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Institutional quality and regional economic development in Europe: from aggregate governance to educational sector institutions

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Contents

Abstract (Italian)

Questa tesi analizza la relazione tra qualità istituzionale e sviluppo economico regionale in Europa, con un focus specifico sulla governance dell'educazione.

Nel dibattito europeo sulle disparità territoriali emerge sempre più spesso il tema di risultati educativi diseguali, qualità non omogenea dei servizi pubblici e preoccupazioni legate a un possibile sotto-investimento in istruzione, questi aspetti sono rilevanti non solo sul piano dell'equità, ma anche su quello della crescita: l'educazione è uno dei principali canali di accumulazione di capitale umano e, di conseguenza, di produttività e opportunità economiche nel lungo periodo.

Utilizzando l'European Quality of Government Index (EQI) a livello NUTS2, la tesi studia se le regioni caratterizzate da una migliore qualità percepita delle istituzioni pubbliche presentano livelli di reddito più elevati, e se la componente "education" della qualità istituzionale contribuisce in modo distinto rispetto all'indicatore complessivo.

Accanto all'EQI totale, viene quindi impiegato un indice istituzionale specifico per l'educazione, che sintetizza la qualità e la performance percepita delle istituzioni in ambito educativo, collegandolo al PIL pro capite regionale (in log) per il 2017 e il 2024.

L'analisi combina confronti cross-section con evidenza panel (2013–2024) e specifiche orientate al timing, in modo da valutare se la qualità istituzionale misurata in precedenza sia più coerentemente associata alla performance economica successiva.

Nel complesso, la tesi indica che qualità istituzionale e governance dell'educazione sono strettamente connesse alla prosperità regionale e che il miglioramento dell'efficacia dei servizi pubblici può essere rilevante per ridurre divari territoriali persistenti.

Abstract (English)

This thesis studies how institutional quality relates to regional economic development in Europe, with a specific focus on education governance.

In many European regions, policy debates increasingly emphasize persistent gaps in educational outcomes and concerns about underinvestment and unequal quality of public services, these issues matter not only for equity, but also for long-run productivity, because education is a key driver of human capital accumulation and economic opportunities.

Using the European Quality of Government Index (EQI) at the NUTS2 level, the analysis examines whether regions with higher perceived quality and performance of public institutions tend to be richer, and whether education-related governance plays a distinct role within this broader relationship.

Alongside the overall EQI measure, the thesis employs an education-specific institutional component that captures perceptions of governance quality in the education domain and relates these measures to regional GDP per capita (in logs) for 2017 and 2024.

To complement cross-sectional comparisons, the thesis also uses panel data analysis for the period 2013–2024, to assess whether lagged institutional quality is more closely associated with subsequent economic performance.

Overall, the findings suggest that institutional quality and education governance are closely linked to regional prosperity, and that improving the quality and effectiveness of public services may be relevant for reducing persistent regional disparities.

I. Introduction

Regional disparities in economic performance remain one of the most persistent features of the European economy, even within the European Union, where market integration, cohesion policy and institutional harmonization have advanced substantially, differences in living standards across regions continue to be large and durable.

These gaps matter not only for equity and social cohesion but also for efficiency: persistent underperformance in some areas implies unrealized productive potential, lower aggregate growth and political tensions that can undermine integration and policy effectiveness.

A substantial literature has sought to explain why some places are richer than others, classic determinants include geography, industrial specialization and human capital accumulation.

At the same time, a prominent line of research emphasizes institutions, the quality of public governance, the effectiveness and impartiality of public services, the ability of the state to enforce rules, and the extent to which public authority is exercised in a predictable and non-corrupt manner, as fundamental drivers of long-run development.

The intuition is simple: when institutions are effective and impartial, economic agents face lower uncertainty and transaction costs, investments are better protected, public resources are allocated more efficiently and productive activities are less distorted by rent-seeking.

Empirically, however, studying institutions is difficult for at least two reasons: first, institutions are often measured at the country level, whereas many relevant economic disparities occur at a sub-national level, national measures are informative but they cannot capture the often large institutional heterogeneity within countries, especially in Europe where administrative capacity, public service quality, and perceived corruption may differ markedly across regions.

Second, institutions tend to change slowly, and their effects may unfold over time, this creates challenges in distinguishing contemporaneous correlations from relationships that reflect delayed impacts or reverse causality.

This thesis addresses these challenges by leveraging a uniquely relevant dataset: the European Quality of Government Index (EQI), a sub-national measure of institutional

quality at the NUTS2 level.

The EQI is designed precisely to make “quality of government” observable at the regional level, enabling systematic comparisons across regions and across countries, this feature is crucial for Europe, where regional development and cohesion are policy priorities and where within-country differences can be as economically meaningful as differences between countries.

In addition to the overall EQI measure, the analysis also considers a sectoral governance component related to education, to explore whether the institutional–income relationship is driven by specific governance dimensions rather than only by broad governance quality.

The guiding idea is to treat institutional quality not as an abstract national characteristic, but as a regional attribute that can vary within the same country and potentially shape local economic outcomes.

This thesis combines cross-sectional and panel approaches, each contributing a different piece of evidence.

The cross-sectional analysis focuses on 2017 and 2024 and estimates OLS regressions of log GDP per capita on institutional quality measures.

Across cross-sectional specifications, the analysis progressively enriches the set of controls, baseline controls include log population and the unemployment rate, while extended controls incorporate a proxy for human capital (tertiary education share) and sectoral composition (shares of agriculture, industry, and construction), with services acting as the reference category when shares sum to one.

In addition, the analysis introduces macro-area dummies (South, West-Central, North, East) to capture broad European bloc heterogeneity. This step is important because part of the institutional–income relationship may reflect large-scale historical and structural differences across European groups rather than purely within-bloc variation.

While cross-sectional evidence is informative, it can be confounded by persistent regional characteristics that jointly influence institutions and income, for this reason, the thesis also estimates regional fixed-effects models on a panel restricted to the waves 2013, 2017, and 2021.

The fixed effects estimator removes all time-invariant regional characteristics and identifies the relationship using within-region changes over time, making it conceptually

closer to a "within" comparison of the same region across different years, standard errors are clustered at the regional level to account for dependence within NUTS2 units over time.

A central complication is that institutions may not affect income contemporaneously. Institutional improvements, such as better governance, more effective public services, or reduced corruption, can take time to translate into productive investment and higher measured income.

Moreover, contemporaneous specifications are potentially affected by simultaneity: higher income may itself influence institutional quality (through better fiscal capacity, stronger accountability, or different political equilibria), making it difficult to interpret a contemporaneous relationship.

To address these timing issues more directly, the thesis estimates additional fixed effects specifications that relate income to institutions measured earlier.

Two complementary strategies are used: the first employs a fixed four-year lag (L4) within the 2013, 2017, 2021 and 2024 panel, linking income to institutional quality measured in the previous wave. The second constructs a previous-wave measure and extends the panel to include 2024, allowing income to be related to the most recent prior institutional observation available for each region.

Together, these approaches help align the timing of institutions and outcomes and provide evidence that is more consistent with delayed effects and less exposed to contemporaneous reverse causality.

Finally, the thesis includes an external validation exercise that compares EQI with a widely used national governance measure: the Worldwide Governance Indicators (WGI) Government Effectiveness indicator (2017).

Since WGI varies only at the country level, the analysis clusters standard errors by country, and uses this exercise as a consistency check rather than as an alternative sub-national governance measure. The objective is to verify that EQI behaves coherently relative to a recognized benchmark while acknowledging that WGI primarily captures between-country heterogeneity.

This thesis contributes to the empirical literature on institutions and development in three ways: first, it emphasizes the value of sub-national institutional measurement for understanding European regional disparities, complementing country-level approaches

that may hide within-country heterogeneity.

Second, it evaluates institutional–income relationships in multiple years, including the most recent EQI wave and a transparent proxy for the corresponding income year.

Third, it explicitly addresses timing by moving beyond contemporaneous fixed effects models and implementing previous-wave specifications that better align institutional measurement with subsequent economic outcomes.

Throughout, results are interpreted cautiously as associations rather than causal effects, while highlighting patterns that are consistent with delayed institutional impacts.

II. Institutional quality and measurement

1.1 EQI: definition, pillars and wave structure

The European Quality of Government Index (EQI) is a sub-national measure of institutional quality produced by the Quality of Government (QoG) Institute at the University of Gothenburg.

Its main purpose is to make "quality of government" observable at the regional level in Europe, allowing governance to be compared not only across countries but also within countries across regions, this is precisely what makes the EQI particularly useful in empirical research on regional development (University of Gothenburg, 2024).

Many widely used governance indicators exist only at the national level, while administrative measures at the local level are often not harmonized and therefore hard to compare across different institutional systems.

The EQI addresses this gap by relying on a harmonized survey framework that is implemented across countries and then aggregated consistently to the regional scale, producing an institutional indicator that can be employed in regional growth and development analyses (University of Gothenburg, 2024).

Methodologically, the EQI is built from large-scale survey evidence, the underlying data come from citizens' responses, so the index reflects both perceptions and experiences of governance in everyday interactions with the public sector. The survey is designed to capture multiple sides of institutional quality rather than reducing governance to a single dimension, in practice, EQI is organised around three core components.

The first concerns the quality of public services, where respondents evaluate how well key services perform in their area, with particular emphasis on education, healthcare, and policing or public safety.

The second focuses on impartiality, meaning whether public services and decisions are delivered fairly and without preferential treatment; survey items probe whether some groups receive advantages or whether citizens are treated equally when accessing services such as schools, hospitals, and the police.

The third component addresses corruption, combining questions about how widespread corruption is perceived to be in public services with questions closer to direct experience, such as whether respondents have encountered requests for informal

payments or “gifts” in specific sectors.

This structure is important for empirical work because it treats institutional quality as a multidimensional concept that jointly reflects service performance, neutrality of administration and integrity (University of Gothenburg, 2024).

A further strength of the EQI is its effort to maintain comparability across countries, survey-based measures can be affected by differences in response styles across national contexts, so the QoG methodology anchors the regional survey information to a broader governance benchmark at the country level.

In the official documentation, regional scores are interpreted relative to the national average and this “within-country” information is then linked to an external national reference so that the resulting scale is more readable in cross-country comparisons.

Because the EQI is estimated from sample survey data, the regional datasets also provide information on statistical uncertainty, such as margins of error and lower and upper bounds associated with the index. This is particularly useful in a thesis context, as it transparently communicates that the EQI is not a noise-free administrative statistic but an estimate derived from a finite sample of respondents.

The concept of “waves” is central to understanding how the EQI should be used in applied research: EQI is not available annually, the survey is conducted in specific rounds, and the index is published for those reference years. The main waves documented by the QoG Institute correspond to 2010, 2013, 2017, 2021, and 2024, as a result, the EQI should be interpreted as a sequence of snapshots of regional institutional quality, spaced over time, rather than a continuous year-by-year series. This feature reflects the practical costs and complexity of running a harmonised, multi-country, sub-national survey but it also represents a methodological advantage because each wave is designed explicitly to support cross-regional comparability at a European scale.

The QoG Institute makes available regional “time-series” datasets that stack the waves into a consistent structure, alongside microdata at the individual level and additional country-level materials intended to facilitate comparisons over time under consistent survey modes.

For the most recent wave, the official documentation also describes the fieldwork period and survey modes, including the combination of telephone and online interviews and the use of weighting procedures to improve representativeness.

Overall, the wave-based nature of the EQI is not a minor technical detail: it is the organising principle that determines how the index is observed over time, how datasets should be constructed, and how empirical strategies should be aligned with the available measurement points (University of Gothenburg, 2024).

In this thesis, we use the EQI as the baseline proxy for institutional quality at the NUTS2 level and exploit its wave-based structure (2010, 2013, 2017, 2021 and 2024) to build a consistent region–wave panel.

The multidimensional nature of the index also provides a natural link to public service delivery, which is central to the mechanisms discussed in the regional-development literature.

At the same time, the survey-based construction of the EQI calls for cautious interpretation of short-run changes and conservative inference; for this reason, our empirical specifications rely on clustered standard errors at the regional level and a set of robustness checks.

In the baseline analysis, we relate regional economic development, proxied by GDP per capita, to institutional quality measured by the EQI, controlling for standard demographic and labour-market covariates. Education is discussed here as a plausible channel through which governance may matter; empirically, we account for regional human capital using available proxies such as tertiary educational attainment.

1.2 Education as a potential driver

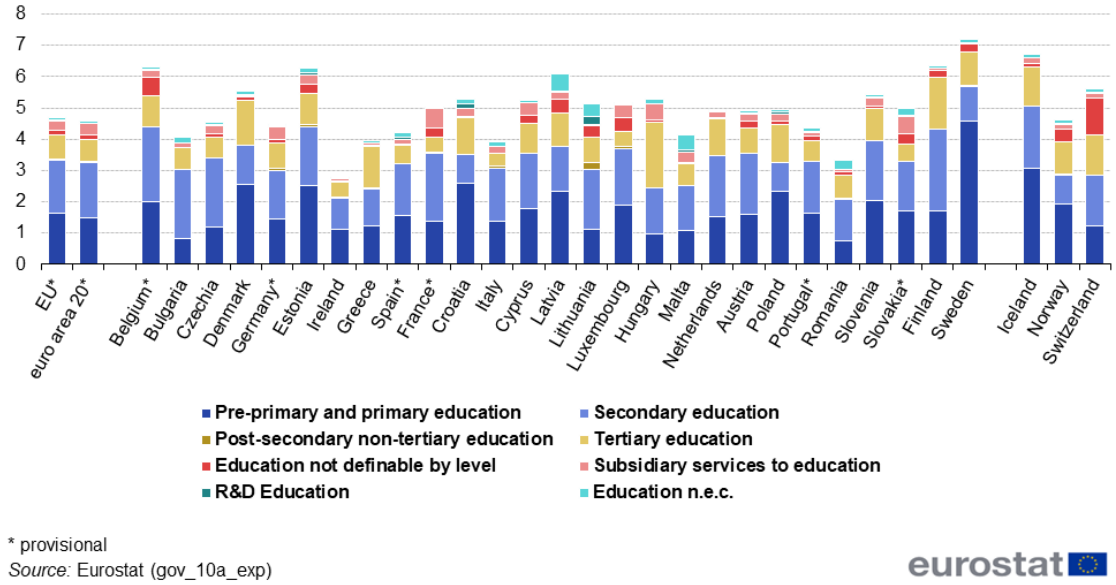
Human capital accumulation is a key driver of long-run productivity and regional economic performance, in this perspective, public investment in education is often regarded as a central policy lever to foster skills, innovation capacity and social mobility.

At the same time, descriptive evidence suggests that education spending has not followed a clear upward trajectory over the last decades, at least when measured in relative terms.

For the EU aggregate, government expenditure on education as a share of GDP has remained within a relatively narrow band over 1995–2023 (roughly between 4.6% and 5.1%), with a decline from the mid-1990s to the pre-crisis years and subsequent fluctuations partly driven by business-cycle movements in GDP (Eurostat, 2025).

As shown in Figure 1, in 2023, EU government expenditure on education amounted to around 4.7% of GDP and 9.6% of total government expenditure (Eurostat, 2025).

Figure 1.1. General government expenditure on education by level (2023, % of GDP)



* provisional
Source: Eurostat (gov_10a_exp)

eurostat

Source: Eurostat, 2023

A similar pattern emerges when looking at the composition of public budgets: across OECD countries, the share of government expenditure devoted to education declined on average from 11% in 2015 to 10% in 2022, indicating that education has, in many cases, not been prioritised relative to other spending items (OECD, 2025).

While these indicators are descriptive and sensitive to the chosen denominator (e.g. GDP versus real expenditure or expenditure per student), they highlight a relevant policy concern: sustaining and improving education outcomes may require not only adequate resources but also an institutional environment capable of allocating and managing them effectively.

Importantly, education spending is an input, not an outcome, a stable or declining spending-to-GDP ratio does not automatically imply weaker human-capital accumulation, results depend on how resources are allocated (e.g., teachers' quality, infrastructure, class size, targeting of disadvantaged areas) and on broader institutional constraints.

For this reason, the education channel is best interpreted by jointly considering

spending patterns and human-capital proxies available at the regional level, such as tertiary educational attainment, alongside broader measures of learning and skills documented in international assessments.

This distinction motivates why, in the econometric analysis, we control for regional human capital while treating education expenditure evidence mainly as a stylised fact and a policy-relevant background condition.

The link with institutional quality follows naturally, even with similar budget envelopes, regions operating in environments with higher government quality may transform resources into outcomes more effectively through better procurement, less leakage and favouritism and more impartial access to public services, conversely, weak governance can reduce the marginal return of public spending and widen inequalities in service delivery.

This governance–effectiveness perspective is consistent with evidence showing that public expenditures are more strongly associated with development outcomes where governance quality is higher (Rajkumar and Swaroop, 2008).

In our framework, the EQI provides a regionally disaggregated measure of institutional quality, allowing us to investigate whether better governance is systematically associated with higher levels of regional economic development.

The education sector is therefore interpreted as a plausible channel through which institutional quality may matter, stronger institutions may improve the efficiency of public service delivery and the productivity of both public and private investments, ultimately supporting higher GDP per capita.

III. Literature review

3.1 Conceptual framework

Institutions can be broadly defined as the set of formal rules (laws, enforcement, property rights, administrative procedures) and informal norms (social trust, civic culture, accepted practices) that shape economic and political interactions.

The quality of institutions, captured by dimensions such as government effectiveness, impartiality in public service delivery and the control of corruption, affects the incentives faced by firms and households and, ultimately, the efficiency with which resources are allocated.

In this framework, higher-quality institutions tend to reduce transaction costs and uncertainty, improve contract enforcement and limit rent-seeking; they can foster productive investment and innovation, improve the functioning of labour and product markets, and strengthen the capacity of the public sector to provide high-quality services; these channels translate into higher productivity and, in the long run, into higher income levels.

This thesis is built on this conceptual foundation by studying institutional quality and regional economic development in Europe, with a specific focus on NUTS2 regions and the European Quality of Government Index (EQI) as the main institutional measure.

3.2 Institutions as driver of development: classic contributions

The idea that institutions are central to economic development rests on a simple but powerful intuition: prosperity does not depend only on resources and technology but on the incentives and constraints that shape how individuals, firms and governments behave.

In this perspective, institutional quality affects whether economic effort is directed toward productive activities such as investment, innovation, skill formation or diverted toward rent-seeking, protection and informal arrangements.

This is one reason why institutional explanations have become a dominant lens in development economics: they provide a framework capable of accounting for persistent differences in income levels across places, even when standard factors such as capital

accumulation are considered.

This foundation is essential for the regional EU context of this thesis, because it clarifies why a strong cross-sectional association between institutional quality and income is plausible and why more demanding designs (fixed effects, lags and robustness strategies) are needed to interpret the relationship.

A foundational conceptual contribution is provided by North (1990), who defines institutions as the "rules of the game" that structure political and economic interaction; in North's framework, the key mechanism runs through transaction costs and enforcement: where property rights are secure, contracts are enforceable and administrative procedures are predictable, transaction costs are lower and the returns to productive investment are higher.

Conversely, when enforcement is weak and public administration is unreliable, agents have rational incentives to allocate resources to coping strategies such as informal protection, bribery, lobbying and other forms of diversion because these may be privately optimal even if socially inefficient.

North (1990) also stresses that institutions tend to be persistent due to path dependence: institutional arrangements are supported by organizations and interest groups that benefit from them, so inefficient equilibria may survive for long periods, this persistence is particularly relevant when moving from national to sub-national settings: even under the same formal legal framework, effective governance can differ substantially across territories because enforcement capacity, administrative practices, and local norms evolve in historically contingent ways. The implication is that institutional quality can vary meaningfully within countries and may help explain enduring regional disparities.

While North (1990)'s work clarifies the conceptual channel, a major empirical challenge remains, institutions are endogenous so richer economies may demand or finance better institutions and omitted factors, such as historical, geographic, cultural and political, may jointly shape both institutions and income.

Acemoglu et al. (2001) tackle this identification problem directly and, in doing so, set a benchmark for empirical work on institutions, their central argument is that variation in modern institutions can be traced back to colonial strategies that depended on local conditions, in particular settler mortality.

Where mortality risks were high, Europeans tended to establish extractive institutions oriented toward resource extraction with limited protection of local rights; where mortality was low, they were more likely to settle and develop institutions conducive to private investment and broad-based economic activity.

Because these institutional arrangements persisted after independence, historical settler mortality can serve as an instrument for modern institutional quality.

In their instrumental variables estimates, institutional quality has a strong positive effect on log income per capita and the IV coefficient is larger than the OLS one, consistent with the idea that naïve correlations understate the role of institutions due to endogeneity and measurement error. Beyond the specific colonial setting, the broader methodological lesson is that credible inference requires strategies that reduce simultaneity and omitted-variable bias when studying institutions.

Hall and Jones (1999) provide an additional step that is especially useful for connecting institutions to measurable economic outcomes, rather than starting from institutions alone, they begin with a development accounting decomposition that separates proximate sources of income differences, such as capital intensity and human capital, from a residual component interpreted as productivity.

Using a standard production framework, they show that observed cross-country differences in output per worker cannot be explained solely by differences in factor accumulation; a large share is accounted for by variation in total factor productivity.

Then, they introduce the notion of "social infrastructure", defined as the institutions and policies that support productive activity and discourage diversion and argue that it influences development both indirectly, by shaping investment and human-capital accumulation, and directly, by improving allocative efficiency and productivity.

Like Acemoglu et al. (2001), they confront endogeneity through instruments rooted in historical and geographic variation, the importance of this contribution for institutional research is twofold: first, it makes explicit that the institutional channel is not merely about "more capital" but about using capital and labour more effectively, an interpretation that becomes highly relevant when thinking about differences in performance across regions that may share similar technologies or market access.

Second, it naturally motivates mechanisms based on human capital: if institutions shape incentives and the functioning of public systems, the quality of education and skill

formation becomes a plausible route through which governance translates into income differences.

Rodrik et al. (2004) further strengthen the institutions perspective by placing it in direct competition with alternative deep determinants, most notably geography and trade integration. Their contribution is to formulate an empirical "horse race" in which institutions, geography and openness are considered jointly, while maintaining an explicit focus on identification through instrumental variables.

The central conclusion, often summarized as "institutions rule", is that institutional quality emerges as the dominant determinant of income levels once endogeneity is addressed, while geography and trade play more limited direct roles in the preferred specifications. At the same time, geography may still matter indirectly by shaping institutional trajectories, this perspective is valuable in European regional analysis because it suggests that even in relatively integrated settings, where trade barriers are lower and geographic variation is smaller than in the global cross-country sample, governance differences may remain a key driver of persistent income.

Taken together, these classic contributions support a coherent narrative: institutions matter because they shape incentives, reduce transaction costs and constrain diversion.

Empirically, the relationship between institutions and income must be interpreted with caution unless identification strategies address reverse causality and omitted variables. Institutions plausibly affect development through both proximate factor accumulation, especially human capital, and deeper productivity mechanisms.

This narrative provides the intellectual foundation for studying institutional quality at the sub-national level: if institutional arrangements and administrative performance differ across regions, then one should expect systematic differences in long-run income levels across territories.

In the European context, the availability of a regional institutional measure such as the EQI makes it possible to test these ideas at the NUTS2 level.

The emphasis on public service quality, impartiality and corruption control is also consistent with the classic mechanisms: these features directly affect the costs of doing business, the credibility of the public sector, and the effectiveness of key public services such as education.

As a result, the transition from the macro "institutions and development" literature

to the regional EQI literature is not a change of topic but a change of scale: the same fundamental argument is applied to within-Europe spatial disparities, with the additional advantage that regional data allow richer comparisons and, in some cases, panel approaches that help separate cross-sectional associations from within-unit variation over time.

3.3 EQI-based evidence on institutions and regional development

A key reason why the EQI became so influential in the European regional-growth debate is that it finally made within-country institutional differences measurable in a systematic way.

The EQI was designed to capture "quality of government" as people perceive and encounter it, low corruption, impartial treatment and effective public services, using a large-scale survey at the regional level, rather than relying only on national governance indicators that implicitly assume that institutions are uniform within borders.

The core measurement logic is intentionally close to mechanisms economists care about: how citizens experience the functioning of public administration and frontline services and whether access seemed as impartial or distorted by favouritism and corruption.

In the EQI framework, the survey questions are explicitly anchored to major public-service sectors (public education, public health care and police), asking respondents to rate quality, impartiality and corruption prevalence in each sector.

This detail matters because it creates a natural bridge between an "overall institutions" hypothesis and sectoral-channel hypotheses: if institutions influence development partly by shaping human capital or service delivery, the measurement already contains sector-specific signals that can be aggregated into education focused indices.

The earliest EQI research established two points that later empirical work repeatedly builds on: first, governance differences across EU regions are large and often do not align neatly with national averages, which supports the idea that regional economic divergence can be partly institutional even inside advanced democracies.

Second, the concept is multidimensional: corruption, impartiality and service

quality move together but not perfectly, making "institutions" empirically richer than a single national score, this measurement contribution is formalized in the foundational Regional Studies paper that introduced the EQI for EU countries and regions and clarified its interpretation as "low corruption, impartial public services and rule of law" at both national and sub-national levels.

The starting point of the EQI literature is the idea that subnational governance differences are not marginal "noise" around national institutions but potentially meaningful determinants of regional trajectories.

The paper by Charron et al. (2014) is central in establishing this claim: it introduces a coherent definition of quality of government at the regional level, centered on corruption control, impartiality and service quality. They document that Europe displays large and systematic governance gradients, not only across countries, but also across regions within the same country.

The descriptive evidence is particularly important because it shifts the discussion from purely national institutional rankings to a territorial perspective: regions that share national laws and broad political structures can still differ in how rules are implemented and how citizens experience public services, suggesting that economic disparities within the EU may partly reflect differences in administrative capacity, impartial treatment and corruption risks.

A closely related step is to treat regional governance as an outcome to be explained, rather than only a regressor, Charron et al. (2015) address exactly this question by highlighting that within-country gaps in government quality reflect persistent features of the regional political–administrative environment.

This strand matters for empirical interpretation because it frames EQI as a slow-moving variable: governance quality tends to evolve gradually and it is often correlated with historical legacies and long-run socio-political equilibria. As a consequence, cross-sectional patterns can capture long-term institutional–development coevolution, whereas within-region estimates will inevitably rely on smaller variation and therefore be more demanding in terms of signal-to-noise ratio.

This provides a natural explanation for why "between-region" evidence is often strong, while fixed-effects estimates can be weaker or less precisely estimated, even when the underlying structural relationship is meaningful.

The measurement side also evolved with the project, Charron et al. (2019) present the 2017 wave and discuss methodological improvements relative to earlier rounds, as well as patterns and trends across space and time. This is relevant for applied research because it highlights both the value and the limits of longitudinal use: the EQI is explicitly built to enable cross-regional comparison, yet changes over time must be interpreted carefully, given the inherent noise in survey-based measures, the slow-moving nature of governance and the practical challenges of ensuring perfect comparability across waves and territorial definitions.

From an applied perspective, this matters because it highlights that repeated waves allow researchers to study institutional dynamics; on the other hand, governance is intrinsically persistent and the EQI is survey-based, which implies that year-to-year changes should not automatically be interpreted as deep institutional reforms.

In other words, the multi-wave EQI provides an opportunity for panel analysis but the identification power typically remains strongest for explaining persistent cross-sectional differences.

Once EQI is available, the empirical literature quickly moves to the central regional development question: “does better government quality translate into better economic performance?”.

One influential policy-oriented strand focuses on the effectiveness of public investment and EU place-based policy, Rodríguez-Pose and Garcilazo (2015) and the subsequent journal article argue that institutional quality is not only a direct correlate of regional performance; it also shapes the returns to public investment, especially EU Structural and Cohesion Funds.

Their core idea is intuitive but powerful: in regions with weak governance, investment projects may suffer from misallocation, implementation delays or corruption risks, so additional spending yields lower marginal returns; where government quality is higher, funds are more likely to be selected, executed, and monitored effectively, producing larger growth payoffs.

This “institutions-as-a-multiplier” perspective is particularly important for an EU regional thesis because it ties the institutional concept to a concrete policy mechanism that is central to European regional policy and cohesion debates.

A complementary mechanism concerns innovation and the capacity to generate and

absorb new technologies, Rodríguez-Pose and Di Cataldo (2015) link regional government quality to innovative performance and argue that institutional quality affects the functioning of innovation systems, the credibility and effectiveness of innovation policy and the general environment in which knowledge-intensive activity takes place.

This work shows that regional government quality and its components help explain why some European regions generate more innovation than others, the underlying logic is that innovation is particularly sensitive to institutional frictions: it depends on stable rules, credible enforcement, efficient public administration and a supportive ecosystem of public services and policy implementation.

By highlighting innovation, this work strengthens the argument that institutions matter not only for static efficiency or short-run performance but also for dynamic capabilities that drive longer-run growth trajectories.

Beyond long-run levels and innovation, another major outcome domain is how regions respond to shocks, Ezcurra and Ríos (2019) study the Great Recession and show that higher quality of government is associated with greater regional resilience.

The key message is that institutions influence not only where regions stand in "normal times" but also how they adjust when conditions deteriorate: more effective and less corrupt administrations may implement crisis responses better, coordinate labour market policies more efficiently and reduce the waste that can become particularly costly during downturns.

This evidence is also methodologically informative, because crisis episodes create strong common shocks that may interact with institutional capacity, making it plausible that governance differences become especially visible in downturn-and-recovery dynamics rather than only in smooth growth paths.

As the EQI literature matured, a recurring theme became the recognition that regions are embedded in wider spatial systems, so the relevant institutional environment is not necessarily confined within administrative borders.

The spatial dimension is brought even more explicitly into the growth debate by Peiró-Palomino (2019), who examines the relationship between government quality and regional growth in the EU-28 over 2010–2017 and explicitly brings attention to both the components of EQI (quality, impartiality, corruption control) and the possibility of spatial spillovers.

Two insights are especially useful for subsequent empirical work: first, the paper emphasizes that not all components contribute equally, which matters when interpreting EQI as a composite index: corruption control and impartiality may be more tightly linked to economic performance in some contexts than the perceived quality dimension.

Second, by discussing spatial dependence, the study suggests that some of the cross-sectional strength of the EQI–performance relationship may reflect not only a region's own institutional quality but also the governance quality of its neighbours, through labour mobility, firm networks, market access and learning effects.

This helps explain why "between-region" patterns can be pronounced, while strict within-region identification may look weaker if it removes slow-moving, spatially structured variation that carries much of the economically relevant signal.

The importance of institutional frictions in shaping economic interactions is explored through a different lens by Barbero et al. (2021), their work studies interregional trade flows within the EU using a structural gravity approach and show that differences in regional government quality significantly shape trade between regions.

The mechanism is best understood as "institutional trade costs": weaker governance can increase uncertainty, administrative burden and the perceived risk of opportunistic behaviour, which discourages exchange even inside a formally integrated market.

The paper also reports heterogeneity by sector and by regional development level, suggesting that institutional frictions are not uniform across economic activities and may bite particularly hard where value chains rely on complex contracts, logistics, and regulatory interaction.

For a regional development thesis, this evidence strengthens the micro foundation of the EQI–income relationship: institutions can influence productivity and income partly by shaping the intensity and efficiency of interregional economic interaction.

A complementary perspective shifts the focus from output to broader welfare outcomes, Peiró-Palomino et al. (2020) construct a composite indicator of regional well-being for 168 European regions using ten domains in the spirit of multidimensional welfare frameworks and they find a robust positive association between quality of government and well-being.

While this strand is not cantered on GDP per capita, it is conceptually valuable because it reinforces the idea that government quality operates through multiple channels

at once: higher incomes may coexist with better access to services, greater safety, and improved social outcomes, all of which are plausibly linked to low corruption and impartial service delivery.

In the context of an EQI-based income study, these results support a cautious but meaningful interpretation: when we observe a strong relationship between EQI and GDP per capita, it may capture a broader institutional environment that simultaneously shapes economic and social performance.

A broader welfare-oriented contribution is provided by Arribas, Peiró-Palomino and Tortosa-Ausina (2020), who link EQI to a composite measure of regional well-being across multiple domains.

By moving beyond GDP per capita, this approach reinforces the interpretation of EQI as capturing the quality of everyday governance that affects citizens directly through service access, fairness and perceived integrity of public institutions.

Their findings that regions with higher quality of government score better in overall well-being, together with discussions of core–periphery differences, support the view that institutional quality is not merely correlated with income but is part of a wider package of social and economic performance, consistent with multi-channel effects operating through public services, opportunities and trust in institutions.

Finally, one of the most methodologically relevant contributions for an empirical thesis using both cross-sectional and panel strategies is the growing evidence from multi-wave EQI panels, Filip and Setzer (2025) analyse around 200 European regions over 2010–2021 using a two-way fixed effects framework and document a positive relationship between institutional quality and medium-term GDP growth, with stronger effects in lower-income regions.

This result is important not only for its substantive conclusion but also for how it frames the cross-versus-within distinction: the strongest information in EQI may lie in persistent differences, yet within-region changes, while limited, can still be informative when analysed over an appropriate horizon and when the outcome is defined in growth terms rather than levels.

The emphasis on heterogeneity (larger effects in poorer regions) also connects naturally to core EU themes of convergence and cohesion, suggesting that improvements in governance could have particularly large marginal benefits where initial institutional

constraints are binding.

Taken together, the EQI-based literature offers a coherent picture that is directly relevant for a thesis structured around both narrative and identification.

The cross-sectional evidence consistently associates better government quality with higher regional performance but it also makes clear that this relationship is shaped by national context, spatial dependence and institutional persistence.

Panel evidence using fixed effects tends to be more demanding, partly because governance changes slowly and survey measures contain noise, yet recent work shows that meaningful within-region relationships can emerge, especially when focusing on growth over multi-year horizons and allowing for heterogeneity across regions.

At the same time, a strong message across contributions is that institutions matter through concrete mechanisms, policy effectiveness, innovation capacity, resilience and market integration, rather than as an abstract correlate.

This is precisely what makes EQI particularly suitable for a thesis that starts from the overall relationship between institutional quality and GDP per capita and then turns to mechanisms. EQI is built on service-specific questions about key public services and it naturally supports sectoral decompositions that bring the analysis closer to concrete channels such as human capital and service performance.

IV. Datasets

4.1 Main dataset

Before turning to the econometric analysis of EQI, we first describe how the baseline dataset was constructed and how the different data sources were harmonized at the NUTS2 region–year level.

Our empirical unit of analysis is the NUTS2 region–year pair, the time dimension is organised around the official EQI survey waves (2010, 2013, 2017, 2021 and 2024).

The baseline dataset was built by combining institutional information from the QoG Institute with a set of regional socio-economic covariates extracted from Eurostat and by harmonising all sources into a consistent panel format.

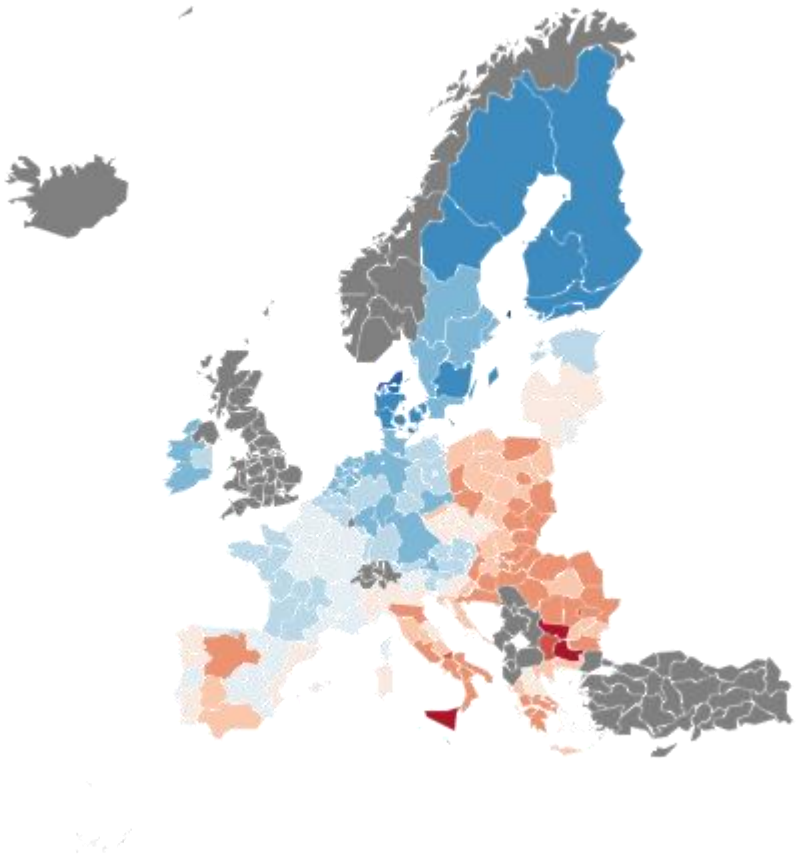
We started from the official EQI regional release in long format, which provides the overall EQI score and its three pillar indicators (quality, impartiality and corruption) for NUTS2 regions in each wave year, together with harmonised regional identifiers (country name and NUTS codes).

This file constitutes the institutional backbone of the dataset and fixes both the unit of observation and the set of years that can be used for wave-based comparisons, all subsequent data preparation steps were organised so as to preserve this region–wave structure and to ensure that additional covariates could be merged consistently on the same keys (University of Gothenburg, 2024).

The resulting panel covers 186 NUTS2 regions across 20 countries, for a total of 930 region–wave observations, he geographical coverage of the sample is illustrated in Figure 4.1.

Regional identifiers were harmonised to a consistent NUTS2 classification; where codes changed across releases, we applied a concordance to preserve comparability over time.

Figure 4.1 Countries included in the EQI regional sample



Source: Quality of Government Institute, University of Gothenburg. EQI.

Socio-economic covariates were merged from Eurostat annual series and aligned to the EQI wave years to preserve the region–wave structure, because GDP per capita is not available for the 2010 wave in our Eurostat extraction, the econometric analysis starts in 2013. After listwise deletion, baseline specifications (ln_pop and unemployment_rate) are estimated on 711 region–wave observations, while extended specifications that add tertiary education and sectoral employment shares are estimated on 686 observations.

To complement the institutional indicators with regional controls, we extracted several NUTS2-level series from Eurostat's online database, we focused on standard demographic and labour-market variables that are commonly used as controls in regional growth and development analyses: total population (persons), population density (inhabitants per square kilometre), the employment rate and the unemployment rate (both

expressed as percentages) and regional GDP at current market prices (million euro), which is later used to compute GDP per capita.

These series were downloaded in TSV format and imported into Stata, Eurostat TSV files typically store multiple dimensions in a single "identifier" column (e.g., frequency, unit of measurement, and geographical code), while the remaining columns contain yearly values.

Therefore, the first step for each dataset consisted in unpacking the identifier column to recover the NUTS2 geographical code and the relevant measurement dimensions.

For each series, we then restricted the data to a single, coherent definition by selecting the appropriate combination of dimensions, for instance, for GDP we retained annual frequency and the unit "million euro" at current prices; for population we retained annual frequency and total population; for the labour-market indicators we selected annual frequency, total sex, total education and total citizenship and we focused on the age group 20–64 to keep employment and unemployment rates defined consistently across waves. Once the relevant subset had been identified, we cleaned the year-specific values to ensure they were usable as numeric variables.

Eurostat often encodes missing data with the symbol ":" and attaches quality markers or observation flags (such as provisional values or breaks in series) as letters appended to numeric entries, during the conversion from strings to numeric format, non-numeric characters were removed and purely non-numeric entries were treated as missing, so that the resulting variables could be used in subsequent transformations and merges without introducing parsing errors.

After cleaning, each Eurostat dataset was reshaped from the original wide structure (years in columns) into a long panel structure with one observation per NUTS2 region and year, so that region and year jointly form a unique key.

We also harmonised the regional dimension by removing non-regional records and aggregates (such as supranational totals or "Not regionalised/Unknown" categories), ensuring that the remaining observations correspond to actual NUTS2 regions, this procedure yielded a set of cleaned, standardised Eurostat files, each containing a single covariate measured consistently across regions and years and ready to be integrated into the EQI panel (Eurostat, 2024).

We began the Eurostat integration from regional GDP, since it is the key ingredient needed to construct the main economic outcome (GDP per capita), Regional GDP was extracted from Eurostat's regional accounts dataset on GDP at current market prices (dataset nama_10r_2gdp).

The raw Eurostat file is structured so that the first column encodes multiple dimensions, most importantly frequency, unit of measurement and geographic identifier, while subsequent columns report yearly values. In Stata, we first unpacked this combined identifier to recover the frequency, the unit and the NUTS2 code.

We then restricted the dataset to annual observations and retained GDP measured in million euro at current prices (unit MIO_EUR), which is the most standard form for regional GDP in this dataset.

After selecting the relevant subset, we cleaned the values to ensure consistent numeric formatting: Eurostat uses ":" to denote missing values and may append quality markers or flags to numeric entries.

These markers were stripped during the conversion to numeric format, and purely non-numeric entries were treated as missing; we then reshaped the dataset from wide to long so that each observation corresponds to a unique NUTS2 region × year pair, and saved a clean intermediate file containing GDP in million euro with a unique region–year key.

At this point, the first integration step consisted in merging this cleaned GDP file into the baseline EQI panel using (NUTS2_code, year) as the merging key.

Before merging, we harmonised the geographic identifier to avoid silent mismatches, standardising the NUTS2 codes (for example, trimming spaces and enforcing consistent casing), the merge was designed explicitly as a gap-filling procedure: rather than replacing existing values, we updated the baseline panel only where GDP was missing and the newly extracted Eurostat value was available.

This "replace-only-if-missing" rule preserves the original structure of the baseline dataset while systematically improving completeness, after the merge, most remaining missing values were concentrated in the most recent wave, reflecting the fact that Eurostat GDP availability is not perfectly aligned with the EQI wave-year timing; this issue is addressed transparently as follows (Eurostat, 2024).

A specific issue arises for the most recent EQI wave (2024): at the time of data

extraction, Eurostat regional GDP at the NUTS2 level is not yet fully available for 2024.

To retain the 2024 EQI wave in the analysis while remaining transparent about the information content of the income measure, we proxy 2024 regional GDP with the last available year, namely 2023, we then recompute GDP per capita and its logarithm consistently using the same scaling and population data.

This approximation is explicitly tracked in the dataset through the dummy gdp_is_proxy2024 (equal to one for all 2024 observations in the current dataset) and auxiliary fields storing the original GDP value and the 2023 GDP used for the proxy.

After GDP, we extracted population data, which serve two purposes: they are used directly as a control variable and they are needed mechanically to compute GDP per capita.

Population data were drawn from Eurostat's regional table on population on 1 January (table tgs00096), as in the GDP case, we unpacked the combined dimension column and retained a single consistent definition of the series by selecting annual frequency and total population.

In practice, this required restricting the dataset to the appropriate unit (number of persons) and to total categories for age and sex, so that the resulting population values represent the full resident population of each NUTS2 region.

We again cleaned Eurostat missing codes and observation flags during numeric conversion, reshaped the file into a long region–year panel, and saved a clean intermediate population dataset with a unique NUTS2_code–year key.

The population series extracted in this step provided robust coverage for the core wave-years in which Eurostat regional population is consistently available in the chosen format; in earlier wave-years, coverage may be incomplete depending on the extraction and the specific Eurostat representation of the series.

The integration logic remained the same as for GDP: we merged the cleaned population file into the GDP-augmented EQI panel and filled population values only where the baseline panel contained missing entries (Eurostat, 2024).

We then added population density as a compact control for settlement patterns and urbanisation at the regional level, population density was extracted from Eurostat's regional table on population density (table tgs00024) and restricted to annual frequency and the unit "persons per square kilometre" (PER_KM2).

The data were cleaned and reshaped using the same workflow, unpacking identifiers, selecting the correct unit, converting to numeric while handling Eurostat missing and flags, and reshaping to long format, so that the resulting dataset contains one observation per NUTS2 region and year.

As in the other covariates, the density series was merged into the panel sequentially and used to fill missing density values without overwriting existing observations, differences in year coverage across Eurostat series imply that density is particularly complete for the mid waves used in the core panel specifications, while coverage is weaker in some endpoints where the density series and the EQI waves do not overlap perfectly.

Finally, we complemented the demographic information with labour-market indicators, employment and unemployment rates, because they capture structural differences in regional economic conditions that could confound the relationship between institutional quality and income levels.

These variables were extracted from Eurostat's Labour Force Survey (LFS) regional data, which are provided in large, multi-dimensional files, for both employment and unemployment rates, the key step was to impose a single consistent definition by selecting annual frequency, percentage units, total sex, total education and total citizenship categories, in addition, to ensure coherence between employment and unemployment measures, we focused on the same age group (20–64) in both series.

After unpacking the dimension column and applying these filters, we selected the relevant wave-years, cleaned the values to remove Eurostat flags and missing codes, reshaped each dataset to a long NUTS2×year structure and saved intermediate clean files for employment and unemployment rates.

Each series was then merged into the panel using the same gap-filling strategy as before: values from the cleaned Eurostat files were used to update the baseline only where the corresponding variable was missing, thereby improving completeness while preserving any information already present in the reference panel (Eurostat, 2024).

Overall, these first Eurostat extractions, GDP, population, density, employment and unemployment, follow a single replicable logic: each series is pulled from Eurostat in its raw multi-dimensional format, reduced to one coherent definition through dimension selection, cleaned for numeric consistency, reshaped into a long panel keyed by

NUTS2_code and year and then merged sequentially into the EQI backbone using a conservative update rule that fills missing values without mechanically overwriting existing data.

This produces a harmonised baseline panel in which institutional variables from EQI and core macro-demographic controls from Eurostat are aligned on the same region–wave structure and are therefore ready for the construction of derived variables and for the subsequent econometric specifications.

Beyond the baseline controls, we further enriched the panel with two sets of structural covariates, we added a proxy for regional human capital, measured as the share of the population with tertiary education, which helps separate the role of institutions from differences in educational attainment, and indicators of economic structure by computing sectoral employment shares (agriculture, industry and construction).

These variables capture persistent differences in productive specialization across regions; the services share is implicitly determined as the residual and is typically excluded from regressions to avoid perfect collinearity among sectoral shares (Eurostat, 2024).

We can now move to the core of our analysis, we constructed education-specific governance index using the EQI individual-level survey microdata.

This step is necessary because the regional EQI release already provides aggregated institutional measures but it does not directly provide a ready-made education governance index at the regional level.

The sectoral dimension exists at the questionnaire level, where respondents are asked separately about the performance and integrity of different public services, we therefore rely on the EQI microdata files released by the Quality of Government Institute, which are collected in distinct survey waves (2010, 2013, 2021 and 2024) (University of Gothenburg, 2024).

The construction begins by selecting a set of education-sector questionnaire items that mirrors the EQI conceptual structure: one item capturing service quality, two items capturing impartiality (favoritism or special advantages and equal treatment) and one item capturing perceived corruption, for example, in the more recent waves, corruption is asked explicitly for the education sector (schools), which corresponds to q14 in the questionnaire.

In earlier waves, the education corruption item appears under different question numbers; we map it consistently across waves using the EQI microdata codebooks, ensuring that the underlying item is comparable even when the numeric label changes.

This codebook-driven mapping is crucial: it prevents mechanically mixing non-equivalent items across waves and ensures that each sectoral indicator is constructed from conceptually identical components.

Before aggregation, we harmonize the direction of the scales so that higher values always correspond to better governance, quality items are typically already oriented "positively" (higher = better quality), while impartiality and corruption items are often oriented "negatively" (higher = more favoritism, less equal treatment, or more corruption).

We therefore reverse-code the latter, when a response is recorded on a 1–10 scale (common for favoritism and corruption), we transform it as $x^{good} = 11 - x$, so that "more favoritism/corruption" becomes "less favoritism/corruption", when the equal-treatment item is recorded on a 1–4 agree/disagree scale, we reverse it as $x^{good} = 5 - x$, so that stronger agreement with equal treatment maps into higher values on the "good governance" scale.

Non-substantive answers (e.g., refusals or "don't know," when present) are converted to missing values so that they do not enter the computation of averages.

Because the microdata are at the respondent level, while the analysis is at the region–year level, the next step is aggregation, each respondent is linked to a NUTS2 region and a survey wave-year, and for each component we compute a weighted regional mean using the survey's post-stratification weights, which are designed to make regional averages more representative and comparable across regions that may be over- or under-sampled.

Formally, for component $k$in region $r$and wave-year t, we compute

$$\bar{x}_{r,t}^{(k)} = \frac{\sum_{i \in (r,t)} w_i \; x_i^{(k)}}{\sum_{i \in (r,t)} w_i},$$

where $w_i$is the post-stratification weight, alongside these weighted means, we store a transparency measure of sample support, n_resp, defined as the number of respondents contributing valid information to the construction in each region–year (after applying the

missing-value rules).

At this stage we have, for every region–year, four aggregated education components.

Since the components come from different response scales (e.g., 1–10 vs 1–4), we standardize them so that no component dominates the index purely because it has a wider numerical range.

Operationally, we standardize the aggregated region–year component means (not the individual responses) and we do so within each wave-year, i.e. relative to the cross-regional distribution in that survey year:

$$z_{r,t}^{(k)} = \frac{\bar{x}_{r,t}^{(k)} - \mu_t^{(k)}}{\sigma_t^{(k)}}.$$

The sectoral index in region $r$and year $t$is then constructed as an equal-weighted average of the four standardised components:

$$Index_{r,t}^{sector} = \frac{1}{4}\sum_{k=1}^{4} z_{r,t}^{(k)}\ .$$

This yields the "raw" sectoral indicator (e.g., edu_index_raw), which is directly interpretable as a composite measure of perceived governance quality in the service: higher values correspond to higher perceived quality, more impartial treatment and lower corruption.

To make the indices especially suitable for econometric work that separates cross-country differences from within-country variation, we additionally construct country-centered versions. For each year $t$and country c, we subtract the country mean from the region's index:

$$Index_{r,t}^{sector,cc} = Index_{r,t}^{sector} - \bar{Index}_{c,t}^{sector}.$$

In this form, positive values indicate that a region is above its own country's average in that wave-year, finally, for ease of interpretation in regressions, we also provide a standardized version (in standard deviation units) by z-scoring the country-centered index within each wave-year, these steps correspond to the three education versions stored in the panel (*_raw, *_raw_cc and the standardized *_index).

The aggregation produces an intermediate dataset with a unique key $(NUTS2\_code, year)$ containing the sectoral indices and respondent counts.

This intermediate file is then merged one-to-one into the baseline EQI regional panel using the same region–year key, the result is a harmonized panel in which the overall EQI and its official pillars coexist with the newly constructed sectoral governance measures.

Where territorial identifiers are not perfectly harmonized in a given wave (a risk that can arise in the most recent wave-year), the sector indices are computed for the set of regions–years where the NUTS2 linkage is stable; the dataset retains n_resp and missing patterns to make this limitation transparent rather than implicit.

Table 4.1 reports descriptive statistics (mean, standard deviation, minimum and maximum) for the main variables used in the empirical analysis.

Table 4.1 – Descriptive statistics (panel 2013–2017–2021–2024)

Variable	N	Mean	SD	Min	Max
ln (GDP per capita)	723	10.054	0.594	8.194	11.613
EQI (total)	744	-0.091	1.010	-2.634	2.822
ln (Population)	736	14.085	0.877	10.258	16.336
Unemployment rate (%)	732	9.138	6.032	1.300	36.200
Share tertiary educated	723	0.301	0.105	0.114	0.647
Share agriculture	706	0.064	0.065	0.001	0.496
Share industry	723	0.174	0.077	0.041	0.430
Share construction	725	0.070	0.017	0.019	0.148
Education governance index (z)	567	0.000	1.001	-4.358	5.250
Health governance index (z)	567	0.000	1.001	-3.827	4.800

Notes: Mean, standard deviation, minimum and maximum are reported. N varies because of missing values across variables.

Table 4.2 decomposes variability into overall, between-region and within-region components, anticipating the interpretation of the fixed-effects results.

Table 4.2 – Standard deviation decomposition (overall, between, within)

Variable	SD_overall	SD_between	SD_within
ln (GDP per capita)	0.594	0.567	0.181
EQI (total)	1.010	0.986	0.224
ln (Population)	0.877	0.876	0.033
Unemployment rate (%)	6.032	5.164	3.202
Share tertiary educated	0.105	0.098	0.038
Share agriculture	0.065	0.062	0.021
Share industry	0.077	0.076	0.011
Share construction	0.017	0.015	0.007
Education governance index (z)	1.001	0.890	0.583
Health governance index (z)	1.001	0.886	0.543

Notes: Overall, between-region, and within-region standard deviations are reported for the 2013–2024 panel.

4.2 Cross section

To estimate the cross-sectional relationship between institutional quality and regional development in the year with the broadest overlap of available covariates, we constructed a dedicated cross-section dataset for 2017.

This file is obtained by starting from the harmonised NUTS2–year panel and restricting the data to the EQI wave-year 2017, so that the unit of observation becomes a single record for each NUTS2 region in that year.

The resulting dataset contains 183 observations (NUTS2 regions) and is used as the reference sample for the baseline OLS specifications.

The dataset includes the overall EQI score (EQI) together with the core institutional components released in the EQI regional file, in particular, it contains the three official pillars (qualityp, impartialityp and corruptionp) which are provided by the QoG Institute in country-centred and standardised form, as well as additional corruption sub-components available for 2017 (corruption_subPer and corruption_subExp).

The file also retains the EQI uncertainty measures (EQI_me, EQI_low_me, EQI_high_me) when available.

Alongside institutional variables, the dataset contains the macro-demographic controls used in the cross-section regressions: total population (population), GDP in

levels (gdp), employment and unemployment rates (employment_rate, unemployment_rate) and population density (pop_density), using these inputs, we compute GDP per capita (gdp_pc) and define the main outcome variable as the logarithm of GDP per capita (ln_gdp_pc); we also compute the logarithm of population (ln_pop) as a parsimonious size control.

The construction is designed to keep the cross-section transparent and replicable; the dataset retains all NUTS2 regions observed in the 2017 EQI wave for which the outcome and the main institutional indicator are available (in the released file, ln_gdp_pc and EQI are fully observed for the 2017 cross-section).

For specifications that include additional controls or sub-components, the effective estimation sample is determined by standard listwise deletion, so that each regression is run on the subset of regions with non-missing values for the variables included in that specification.

4.3 WGI comparison dataset

To complement the regional institutional measure (EQI) with a country-level benchmark, we use the Worldwide Governance Indicators (WGI), focusing on the Government Effectiveness component.

Unlike the EQI, which varies across regions within a country, the WGI measure is defined at the national level and therefore takes the same value for all regions belonging to the same country in a given year.

For this reason, we prepared a compact country-level dataset for the year 2017, saved as wgi_ge_2017_eu.dta, containing only two variables: the country identifier (cname) and the Government Effectiveness estimate in 2017 (WGI_GE_2017).

The file is restricted to the set of countries observed in our European EQI sample, so that it can be merged cleanly to the regional data.

We then merge the WGI file to the regional cross-section dataset cross_eqi_2017.dta using the country name as the key, since multiple NUTS2 regions belong to the same country, while each country appears only once in the WGI file, the merge is naturally a many-to-one merge (regional observations matched to a single country record).

After the merge, we retain only successfully matched observations, ensuring that the WGI value is available for each region included in the comparison exercise.

To keep the estimation sample consistent and transparent across specifications, we apply a standard non-missing restriction on the outcome, the institutional indicators and the relevant controls used in the regression, so that the WGI-based cross-section is estimated on a well-defined subset of regions with complete data in 2017.

The same complete-case restriction is also used for the EQI-based comparison regression reported alongside the WGI benchmark.

Conceptually, this exercise allows us to compare a sub-national institutional measure (EQI) with a national governance benchmark (WGI), highlighting whether the cross-sectional association with regional income is primarily driven by country-level institutional differences or by within-country regional variation (World Bank, 2024).

V. Methodology

5.1 Econometric approaches in EQI literature

The EQI literature operates at the intersection of three empirical challenges. First, governance is observed at the regional level but regions are nested within countries, so a large share of the raw correlation between institutions and outcomes may reflect national-level differences rather than genuine within-country variation. Second, regions interact in space through labor mobility, market access, and shared infrastructure, which introduces spatial dependence and the possibility that institutional quality in neighboring regions affects local outcomes. Third, institutional quality is plausibly endogenous: richer regions may be able to sustain better governance, while unobserved factors (historical legacies, political culture, administrative traditions) can influence both governance and development.

For this reason, much of the empirical literature has progressively moved from simple cross-sectional specifications to more demanding panel and identification strategies.

A first and influential strand relies on cross-sectional OLS, often because early EQI waves provided a snapshot of sub-national governance that could be linked to regional characteristics. A representative example is the work by Charron and Lapuente (2014), which treats the EQI itself as the dependent variable and estimates cross-sectional OLS models where regional QoG is explained by historical and contemporary covariates.

By including country fixed effects (or equivalent national controls), the analysis isolates *within-country* differences in regional governance, addressing the concern that cross-country heterogeneity dominates the variation. In related specifications, they also consider country-level governance measures and broad macro-area dummies (North–South–East–West) as additional ways to absorb large-scale context when full saturation with country dummies is not feasible or when one wants to preserve some between-country signal.

A second, very common empirical approach frames the institutions–development link within standard regional growth regressions. Peiró-Palomino (2019) adopts a Barro-style cross-sectional growth specification in which cumulative growth of GDP per capita is regressed on initial income, EQI and a set of Solow-type controls (human capital,

innovation proxies such as R&D and other structural covariates). Methodologically, this design addresses the most basic omitted-variable concern: regions differ systematically in fundamentals that predict growth, so the EQI coefficient should be estimated conditional on initial development and key inputs. At the same time, the paper explicitly recognises that the "European growth space" is heterogeneous, so it introduces qualitative dummies (e.g., New Member States, capital regions) and even interactions between EQI and group dummies to capture differential slopes across institutional and historical contexts. Rather than assuming one homogeneous institutional effect across the continent, researchers often test for heterogeneity between core and periphery or between older and newer EU members.

Within the same growth framework, Peiró-Palomino pushes the analysis further by introducing explicit spatial econometric specifications, notably spatial lag and spatial Durbin models. The motivation is straightforward: if regional growth is spatially correlated and if governance spillovers travel across borders, a purely non-spatial regression risks attributing to "own" institutional quality what is partly driven by neighbouring regions' performance and institutions. Spatial Durbin models, in particular, allow both the dependent variable and regressors (including EQI) to enter with spatial lags, separating direct local effects from indirect spillover effects. Estimation therefore moves beyond OLS to methods appropriate for spatial dependence (e.g., maximum likelihood) and the paper compares specifications with and without spatial terms to show whether conclusions depend on modelling spatial interaction explicitly.

A closely related, shock-oriented application is provided by Ezcurra and Ríos (2019), who study regional resilience during and after the Great Recession. Here the dependent variables are crisis outcomes (e.g., the drop in regional GDP during the downturn and the subsequent recovery), estimated in cross-section. The econometric strategy again combines "standard" regional controls (pre-crisis development, labour-market conditions, sectoral structure, human capital) with spatial components (spatial lag or spatial Durbin-type terms) to capture geographic interdependence. The identification logic is that large aggregate shocks can make institutional capacity particularly visible: governance may matter less in tranquil periods but becomes crucial in downturn-and-recovery dynamics.

The paper also tests robustness to alternative spatial weight matrices and

specifications with and without spatial dependence.

As the EQI project matured and multiple waves became available, a third strand increasingly relied on panel data methods, especially fixed effects, Filip and Setzer (2025) represent this approach by using a multi-wave EQI panel for around 200 regions and estimating two-way fixed effects (region and time) models that relate subsequent medium-term growth to institutional quality measured at the beginning of the period, conditional on time-varying controls. The "two-way" structure includes region fixed effects, which control for time-invariant characteristics (geography, deep administrative traditions), and year effects, which absorb macro shocks and wave-specific factors. In addition, the paper operationalises resilience through interaction terms between EQI and shock measures (e.g., the COVID-related output decline), allowing institutions to affect not only average growth but also the sensitivity of regions to adverse shocks.

This interaction-based design has become a standard template in the EQI resilience literature because it ties governance to a clearly interpretable mechanism: stronger institutions dampen the impact of negative shocks. Because endogeneity concerns remain even in fixed effects settings (time-varying omitted shocks, reverse causality), some EQI papers complement FE with instrumental-variable logic. Filip and Setzer explicitly explore IV strategies using national governance measures (such as WGI) as instruments for regional EQI, treating country-level governance as a source of exogenous variation that helps discipline simultaneity.

This step relies on exclusion restrictions but reflects a broader pattern in the literature: when institutions are potentially endogenous, results are compared across FE and IV specifications.

A policy-oriented branch of the literature asks a slightly different question: not only whether institutions correlate with development but whether they condition the effectiveness of public investment, Rodríguez-Pose and Garcilazo (2015) examine EU Structural and Cohesion Funds and argue that governance acts as a "multiplier" of policy.

Where quality of government is low, funds may be misallocated or poorly implemented, so marginal returns are weak; where governance is high, the same spending generates stronger growth. Econometrically, this is typically implemented through interaction terms between investment (or fund intensity) and QoG measures, estimated in panel settings with time effects and national context controls.

A practical methodological aspect highlighted in their approach is the combination of regional variation in EQI (available from 2010) with national governance series (WGI) to cover longer periods, which effectively separates a time-varying country component from a more time-invariant regional "deviation" component. The key identification idea is embodied in the interaction coefficient: it measures whether the marginal effect of investment depends on institutional quality.

Innovation-focused work brings similar concerns but in a different outcome space, Rodríguez-Pose and Di Cataldo (2015) adopt a "knowledge production function" perspective, where regional innovation output (typically patents per capita) is related to innovation inputs (R&D intensity, human capital, industrial structure, agglomeration) and EQI.

The methodological relevance is twofold: first, innovation outcomes often exhibit strong cross-country institutional gradients and structural differences, so the literature frequently uses country fixed effects or equivalent de-trending to make comparisons more internal to countries. Second, endogeneity is explicitly discussed: innovative regions may demand better institutions, and institutions may respond to innovation-driven development, for this reason, the study reports robustness to strategies that "control for endogeneity of institutions", consistent with the broader EQI trend of not treating the governance regressor as automatically exogenous.

Finally, some of the most methodologically distinctive contributions use EQI in settings where the dependent variable is bilateral rather than regional-level, Barbero et al. (2021) study interregional trade flows using a structural gravity framework.

In this class of models, unobserved heterogeneity is addressed primarily through rich fixed-effects structures (typical of modern gravity estimation) and through a set of standard geographic and relational controls that explain trade intensity.

Within this structure, differences in regional government quality can be interpreted as "institutional trade costs" that raise uncertainty and administrative burden and therefore depress exchange.

Even when such models are not directly replicable without bilateral data, they illustrate how institutional quality can be inserted into established empirical frameworks based on fixed effects and on separating bilateral frictions from region-specific factors.

An additional branch expands the outcome concept beyond income to

multidimensional welfare, Arribas et al. (2020) construct a composite regional well-being index using OECD domains and then relate this index to EQI in cross-sectional OLS specifications with controls. Methodologically, the contribution is useful because it highlights two common practices in this literature: (i) the construction of composite outcome indices through aggregation procedures (often PCA-like or weighted averages consistent with OECD methodology) and (ii) systematic exploration of heterogeneity through interactions such as EQI × Periphery, to test whether institutions matter differently in core versus peripheral regions. This reinforces a general econometric message: in a continent with large structural divides, average coefficients can hide meaningful slope differences that are policy relevant.

Taken together, these papers show that the "standard" EQI econometric toolbox is not a single model but a coherent family of designs.

5.2 Empirical strategy and model specification

Against this background, our empirical strategy follows the main approaches used in the EQI literature, adapting them to the wave-based nature of our data.

We start from transparent cross-sectional associations and progressively tighten the design by adding richer controls and macro-area indicators, exploiting region and wave fixed effects and imposing temporal ordering through lagged governance measures.

The objective is not to claim experimental identification but to provide a coherent sequence of estimates that clarifies how the EQI–development relationship behaves as we move from broad between-region comparisons to within-region variation over time and to specifications that are more consistent with the institutional mechanism under study.

While we report results using the aggregate EQI as a standard benchmark in literature, the core contribution of this thesis is the construction and empirical use of an education-specific governance index derived from EQI microdata.

Accordingly, the empirical strategy and the presentation of results prioritize the education governance index, using aggregate EQI estimates mainly as a reference point for comparability.

Formally, let $Y_{r,t}$ denote economic performance in region $r$observed in EQI wave-year t, measured as GDP per capita and modelled in logarithms, ln ($gdp\_pc_{r,t}$),

institutional quality is captured by $G_{r,t}$, proxied by the EQI, and by an education governance index derived from EQI microdata.

In all specifications, we condition on a vector $X_{r,t}$ of observable covariates that capture key structural differences across regions, demographic scale, labour-market conditions, human capital, and economic structure, so that the institutional coefficient is interpreted as a conditional association rather than a simple bivariate correlation.

The baseline empirical model can be written as:

$$\ln(gdp\_pc_{r,t}) = \beta_0 + \beta_1 G_{r,t} + X'_{r,t}\gamma + u_{r,t},$$

where $u_{r,t}$collects omitted determinants of regional income, including both time-invariant regional traits and time-varying shocks.

The sequence of models introduced below differs in how it deals with these unobservables: cross-sectional OLS relies on conditioning and broad contextual controls, while fixed-effects models explicitly remove time-invariant regional heterogeneity and wave fixed effects absorb common shocks.

5.3 Cross-sectional specifications

We begin with cross-sectional regressions for the 2017 and 2024 EQI wave-years, estimated on the main dataset by restricting the sample to a single year at a time, this step provides a transparent benchmark based on between-region variation within the same wave, allowing us to quantify how differences in institutional quality across regions relate to differences in economic performance under a common measurement round.

The baseline cross-sectional specification is:

$$\ln\left(gdp_{pc_{r,t}}\right) = \beta_0 + \beta_1\, EQI_{r,t} + u_{r,t}, \qquad t \in \{2017{,}2024\}.$$

Given the log-level functional form, $\beta_1$is interpreted as a semi-elasticity: a one-unit increase in EQI is associated with an approximate $100 \cdot \beta_1\%$ difference in GDP per capita, for larger coefficients, the exact percentage interpretation is $(e^{\beta_1} - 1) \cdot 100$.

A key concern in cross-sectional designs is that EQI may be correlated with other

determinants of income that differ systematically across regions; to address this, we estimate progressively richer specifications by conditioning on observable covariates $X_{r,t}$ that capture scale effects, labour-market conditions, human capital and productive structure:

$$\ln\left(gdp\_pc_{r,t}\right) = \beta_0 + \beta_1\, EQI_{r,t} + X'_{r,t}\gamma + u_{r,t}.$$

This strategy is implemented through a parsimonious control set, most importantly ln (population) and unemployment and an extended set including tertiary education shares and sectoral composition.

The role of these controls is not merely to increase model fit, but to reduce the scope for omitted-variable bias by absorbing broad structural differences that could otherwise be incorrectly attributed to institutional quality.

To further account for wide contextual heterogeneity across Europe, some cross-sectional specifications include macro-area dummies (South, West-Central, North, East), these indicators are constructed from country membership and entered as categorical controls.

Their interpretation is that of "broad context" adjustments: they absorb average differences across large European blocks that reflect persistent historical, institutional and economic divides. The coefficient on EQI in these models is therefore estimated net of macro-area level shifts, reducing the risk that results are driven purely by coarse North–South or West–East contrasts.

All cross-sectional OLS specifications are estimated with heteroskedasticity-robust standard errors, this choice reflects the fact that regional data are typically characterised by unequal residual variance across observations, due to large differences in region size, industrial structure and exposure to shocks, robust standard errors leave point estimates unchanged but provide inference that is less sensitive to violations of homoskedasticity.

Finally, in addition to the aggregate EQI, we estimate cross-sectional specifications where institutional quality is proxied by sector-specific governance indices derived from EQI microdata (education).

These sector-specific cross-sectional regressions are estimated both with and without macro-area dummies, mirroring the aggregate EQI specifications (2017 and 2024).

These regressions replicate the same empirical structure used for EQI, thereby allowing a coherent comparison between the overall governance measure and governance in specific public-service domains.

The purpose is to provide structured evidence on potential channels: if institutions matter partly through the functioning of key services, the estimated association with income should be detectable when governance is measured in those domains as well.

This cross-sectional bloc establishes a clear baseline and guides interpretation of subsequent results, the next step moves from between-region comparisons to a panel setting, where region fixed effects allow us to net out time-invariant unobserved heterogeneity and identify the relationship using within-region changes across waves.

5.4 Panel model

To move beyond purely cross-sectional comparisons, we exploit the multi-wave structure of the EQI and estimate panel models on the 2013–2017–2021–2024 sample.

The rationale is that cross-sectional estimates rely on between-region variation and may therefore reflect not only institutional mechanisms but also persistent differences across regions, geography, historical development paths, long-run administrative capacity, and other time-invariant factors, which are difficult to measure and that may be correlated with both EQI and GDP per capita.

A standard way to formalise this concern is to decompose the unobserved component as:

$$u_{r,t} = \alpha_r + \varepsilon_{r,t},$$

where $\alpha_r$captures unobserved region-specific characteristics that are constant over time, and $\varepsilon_{r,t}$captures idiosyncratic shocks that vary across waves, in this framework, cross-sectional OLS can be biased if $EQI_{r,t}$is correlated with α_r.

Fixed effects (FE) models address this issue by allowing α_r to be correlated with the regressors and identifying the coefficient of interest using within-region changes over time.

Our baseline FE specification can be written as:

$$\ln\left(gdp_{pc_{r,t}}\right) = \beta_1\, EQI_{r,t} + X'_{r,t}\gamma + \alpha_r + \varepsilon_{r,t},\ \ t \in \{2013,2017,2021\}$$

where $X_{r,t}$ includes time-varying controls (demographic scale, labour-market conditions, human capital and sectoral composition), the key interpretation is that $\beta_1$is estimated from deviations of each region from its own average over the observed waves.

Equivalently, the FE estimator removes all time-invariant components, both observed and unobserved, so that identification does not rely on comparing intrinsically different regions, but on how changes in governance within a region relate to changes in income within the same region.

In the preferred specifications we also include wave fixed effects (year dummies):

$$\ln\left(gdp\_pc_{r,t}\right) = \beta_1\, EQI_{r,t} + X'_{r,t}\gamma + \alpha_r + \lambda_t + \varepsilon_{r,t},$$

where λ_t absorbs common shocks that affect all regions in each wave (e.g., Europe-wide macroeconomic conditions, common policy environments and wave-specific influences).

With both α_r and λ_t, the coefficient $\beta_1$is interpreted as the association between within-region changes in governance and within-region changes in GDP per capita, net of common time shocks.

Even with fixed effects, identification still requires that the remaining idiosyncratic shocks are not systematically related to the regressors once controls and fixed effects are accounted for.

In other words, FE eliminates bias coming from time-invariant unobservable but time-varying confounding may remain; this motivates the inclusion of time-varying controls and the additional robustness checks implemented in the subsequent lag/previous-wave specifications.

Inference in panel models is based on standard errors clustered at the regional level; clustering is essential because observations for the same region across waves are likely to share persistent shocks and serial correlation in $\varepsilon_{r,t}$.

Treating region–wave observations as independent would typically understate uncertainty and overstate statistical significance; clustering provides more reliable inference under arbitrary within-region correlation.

Regional GDP per capita is highly persistent over time. Estimating specifications

in levels rather than in growth may captures long-run co-movements between institutional quality and income rather than short-run growth effects. Given the limited number of EQI waves, dynamic panel methods are not feasible. The fixed-effects models should therefore be interpreted as identifying medium-run within-region associations rather than short-run causal growth effects.

As a complementary sectoral exercise, we estimate contemporaneous fixed-effects models replacing EQI with the education governance index.

The goal is to assess whether the EQI–income association is also visible when governance is measured in the education domain, results are interpreted cautiously given the limited within-region variation across EQI waves.

Finally, it is important to note a practical implication of working with EQI wave data: institutional quality is a relatively slow-moving variable and the panel includes a limited number of waves.

This makes FE estimation more demanding because within-region variation is smaller than between-region variation, potentially leading to less precise estimates. For this reason, FE results should be interpreted as a more stringent robustness step: if the relationship remains visible when relying only on within-region changes, this strengthens the empirical case that the cross-sectional association is not driven solely by time-invariant regional heterogeneity.

5.5 Lagged model

A remaining concern in the institutions–development relationship is simultaneity and reverse causality, even after controlling for time-invariant regional heterogeneity through fixed effects, institutional quality may still be correlated with the time-varying error component $\varepsilon_{r,t}$.

This can occur, for instance, if (i) short- to medium-run economic shocks affect both income and perceived quality of government in the same wave, or (ii) improvements in regional economic performance increase fiscal capacity and political demand for better governance, generating feedback from $Y_{r,t}$to $EQI_{r,t}$, in such cases, contemporaneous regressions may partly capture joint responses to shocks rather than the directional effect from institutions to development.

To strengthen the temporal ordering and reduce mechanical simultaneity, we estimate fixed-effects specifications in which governance enters with a lag aligned with the EQI wave structure.

Since EQI wave spacing is not fully regular once 2024 is included (2021→2024 is three years), we adopt a previous-wave measure that links each observation to the immediately preceding EQI wave for the same region (2017→2013, 2021→2017, 2024→2021).

$$\ln\left(gdp_{pc_{r,t}}\right) = \beta_1 \, EQI_{r,t-4} + X'_{r,t}\gamma + \alpha_r + \lambda_t + \varepsilon_{r,t}, \quad t \in \{2017,2021\}.$$

Here, $EQI_{r,t-4}$is predetermined relative to current outcomes by construction, because it is measured in an earlier wave.

Economically, this specification matches the idea that institutional changes influence development with delay rather than instantaneously, while also reducing the scope for contemporaneous income shocks to feed directly into measured governance.

The inclusion of region fixed effects α_r and wave fixed effects λ_t ensures that identification relies on within-region changes and is not driven by persistent regional differences or common time shocks.

However, the lagged FE approach should be interpreted as a robustness device rather than as a definitive solution to endogeneity.

First, if unobserved shocks are persistent, the lagged governance measure may still be correlated with future idiosyncratic shocks (e.g., a region experiencing a long-lasting decline could exhibit both deteriorating governance perceptions and declining income).

Second, institutional reforms may be anticipated and correlated with expectations about future economic conditions, which can also link $EQI_{r,t-4}$ to $\varepsilon_{r,t}$.

For these reasons, the lag specification does not eliminate all possible sources of bias; instead, it provides an additional check that is more consistent with the hypothesised direction of causality and less sensitive to contemporaneous feedback.

In line with the channel-based interpretation of governance, we replicate the same lagged FE framework using sector-specific governance indices derived from EQI microdata.

In particular, we estimate:

$$\ln(gdp\_pc_{r,t}) = \beta_1 S_{r,t-4} + X'_{r,t}\gamma + \alpha_r + \lambda_t + \varepsilon_{r,t},$$

where $S_{r,t-4}$ denotes governance in specific public-service domains (education), this allows us to examine whether earlier improvements in these governance dimensions are systematically related to subsequent economic performance within regions, thereby providing structured evidence on plausible mechanisms while keeping the same identification structure as in the aggregate EQI model.

Standard errors are clustered at the regional level, as in the contemporaneous FE specifications, to allow for serial correlation and heteroskedasticity within regions across waves.

Because the spacing between EQI waves is not fully regular once 2024 is included, we adopt a previous-wave governance measure that links outcomes in each wave to the immediately preceding institutional observation available for the same region.

We therefore construct a "previous wave" governance measure, defined as the value of governance observed in the immediately preceding EQI wave for the same region. Concretely, 2017 is linked to 2013, 2021 to 2017, and 2024 to 2021.

Using this construction, we estimate fixed-effects models of the form:

$$\ln(gdp\_pc_{r,t}) = \beta_1 G_{r,t}^{prev} + X'_{r,t}\gamma + \alpha_r + \lambda_t + \varepsilon_{r,t},$$

where $G_{r,t}^{prev}$ denotes the previous-wave value of EQI (and, in separate specifications, of the education governance indices).

This approach preserves the intended temporal ordering, governance measured earlier relative to current outcomes, while remaining consistent with the wave-based nature of the data. In addition, it allows the analysis to retain the 2024 wave without forcing an artificial fixed-length lag that is not supported by the survey timing.

5.6 External benchmark: WGI Government Effectiveness

As an external benchmark, we complement the EQI-based regional analysis with a widely used country-level governance indicator: the Worldwide Governance Indicators

(WGI) – Government Effectiveness.

The motivation is not to replace EQI, whose key advantage is precisely its sub-national variation, but to provide a reference point that helps interpret whether the governance–income relationship observed in cross-sectional EQI regressions is primarily driven by broad national institutional differences or whether sub-national governance variation adds information beyond the country level.

Operationally, this exercise is implemented on a dedicated 2017 cross-sectional dataset (cross_eqi_2017.dta), which is merged many-to-one at the country level with the WGI Government Effectiveness file (wgi_ge_2017_eu.dta) using the country identifier.

The analysis is then restricted to matched observations to ensure consistent country-level alignment. We estimate cross-sectional regressions of the form:

$$\ln\left(gdp\_pc_{r,2017}\right) = \beta_0 + \beta_1\, WGI\_GE_{c(r),2017} + X'_{r,2017}\gamma + u_{r,2017},$$

where $WGI\_GE_{c(r),2017}$ denotes Government Effectiveness for the country $c$to which region $r$belongs, and $X_{r,2017}$ includes regional controls such as demographic scale and labor-market conditions.

Because WGI varies only at the country level, identification in this benchmark is predominantly cross-country: within a given country, all regions share the same WGI value and regional variation in the dependent variable is captured by the control set and the residual.

This feature is precisely what makes the exercise informative as a benchmark: it provides a clear comparison between a governance signal defined at the national level and the regional governance signal captured by EQI.

To facilitate a direct comparison, we also estimate an analogous specification replacing $WGI\_GE_{c(r),2017}$ with $EQI_{r,2017}$ on the same matched 2017 sample, this ensures that differences across the two benchmarks are not driven by changes in sample composition.

Inference is based on heteroskedasticity-robust standard errors, consistent with the cross-sectional specifications in the main analysis.

The WGI benchmark is therefore interpreted as a robustness and interpretation device: if WGI is strongly related to regional income, this supports the view that national

institutional context is an important component of the overall institutions–development relationship; if EQI remains informative even when accounting for national context in other specifications, this highlights the additional explanatory content of sub-national governance variation.

VI. Results

6.1 Cross section

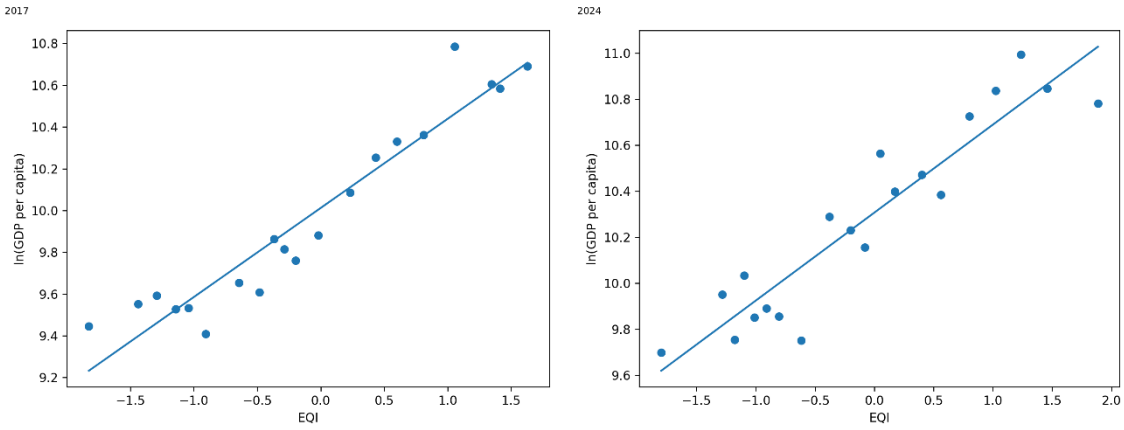
This section examines whether regional institutional quality is systematically associated with differences in economic performance across European NUTS2 regions.

The cross-sectional framework provides a transparent first look at the data by comparing regions within a given year, while cross-sectional estimates are inherently correlational and may reflect unobserved heterogeneity across countries or broad European blocs, they are useful to document the magnitude of the EQI–income relationship and to assess how it changes once we account for key observable characteristics such as population size, labor-market conditions, human capital and economic structure.

Across both years, the baseline specification indicates a strong positive association between institutional quality (EQI) and regional income: in 2017, a one-point increase in EQI is associated with a 0.431 increase in log GDP per capita ($p<0.001$), while in 2024 the corresponding coefficient is 0.377 ($p<0.001$), this bivariate pattern is visualized in Figure 6.1.

The cross-sectional regression results for EQI are reported in Table 6.1 (2017) and Table 6.2 (2024).

Figure 6.1: EQI and regional income: ln (GDP per capita) vs EQI (2017 and 2024).



Source: Author's elaboration on EQI (QoG Institute) and Eurostat regional GDP.

Interpreted in levels, these magnitudes imply sizeable differences in income across regions with different institutional quality (roughly +54% in 2017 and +46% in 2024 for a one-point change in EQI, holding other factors constant in the baseline model).

Adding basic controls for regional size and labor-market conditions does not materially alter the relationship: in 2017, the EQI coefficient slightly increases to 0.463 ($p<0.001$), while in 2024 it remains essentially unchanged at 0.383 ($p<0.001$).

This stability suggests that the raw EQI–income association is not simply reflecting differences in population size or unemployment rates across regions.

At the same time, the unemployment coefficient illustrates how cross-sectional correlations can be sensitive to broader heterogeneity: in 2017 it is weakly positive in the basic-control model but becomes strongly negative once macro-area dummies are introduced, consistent with the idea that cross-country or macro-bloc differences may confound the simple unemployment–income correlation.

When we augment the model with extended controls capturing human capital and sectoral composition (tertiary education share and sectoral employment shares), the EQI coefficient declines but remains highly significant in both years (0.308 in 2017; 0.252 in 2024, both $p<0.001$).

This reduction is consistent with the notion that part of the EQI–income correlation is shared with structural characteristics of regions: better-governed regions tend to be more educated and have different economic specialization patterns.

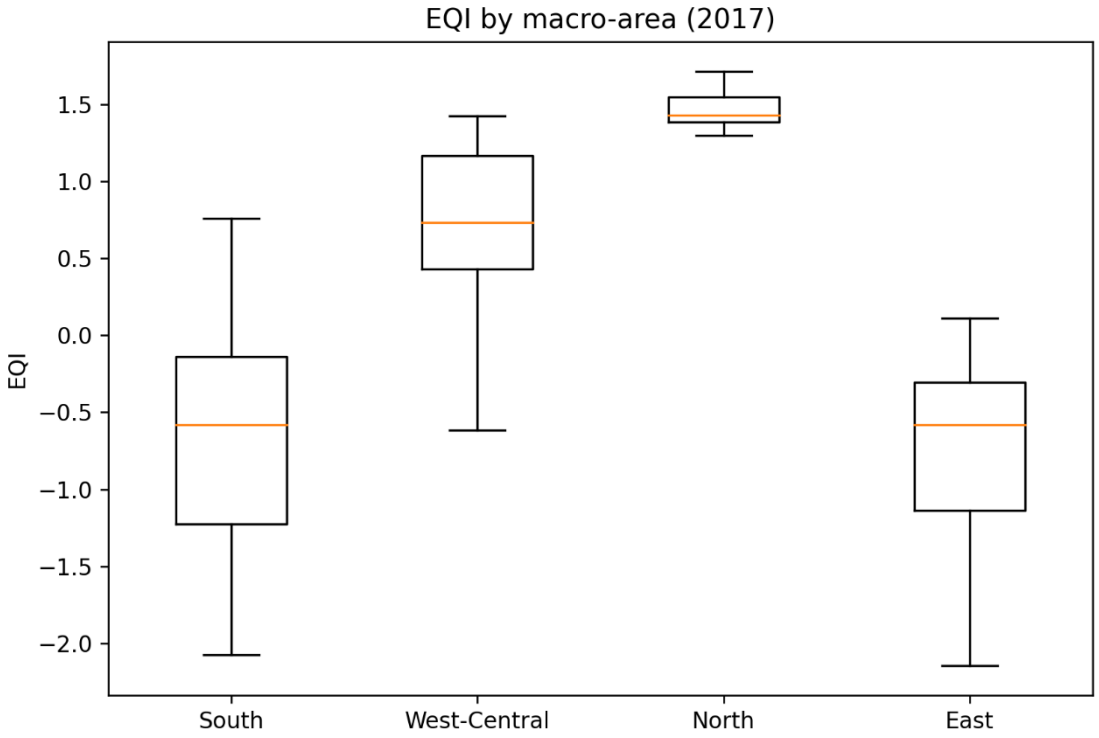
Sectoral shares are strongly related to income in both years, with higher weights in agriculture, industry and construction generally associated with lower GDP per capita relative to the omitted sector (services), in line with systematic productivity differences across economic structures.

A central question in this cross-sectional setting is how much of the EQI–income relationship reflects broad macro-level differences across European blocs rather than within-bloc variation.

To address this, we introduce macro-area dummies (South, West-Central, North, East), with macro dummies and basic controls, the EQI coefficient drops to 0.134 in 2017 and 0.164 in 2024 (both statistically significant), indicating that a substantial share of the baseline correlation is explained by large-scale geographical/institutional heterogeneity.

Macro-area differences in EQI are illustrated in Figure 6.2.

Figure 6.2: EQI distribution by macro-area (2017).



Source: Author's elaboration on EQI (QoG Institute).

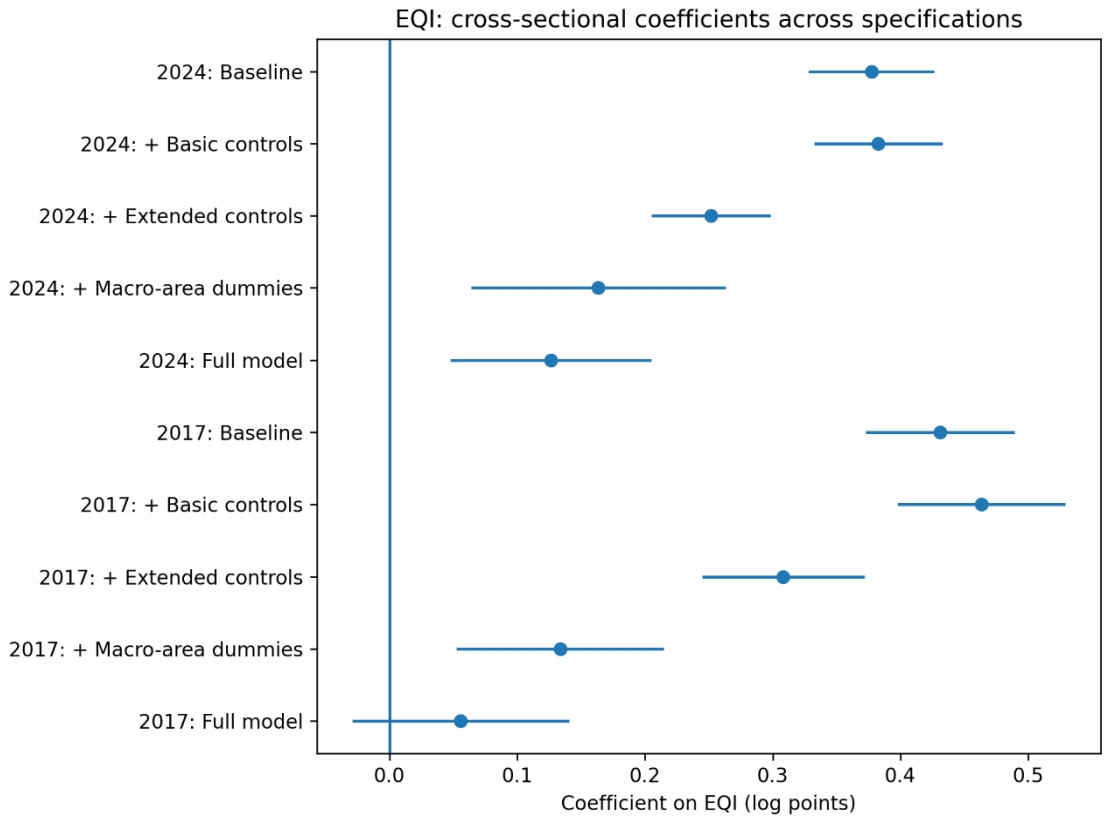
The macro-area effects themselves are economically meaningful: the "East" dummy is negative and strongly significant in both years, highlighting persistent income gaps across broad European groupings.

Importantly, the comparison between 2017 and 2024 becomes more informative in the most demanding specification that combines macro-area dummies with the extended control set.

In 2017, the EQI coefficient becomes small and statistically insignificant (0.056, p≈0.20), suggesting that once we compare regions that are similar in macro-area conditions and observable structural characteristics, the remaining EQI–income association is limited in that year, on the other hand, in 2024 the EQI coefficient remains positive and statistically significant even in the full model (0.126, p=0.002).

This pattern suggests that, by 2024, EQI captures additional within–macro-area institutional variation that remains correlated with regional income beyond differences in human capital and sectoral composition.

Figure 6.3: EQI: cross-sectional coefficients across specifications (2017 and 2024)



Source: Author's elaboration (OLS, robust SE).

While these estimates remain correlational and should not be interpreted causally, the persistence of the EQI coefficient in 2024 strengthens the interpretation that sub-national institutional quality contains economically relevant information even after accounting for broad regional blocks and key observable covariates.

Finally, the number of observations varies slightly across specifications because some regions have missing values in specific controls (notably in the extended-control models), robust standard errors are used throughout.

Table 6.1 – Cross-section (2017): EQI

	Bivariate	Base	Extended	Base + Macro FE	Extended + Macro FE
EQI	0.431***	0.463***	0.308***	0.134***	0.056
	(0.030)	(0.034)	(0.032)	(0.041)	(0.043)
ln (Population)			0.061**		0.047**
			(0.031)		(0.021)
Unemployment rate			-0.001		-0.033***
			(0.005)		(0.005)
Share tertiary educated			-0.409		0.847***
			(0.350)		(0.271)
Share agriculture			-3.545***		-2.193***
			(0.433)		(0.284)
Share industry			-2.374***		-0.647*
			(0.399)		(0.376)
Share construction			-4.161**		-0.684
			(1.740)		(1.166)
N	183	182	177	182	177
R^2	0.517	0.535	0.749	0.779	0.884

Notes: Dependent variable is ln (GDP per capita). Robust (HC1) standard errors. 'Macro FE' are macro-area fixed effects (constructed from cname). Significance: *** p<0.01, ** p<0.05, * p<0.10.

Table 6.2 – Cross-section (2024): EQI

	Bivariate	Base	Extended	Base + Macro FE	Extended + Macro FE
EQI	0.377***	0.383***	0.252***	0.164***	0.126***
	(0.025)	(0.026)	(0.024)	(0.051)	(0.040)
ln (Population)			0.066**		0.055**
			(0.027)		(0.022)
Unemployment rate			-0.022***		-0.045***
			(0.007)		(0.007)
Share tertiary educated			-0.163		0.360
			(0.271)		(0.225)
Share agriculture			-3.207***		-2.916***
			(0.416)		(0.360)
Share industry			-1.944***		-1.005***
			(0.381)		(0.379)
Share construction			-5.625***		-2.147**
			(1.172)		(1.065)
N	186	182	171	182	171
R^2	0.574	0.61	0.791	0.715	0.849

Notes: Dependent variable is ln (GDP per capita). Robust (HC1) standard errors. 'Macro FE' are macro-area fixed effects (constructed from cname). Significance: *** p<0.01, ** p<0.05, * p<0.10.

6.2 Cross section with education

To explore whether the relationship between institutional quality and regional income is driven by specific governance dimensions, we replicate the cross-sectional analysis using the education-related institutional component.

In particular, we replace EQI with the education index, which captures perceived quality and performance of public services and institutions in the education domain at the regional level.

The corresponding education cross-sectional regressions are reported in Table 6.3 (2017) and Table 6.4 (2024).

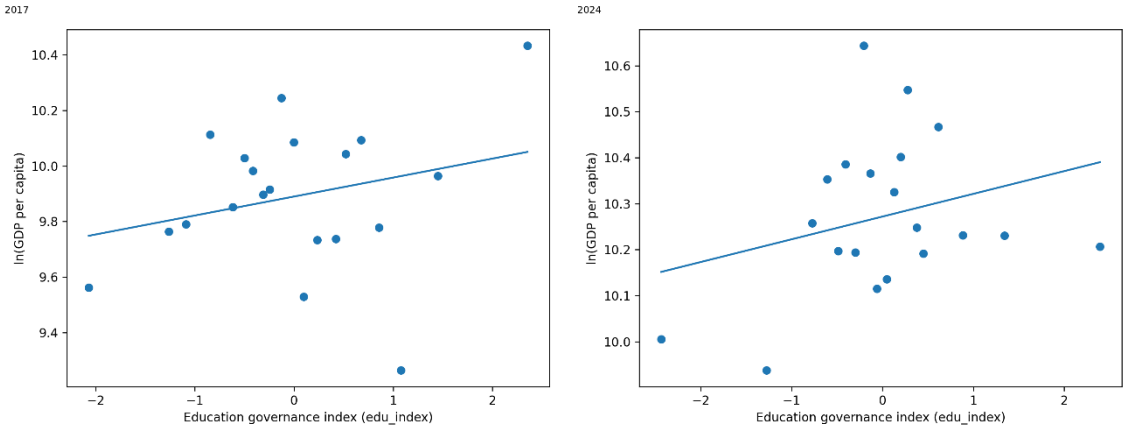
We estimate the same sequence of specifications as in the main EQI analysis, progressively adding baseline controls, extended controls (human capital and sectoral structure) and macro-area dummies, to assess robustness to observable regional characteristics and broad European heterogeneity.

Building on the main cross-sectional findings for EQI, we investigate whether education exhibits a similar relationship with regional income.

The bivariate estimates show a positive and statistically significant association in both years (β=0.330 in 2017; β=0.304 in 2024; $p<0.001$), indicating that regions with higher perceived education-governance quality tend to be richer.

This relationship is illustrated in Figure 6.4

Figure 6.4: Education governance index and regional income: ln (GDP per capita) vs education index (2017 and 2024).



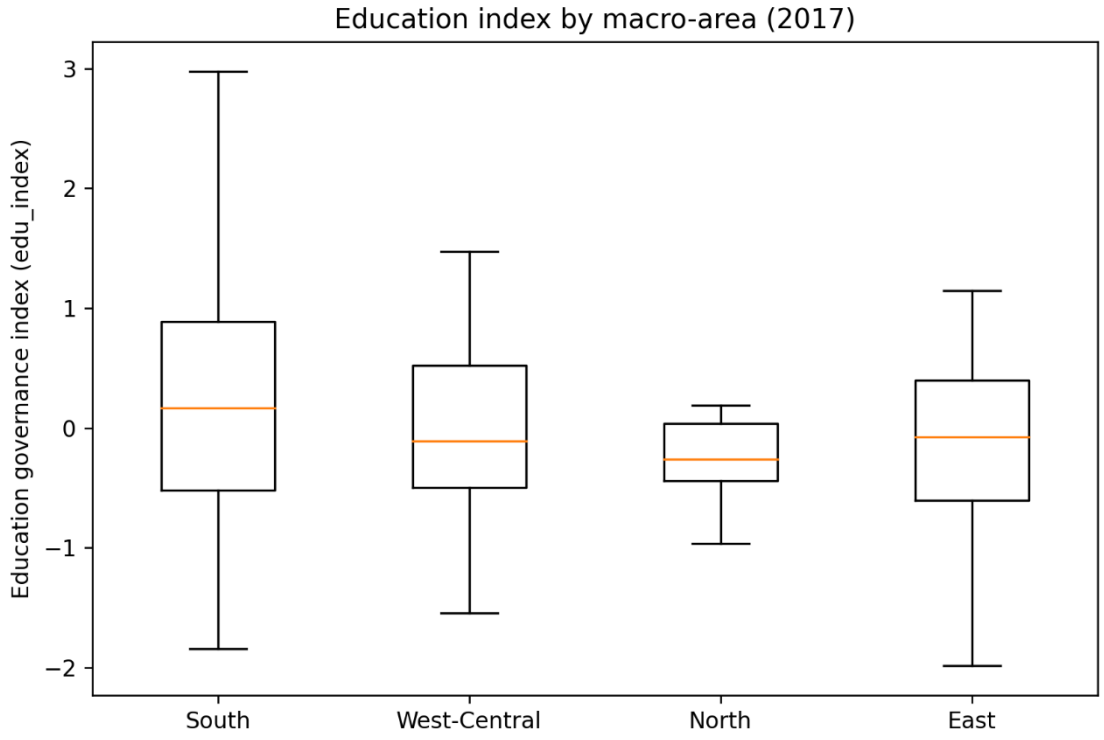
Source: Author's elaboration on QoG education index and Eurostat regional GDP.

In economic terms, a one–standard deviation increase in education index (roughly 0.82–0.84 in our sample) is associated with about 29–31% higher GDP per capita in the bivariate specification, this association remains strong after adding baseline controls (β=0.401 in 2017; β=0.314 in 2024; $p<0.001$).

The key pattern emerges once we account for broad European heterogeneity: including macro-area dummies substantially attenuates the education-index coefficient (β=0.193 in 2017; β=0.087 in 2024).

Macro-area patterns for the education index are shown in Figure 6.5.

Figure 6.5: Education index distribution by macro-area (2017)



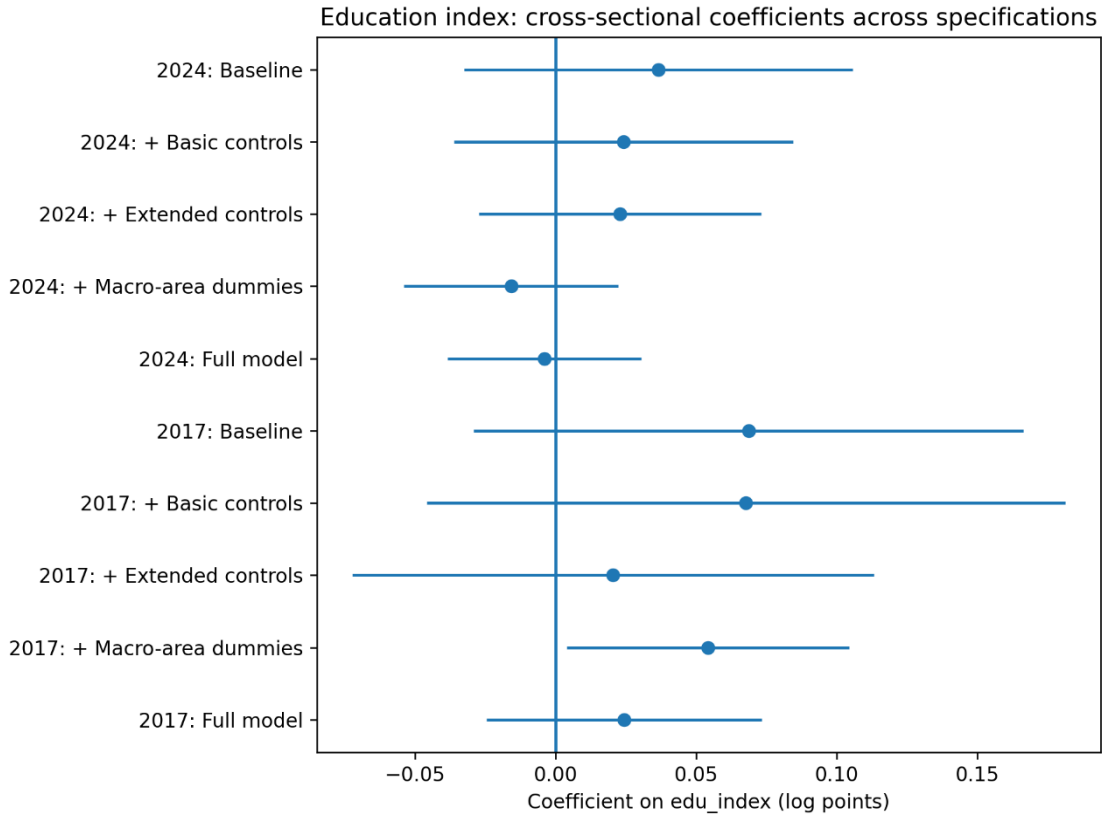
Source: Author's elaboration on QoG education index.

This attenuation is consistent with the idea that education-related institutional quality differs systematically across macro-European blocs and that part of the raw correlation reflects cross-bloc differences rather than purely within–macro-area variation.

Importantly, even in the most demanding specification (macro dummies plus extended controls), the education index remains positive and significant (β=0.186 in

2017; β=0.106 in 2024; p<0.001).

Figure 6.6: Education index: cross-sectional coefficients across specifications (2017 and 2024)



Source: Author's elaboration (OLS, robust SE).

Interpreted again in standard deviation units, this corresponds to roughly 9–17% higher GDP per capita for a one–SD increase, suggesting that the education-governance dimension retains explanatory power beyond observable human capital and sectoral structure.

Overall, compared with the main EQI results, the education component appears more sensitive to macro-level heterogeneity and weaker in 2024 than in 2017.

Since the extended-control models include a direct human-capital proxy (tertiary education share), these specifications can be viewed as conservative tests of whether education-related governance retains explanatory power beyond education attainment and sectoral structure.

Finally, 2017 estimates are based on a smaller sample due to missing values in

education index, so cross-year magnitude comparisons should be interpreted cautiously.

Table 6.3 – Cross-section (2017): Education governance

	Bivariate	Base	Extended	Base + Macro FE	Extended + Macro FE
Education governance (edu_index_raw)	0.330***	0.401***	0.241***	0.193***	0.186***
	(0.052)	(0.067)	(0.054)	(0.056)	(0.049)
ln (Population)			0.065		0.116***
			(0.046)		(0.024)
Unemployment rate			-0.005		-0.029***
			(0.006)		(0.006)
Share tertiary educated			0.885*		0.712***
			(0.519)		(0.250)
Share agriculture			-3.737***		-2.017***
			(0.444)		(0.295)
Share industry			-3.232***		-0.638
			(0.442)		(0.469)
Share construction			-1.797		1.512
			(2.349)		(1.134)
N	121	120	118	120	118
R^2	0.191	0.202	0.693	0.805	0.909

Notes: Dependent variable is ln (GDP per capita). Robust (HC1) standard errors. 'Macro FE' are macro-area fixed effects (constructed from cname). Significance: *** p<0.01, ** p<0.05, * p<0.10.

Table 6.4 – Cross-section (2024): Education governance

	Bivariate	Base	Extended	Base + Macro FE	Extended + Macro FE
Education governance (edu_index_raw)	0.304***	0.314***	0.215***	0.087**	0.106***
	(0.040)	(0.043)	(0.026)	(0.043)	(0.029)
ln (Population)			0.040		0.050**
			(0.026)		(0.021)
Unemployment rate			-0.020***		-0.040***
			(0.007)		(0.007)
Share tertiary educated			0.851***		0.656***
			(0.266)		(0.220)
Share agriculture			-4.182***		-3.032***
			(0.438)		(0.365)
Share industry			-2.063***		-0.808**
			(0.357)		(0.358)
Share construction			-4.477***		-1.673
			(1.553)		(1.139)
N	186	182	171	182	171
R^2	0.258	0.292	0.745	0.701	0.851

Notes: Dependent variable is ln (GDP per capita). Robust (HC1) standard errors. 'Macro FE' are macro-area fixed effects (constructed from cname). Significance: *** p<0.01, ** p<0.05, * p<0.10.

6.3 Fixed effect panel

We next move from cross-sectional OLS to a panel framework with regional fixed effects (NUTS2 FE), restricting the sample to the 2013, 2017, 2021 and 2024 waves, this specification identifies the association between institutional quality and income using within-region variation over time, net of all time-invariant regional characteristics (e.g., geography, long-run productive structure, historical factors).

Standard errors are clustered at the regional level to account for serial correlation within NUTS2 units.

Panel fixed-effects estimates for EQI (2013–2017–2021–2024) are reported in Table 6.5.

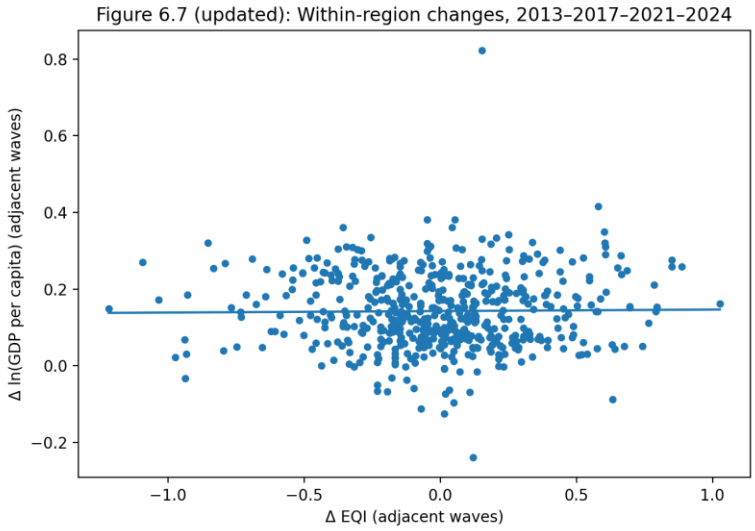
Overall, these estimates suggest that the strong cross-sectional EQI–income relationship documented earlier is not mirrored in contemporaneous within-region changes in this short panel.

A key reason is that the fixed effects estimator removes the large "between" component that dominates the cross-section: many regions display relatively persistent institutional quality rankings over 2013–2024, so the identifying variation in EQI within a region is limited and potentially noisy.

In a short panel with only four waves, this can make the within association difficult to detect, especially if institutional changes affect income with lags rather than contemporaneously, or if measurement error in EQI attenuates within estimates.

Within-region co-movements in changes are visualized in Figure 6.7.

Figure 6.7: Within-region changes: Δ ln (GDP per capita) vs Δ EQI (panel 2013–2024).



Source: Author's elaboration (NUTS2 panel).

The positive and significant coefficients on the year indicators (2017, 2021 and 2024 relative to 2013) confirm the presence of strong common time patterns in income across regions.

This also helps explain why some controls change behavior across specifications: for instance, unemployment is strongly negative in the fixed effects model without year dummies but becomes essentially zero once year effects are added, indicating that part of the unemployment–income correlation is driven by aggregate shocks or period-specific factors shared across regions.

Taken together, the fixed effects evidence suggests that the EQI–income relationship in Europe is primarily associated with persistent cross-regional differences, while contemporaneous within-region changes in EQI over 2013, 2017, 2021 and 2024 do not provide additional explanatory power.

This motivates the subsequent previous-wave specifications, which better align institutional measurement with the timing of economic outcomes and help mitigate simultaneity concerns.

As discussed in Section 4.4, fixed-effects models identify the relationship using within-region variation over time, net of time-invariant regional characteristics, we therefore interpret these estimates as a stringent robustness check relative to cross-

sectional OLS.

Table 6.5 – Panel FE (2013–2024): contemporaneous EQI

	Base	Base + Year FE	Extended	Extended + Year FE
EQI	-0.002	-0.007	0.020	-0.006
	(0.035)	(0.020)	(0.020)	(0.018)
ln (Population)			-0.920***	-0.940***
			(0.327)	(0.298)
Unemployment rate			-0.009***	0.002
			(0.002)	(0.003)
Share tertiary educated			2.843***	0.624**
			(0.214)	(0.270)
Share agriculture			-1.754***	-1.078***
			(0.293)	(0.255)
Share industry			-0.728	-0.177
			(0.564)	(0.452)
Share construction			4.240***	2.842***
			(0.789)	(0.700)
N	711	711	686	686
Within R^2	0.376	0.777	0.716	0.808

Notes: Dependent variable is ln (GDP per capita). Region fixed effects. Standard errors clustered at NUTS2 level. Within R^2 reported. Significance: *** p<0.01, ** p<0.05, * p<0.10.

6.4 Fixed effect panel with education

We then replicate the fixed-effects analysis using the education-related institutional component, in the panel setting we rely on the educational index (country-centered and standardized by year), which is designed to capture relative within-country regional differences net of common cross-country shifts.

Panel fixed-effects estimates for the education governance index are reported in Table 6.6.

Across all fixed effects specifications, the contemporaneous association between education and regional income is essentially zero.

In the baseline fixed effects model with population and unemployment controls, the coefficient on education is 0.003 (p=0.789), adding year dummies yields a similarly negligible estimate (−0.001, p=0.852).

Results remain unchanged when including the extended control set (human capital and sectoral composition): the coefficient stays close to zero (≈ −0.001 to −0.003) and is never statistically significant (p-values between 0.65 and 0.88), both with and without year fixed effects.

As in the EQI models, year dummies absorb a substantial part of the time variation in income, with the within R^2 increasing to around 0.79–0.84 once year fixed effects are included.

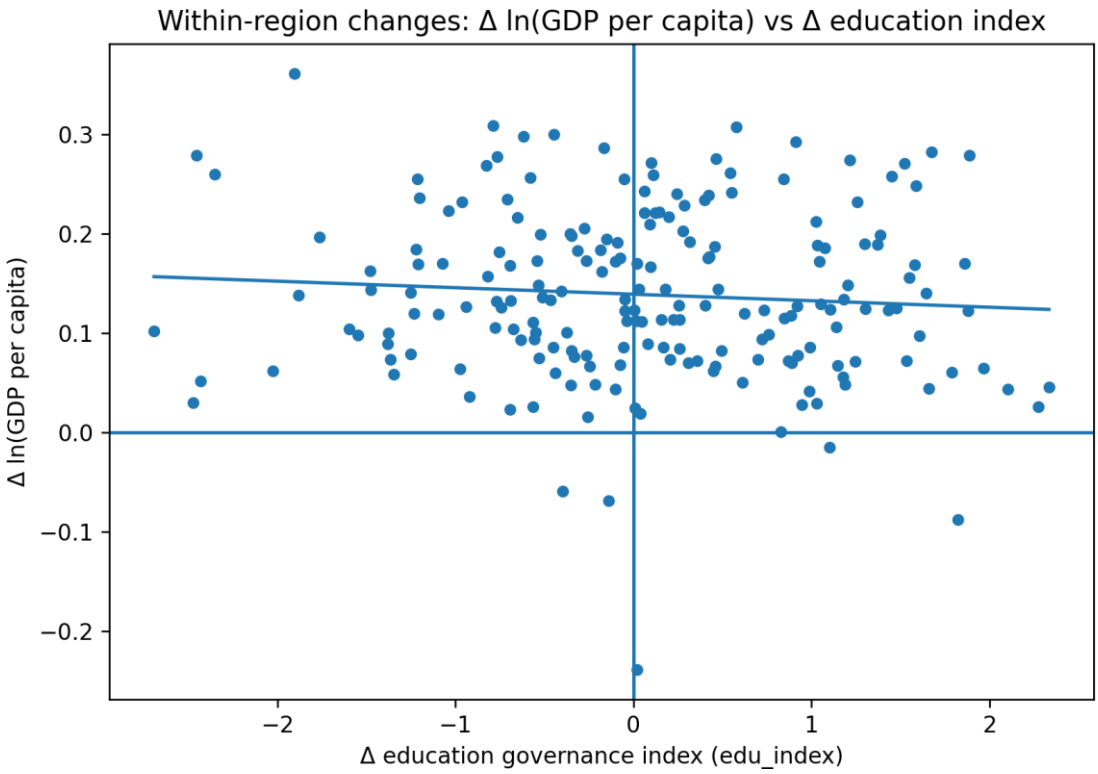
Several controls display strong within associations, particularly unemployment in some specifications and sectoral structure, whereas the education index does not show a robust contemporaneous within-region relationship with GDP per capita in this short panel.

Overall, these findings suggest that the positive cross-sectional correlation between education-related governance quality and income documented in 2017 and 2024 is driven mainly by persistent between-region differences, while within-region changes in the standardized education component over 2013, 2017, 2021 and 2024 provide limited additional explanatory power in contemporaneous fixed effects specifications.

The corresponding within-region change plot is shown in Figure 6.8.

Figure 6.8: Within-region changes: Δ ln (GDP per capita) vs Δ education governance index (panel).

Source: Author's elaboration (NUTS2 panel).



This again supports the use of previous-wave approaches to better align institutional variation with the timing of economic outcomes.

Table 6.6 – Panel FE (2013–2024): contemporaneous education

	Base	Base + Year FE	Extended	Extended + Year FE
Education governance (edu_index)	0.001	-0.000	0.003	0.001
	(0.011)	(0.007)	(0.008)	(0.007)
ln (Population)			-1.061***	-1.199***
			(0.355)	(0.253)
Unemployment rate			-0.011***	0.004**
			(0.002)	(0.002)
Share tertiary educated			2.750***	0.168
			(0.233)	(0.250)
Share agriculture			-2.547***	-1.437***
			(0.253)	(0.207)
Share industry			-2.354***	-1.435***
			(0.570)	(0.431)
Share construction			1.322*	0.193
			(0.690)	(0.509)
N	545	545	529	529
Within R^2	0.373	0.854	0.753	0.879

Notes: Dependent variable is ln (GDP per capita). Region fixed effects. Standard errors clustered at NUTS2 level. Within R^2 reported. Significance: *** p<0.01, ** p<0.05, * p<0.10.

6.5 Previous-wave fixed effect panel

We now turn to timing-consistent specifications based on previous-wave governance measures (Section 4.5).

To align institutional measurement with the timing of outcomes and mitigate simultaneity concerns, we construct “previous wave” measures, defined as the last observed institutional value available for each region, and estimate region fixed-effects models with year dummies.

This approach has two advantages: first, it exploits all available information on institutional quality by extending the panel to include 2024.

Second, it accommodates the fact that the time distance between waves is not always identical, allowing institutional quality measured in the most recent prior wave to predict subsequent income.

Timing-consistent “previous-wave” fixed-effects results are reported in Table 6.7 (EQI) and Table 6.8 (education).

For EQI, the previous-wave estimates point to a positive association, although the strength of the evidence is more moderate than in the contemporaneous fixed-effects specifications.

With baseline controls and year dummies, the coefficient on EQI_prevwave is 0.031 (p=0.102), i.e., positive but not statistically significant at conventional levels, once extended controls are included, the coefficient increases slightly and becomes statistically significant (0.038, p=0.039).

In log terms, this magnitude corresponds to roughly 3–4% higher GDP per capita associated with a one-point higher EQI in the previous wave, taken together, the prev-wave results are consistent with a timing interpretation in which earlier institutional quality predicts subsequent income.

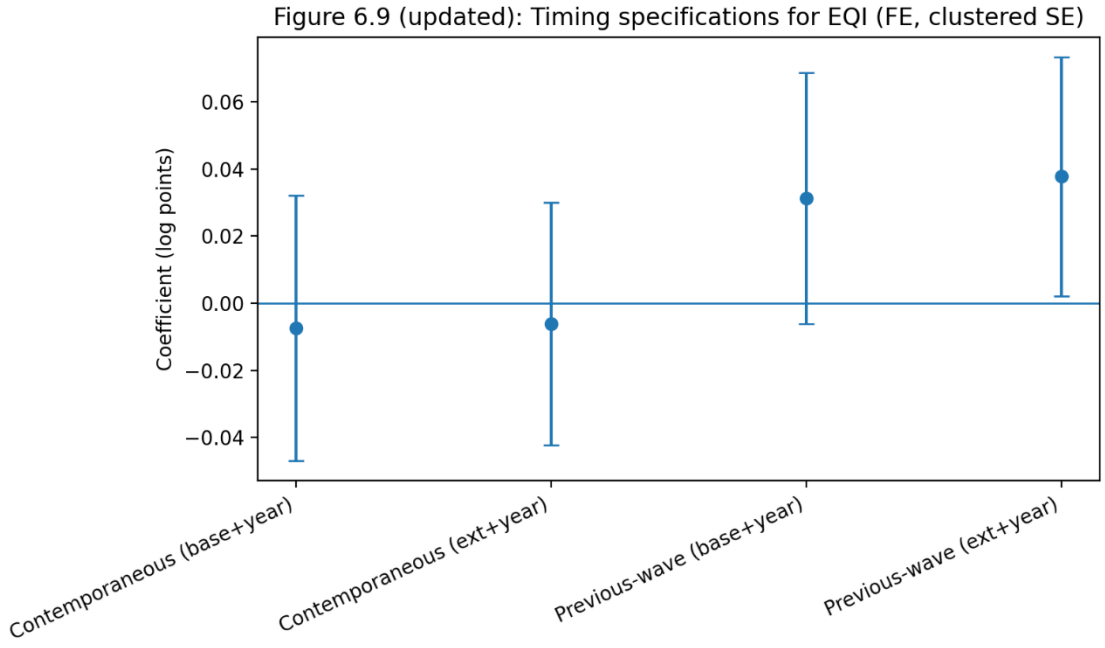
For the education component, the previous-wave relationship is weaker, the coefficient on educational pre wave is small and statistically insignificant with baseline controls (0.0076, p=0.263) and remains only marginal in the extended-control model (0.0099, p=0.097).

Overall, the pre-wave specifications reinforce the idea that the strongest timing signal emerges for broad institutional quality (EQI), while education-related institutional

variation provides at best limited additional predictive content for subsequent income once fixed effects, year dummies, and key covariates are included.

Timing specifications are summarized visually in Figure 6.9 (EQI) and Figure 6.10 (education).

Figure 6.9: EQI: timing specifications (FE contemporaneous vs previous-wave).



Source: Author's elaboration (FE models, clustered SE).

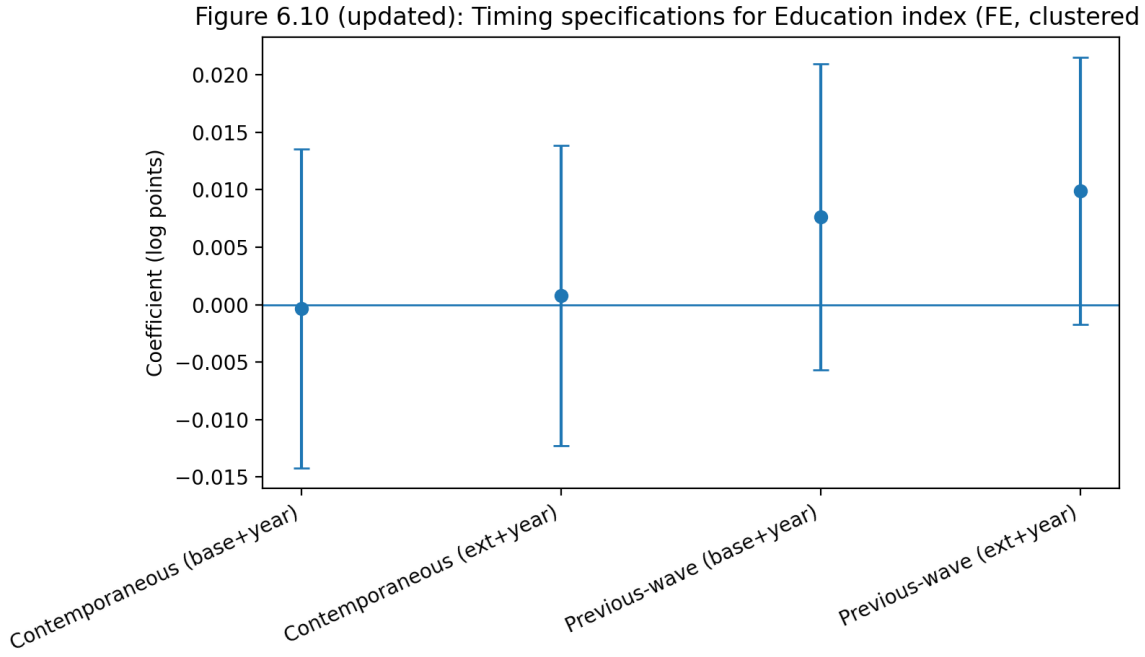
The pre-wave specifications, using a longer panel that includes 2024, deliver more moderate but broadly consistent evidence for EQI, with statistical significance emerging in the richer specification.

By contrast, results for the education-related component are systematically weaker: the lagged effect is small and becomes only marginal under extended controls, and the previous-wave coefficient is at most marginal (around the 10% level) in the extended specification.

The education-related governance component appears to capture persistent structural differences across regions rather than short-run institutional dynamics. While cross-sectional associations are strong, within-region changes over short horizons provide

limited additional explanatory power. This pattern is consistent with the long-term nature of human capital formation.

Figure 6.10: Education index: timing specifications (FE contemporaneous vs previous-wave).



Source: Author's elaboration (FE models, clustered SE).

Taken together, these findings suggest that the cross-sectional EQI–income relationship reflects, at least in part, a timing-consistent pattern whereby earlier institutional quality predicts subsequent regional income, whereas the education-specific institutional dimension provides limited additional predictive power in the within-region panel setting.

Table 6.7 – Timing (previous-wave FE): EQI

	Base + Year FE	Extended + Year FE
EQI (previous-wave)	0.031	0.038**
	(0.019)	(0.018)
ln (Population)		-1.241***
		(0.218)
Unemployment rate		0.008***
		(0.002)
Share tertiary educated		0.146
		(0.231)
Share agriculture		-1.279***
		(0.248)
Share industry		-1.181***
		(0.375)
Share construction		0.417
		(0.468)
N	542	523
Within R^2	0.836	0.859

Notes: Dependent variable is ln (GDP per capita). Previous-wave is the immediately preceding observed institutional value. Region fixed effects and year fixed effects included. Standard errors clustered at NUTS2 level. Within R^2 reported. Significance: *** p<0.01, ** p<0.05, * p<0.10.

Table 6.8 – Timing (previous-wave FE): Education governance

	Base + Year FE	Extended + Year FE
Education governance (previous-wave)	0.008	0.010*
	(0.007)	(0.006)
ln (Population)		-1.275***
		(0.229)
Unemployment rate		0.012***
		(0.003)
Share tertiary educated		-0.055
		(0.302)
Share agriculture		-0.922***
		(0.233)
Share industry		-1.258***
		(0.374)
Share construction		0.042
		(0.677)
N	366	352
Within R^2	0.882	0.899

Notes: Dependent variable is ln (GDP per capita). Previous-wave is the immediately preceding observed institutional value. Region fixed effects and year fixed effects included. Standard errors clustered at NUTS2 level. Within R^2 reported. Significance: *** p<0.01, ** p<0.05, * p<0.10.

6.6 Comparison with WGI

As an external validation exercise, we compare EQI with a widely used national governance indicator, the Worldwide Governance Indicators (WGI) Government Effectiveness measure for 2017.

The motivation is straightforward: while EQI is explicitly designed to capture sub-national institutional quality, it is useful to verify that it is broadly consistent with an established country-level governance proxy commonly used in the macro growth literature.

We therefore merge the 2017 WGI series to the regional dataset and estimate cross-sectional OLS regressions on a common sample of regions with complete information on GDP per capita, institutional measures, and baseline controls.

Since WGI varies only at the country level (all regions within the same country share the same WGI value), standard errors are clustered at the country level to obtain appropriate inference.

For this reason, we cluster standard errors at the country level. Under this more conservative inference, WGI remains strongly and positively associated with regional income ($\beta=0.800$, $p<0.001$), indicating that regions located in countries with higher government effectiveness tend to exhibit higher GDP per capita.

Estimating the EQI specification on the same sample yields a similarly strong result ($\beta=0.463$, $p<0.001$), confirming that the positive institutional-quality gradient documented in the main cross-sectional analysis is not driven by differences in sample composition.

When both WGI and EQI are included jointly, WGI remains statistically significant ($\beta=0.494$, $p=0.024$) and the EQI coefficient stays positive but becomes marginally significant ($\beta=0.198$, $p=0.058$).

This pattern is consistent with substantial overlap between national and regional governance measures, in particular, WGI absorbs an important part of the between-country institutional variation, leaving EQI to capture the residual component that is more closely related to within-country regional heterogeneity.

The reduced precision of the EQI estimate in the joint regression therefore reflects shared variance (and the limited number of country clusters) rather than a contradiction of the main findings.

Overall, these results support the external consistency of EQI with established governance indicators and reinforce the interpretation of EQI as a measure that combines both country-level institutional differences and meaningful within-country regional variation.

At the same time, because WGI is national by construction, these regressions should be viewed as validation exercises rather than causal tests, and the joint specification should be interpreted with caution.

VII. Conclusion

This thesis examined the relationship between institutional quality and regional economic development in Europe using the European Quality of Government Index (EQI) at the NUTS2 level.

The motivation was twofold: first, regional disparities in income remain large and persistent within the European Union, raising both economic and policy concerns.

Second, most widely used governance indicators are measured at the national level and therefore cannot capture potentially substantial within-country heterogeneity in public service quality, impartiality, and corruption perceptions.

By focusing on EQI, a sub-national institutional measure, and complementing it with a sectoral governance component related to education, the thesis aimed to provide a regionally grounded perspective on the institutions–development nexus in Europe.

7.1 Summary of findings

The empirical analysis combined cross-sectional and panel approaches, each shedding light on a different dimension of the institutional–income relationship.

7.1.1. Cross sectional evidence

In cross-section, the overall EQI measure is strongly and positively associated with regional GDP per capita.

The relationship is large and highly statistically significant in both 2017 and 2024, and it remains robust to the inclusion of baseline controls for regional size (log population) and labor-market conditions (unemployment rate).

When extending the model to include a proxy for human capital (tertiary education share) and sectoral composition, the EQI coefficient declines but remains economically meaningful, consistent with the idea that part of the raw EQI–income correlation is shared with structural regional characteristics.

Introducing macro-area dummies (South, West-Central, North, East) substantially attenuates the coefficient, suggesting that broad European heterogeneity explains a non-

trivial fraction of the raw cross-sectional relationship.

A notable difference across years emerges in the most demanding specification: in 2017 the EQI coefficient becomes small and statistically insignificant once macro-area controls and extended covariates are included, whereas in 2024 EQI remains positive and statistically significant even in the full model.

This pattern suggests that, in the more recent cross-section, institutional quality retains within–macro-area variation associated with regional income beyond what is captured by observable covariates.

The education-related institutional component displays a similar but more fragile cross-sectional pattern.

The education index is positively and significantly associated with income in both years and remains significant after baseline controls, however, its coefficient is more sensitive to macro-area controls and appears weaker in 2024 than in 2017.

Even in the most demanding cross-sectional specification, the education index remains positive and statistically significant, though with smaller magnitudes than in simpler models.

Taken together, these results are consistent with education-related governance being one dimension through which institutional quality co-moves with regional development, while also indicating that the education component is more exposed to broad cross-bloc heterogeneity.

7.1.2 Panel fixed-effects evidence

In fixed-effects models, contemporaneous coefficients on EQI and on the education index are close to zero and statistically insignificant across specifications, suggesting that the strong cross-sectional gradient is not mirrored in short-run within-region changes.

7.1.3 Lagged and previous-wave measures

Lagged and previous-wave specifications reintroduce a clearer timing-consistent signal for EQI, while evidence for the education component remains weaker and more specification-sensitive.

7.1.4 External validation with WGI.

Finally, the thesis compared EQI with a widely used national governance indicator, WGI Government Effectiveness (2017).

Using country-clustered inference (appropriate because WGI is constant within countries), both WGI and EQI are strongly and positively associated with regional income when entered separately.

When included jointly, WGI remains statistically significant and EQI remains positive but becomes marginally significant, this is consistent with overlap between national and sub-national governance measures: WGI primarily captures between-country institutional differences, while EQI combines between-country variation with within-country regional heterogeneity.

This exercise therefore supports the external consistency of EQI with established governance metrics while highlighting that the two measures are not independent and should not be interpreted as separate causal drivers in the same cross-sectional regression.

7.2 Interpretation and implications

The empirical patterns documented in this thesis can be interpreted as evidence that institutional quality is closely intertwined with regional prosperity in Europe, but that the relationship is highly dependent on the type of variation exploited, between regions and countries in cross-section versus within-region changes over time in fixed-effects models, and on the timing between institutional measurement and economic outcomes.

Rather than being contradictory, the cross-sectional and panel results are consistent with a view of institutions as a slow-moving determinant of development whose effects are largely embedded in persistent regional differences and may materialize with delays.

A first key interpretation concerns the role of broad European heterogeneity, in the cross-sectional regressions, the introduction of macro-area dummies substantially attenuates the institutional coefficients, this suggests that a meaningful share of the raw institutions–income gradient reflects large-scale differences across European blocs, which plausibly bundle together a wide set of historical, structural and institutional

factors.

In practice, this means that cross-sectional estimates without macro controls should be read primarily as capturing an institutional-development gradient that is strongly shaped by between-bloc (and between-country) variation.

Once macro differences are accounted for, the remaining coefficient reflects a more demanding comparison: how much institutional quality matters among regions that are broadly similar in large-scale European context.

The fact that EQI still shows a positive association in 2024 under demanding specifications can be interpreted as evidence that sub-national institutional differences remain economically relevant even within broad blocks, while the weaker 2017 full-model result suggests that the extent to which EQI captures incremental variation beyond macro structure may vary across waves and sample composition.

A second interpretation relates to the sharp contrast between cross-sectional and contemporaneous fixed-effects estimates.

The fixed effects framework asks a different question: whether changes in institutional quality within the same region over time are associated with changes in income for that region, net of all time-invariant characteristics.

The near-zero contemporaneous fixed effects coefficients for both EQI and the education component indicate that short-run within-region movements in these measures over 2013, 2017, 2021 and 2024 do not translate into immediate income differences in the same period.

This pattern is consistent with at least three mechanisms: first, institutional quality is relatively persistent; therefore, the within variation available in a short panel is limited.

Second, institutional measurement is noisy, especially when derived from perceptions, and measurement error tends to attenuate within estimates more strongly than cross-sectional ones.

Third, the institutional channel is plausibly slow: reforms in public governance, impartiality and service quality can affect investment, productivity and economic structure gradually, rather than within the same wave.

Under these conditions, it is not surprising that cross-sectional relationships can be strong while contemporaneous within estimates are weak.

This interpretation is reinforced by the timing exercises, when institutional quality

is shifted backward in time, either using a fixed lag or a previous-wave definition, EQI exhibits a more timing-consistent association with subsequent income.

From an economic standpoint, this pattern aligns with a delayed-effect story: earlier governance quality plausibly shapes later outcomes by affecting the environment in which firms and households operate, the effectiveness of public investment, the functioning of labor markets, and the allocation of resources.

From an econometric standpoint, lagging institutions also reduces (though does not eliminate) simultaneity concerns, because current income is less likely to mechanically influence past institutional measures.

The fact that the lagged EQI results are stronger and more robust than the prev-wave results may also reflect the greater comparability and clarity of a fixed lag structure relative to a flexible "previous observation" timing that can vary across regions and waves.

The education-specific governance component deserves a more nuanced interpretation, in cross-section, education-related institutional quality is positively associated with regional income, which is consistent with a channel in which better governance in the education domain supports human capital formation, reduces inefficiencies in service delivery, and improves the productivity potential of the workforce.

However, in within-region panel settings, especially when previous-wave variants are used, the evidence for the education component is weaker and less stable than for EQI.

This may reflect a genuinely smaller role for the education-governance dimension in explaining short-run income dynamics, but it may also reflect measurement and specification features.

In particular, education-related institutional indices may exhibit limited within variation across waves and extended-control models include human-capital proxies that are conceptually close to education outcomes, which can make the education-governance coefficient a conservative estimate of any independent role beyond observed education attainment and structure.

Under this reading, the education results are informative: they suggest that the education component is an economically meaningful correlate in cross-section, but that

its incremental predictive content in within-region timing tests is weaker than that of broad governance quality.

The external validation exercise with WGI helps interpret EQI as a governance measure positioned between two levels of variation.

WGI captures country-level institutional quality and is strongly associated with regional income, as expected in Europe where national frameworks remain important determinants of public sector effectiveness.

When WGI and EQI are included jointly with country-clustered inference, the reduction in EQI precision is consistent with overlap between national and sub-national governance measures and with the fact that WGI absorbs much of the between-country institutional component.

This result does not weaken EQI; rather, it clarifies that EQI contains both a national component (shared with WGI) and a sub-national component that becomes more difficult to isolate in a simple cross-sectional regression once the country-level index is included.

These interpretations point to several implications, from a methodological perspective, the results highlight that empirical conclusions about "institutions and development" depend crucially on whether the analysis exploits between or within variation and on whether institutional measurement is aligned with the timing of outcomes.

Cross-sectional regressions are informative about persistent institutional gradients but can conflate institutional quality with broad macro heterogeneity.

Fixed effects remove time-invariant confounders but require sufficient within variation and are likely to understate relationships when institutions are persistent or measured with noise.

Timing strategies (lags and previous-wave measures) provide a useful compromise: they preserve the within-region framework while allowing for delayed effects and reducing simultaneity.

In practice, the combination of approaches used in this thesis suggests a coherent workflow for future work with EQI-type data: document cross-sectional patterns, test within-region contemporaneous relationships and then assess timing-consistent relationships using lagged institutional measures.

From a policy perspective, the evidence is consistent with the view that governance

quality is closely linked to regional prosperity and that differences in institutional quality may contribute to persistent regional gaps.

The timing results, in particular, support the idea that institutional quality measured earlier is associated with better subsequent economic performance, which is broadly consistent with the premise of EU cohesion strategies that emphasize administrative capacity, impartiality, and effectiveness of public services.

At the same time, the weak contemporaneous fixed effects results caution against expecting immediate income gains from institutional reforms: improvements in governance may be slow to translate into measurable economic outcomes.

This implies that policies aimed at strengthening institutions should be assessed on medium-run horizons and accompanied by complementary investments in human capital and productive structure, which likely mediate the institutional channel.

The education-specific findings suggest that domain-level governance can matter, but that its role may be intertwined with broader governance quality and with observed education outcomes; policy design should therefore consider both general governance capacity and sector-specific implementation quality.

Finally, the thesis results also imply that reducing regional disparities may require attention not only to local governance but also to the broader institutional environment in which regions operate.

Since macro-area heterogeneity explains a substantial share of cross-sectional differences, reforms and investments that improve national institutional frameworks, administrative capacity and accountability may have wide-reaching effects, while regional-level improvements may be most effective when they operate within supportive national institutions.

7.3 Limitations

Despite the breadth of specifications and robustness checks, several limitations should be kept in mind when interpreting the results.

Although the thesis combines cross-sectional evidence with regional fixed effects, clustered inference and timing-sensitive specifications (previous-wave measures), the analysis does not deliver a fully causal estimate of the effect of institutional quality on

income.

Cross-sectional regressions are exposed to omitted-variable bias stemming from persistent historical, geographic and structural factors that correlate with both institutions and development.

Fixed-effects models mitigate time-invariant confounding but they do not address time-varying unobservables and do not, by themselves, solve reverse causality.

Lagging institutional variables reduces simultaneity concerns, yet it cannot be ruled out that earlier institutions are correlated with earlier (or anticipated) economic conditions or with omitted trends that jointly drive both institutions and income.

Second, the panel dimension is short and institutions are slow-moving, the fixed effects analysis relies on a limited number of waves (2013, 2017, 2021 and 2024, with extensions including 2024 for prev-wave).

With only a few time points, within-region identification is challenging, especially for slow-moving variables such as institutional quality, limited within variation mechanically reduces power, and results can be sensitive to sample composition and measurement noise.

More generally, the short panel cannot capture longer-run dynamics through which institutions may influence structural transformation, productivity, and investment, channels that may unfold over a decade rather than within a four-year window.

Third, measurement error is likely and may differ across specifications, EQI is ultimately based on survey responses and perceptions, which are informative but not error-free.

Measurement error tends to attenuate estimates, particularly in within-region fixed effects models where identification relies on changes over time, differences across waves may reflect genuine institutional change but may also partly reflect sampling variation, changes in respondent composition, or shifts in perceptions that are not fully aligned with objective institutional performance.

The education component may be especially exposed to these issues, which could partly explain why its within-region timing results appear weaker and less stable than the overall EQI measure.

Fourth, the construction and interpretation of sectoral and human-capital controls involve trade-offs, extended-control specifications include tertiary education share and

sectoral composition variables, these controls improve comparability across EQI and education regressions and help account for key structural correlates of income.

However, they may also be “strong” controls in the sense that they can absorb part of the institutional channel, particularly in the education-index regressions, where tertiary education is conceptually close to education outcomes.

As a result, extended-control models can be interpreted as conservative tests of whether education-related governance retains explanatory power beyond observed human capital and structure, but they may understate broader indirect institutional effects that operate through these channels.

Fifth, sample composition varies across models, the number of observations changes across specifications due to missing values in controls and, more prominently, due to missing values in the education index in some years.

This matters because changes in sample composition can affect coefficient magnitudes and significance, and comparisons across years or across institutional measures should therefore be made cautiously, in particular, the smaller 2017 sample for education may reduce precision and may also alter representativeness if missingness is not random (e.g., concentrated in certain countries or regions).

Sixth, the 2024 income outcome relies on a transparent proxy choice, to extend the analysis to 2024, to extend the analysis to 2024, the thesis proxies regional GDP in 2024 using 2023 values for all NUTS2 regions in the current dataset.

While this strategy is clearly documented and preserves comparability, it introduces a limitation: it may smooth or misalign the timing between measured institutions and the income outcome in the “2024” cross-section.

This is unlikely to overturn broad cross-sectional patterns, but it should be acknowledged when interpreting year-to-year differences in coefficients under demanding specifications.

Seventh, the “pre wave” timing measure is informative but heterogeneous, this approach links income to the last observed institutional value for each region and enables the inclusion of 2024.

However, the effective lag length can vary across regions depending on which waves are observed and on missingness, this heterogeneity makes the prev-wave specification less clean than the fixed lag (L4) model and may partly explain why pre-

wave results are more moderate and sometimes specification-sensitive.

Eighth, cross-regional dependence and spatial spillovers are not explicitly modelled, European regions are interconnected through labor mobility, commuting patterns, supply chains, and policy spillovers.

If economic performance in one region affects neighboring regions, or if governance improvements generate spillovers beyond regional borders, standard regression assumptions may be violated and estimated standard errors may be understated.

While clustering at the regional level in panel models and at the country level in WGI regressions addresses some dependence structures, the analysis does not explicitly incorporate spatial econometric methods or spatially correlated error processes.

Ninth, the WGI validation exercise is informative but limited by levels of aggregation, WGI is measured at the country level and therefore mainly captures between-country institutional variation.

Its use in this thesis is primarily as an external consistency check rather than as a substitute for sub-national institutional measures, in joint regressions, overlap between WGI and EQI is expected, and inference is constrained by the limited number of country clusters.

Consequently, WGI-based results should be interpreted carefully and not as evidence that one measure dominates the other.

Overall, these limitations do not undermine the central contribution of the thesis, documenting robust cross-sectional patterns and timing-consistent relationships for EQI at the regional level, but they frame the findings as evidence of meaningful associations rather than definitive causal effects.

They also point naturally to future research directions aimed at strengthening identification, extending the time dimension, improving measurement, and accounting for spatial interdependence.

7.4 Possible future research

The results and limitations discussed above point to several promising avenues for future research.

A natural next step is to move beyond associational evidence by exploiting research designs that provide more credible causal variation in institutional quality, this could involve quasi-experimental approaches based on governance reforms, anti-corruption initiatives, administrative-capacity programs, or policy discontinuities that affect regions differentially over time.

Where feasible, combining EQI with information on institutional reforms, EU-funded capacity-building interventions, or rule-of-law enforcement episodes could help establish clearer causal links.

Instrumental-variable strategies may also be explored, although valid instruments for sub-national institutions are difficult to justify and should be evaluated carefully.

As additional EQI waves become available, extending the panel would be valuable to better capture slow-moving institutional effects and to increase within-region variation, with more time points, it would be possible to estimate richer dynamic models (e.g., distributed lags, medium-run responses, or impulse-style effects) and to assess whether institutional improvements translate into changes in income levels, growth rates, or volatility over longer horizons, a longer panel would also allow more informative heterogeneity analyses (e.g., whether institutional effects differ before and after major macro shocks).

Future work could examine whether the institutions–income relationship is stronger in specific subsets of regions, for example, effects may differ between Eastern and non-Eastern macro areas, between high- and low-income regions, or between regions with different initial institutional quality, nonlinearities are also plausible: institutional improvements may have larger marginal effects when starting from very low institutional quality, or may matter most once a threshold level of administrative capacity is achieved, testing these patterns can provide a more policy-relevant picture than a single average effect.

The education component provides a first step toward understanding whether specific governance dimensions matter, a natural extension is to replicate the same framework for additional sectoral components, such as health or law enforcement, where institutional performance plausibly affects welfare and productivity through different mechanisms and time scales, moreover, future work could move from “correlation with income” toward explicit channel testing by linking institutional components to intermediate outcomes:

educational attainment and quality metrics, health outcomes, innovation intensity, firm dynamics, investment rates, or public investment effectiveness.

Regional economies are interconnected, so institutional improvements or economic growth in one region may spill over to neighboring areas through commuting, supply chains, and migration, incorporating spatial econometric approaches (e.g., spatial lag/error models) or network-based dependence structures could help address cross-regional correlation and provide a richer interpretation of how governance quality affects development in geographically integrated environments such as the EU.

Given that EQI relies on perceptions and survey-based information, future research could triangulate institutional quality using administrative or outcome-based indicators where available (e.g., procurement transparency, judicial efficiency proxies, service-delivery performance metrics), combining survey-based governance measures with objective administrative indicators could help separate genuine institutional change from shifts in perceptions and reduce measurement error, it would also help clarify whether different institutional dimensions are captured more reliably than others.

The WGI validation exercise highlights that national frameworks remain crucial, future work could adopt an explicit multi-level governance perspective, distinguishing the relative roles of national and regional institutions, for example, one could test whether regional institutional quality matters more in countries with stronger national governance (complementarity) or instead matters more where national institutions are weaker (substitution), this would bring the analysis closer to policy debates on decentralization and administrative capacity across governance levels.

Overall, these directions would strengthen identification, deepen the interpretation of institutional channels and improve the policy relevance of regional institutional measures in explaining European development patterns.

7.5 Concluding remarks

This thesis provides evidence that institutional quality measured at the regional level is strongly associated with regional prosperity in Europe.

The cross-sectional results confirm a clear institutional gradient across regions in both 2017 and 2024, while fixed-effects models underscore that contemporaneous within-

region relationships are difficult to detect in a short panel with persistent institutional measures.

Importantly, timing-focused specifications offer a more coherent picture: when institutional quality is measured prior to income outcomes, EQI shows robust and economically meaningful associations with subsequent regional income, whereas evidence for the education-specific component is weaker and less stable.

Finally, the external validation using WGI supports the consistency of EQI with widely used governance indicators and clarifies the overlap between national and sub-national governance measures.

Taken together, the findings reinforce the importance of sub-national institutional measurement for understanding regional development and suggest that institutional improvements may be most relevant when assessed over medium-run horizons rather than in contemporaneous comparisons.

While the analysis remains correlational, it highlights patterns that are consistent with delayed institutional impacts and motivates future work aimed at strengthening causal inference and clarifying sectoral mechanisms.

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