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Regulatory Quality and Economic Performance: Evidence from European Countries

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Abstract: This study investigates the relationship between regulatory quality and economic growth across 11 European countries over the period 2010–2023 using a comprehensive panel data framework. Employing pooled OLS, fixed effects, two-way fixed effects, and System GMM estimators, the analysis examines the robustness, heterogeneity, and dynamic properties of the regulatory quality–growth nexus. The results indicate that regulatory quality does not have a statistically significant or robust effect on economic growth once country-specific and time-specific heterogeneity are controlled for. Additional analyses reveal no significant differences across Western, Central, and Eastern European countries, nor evidence of dynamic or non-linear effects. The findings suggest that in mature and highly regulated European economies, regulatory quality may act more as a background institutional condition rather than a direct driver of short-term growth, highlighting the importance of complementary macroeconomic factors.

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1. Introduction

The relationship between regulatory quality and economic growth has attracted significant attention in economic literature; however, its empirical relevance remains uncertain, particularly across European economies with varying institutional structures and levels of development. Regulatory quality is widely recognized as a critical driver of economic performance, as effective policy frameworks enhance private-sector activity, attract investment, and support sustainable economic growth (Udemba et al., 2025). Similarly, strong governance structures improve economic outcomes by increasing efficiency, promoting responsible practices, and supporting long-term value creation (Filfilan & Shawdari, 2025). From a broader perspective, regulatory efficiency fosters predictable economic environments that facilitate business activity and investment (Valdiglesias & Quintana, 2026). Empirical evidence largely supports this view; for instance, panel regression analyses show that improved regulatory

quality enhances growth outcomes (Lee et al., 2021), while further studies demonstrate that it can moderate the relationship between financial development and economic growth, particularly in developed economies (Ullah et al., 2024). Additionally, regulatory quality interacts with financial and environmental dynamics, influencing both economic growth and environmental sustainability through asymmetric channels (Islam et al., 2024; Sikic et al., 2025).

Despite these contributions, the literature presents mixed and context-dependent findings, particularly in highly regulated and mature economies such as Europe, where the marginal impact of regulatory quality may be limited or heterogeneous. Existing studies often focus on single countries, specific regions, or particular economic channels (e.g., finance, environment), with limited attention to comprehensive panel frameworks that jointly examine robustness, heterogeneity, and dynamic effects. This creates a critical research gap in understanding whether regulatory quality consistently influences economic growth when controlling for macroeconomic factors, cross-country differences, and temporal dynamics.

Addressing this gap, the present study provides a comprehensive panel analysis of 11 European countries over the period 2010-2023, integrating static, dynamic, and robustness-based econometric approaches. The novelty of this study lies in its unified framework that combines two-way fixed effects, heterogeneity analysis between Western, Central, and Eastern European economies, dynamic and non-linear specifications, and endogeneity correction through System GMM. This approach allows for a more rigorous and multidimensional evaluation of the regulatory quality-growth nexus.

Accordingly, the study is guided by the following research questions:

RQ1: How does regulatory quality affect economic growth across selected European countries during 2010-2023?

RQ2: Does regulatory quality remain significant after controlling for macroeconomic factors, and does its effect vary by country group or timing?

2. Materials and Methods

2.1 Data and Variable Construction

This study employs a balanced panel dataset of 11 European countries over the period 2010–2023, $(N = 11, T = 14)$ yielding 154 country-year observations. The sample includes both Western European economies (Austria, France, Germany) and Central and Eastern European (CEE) countries (Czechia, Slovakia, Poland, Hungary, Slovenia, Croatia, Romania, and Bulgaria), enabling comparative institutional analysis across different stages of economic development. GDP growth (NY.GDP.MKTP.KD.ZG) is used as the dependent variable, representing the standard measure of short- to medium-run macroeconomic performance; using growth rates rather than levels removes country-specific trends and aligns with fixed-effects estimation based on within-country variation. The key explanatory variable is regulatory quality (RQ.EST) from the World Bank's Worldwide Governance Indicators, which captures the ability of governments to design and implement policies that support private-sector development. In line with the institutions-for-growth hypothesis, stronger regulatory frameworks reduce

transaction costs, enhance investment incentives, and improve resource allocation, thereby fostering economic performance. The index is standardized, ranging approximately from −2.5 to +2.5, where a one-unit increase reflects a substantial improvement in institutional quality. To isolate this effect, the model incorporates key macroeconomic controls: inflation, which reflects macroeconomic stability and influences investment efficiency; trade openness, which captures economic integration and productivity gains through international trade; and foreign direct investment (FDI), which represents external capital inflows and technological transfer. Including FDI also enables the separation of the direct effect of regulatory quality on growth from its indirect impact through investment attraction.

Table 1. Variable Definitions and Theoretical Justification

Variable Type	Variable	Description	Theoretical Justification
Dependent	GDP Growth (%)	Annual percentage growth rate of GDP	Standard indicator of macroeconomic performance; growth rates remove country-specific trends and suit fixed-effects estimation
Key Explanatory	Regulatory Quality	Measures government ability to design and implement policies supporting private-sector development	Core to institutions-for-growth hypothesis; improves investment climate and resource allocation (Acemoglu & Johnson, 2005; Kaufmann et al., 2010)
Control	Inflation (%)	Annual inflation rate	Captures macroeconomic stability; high inflation distorts investment and growth (Barro, 1995)
Control	Trade Openness (% GDP)	Total trade as a share of GDP	Reflects economic integration and productivity gains (Frankel & Romer, 1999)
Control	FDI (% GDP)	Net foreign direct investment inflows	Captures capital inflows and technology transfer; separates direct and indirect institutional effects (Bevan & Estrin, 2004)

Source: Own Research.

2.2 Empirical Specification

The baseline empirical model is specified as:

$$GDP\_Growth_{it} = \beta_0 + \beta_1 RQ_{it} + \beta_2 Inflation_{it} + \beta_3 Trade_{it} + \beta_4 FDI_{it} + \alpha_i + \lambda_t + \varepsilon_{it} \quad (1)$$

where i indexes countries and t denotes time. The term α_i captures unobserved country-specific effects (e.g., geography, legal origin), while λ_t $controls$ for common time shocks (e.g., financial crises, COVID-19).

2.3 Estimation Strategy and Diagnostic Tests

To ensure robustness and reliability of the empirical findings, a sequence of panel data estimators and diagnostic procedures is employed. The analysis begins with a pooled Ordinary Least Squares (OLS) model, which serves as a baseline specification without accounting for unobserved heterogeneity. This is followed by Fixed Effects (FE) models that control for time-invariant country-specific characteristics, and Two-Way Fixed Effects (TWFE) models that

additionally incorporate time effects to capture common macroeconomic shocks, forming the primary specification of the study. Random Effects (RE) models are also estimated for comparison, with the Hausman test used to determine the consistency and suitability of the RE estimator relative to FE. All regressions are estimated using country-clustered standard errors to account for within-country serial correlation. In cases where cross-sectional dependence is detected, Driscoll–Kraay standard errors are applied to ensure robustness to both cross-sectional and temporal dependence.

Before estimation, standard panel diagnostics are conducted to validate the properties of the data. Panel unit root tests (Fisher-ADF, Maddala & Wu, 1999) are used to assess stationarity, as the presence of non-stationary variables may lead to spurious regression results. Additionally, panel Granger causality tests (Hurlin & Venet, 2001) are employed to examine the temporal direction of relationships, providing preliminary evidence on whether regulatory quality can be considered a driver of economic growth. Following estimation, further diagnostic tests are performed to verify model assumptions. The Pesaran (2004) cross-sectional dependence test is used to detect contemporaneous correlation across countries, while the Wooldridge (2002) test evaluates the presence of serial correlation in panel residuals. Finally, Variance Inflation Factors (VIF) are calculated to assess potential multicollinearity among explanatory variables. Together, these estimation strategies and diagnostic procedures ensure that the empirical results are robust, reliable, and consistent with econometric best practices.

2.4 Robustness, Extensions, and Endogeneity

To strengthen the validity of the empirical findings, several robustness checks and model extensions are implemented. First, a COVID-19 shock adjustment is introduced through a binary dummy variable for the years 2020 – 2021 to capture the impact of the global pandemic on economic activity. Second, heterogeneity analysis is conducted by splitting the sample into Western European and Central and Eastern European (CEE) countries, complemented by interaction models to test whether the effect of regulatory quality differs across these groups. Third, dynamic and non-linear specifications are considered to capture more complex relationships. A lagged regulatory quality term (RQ_{t-1}) is included to test for delayed effects. In contrast, a quadratic term (RQ^2) is introduced to examine potential diminishing returns and non-linearities in the relationship between regulatory quality and economic growth.

To address potential endogeneity arising from reverse causality and omitted variable bias, the study employs the System Generalized Method of Moments (System GMM) estimator (Blundell & Bond, 1998). This approach removes fixed effects through first differencing, uses lagged endogenous variables as internal instruments, and improves efficiency by combining moment conditions in both levels and differences. Model validity is assessed using the Hansen test for overidentifying restrictions and the Arellano–Bond tests for serial correlation in first-differenced errors (AR(1) and AR(2)). Overall, the study integrates static panel models, robustness diagnostics, heterogeneity analysis, and dynamic estimation techniques within a unified empirical framework. This comprehensive approach ensures that the relationship between regulatory quality and economic growth is examined rigorously, addressing key econometric concerns including heterogeneity, cross-sectional dependence, and endogeneity.

3. Results

GDP growth averages 2.13% with moderate volatility, while regulatory quality shows relatively low dispersion across countries. Inflation remains generally stable but exhibits occasional spikes. Trade openness is high, indicating strong global integration, particularly in smaller economies. FDI is highly volatile, driven by extreme inflow and outflow episodes. Country-level averages reveal higher growth in emerging economies (e.g., Poland, Romania) and stronger institutional quality in developed countries (e.g., Germany, Austria), highlighting structural heterogeneity within the sample.

Table 2. Descriptive Statistics (2010–2023)

Variable	N	Mean	Std. Dev.	Min	Q25	Median	Q75	Max
GDP Growth(%)	154	2.12900	2.9980	-8.311	0.7510	2.29800	3.9180	12.6320
Regulatory Quality	154	0.83300	0.4380	0.119	0.4390	0.76500	1.2070	1.69500
Inflation (%)	154	3.04500	3.6090	-1.545	0.9660	1.99900	3.5230	17.1250
Trade (% of GDP)	154	116.871	37.610	56.588	83.412	108.293	147.70	204.056
FDI (% of GDP)	154	3.25700	11.734	-40.108	1.5320	2.64500	3.8780	105.636

Source: Own Research.

Table 3. Country-Level Averages

Country	GDP Growth	Reg. Quality	Inflation	Trade	FDI
Austria	1.354	1.455	2.793	106.949	-0.629
Bulgaria	2.183	0.388	3.279	123.478	3.527
Croatia	1.863	0.273	2.283	92.9040	3.558
Czechia	1.903	1.074	3.547	141.899	3.688
France	1.263	1.205	1.671	64.1120	1.707
Germany	1.461	1.573	2.095	78.5070	2.322
Hungary	2.510	0.538	4.642	164.259	11.157
Poland	3.456	0.792	3.599	98.3800	3.450
Romania	2.778	0.379	4.271	82.7800	2.526
Slovakia	2.600	0.774	3.132	179.654	2.265
Slovenia	2.047	0.708	2.181	152.657	2.262

Source: Own Research.

The correlation results indicate generally weak linear relationships among variables. GDP growth shows a small positive association with trade openness (0.151) and inflation (0.072), while its relationship with regulatory quality (−0.099) and FDI (−0.037) is negligible. Regulatory quality is moderately negatively correlated with trade (−0.250), suggesting structural differences between more regulated and more open economies. Inflation is weakly positively related to trade (0.189), while FDI exhibits very low correlations with all variables. Overall, the absence of high correlations ($|r| < 0.3$) suggests that multicollinearity is not a concern, supporting the reliability of subsequent regression analysis.

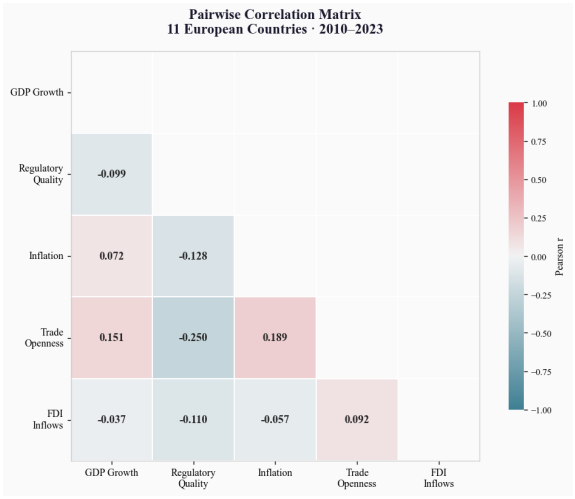

Figure 1. Variable Correlation Matrix

Figure 2 presents the temporal evolution of key variables across 11 European countries over the period 2010–2023. GDP growth exhibits relatively stable patterns until 2019, followed by a sharp contraction in 2020 across all countries, reflecting a common external shock, and a strong rebound in 2021. Regulatory quality remains comparatively stable over time, with only gradual improvements or minor fluctuations, indicating institutional persistence. Inflation shows moderate levels before 2020 but rises sharply in the post-2021 period, highlighting increasing macroeconomic pressures across the sample. Trade openness demonstrates a generally upward trend for most countries, with temporary declines around 2020, followed by recovery, suggesting resilience in international trade integration. In contrast, FDI inflows are highly volatile, with significant spikes and drops in specific years, indicating sensitivity to external economic conditions and country-specific investment dynamics. Overall, the trends reveal synchronized shocks in GDP and trade during crisis periods, stable institutional structures, and increasing inflationary pressures in recent years, while FDI remains the most unstable component.

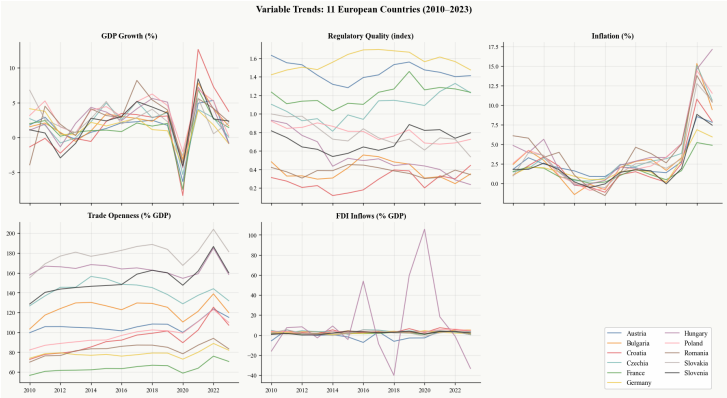

Figure 2. Variable Trends (2010–2023)
Source: Own Research.

The panel unit root results indicate mixed stationarity across variables. Regulatory quality and trade openness are stationary at levels, while GDP growth, inflation, and FDI are non-stationary. This suggests the need for appropriate transformations (e.g., first differencing) or model specifications that account for non-stationarity to ensure robust econometric estimation.

Table 4. Panel Unit Root Test (Fisher-ADF, Maddala & Wu, 1999)

Variable	Chi-square	p-value	N	Stationary I(0)
GDP Growth	23.951	0.350	11	No
Regulatory Quality	36.631	0.026	11	Yes
Inflation	0.391	1.000	11	No
Trade	39.113	0.014	11	Yes
FDI	18.635	0.668	11	No

Source: Own Research.

The Granger causality results show no statistically significant causal relationship between regulatory quality and GDP growth in either direction. This suggests that, within the sample period, neither variable provides predictive power for the other in a dynamic panel context.

Table 5. Panel Granger Causality Test (Fisher Combination, Lag = 2)

Direction	Chi-square	p-value	N	Significance
Regulatory Quality → GDP Growth	23.604	0.368	11	No
GDP Growth → Regulatory Quality	21.780	0.473	11	No

Source: Own Research.

The results indicate that regulatory quality does not have a robust or statistically significant effect on GDP growth once country and time heterogeneity are controlled for. While the pooled OLS model suggests a negative and significant relationship, this effect disappears after introducing fixed effects, indicating that the initial result is driven by cross-country differences rather than within-country dynamics. In the fully specified TWFE model (M4), regulatory quality remains statistically insignificant, suggesting that improvements in institutional quality do not translate into short-term economic growth within countries over time. Among control variables, only inflation shows a weak negative effect, indicating that higher inflation may slightly reduce growth. Overall, the findings imply that regulatory quality alone is not a strong short-run driver of economic growth in the selected European countries during the study period.

Table 6. Panel Regression Results: Effect of Regulatory Quality on GDP Growth

Variables	M1 Pooled OLS	M2 Entity FE	M3 Two-way FE	M4 TWFE + Controls
Regulatory Quality	-0.676**	2.029	0.065	-0.520
	(0.330)	(1.976)	(1.758)	(1.733)
Inflation	—	—	—	-0.252*
				(0.140)
Trade Openness	—	—	—	0.042
				(0.053)
FDI Inflows	—	—	—	0.003
				(0.005)
Constant	2.692***	—	—	—
	(0.353)			
Observations	154	154	154	154
R^2 (within)	-0.005	0.006	0.000	-0.006
Entity FE	No	Yes	Yes	Yes
Time FE	No	No	Yes	Yes
Controls	No	No	No	Yes
SE (clustered)	Country	Country	Country	Country

Source: Own Research.

Notes: Clustered standard errors in parentheses. * p<0.10, ** p<0.05, *** p<0.01.

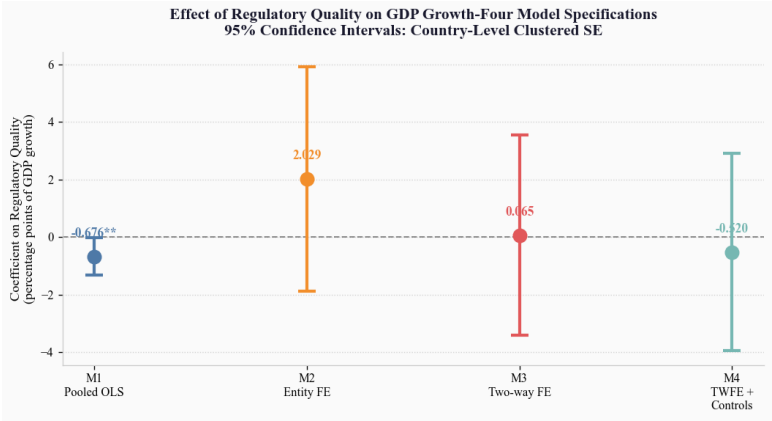

Figure 3. Effect of Regulatory Quality on GDP Growth
Source: Own Research.

Table 7. Robustness and Model Validation Results

Test / Model	Statistic / Coefficient	p-value	Interpretation
Random Effects (β RQ)	-0.460	0.455	Not significant
Hausman Test	2.033	0.154	RE consistent (fail to reject H_0)
VIF (RQ)	1.085	—	No multicollinearity
VIF (Controls)	~1.02–1.10	—	No multicollinearity

Source: Own Research.

Figure 4 illustrates the estimated coefficients of regulatory quality across alternative model specifications with 95% confidence intervals. The random effects model confirms that regulatory quality remains statistically insignificant when macroeconomic controls are included. The Hausman test indicates no systematic difference between fixed and random effects estimators, suggesting that the RE specification is consistent. Variance Inflation Factor (VIF) results show no evidence of multicollinearity among explanatory variables, supporting the reliability of coefficient estimates. The coefficient stability plot further demonstrates that estimates of regulatory quality vary across specifications but remain statistically insignificant in most cases, with confidence intervals consistently overlapping zero.

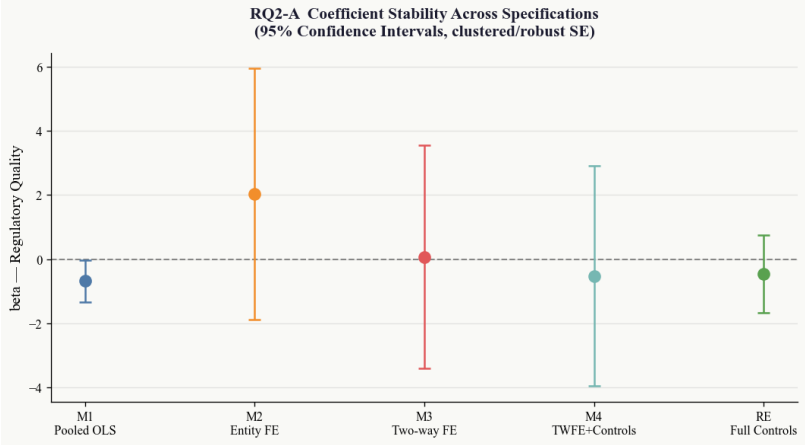

Figure 4. Coefficient Stability Across Specifications
Source: Own Research.

Table 8. Heterogeneity of Regulatory Quality Effect by Country Group

Model / Group	Coefficient (RQ)	Std. Error	p-value	Interpretation
Western Europe (n=3)	-0.075	1.853	0.968	Not significant
CEE (n=8)	0.440	1.155	0.704	Not significant
Interaction (Western)	-2.795	—	0.215	Baseline effect (Western)
Interaction (RQ × CEE)	2.782	—	0.291	No differential effect
Total Effect (CEE)	-0.013	—	—	No net effect

Source: Own Research.

Figure 5 presents coefficient estimates with 95% confidence intervals for the full sample, Western Europe, and CEE countries. The results show no statistically significant effect of regulatory quality on GDP growth in either Western Europe or CEE countries (Tab. 9). The estimated coefficients differ in sign. Still, both are insignificant and associated with wide confidence intervals. The interaction model confirms that the difference in the effect of regulatory quality between Western and CEE countries is not statistically significant. The total marginal effect for CEE economies is close to zero, further supporting the absence of a meaningful relationship.

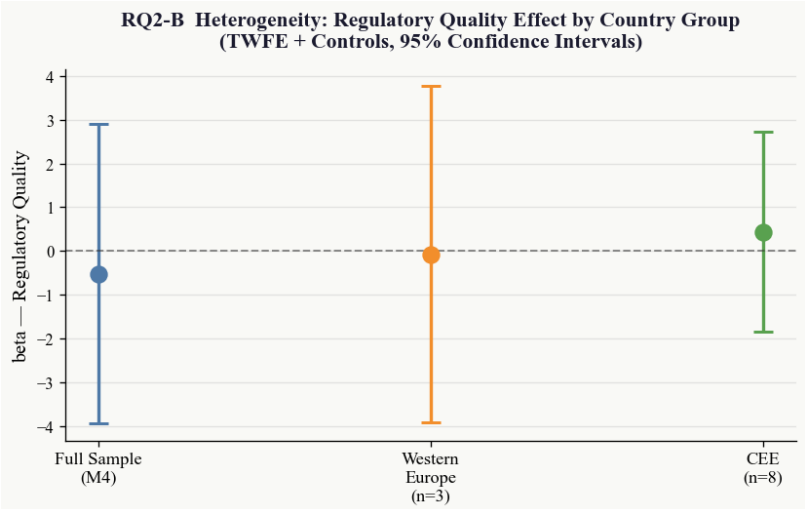

Figure 5. Regulatory Quality Effect by Country Group
Source: Own Research.

Table 9. Dynamic and Non-linear Effects of Regulatory Quality

Model	Coefficient	p-value	Interpretation
Lagged RQ (t−1)	-1.571	0.108	Weak, not significant
RQ (linear term)	1.541	0.697	Not significant
RQ² (quadratic term)	-1.233	0.477	Not significant
Turning Point (RQ*)	0.625	—	Within sample range

Source: Own Research.

The left panel compares contemporaneous and lagged effects of regulatory quality, while the right panel illustrates the marginal effect of regulatory quality across its distribution Figure 6). The lagged regulatory quality coefficient is negative and weakly insignificant, suggesting no strong evidence of delayed effects on economic growth. The quadratic specification indicates a potential inverted-U relationship; however, both the linear and squared terms are statistically insignificant. Although the estimated turning point lies within the observed range, the lack of statistical significance implies that the non-linear relationship is not robust. Overall, there is no empirical support for either dynamic or non-linear effects of regulatory quality on GDP growth

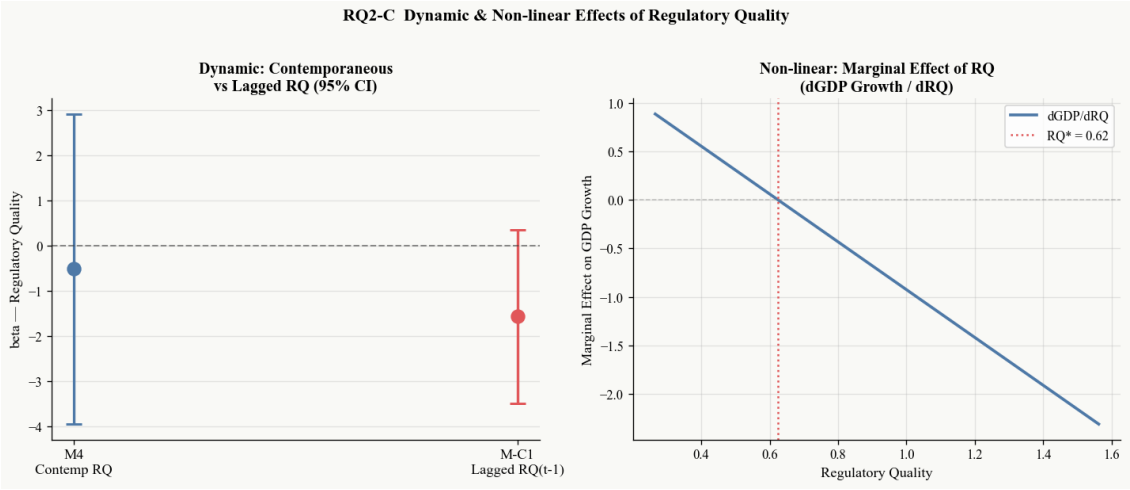

Figure 6. Regulatory Quality Effect by Country Group
Source: Own Research.

The System GMM results show that regulatory quality is not statistically significant after controlling for endogeneity, with a large standard error indicating imprecise estimation (Tab. 10). The coefficient differs substantially from the TWFE estimate, suggesting sensitivity to estimation method. The Hansen test indicates instrument validity; however, the significant AR(2) test raises concerns about instrument reliability and potential model misspecification (Tab. 11). Additionally, the relatively high number of instruments compared to the sample size may weaken inference.

Table 10. System GMM Estimation Results (Arellano–Bond / Blundell–Bond)

Variable	Coefficient	Std. Error	p-value	Interpretation
Lagged GDP (t−1)	-0.324	0.186	0.082	Weak persistence
Regulatory Quality	3.718	8.466	0.661	Not significant
Inflation	0.149	0.162	0.358	Not significant
Trade	0.048	0.081	0.556	Not significant
FDI	-0.010	0.037	0.781	Not significant
Constant	-6.631	16.452	0.687	Not significant

Source: Own Research.

Table 11. : Model Diagnostics

Test	Statistic	p-value	Interpretation
Hansen Test (Overidentification)	9.566	1.000	Instruments valid
AR(1) Test	-1.80	0.072	Expected first-order correlation
AR(2) Test	-2.34	0.019	Potential second-order correlation

Source: Own Research.

4. Discussion

The results of this study indicate that regulatory quality does not have a statistically significant and robust effect on economic growth once country and time heterogeneity are controlled for. While the pooled OLS model initially suggests a significant relationship, this effect disappears in fixed-effects specifications, implying that cross-country differences rather than within-country dynamics drive the observed association. This finding suggests that in mature and highly regulated European economies, the marginal impact of regulatory improvements on growth may be limited. Robustness checks support this conclusion. The random effects model

confirms the insignificance of regulatory quality, and diagnostic tests indicate that the results are not driven by multicollinearity or model instability. However, the sensitivity of the estimates to the inclusion of COVID-19 controls highlights the influence of external shocks, suggesting that institutional factors may interact with global conditions rather than exerting a direct effect on growth. The heterogeneity analysis shows no significant differences between Western, Central, and Eastern European countries, indicating that the effect of regulatory quality does not vary systematically across these groups. Similarly, the dynamic and non-linear specifications provide no evidence of delayed or diminishing-return effects. The System GMM results further confirm the lack of robustness, with insignificant and unstable coefficients. Overall, the findings suggest that regulatory quality acts more as a background institutional condition rather than a direct driver of short-term economic growth in the European context.

5. Conclusion

This study examined the impact of regulatory quality on economic growth across 11 European countries over the period 2010–2023 using a comprehensive panel econometric framework. The findings consistently show that regulatory quality does not exert a statistically significant or robust effect on economic growth once country-specific and time-specific factors are controlled for, and this result remains stable across multiple specifications, robustness checks, and endogeneity corrections. Furthermore, no evidence is found for heterogeneity across country groups or for dynamic and non-linear effects, suggesting that the influence of regulatory quality is limited in the short run within mature European economies. These results imply that while maintaining strong regulatory frameworks is essential for economic stability, incremental improvements in regulatory quality alone may not be sufficient to drive growth, and policymakers should instead focus on complementary factors such as productivity, innovation, and macroeconomic stability. Overall, the study highlights that the regulatory quality–growth relationship is context-dependent and underscores the need for more nuanced approaches in institutional and macroeconomic policy design.

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Declarations

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Author Contributions: All authors contributed equally to this work.

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