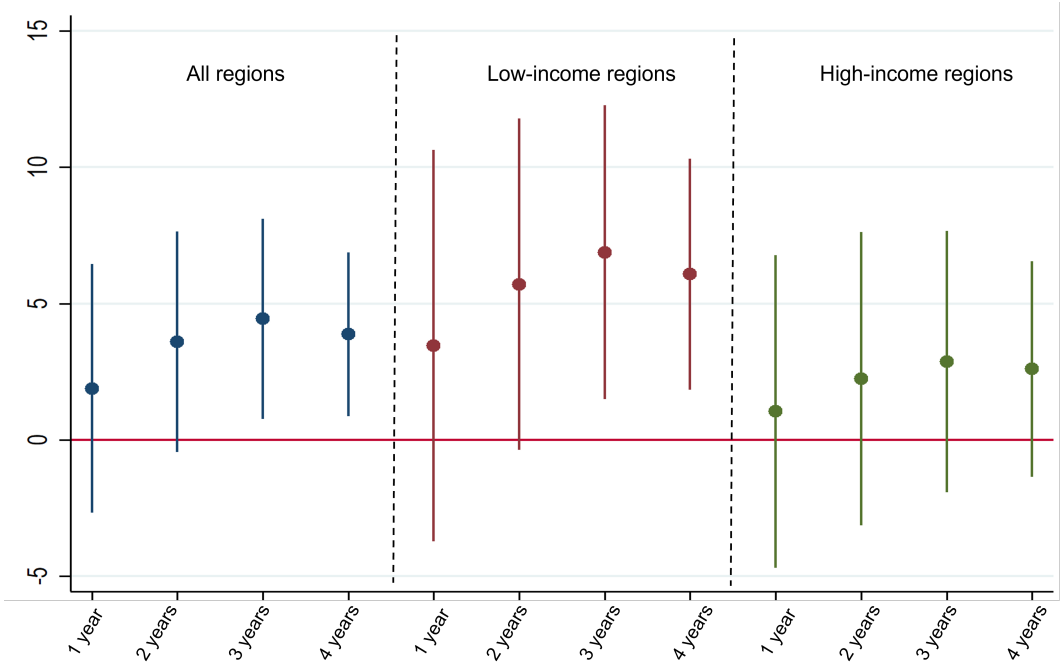


Source: Authors' calculations.

Notes: Results when estimating model 4 from Tables A.4, A.5, A.6, and 1. Fixed effects (time and country) estimates are used. The dots represent the coefficients and the blue lines represent the 90% confidence interval. pc refers to per capita.

In the next step, we examine possible non-linearities, and divide the sample into regions with GDP per capita in 2010 below the median (low-income regions) and regions that were above the median (high-income regions). Figure 5 exhibits that the impact of EQI on GDP per capita growth is positive and statistically significant for low-income regions while the EQI coefficient is not statistically significant in high-income regions (see Table A.7 and Table A.8 in the Appendix). Moreover, the EQI coefficients are higher for low-income regions than for all regions combined. This outcome supports the argument that for low-income regions the impact of improving the quality of their institutions would result in higher growth gains, highlighting the importance of good governance for economic convergence (Diaz del Hoyo et al. (2017) and Rodríguez-Pose and Ketterer (2019)).

Figure 5: Impact of institutional quality on growth - difference by income level



Source: Authors' calculations

Notes: Results when estimating model 4 from Tables A.4, A.5, A.6, 1, A.7 and A.8. Fixed effect (time and country) estimates are used. The dots represent the coefficients and the blue and red lines represent the 90% confidence interval. The low-income regions (high-income regions) are those below (above) the median of GDP per capita in pps in 2010.

We also explore whether cross-country differences in administrative organisation impact the institution-growth nexus. We use the fiscal decentralisation index from the European Committee of the Regions (European Committee of the Regions (2025)) and calculate for each country the degree of decentralisation as the average value of the expenditure ratio and the revenue ratio.[8] In line with the European Committee of the Regions' definition of high decentralisation, a country is classified as decentralised if its average score, ranging from 0% (no decentralisation) to 100% (complete decentralisation), exceeds 35%. Four countries in our sample (Denmark, Germany, Sweden, and Spain) are identified as highly decentralised according to this definition. To test whether high decentralisation influences the relationship between governance quality and GDP growth, we include in our analysis a dummy variable denoted one for the four countries

[8]The expenditure ratio is the relative share of overall subnational expenditure compared to total government expenditure. The revenue ratio is the relative share of subnational own revenues (excl. grants) compared to the total government revenues.

identified as highly decentralised. The interaction term between our decentralization dummy and EQI does not turn out significant, and also alternative specifications of the decentralisation dummy do not provide robust evidence that a region's fiscal autonomy significantly influences the institution-growth nexus (see Table A.9 in the Appendix).

4.3 Scenario analysis

This section illustrates the potential GDP per capita growth in a scenario where regions with low quality of governance improve the quality of their institutions to the 2021 median of all regions (corresponding to an EQI score of 0.49 on the scale from 0 to 1). The scenario implies an average improvement of the EQI score of 0.13 in the regions with below-median quality of institutions. Such long-term improvements in institutional quality are ambitious but not implausible. For illustration, in five EU regions from Lithuania, the Czech Republic, Romania and Bulgaria the improvement of the EQI score between 2010 and 2021 exceeded 0.13.

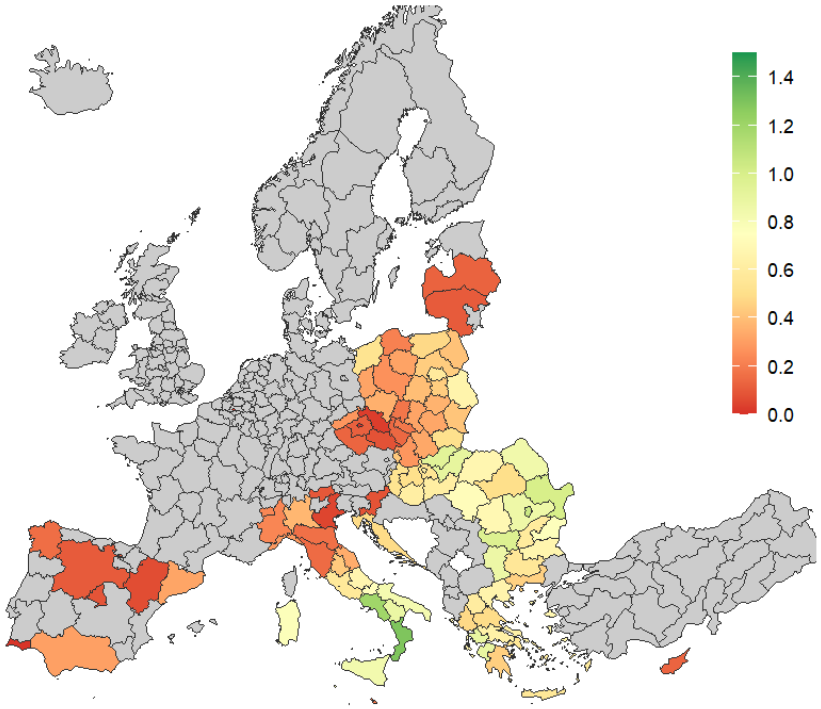
For the scenario analysis, we use the results from Table 1, column (4), where the coefficient associated with institutional quality is 3.868. Based on this estimate, and assuming that all other variables remain constant, an improvement in the governance quality index by 0.13 would result in an increase of their annual GDP per capita growth of 0.5 percentage points on average over four years (0.13×3.868).

Figure 6 illustrates the potential growth impact, assuming that regions with institutional quality below the EU median were to converge to the median. The impact would be significant, especially in the regions with the lowest quality of governance. In some regions in Romania, Bulgaria, Hungary, Greece, and Southern Italy, the improvement of EQI to the EU median could lead to an increase in the annual GDP per capita growth of around 1 percentage point on average over four years.

In Section 4.2 we found the existence of non-linear effects, with institutional quality having a larger impact on low-income regions than on all regions combined. For low-income regions, the potential growth impact steaming from an improvement of governance quality to the EU median would thus be even higher. For instance, an increase in EQI of 0.13 would result in an increase of annual GDP per capita growth by 0.8 percentage points (0.13×6.079) on average over four years in the low-income regions.[9]

[9]The number 6.079 corresponds to the coefficient associated with the EQI variable when running the regression only for low-income regions (see Table A.7, column 4 years, in the Appendix).

Figure 6: Annual GDP per capita increase in percentage points over 4 years from an improvement of institutional quality to the EU median



Source: Authors' calculations.

Notes: Annual GDP per capita increase in percentage points over 4 years from an improvement of regional institutional quality to the EU median (based on EQI coefficients of Table 1 column (4)).

5 Results on institutional quality and economic resilience

This section empirically examines whether higher regional quality of government mitigates the economic impact of a common shock and influences the likelihood of a severe economic crisis.The importance of economic resilience has been evidenced by the frequency of adverse shocks hitting the EU economy over the last years, such as the COVID-19 pandemic, the energy crisis or geopolitical tensions.

Following the methodology implemented in Sondermann (2018), we employ two approaches to operationalise regional economic resilience. The first approach (discussed in Section 5.1) defines economic resilience on the basis of regions' output reaction to common shocks. The second approach (documented in Section 5.2 analyses whether sound institutions reduce the

probability of large crisis episodes.

5.1 Common shocks

The first approach gauges the economic resilience as the estimated correlations between a region's output change and a common shock while conditioning on the quality of the regions' institutions.

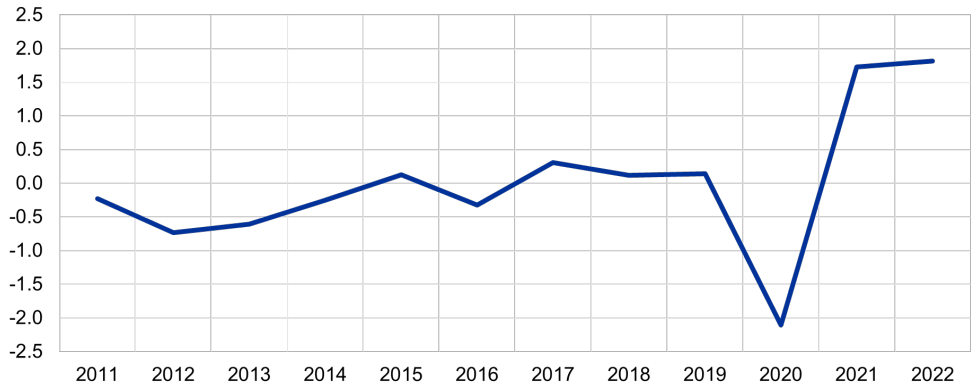
In a first step, we proxy the common shock using panel fixed effects for our specified regions in the EU from 2003 to 2022. While Sondermann (2018) makes use of common patterns across time in country-specific GDP series, we estimate the common shock considering regions and GDP per capita.

$$(lnGDPpc_{i,t+1} - lnGDPpc_{i,t}) = \eta + \alpha_t DV_t + \theta_i DV_i + \epsilon_{i,t} \tag{2}$$

$$\hat{\alpha}_t DV_t = Shock_t \tag{3}$$

where the dependent variable is the annual growth of GDP per capita in PPS in region i in year t. DV_t and DV_i are time and region dummies, respectively. The coefficients associated to the time dummies ($\hat{\alpha}_t$) represent the common reactions across regions, assuming that idiosyncratic disturbances are captured by the region-specific variables. We standardise the time coefficients (with zero mean and unit standard deviation) and depict them from 2011 onwards in Figure 7.

Figure 7: Common unobserved GDP per capita shock



Source: Authors' calculations

Notes: Standardised shock (zero mean and unit standard deviation) resulting from equation 2.

In a second step, to investigate if institutional quality plays a role for economic resilience, we interact the common shock with our regional quality of government indicator. We conduct the following fixed effects panel model:

$$(lnGDPpc_{i,t+1} - lnGDPpc_{i,t}) = \eta + \alpha Shock_t + \beta_2 EQI_{i,t} + \delta Shock_t EQI_{i,t} + \\ + \beta_3 Control_{i,t} + \theta DV_i + \epsilon_{i,t} \tag{4}$$

where the explanatory variables include the *Shock* estimated in equation 2, the institutional quality index (EQI), and the interaction term between the *Shock* and EQI, and additional control variables in line with our benchmark equation of Section 4.2. In addition we control for region's share of tourism given that this sector was most affected by the COVID-19 pandemic.[10]We used fixed effects for regions (DV), and i represents the regions while t the time.

The key estimated parameter is $\hat{\delta}$ which captures the marginal effect of institutional quality when a common shock occurs. The total growth impact is the result of the sum of the marginal effect and the shock, shown by $\hat{\lambda}$ in equation 5 below:

$$\hat{\lambda} = \hat{\alpha} Shock_t + \hat{\delta} Shock_t EQI_{i,t} \tag{5}$$

Equation 5 shows how differences in institutional quality across regions impact the shock absorption capacity in the event of a common shock. The expected result is a negative $\hat{\delta}$ coefficient which would suggest that regions with a higher quality of institutions are less affected by common shocks, or in other words, that these regions are more resilient.

When estimating equation 4, the results confirm the hypothesis that regions with higher quality of government better withstand the negative effect of common shocks on income per capita growth. Table 2 shows the regression results without (column 1) and with control variables (columns 2 to 5). The negative and statistically significant interaction term, $EQI * Shock$, indicates higher resilience to adverse shocks by regions with better institutions. In columns 6 to 8, the three subcomponents of EQI (referring to the quality and impartiality of public services, and corruption) are interacted with the *Shock*. The associated coefficients are significant and negative, suggesting that the various dimensions of institutional quality all influence economic

[10]As proxy for the share of tourism in total GVA per region we used the share of G (wholesale and retail trade), H (transport), and I (accommodation and food service activities) NACE sectors in total GVA. The inclusion of the sectors G and H was done due to data availability restrictions given that only the aggregate data of the three sectors (G, H and I) are available at regional level.

resilience.

Table 2: Economic resilience to a common shock

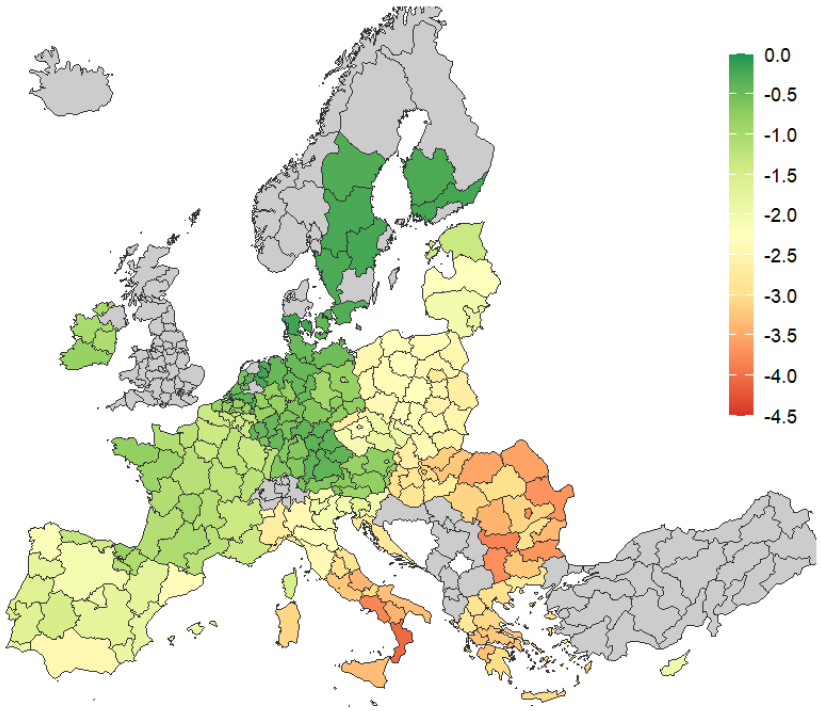
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Shock	5.079***	5.319***	4.895***	4.890***	5.046***	4.474***	4.936***	5.189***
	(0.382)	(0.373)	(0.356)	(0.350)	(0.370)	(0.344)	(0.358)	(0.368)
EQI	-2.852	-1.141	1.981	2.050	0.862			
	(2.541)	(2.534)	(2.599)	(2.598)	(2.731)			
EQI*Shock	-3.359***	-3.505***	-3.119***	-3.173***	-3.208***			
	(0.654)	(0.621)	(0.583)	(0.584)	(0.600)			
Ln GDP per capita pps		-5.769***	-8.298***	-7.704***	-8.827***	-8.435***	-8.134***	-7.976***
		(0.845)	(1.194)	(1.226)	(1.180)	(1.237)	(1.201)	(1.153)
EU funds per capita			0.001**	0.001**	0.001	0.001**	0.001**	0.001**
			(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Employment rate			-0.119	-0.137	-0.121	-0.108	-0.124	-0.129
			(0.078)	(0.084)	(0.084)	(0.079)	(0.079)	(0.079)
Pop low education			-0.223***	-0.218***	-0.197***	-0.226***	-0.219***	-0.216***
			(0.025)	(0.025)	(0.032)	(0.026)	(0.025)	(0.025)
share G, H and I sectors in GVA				-0.091				
				(0.075)				
Fiscal balance per capita growth					0.000			
					(0.000)			
Long term interest rates					0.111**			
					(0.051)			
Trade openness					0.071**			
					(0.018)			
EQI quality						2.148		
						(1.823)		
EQI quality*shock						-2.313***		
						(0.567)		
EQI impartiality							0.121	
							(2.074)	
EQI impartiality*shock							-3.198***	
							(0.599)	
EQI corruption								1.691
								(1.994)
EQI corruption*shock								-3.686***
								(0.600)
Constant	4.435***	61.780***	96.214***	92.736***	94.804***	97.052***	95.648***	93.392***
	(1.278)	(8.599)	(11.226)	(10.888)	(11.014)	(11.798)	(11.261)	(10.825)
Countries	27	25	25	25	24	25	25	25
Regions	207	207	197	197	196	197	197	197
N	2484	2484	2314	2314	2288	2314	2314	2314
R^2	0.55	0.57	0.62	0.62	0.63	0.62	0.62	0.63

Notes: Fixed effect (regions) estimates of the GDP per capita 1 year ahead growth (dependent variable), government quality and control variables. *** significant at 1% level, ** significant at 5%, * significant at 10%. Robust standard errors in parentheses. The variable shock represent the results shown in Figure 7. The NACE sectors covered are: G (wholesale and retail trade), H (transport) and I (accommodation and food service activities).

The above findings can be applied to provide a tentative assessment on the growth impact of the COVID-19 shock due to weak institutional quality. In doing so, we first estimate the total effect of the pandemic shock on GDP per capita for each region by estimating $\hat{\lambda}$ as defined in equation 5 and considering the values of EQI in 2019 and the common shock of 2020 (as shown in Figure 7). For each region, we then compare the growth impact linked to institutional quality to the average impact of the shock in the top 10 regions in terms of institutional quality. Figure 8 depicts these results. Compared to the estimated GDP per capita decline due to the pandemic shock in the top 10 regions in terms of quality of government, the regions with the

lowest institutional quality are estimated to have had an additional GDP per capita decline of around 4 percentage points.

Figure 8: Estimated additional GDP per capita decline in 2020 due to the Covid pandemic compared with the top 10 regions in terms of institutional quality



Source: Authors' calculations.

Notes: The top 10 regions in terms of institutional quality are based on the estimates of EQI for 2019.

Overall, these computations should be interpreted with caution due to their rather mechanical nature. In particular, the exercise does not explicitly consider general equilibrium issues, such as the impact of economic policies in laying the ground for the post-COVID recovery, or differences in the exposure to the COVID-shock across regions. In addition, one might argue that the EU has been hit by various shocks of different nature during that period, such as the energy crisis or the fiscal and monetary policy responses. Countries and regions have not been affected similarly to these shocks. As documented by de Groot et al. (2020), for instance, there is heterogeneity in the regional patterns of monetary policy transmission, with the output response to monetary policy shocks being stronger and more persistent in poorer regions. To better account for region-specific effects, Section 5.2 conducts an additional analysis which focuses on the

likelihood of extreme negative regional growth outcomes without considering the source of the shock.

5.2 GDP crisis events

An alternative approach to better understand the relationship between institutional quality and economic resilience is to establish whether better institutional governance reduces the probability for a region to enter into a severe crisis. The key advantage of this approach is that it abstracts from the origin of the shock (common or region-specific) and simply relies on the extraction of large negative regional growth outturns.

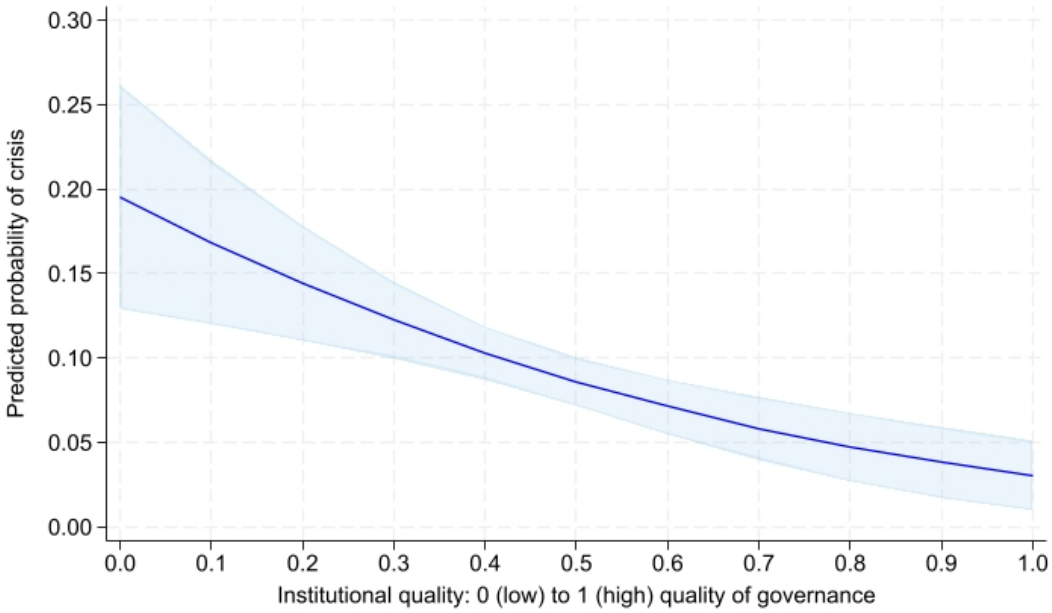
To identify significant declines in GDP, we consider the distribution of GDP per capita growth across all EU regions in our sample from 2010 to 2021. To empirically assess the likelihood of mitigating crisis events through higher quality of institutions, we estimate a probit regression model as specified in equation 6:

$$P(Y_i = 1|X_i) = \Phi(X_{it}\beta_t) \tag{6}$$

where $P(Y_i = 1|X_i)$ is the probability that the binary outcome variable Y_i equals 1, given the covariates X_i. The dependent variable takes the value of 1 if the region i in a specific year t belongs to the 10th percentile of the GDP per capita growth distribution (i.e., crisis event) and 0 otherwise.[11] Φ is the cumulative distribution function of the standard normal distribution. X_i is the vector of independent variables for regions i and time t. β indicates the vector of coefficients to be estimated. Further exogenous variables include the quality of institutions indicator, EQI, as well as our usual set of control variables (employment rate, trade openness, and growth of fiscal balance per capita).

[11] The corresponding value in the 10th percentile is a drop in GDP per capita of 1.88%.

Figure 9: Probability of strong decline in GDP per capita growth at different levels of institutional quality



Source: Authors' calculations.

Notes: Results when running the probit model at margins with robust standard errors clustered at regional level. The control variables (employment rate, trade openness, fiscal budget pc growth) were set to their respective average values. The light blue shaded area represents the 95% confidence interval.

Figure 9 presents the results of the probit model (see Table A.10 in the Appendix for the regression results), showing the predicted probability of crisis events at margins of the respective weakest and strongest institutional outcome. Figure 9 suggests that the probability of a crisis is around 15% when EQI is 0.2 (relatively low institutional quality), and around 5% when EQI is 0.8 (relatively high institutional quality). The large difference in the probability of a crisis between the high and low EQI values suggests that institutional quality is a major determinant of regional economic stability.[12]

6 Robustness tests

We corroborate our analysis by a number of robustness tests.

[12]To mitigate potential endogeneity, we also estimate the probit model using a lagged institutional quality variable. The results were broadly consistent, reaffirming that regions with weaker governance are more likely to face severe GDP declines.

First, a potential concern with our results involves the possible endogeneity issue between quality of government and GDP per capita growth. While regional income growth may be influenced by the quality of government, the quality of government could, in particular over the long-term, also be impacted by regional economic performance, leading to a reverse causality issue. In our baseline regression we took lags of the explanatory variables and controlled for unobserved heterogeneity, following, for instance, Sondermann (2018). To further test for possible endogeneity, we examine whether reversing our baseline equation would reveal a positive impact of GDP per capita growth on the quality of government. However, the results do not indicate a positive relationship (see Appendix Table A.11) and therefore do not provide evidence for reverse causality concerns.

This notwithstanding, we instrument in this section the government quality index and use two-stage least squares method. Specifically, we use the distance of the region to the equator and, alternatively, the legal origins as instrumental variables, following La Porta et al. (1999), Hall and Jones (1999), Masuch et al. (2016) and Augusztin et al. (2025).[13] In the second-stage, aside from including the instrumental variables, we control for lagged regional GDP per capita, EU funds per capita, employment rate and education level. To evaluate the strength of our instrumental variables, a commonly accepted guideline, following Stock and Yogo (2005), is that the F-statistic of the first-stage regression is larger than 10. This threshold is exceeded by both of our instrumental variables (see Table 3). In the second-stage, the fitted value of the two instrumented variables of government quality (distance to equator or legal origin) is included in our preferred specification, column (4) from Table 1. As shown in Table 3, the positive and significant relationship of the instrumented EQI and future GDP per capita growth reinforce our main findings.

[13]To compute the distance from the equator, first, we obtained the latitude in degrees of the largest city by population in each region. Then, since each degree of latitude corresponds to approximately 111 kilometers, we multiplied the absolute value of the latitude (in degrees) by 111 km. This calculation provided us with the distance from the equator in kilometers for each region. The use of distance to equator as an instrument has been used widely in global studies. Its use within the EU countries reduces the variation among regions which could weaken the instrument, but the F-test confirms the strength of our instrument. For legal origins, we employed five dummy variables to represent different country groups based on their legal origins following La Porta et al. (1999). The groups are as follows: English (Cyprus and Ireland), French (Malta, Belgium, Spain, France, Greece, Italy, Luxembourg, the Netherlands, and Poland), German (Austria and Germany), Soviet (Estonia, Lithuania, Latvia, Slovenia, Slovakia, Bulgaria, Czech Republic, Croatia, Hungary, Poland, and Romania), and Scandinavian (Finland, Denmark, and Sweden). Each dummy variable indicates whether a country belongs to one of these specific legal origin groups.

Table 3: Baseline regression with instrumental variables

	EQI IV distance equator	**EQI IV legal origin**
Ln GDP per capita pps	-13.215***	-13.215***
	(1.278)	(1.278)
EQI distance equator	11.739***	
	(3.927)	
EQI legal origin		31.121***
		(10.411)
EU funds per capita	0.002***	-0.001
	(0.000)	(0.001)
Employment rate	0.035	-0.017
	(0.051)	(0.056)
Share of population with low education	-0.084***	0.077
	(0.022)	(0.051)
Constant	128.057***	116.270***
	(11.357)	(10.690)
Countries	25	25
Regions	197	197
N	2314	2314
R^2	0.74	0.74
F-statistic first stage	24.69***	78.25***

Notes: For the first stage equation we use OLS regression with time dummies and clustered standard errors at the regional level to be able to compute the F-test. We did not use regional fixed effects because our instrumental variables are time-invariant. In the second stage equation, we regress the change in GDP per capita 4 years average dependent variable) on government quality (instrumented), control variables and time and regional fixed effects. *** significant at 1% level, ** significant at 5%, * significant at 10%. Robust standard errors in parentheses. The F-statistic is conducted for the variables distance equator, and legal origins for the first stage regressions.

Second, instead of using linear interpolation to fill out the missing years of EQI, we interpolate the EQI with annual data from the World Bank's WGI. Following Rodríguez-Pose and Ketterer (2019), we use the annual changes of the unweighted average of voice and accountability, government effectiveness, rule of law, and control of corruption indicators from the WGI to fill the missing year (i.e., 2011, 2012, 2014, 2015, 2016, 2018, 2019, 2020) of the regional database. This is a fair assumption since the WGI corresponds to the (regionally population-weighted) country mean score of the EQI (see Charron et al. (2014)). The results using this option are broadly in line with our baseline model (Table A.12 in the Appendix).

Third, we restrict our analysis to the subset of EU countries with more than two available regions, reducing the sample to 19 out of 27 member states (see Appendix Table A.1). The results remain broadly consistent with the full sample.

7 Conclusions

The results of this paper document a positive relationship between the quality of institutions and medium-term GDP growth and economic resilience at the regional level. The growth effects of good institutions are asymmetric in that they are more pronounced in low-income regions. If regions with poor governance improve their institutional quality to the EU median, annual GDP per capita growth could increase by 0.5 percentage points on average over four years, and by as much as 0.8 percentage points for low-income regions.

Regions with high quality institutions are also more resilient to adverse shocks. High quality institutions seem to facilitate both better crisis management and more effective policy responses, which help mitigate the adverse impacts of economic downturns. In a region with weaker institutions, the probability of a severe crisis event is three times higher than in a region which is at the frontier of institutional quality.

Overall, these findings underline the substantial economic gains that can be achieved through reforms aimed at improving the quality of government, for instance as a result of the reforms currently implemented under the NextGenerationEU programme (Bańkowski et al., 2024). Policymakers should therefore prioritize institutional reforms aimed at strengthening governance frameworks through increasing public sector efficiency, reducing corruption, and improving access to essential public services. A significant part of institutional policies responsibilities lie at regional level. Specifically, policies to reduce bureaucracy of public services, address the growing urban-rural divide, promote sustainable urban development, support the integration and inclusion of vulnerable and disadvantaged people, or improve the functioning of diverse neighbourhoods could create a more conducive environment for sustainable economic growth and ensure that all regions in the EU have the opportunity to thrive. This approach aligns with broader goals of reducing regional disparities and promoting inclusive growth in the EU.

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Appendix

Table A.1: EU regions by country and NUTS level

Countries	**NUTS 0**	**NUTS 1**	**NUTS 2**
Austria			9
Belgium		3	
Bulgaria			6
Cyprus	1		
Czechia			8
Germany		16	
Denmark			5
Estonia	1		
Greece			13
Spain			17
Finland			5
France			27
Croatia			1
Hungary			8
Ireland			3
Italy			21
Lithuania			2
Luxembourg	1		
Latvia	1		
Malta	1		
Netherlands			12
Poland			17
Portugal			7
Romania			8
Sweden			8
Slovenia			2
Slovakia			4
Total	5	19	183

Notes: A total of 207 regions at different NUTS level are considered in this study.

Table A.2: Descriptive statistics of variables

Source / Variable (unit)	**mean**	**std dev**	**min**	**max**
Data used at regional level				
ARDECO				
nominal GDP per capita in PPS (in euro)	26133	10925	6192	86990
Employment rate (% of total population)	44.55	8.43	17.01	94.26
G, H and I NACE sectors (% of GVA)	20.34	5.43	5.69	51.69
ARDECO and Eurostat				
Infrastructure density (motorways meters per capita)	0.18	0.16	0	1.02
ARDECO and European Commission				
EU funds per capita (in euro)	161.3	167.8	0.0	1285.7
Eurostat				
Gross domestic expenditure on R&D per capita (in euro)	392	484.3	3.9	3177.1
Low education (% of population 25-64 years with less than primary and lower secondary education)	24.27	14.22	2	78.8
Charron et al. (2014, 2015, 2019, 2022)				
European Quality of Government Index (rescaled 0 to 1)	0.50	0.17	0.06	0.97
Data used at country level				
Eurostat				
Fiscal balance (govt. deficit/surplus) per capita (in euro)	-2966	4461	-19104	6054
Trade openness (total imports and exports over GDP)	96.19	43.12	50.92	393.14
ECB				
Long term interest rates (government bonds maturing in ten years, % per annum)	2.65	3.07	-0.48	26.14
European Committee of the Regions (2025)				
Fiscal decentralisation index (average value of expenditure ratio and revenue ratio, score from 0% to 100%)	20.2	11.6	1	45

Notes: The EU funds per capita have been calculated by using the EU funds data from the historic EU payments by region (https://cohesiondata.ec.europa.eu/stories/s/Historic-EU-payments-by-region-1988-2022/47md-x4nq) and the population figures from ARDECO. The funds included were: cohesion fund, the european social fund, the european regional development fund, the european agricultural fund for rural development, the european maritime and fisheries fund, youth employment initiative, and the european aid to the most deprived. Some NUTS2 units in EU funds database did not correspond to the NUTS2 regions in the latest version of ARDECO database, thus for these regions we modified the NUTS2 units to those in ARDECO.

Table A.3: Baseline regression replacing EU funds with R&D expenditure

	(1)	(2)	(3)	(4)
Ln GDP per capita pps	-13.759***	-13.892***	-12.816***	-10.973***
	(1.287)	(1.443)	(1.300)	(1.498)
EQI	3.898*	3.953*	4.720**	4.657**
	(1.994)	(2.011)	(2.014)	(2.279)
Ln GERD per capita	1.350***	1.336***	1.353***	1.268***
	(0.277)	(0.279)	(0.273)	(0.279)
Employment rate		0.020	-0.015	-0.040
		(0.058)	(0.056)	(0.067)
Share of population with low education			-0.088***	-0.101***
			(0.021)	(0.028)
Infrastructure density				1.647
				(3.877)
Constant	129.268***	129.740***	122.814***	106.045***
	(11.846)	(12.371)	(11.095)	(12.529)
Regions	202	202	202	178
N	1,685	1,685	1,685	1,419
R^2	0.77	0.77	0.78	0.72

Notes: Fixed effect (time and regions) estimates of the change in GDP per capita 4 years average ahead growth (dependent variable), government quality and control variables. *** significant at 1% level, ** significant at 5%, * significant at 10%. Robust standard errors in parentheses. GERD stands for Gross domestic expenditure on R&D.

Table A.4: Baseline regression with annual ln GDP per capita growth as dependent variable

	(1)	(2)	(3)	(4)	(5)	(6)
Ln GDP per capita pps	-15.415***	-16.571***	-15.523***	-14.361***	-9.953***	-14.033***
	(1.574)	(1.937)	(2.146)	(1.986)	(1.694)	(2.002)
EQI	1.424	2.082	1.815	1.884	2.636	0.367
	(2.630)	(2.714)	(2.713)	(2.765)	(2.690)	(2.956)
EU funds per capita		0.002**	0.002**	0.003***	0.001	0.002***
		(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Employment rate			-0.127	-0.160*	-0.152	-0.174*
			(0.089)	(0.085)	(0.096)	(0.094)
Share of population with low education				-0.116***	-0.078*	-0.106***
				(0.034)	(0.040)	(0.039)
Infrastructure density					13.134***	
					(4.632)	
Fiscal balance per capita growth						0.000
						(0.000)
Trade openness						0.082***
						(0.027)
Long term interest rate						0.138***
						(0.049)
Constant	155.303***	166.229***	161.499***	154.607***	107.617***	145.161***
	(15.532)	(19.317)	(19.922)	(18.252)	(15.236)	(18.526)
Countries	27	25	25	25	23	24
Regions	207	197	197	197	175	196
N	2484	2330	2330	2314	2030	2288
R^2	0.58	0.61	0.61	0.62	0.60	0.63

Notes: Fixed effect (time and regions) estimates of the change in GDP per capita 1 year ahead growth (dependent variable), government quality and control variables. *** significant at 1% level, ** significant at 5%, * significant at 10%. Robust standard errors in parentheses.

Table A.5: Baseline regression with average annual ln GDP per capita growth over two years as dependent variable

	(1)	(2)	(3)	(4)	(5)	(6)
Ln GDP per capita pps	-15.294***	-14.718***	-13.773***	-12.754***	-10.279***	-12.437***
	(1.178)	(1.620)	(1.761)	(1.632)	(1.741)	(1.651)
EQI	3.791	3.664	3.423	3.588	4.068	2.624
	(2.334)	(2.417)	(2.412)	(2.449)	(2.510)	(2.592)
EU funds per capita		0.002***	0.002***	0.003***	0.001	0.002***
		(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Employment rate			-0.115	-0.141*	-0.103	-0.129
			(0.074)	(0.072)	(0.084)	(0.079)
Share of population with low education				-0.099***	-0.093**	-0.101***
				(0.030)	(0.036)	(0.034)
Infrastructure density					12.593***	
					(4.453)	
Fiscal balance per capita growth						-0.000
						(0.000)
Trade openness						0.049**
						(0.023)
Long term interest rate						0.140***
						(0.042)
Constant	152.060***	146.087***	141.821***	135.570***	107.276***	127.769***
	(11.689)	(16.074)	(16.395)	(15.077)	(15.698)	(15.497)
Countries	27	25	25	25	23	24
Regions	207	197	197	197	175	196
N	2484	2330	2330	2314	2030	2288
R^2	0.64	0.67	0.67	0.68	0.66	0.69

Table A.6: Baseline regression with average annual ln GDP per capita growth over three years as dependent variable

	(1)	(2)	(3)	(4)	(5)	(6)
Ln GDP per capita pps	-14.059***	-12.531***	-12.131***	-11.298***	-10.038***	-10.936***
	(1.132)	(1.340)	(1.510)	(1.427)	(1.703)	(1.436)
EQI	4.983**	4.372**	4.271*	4.435**	4.785**	3.982*
	(2.113)	(2.187)	(2.190)	(2.219)	(2.333)	(2.319)
EU funds per capita		0.002***	0.002***	0.002***	0.001	0.002***
		(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Employment rate			-0.048	-0.069	-0.059	-0.069
			(0.063)	(0.062)	(0.075)	(0.068)
Share of population with low education				-0.081***	-0.082***	-0.075***
				(0.024)	(0.030)	(0.028)
Infrastructure density					10.369**	
					(4.279)	
Fiscal balance per capita growth						-0.000
						(0.000)
Trade openness						0.038*
						(0.021)
Long term interest rate						0.063*
						(0.034)
Constant	138.991***	123.823***	122.018***	116.820***	102.196***	109.909***
	(11.275)	(13.338)	(13.836)	(12.973)	(15.236)	(13.319)
Countries	27	25	25	25	23	24
Regions	207	197	197	197	175	196
N	2484	2330	2330	2314	2030	2288
R^2	0.69	0.71	0.71	0.71	0.68	0.72

Notes: Fixed effect (time and regions) estimates of the change in GDP per capita 2 (top table) and 3 (bottom table) years average ahead growth (dependent variable), government quality and control variables. *** significant at 1% level, ** significant at 5%, * significant at 10%. Robust standard errors in parentheses.

Table A.7: Baseline regression for low-income (below EU median) regions

	(1 year)	**(2 years)**	**(3 years)**	**(4 years)**
Ln GDP per capita pps	-15.248***	-12.818***	-10.995***	-10.610***
	(2.436)	(1.870)	(1.484)	(1.105)
EQI	3.449	5.706	6.879**	6.079**
	(4.328)	(3.658)	(3.250)	(2.555)
EU funds per capita	0.003***	0.003***	0.002***	0.001**
	(0.001)	(0.001)	(0.001)	(0.000)
Employment rate	-0.212*	-0.181*	-0.088	0.007
	(0.118)	(0.097)	(0.083)	(0.071)
Share of population with low education	-0.083*	-0.053	-0.033	-0.034
	(0.046)	(0.041)	(0.034)	(0.028)
Constant	158.010***	130.969***	108.706***	102.189***
	(20.811)	(15.935)	(12.384)	(9.203)
Countries	20	20	20	20
Regions	98	98	98	98
N	1129	1129	1129	1129
R^2	0.59	0.66	0.69	0.71

Notes: Fixed effect (time and regions) estimates of the change in GDP per capita different years average ahead (specified in each column) growth (dependent variable), government quality and control variables. *** significant at 1% level, ** significant at 5%, * significant at 10%. Robust standard errors in parentheses.

Table A.8: Baseline regression for high-income (above EU median) regions

	(1 year)	**(2 years)**	**(3 years)**	**(4 years)**
Ln GDP per capita pps	-23.722***	-22.698***	-20.816***	-18.620***
	(4.407)	(3.826)	(3.449)	(3.007)
EQI	1.042	2.231	2.865	2.595
	(3.455)	(3.242)	(2.888)	(2.381)
EU funds per capita	0.002	0.000	0.001	0.002
	(0.004)	(0.003)	(0.003)	(0.002)
Employment rate	-0.201*	-0.174*	-0.097	-0.044
	(0.109)	(0.090)	(0.078)	(0.065)
Share of population with low education	-0.117**	-0.131***	-0.120***	-0.108***
	(0.045)	(0.039)	(0.028)	(0.023)
Constant	258.782***	245.557***	221.522***	196.205***
	(46.720)	(41.526)	(36.837)	(31.244)
Countries	22	22	22	22
Regions	99	99	99	99
N	1185	1185	1185	1185
R^2	0.69	0.75	0.80	0.83

Notes: Fixed effect (time and regions) estimates of the change in GDP per capita different years average ahead (specified in each column) growth (dependent variable), government quality and control variables. *** significant at 1% level, ** significant at 5%, * significant at 10%. Robust standard errors in parentheses.

Table A.9: Baseline regression with fiscal autonomy index

		(1)	(2)	(3)	(4)	(5)
Ln GDP per capita pps	-4.352***	-3.450***	-4.637***	-4.138***	-3.613***	-3.865***
	(0.587)	(0.471)	(0.516)	(0.523)	(0.515)	(0.517)
EQI	2.986**	1.678*	1.803*	1.180	-0.296	0.677
	(1.268)	(0.975)	(0.971)	(0.936)	(0.890)	(0.928)
Decentralised DV	-0.936	-1.222	-0.107	0.906	-0.134	0.778
	(1.226)	(1.049)	(0.951)	(0.920)	(0.763)	(0.879)
EQI*Decentralised DV	1.138	1.841	-0.010	-1.492	0.091	-1.186
	(1.991)	(1.694)	(1.584)	(1.528)	(1.286)	(1.465)
EU funds per capita		-0.000	-0.000	-0.000	0.000	-0.000
		(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Employment rate			0.104***	0.078***	0.080***	0.068***
			(0.017)	(0.017)	(0.017)	(0.019)
Share of population with low education				-0.033***	-0.025***	-0.027***
				(0.007)	(0.006)	(0.006)
Infrastructure density					0.400	
					(0.363)	
Fiscal balance per capita growth						-0.000
						(0.000)
Trade openness						0.004*
						(0.002)
Long term interest rate						-0.047***
						(0.014)
Constant	43.423***	34.986***	42.225***	39.626***	34.958***	37.219***
	(5.355)	(4.324)	(4.377)	(4.320)	(4.224)	(4.265)
Number of observations	2484	2330	2330	2314	2030	2288
Number of regions	207	197	197	197	175	196
R^2	0.68	0.70	0.70	0.70	0.68	0.71

Notes: Fixed effects (time and regions) estimates of the 4-year average annual growth in GDP per capita (dependent variable). Government quality and control variables are lagged by one year. *** significant at 1% level, ** significant at 5%, * significant at 10%. Robust standard errors in parentheses.

Table A.10: Probit Regression Results

Variable	Coefficient	Robust Std. Error
EQI	-1.014***	0.262
Fiscal balance per capita growth	-0.000***	0.000
Trade openness	-0.007***	0.002
Share employment	0.004	0.005
Constant	-0.361*	0.219
Observations	2484	
Clusters (Regions)	207	
Wald $\chi^2(4)$	47.6	
Prob > χ^2	0.000	
Log Pseudolikelihood	-751.45	
Pseudo R^2	0.068	

Notes: *** significant at 1% level, ** significant at 5%, * significant at 10%. Robust standard errors are clustered at the regional level.

Table A.11: Impact of ln GDP per capita growth on quality of government

	(1)	**(2)**
Ln GDP per capita pps growth (1 year before)	-0.000	
	(0.000)	
Ln GDP per capita pps growth (average 4 years before)		-0.002**
		(0.001)
Constant	0.504***	0.507***
	(0.003)	(0.003)
Countries	27	27
Regions	207	207
N	2484	2484
R^2	0.001	0.008

Notes: Fixed effect (time and regions) estimates of GDP per capita 1 year and 4 years average lag growth on government quality. *** significant at 1% level, ** significant at 5%, * significant at 10%. Robust standard errors in parentheses.

Table A.12: Robustness test with WGI linear interpolation

	(1 year)	**(2 years)**	**(3 years)**	**(4 years)**
Ln GDP per capita pps	-14.350***	-12.748***	-11.225***	-10.617***
	(1.995)	(1.649)	(1.446)	(1.225)
EQI	1.659	3.340*	3.337*	2.472*
	(2.292)	(1.952)	(1.700)	(1.403)
EU funds per capita	0.003***	0.003***	0.002***	0.001***
	(0.001)	(0.001)	(0.001)	(0.000)
Employment rate	-0.163*	-0.148**	-0.078	-0.005
	(0.085)	(0.072)	(0.063)	(0.053)
Share of population with low education	-0.115***	-0.098***	-0.077***	-0.071***
	(0.034)	(0.030)	(0.024)	(0.020)
Constant	154.746***	135.901***	116.935***	108.244***
	(18.338)	(15.224)	(13.157)	(11.021)
Countries	25	25	25	25
Regions	197	197	197	197
N	2314	2314	2314	2314
R^2	0.62	0.68	0.71	0.74

Notes: Fixed effect (time and regions) estimates of the change in GDP per capita different years average ahead (specified in each column) growth (dependent variable), government quality and control variables. *** significant at 1% level, ** significant at 5%, * significant at 10%. Robust standard errors in parentheses.

Table A.13: Robustness test with WGI linear interpolation. Low-income (below EU median) regions

	(1 year)	**(2 years)**	**(3 years)**	**(4 years)**
Ln GDP per capita pps	-15.332***	-12.843***	-10.945***	-10.559***
	(2.460)	(1.871)	(1.484)	(1.113)
EQI	3.898	5.194**	5.398**	4.693**
	(3.172)	(2.465)	(2.215)	(1.836)
EU funds per capita	0.003***	0.003***	0.002***	0.001**
	(0.001)	(0.001)	(0.001)	(0.000)
Employment rate	-0.220*	-0.195**	-0.106	-0.008
	(0.117)	(0.097)	(0.083)	(0.071)
Share of population with low education	-0.081*	-0.049	-0.026	-0.028
	(0.047)	(0.042)	(0.034)	(0.028)
Constant	158.911***	131.848***	109.343***	102.715***
	(21.153)	(16.237)	(12.704)	(9.442)
Countries	20	20	20	20
Regions	98	98	98	98
N	1129	1129	1129	1129
R^2	0.59	0.66	0.69	0.71

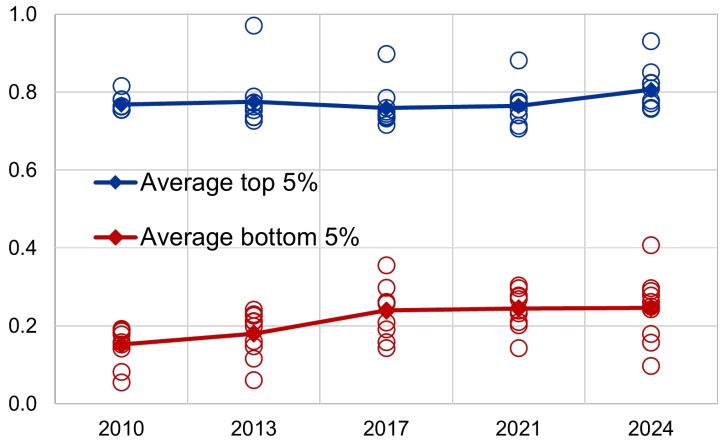
Notes: Fixed effect (time and regions) estimates of the change in GDP per capita different years average ahead (specified in each column) growth (dependent variable), government quality and control variables. *** significant at 1% level, ** significant at 5%, * significant at 10%. Robust standard errors in parentheses.

Table A.14: Robustness test with WGI linear interpolation. High-income (above EU median) regions

	(1 year)	**(2 years)**	**(3 years)**	**(4 years)**
Ln GDP per capita pps	-23.681***	-22.750***	-20.777***	-18.490***
	(4.381)	(3.783)	(3.433)	(3.023)
EQI	0.603	2.619	2.356	1.249
	(3.552)	(3.325)	(2.788)	(2.226)
EU funds per capita	0.002	0.000	0.001	0.002
	(0.004)	(0.003)	(0.003)	(0.002)
Employment rate	-0.202*	-0.179*	-0.101	-0.046
	(0.111)	(0.091)	(0.079)	(0.066)
Share of population with low education	-0.116**	-0.131***	-0.118***	-0.105***
	(0.045)	(0.039)	(0.028)	(0.023)
Constant	258.646***	246.087***	221.579***	195.709***
	(46.515)	(40.949)	(36.499)	(31.306)
Countries	22	22	22	22
Regions	99	99	99	99
N	1185	1185	1185	1185
R^2	0.69	0.75	0.80	0.83

Notes: Fixed effect (time and regions) estimates of the change in GDP per capita different years average ahead (specified in each column) growth (dependent variable), government quality and control variables. *** significant at 1% level, ** significant at 5%, * significant at 10%. Robust standard errors in parentheses.

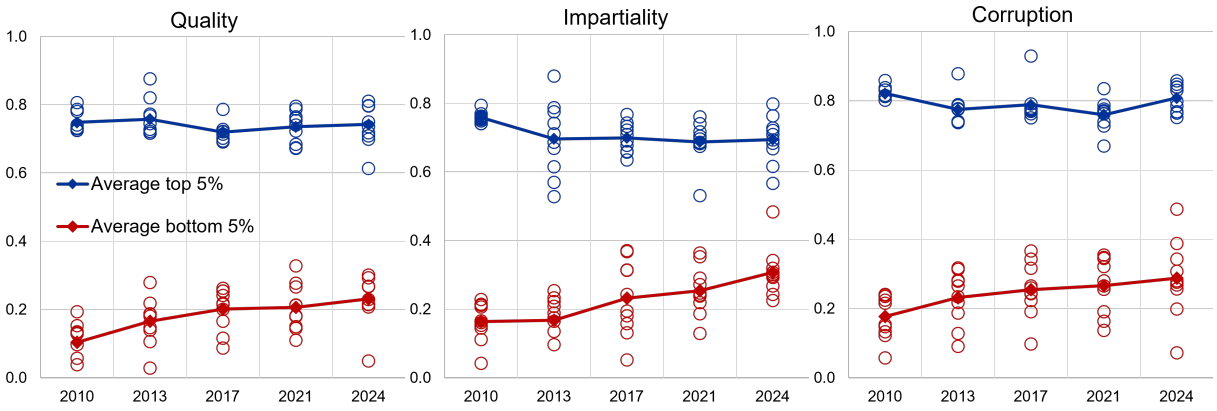
Figure A.1: EQI: developments over time of top 5% and bottom 5% regions in 2010



Source: Charron et al. (2014, 2015, 2019, 2022, 2024) and authors' calculations.

Notes: The top 5% includes the 10 regions with highest levels of EQI in 2010, and the bottom 5% includes the 10 regions with lowest levels of EQI in 2010. The original dataset of EQI ranges from -3 to +3, with higher values representing better government quality. Authors have rescaled the indicator from 0 to 1.

Figure A.2: EQI sub-components: developments over time of top 5% and bottom 5% regions in 2010



Source: Charron et al. (2014, 2015, 2019, 2022, 2024) and authors' calculations.

Notes: The top 5% includes the 10 regions with highest levels of EQI sub-components in 2010, and the bottom 5% includes the 10 regions with lowest levels of EQI sub-components in 2010. The original dataset of EQI sub-components range from -3 to +3, with higher values representing better government quality. Authors have rescaled the sub-indicators from 0 to 1.

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Marinela-Daniela Filip
European Central Bank, Frankfurt am Main, Germany; email: marinela-daniela.filip@ecb.europa.eu

Ralph Setzer
European Central Bank, Frankfurt am Main, Germany; email: Ralph.Setzer@ecb.europa.eu

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