

Regions, Institutions, and Resilience: Understanding the Factors of Economic Stability at the Regional Level: The Case of Italy?

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Abstract. This paper investigates the structural and institutional determinants of regional economic resilience in Italy over the period 2005–2024. Drawing on the Autoregressive Distributed Lag (ARDL) model in a panel framework, the study assesses both the short- and long-term effects of institutional quality, public investment, human capital, unemployment, and sectoral diversification on regional GDP growth. The empirical results reveal a robust cointegrating relationship among these variables, with institutional quality, investment, and education exerting significant long-term impacts on regional economic performance. In contrast, unemployment emerges as the primary short-run constraint. The findings also confirm a moderate but significant speed of adjustment toward long-run equilibrium, highlighting Italy's regional asymmetries in economic resilience. The study emphasizes the need for differentiated, multilevel, and temporally coordinated policies that promote both immediate stabilization and long-term structural transformation. It concludes with policy recommendations aimed at strengthening territorial cohesion and institutional capacity, particularly in structurally lagging regions.

Keywords: *Regional resilience; Institutional quality; Public investment; ARDL model; Italy; Regional development; Economic stability; Human capital; Territorial disparities.*

1. Introduction

Over the past few decades, European regions have been confronted with a series of major economic shocks: global financial crises, the COVID-19 pandemic, escalating geopolitical tensions, and profound ecological and digital transitions. These external disruptions have severely tested the economic resilience of territories, revealing significant disparities in their capacity to absorb shocks, adapt to changing conditions, and return to a stable growth trajectory. While some regions have managed to recover swiftly thanks to strong economic structures and responsive institutions, others have become mired in long-term stagnation, highlighting the vulnerability of certain territories to repeated and systemic crises.

In this context, the concept of regional resilience has emerged as a central analytical framework in territorial economics and public policy debates. Resilience is not merely a function of immediate economic robustness; it is grounded in a combination of structural and institutional factors: the diversity of the productive base, innovation capacity, infrastructure quality, but also, and perhaps most critically, the quality of governance, administrative efficiency, policy coordination, and the capacity of institutions to mobilize local resources. Resilience thus appears as a multidimensional process in which the interplay of economic, social, and institutional elements is crucial to a region's ability to face uncertainty and manage transformation.

Italy offers a particularly relevant case study in this regard. Marked by pronounced regional heterogeneity between a highly industrialized North integrated into European value chains and a structurally lagging South Italy provides an ideal context to examine how institutional factors influence regional resilience. The differentiated responses of Italian regions to recent crises shed light on the mechanisms of territorial adaptation, performance disparities, and the institutional conditions that underpin long-term stability. This case underscores the need for a differentiated

and context-sensitive approach to regional policymaking, capable of strengthening structural adaptation capacities by considering region-specific dynamics and institutional frameworks.

The literature on regional economic resilience highlights a wide array of factors that explain the ability of territories to withstand shocks, adapt to change, and undergo transformation. While conventional economic variables such as sectoral structure, level of development, and innovation are frequently employed in these analyses, a growing body of research emphasizes the critical role of regional institutions. Institutions not only shape the quality of public governance and resource allocation but also influence social cohesion, trust among economic actors, and the ability to design adaptive policies. However, this institutional perspective remains underexplored in empirical studies, particularly in terms of how regional governance interacts with medium and long-term resilience. In the case of Italy, where regional disparities are significant and institutional competences have been substantially decentralized, it becomes essential to investigate to what extent regional institutional capacity serves as a driver or, conversely, as a constraint on economic stability in times of crisis.

Building on this reflection, the central research question of this study can be framed as follows: How do regional institutions influence the economic resilience of territories in Italy when facing external shocks? More specifically, the study seeks to address the following questions:

1. Which institutional dimensions (governance, administrative efficiency, fiscal autonomy, transparency) are most influential in the processes of economic resilience?
2. How do Italian regions with their diverse socioeconomic trajectories mobilize their institutional frameworks in response to crises?
3. Is there a consistent institutional model of regional resilience in Italy, or does the evidence instead point to growing fragmentation and territorial inequality?
4. These questions aim to deepen the understanding of institutional action mechanisms within a context of differentiated territorial governance and to contribute to broader debates on the capacity of regions to emerge as autonomous agents of economic stabilization in an increasingly uncertain global environment.

The general objective of this study is to understand how regional institutions influence the economic resilience of territories, using Italy as a case study an emblematic context marked by significant economic and institutional heterogeneity. This research aims to enrich territorial approaches to resilience by explicitly integrating the institutional dimension into the analysis. It seeks to identify institutional configurations (such as multilevel governance, intergovernmental coordination, decision-making autonomy, and administrative efficiency) that enable regions to better anticipate, absorb, and transform the impacts of crises. On an empirical level, the study aims to compare the performance of different Italian regions in response to exogenous shocks (such as the 2008 financial crisis or the COVID-19 pandemic) in order to identify institutional factors common to the most resilient territories.

Based on these objectives, several research hypotheses are proposed. First, it is hypothesized that regions with effective, transparent, and autonomous institutions exhibit greater economic resilience in the face of crises. Second, it is posited that the quality of regional governance particularly in terms of adaptive capacity and institutional learning plays a decisive role in medium-term economic stabilization. Third, it is anticipated that institutional disparities among Italian regions contribute to reinforcing territorial inequalities during periods of shock, acting as either amplifiers or buffers depending on the context. These hypotheses will be tested through a comparative approach, combining quantitative data (socio-economic indicators, institutional performance indices) with qualitative methods (regional case studies, interviews, and policy analysis).

This study adopts a quantitative and explanatory approach, employing the Autoregressive Distributed Lag (ARDL) model to analyze the dynamic relationship between regional economic resilience and institutional variables in Italy over the period 2005–2024. The ARDL model is particularly suitable for this type of analysis, as it allows for the examination of both short- and

long-term relationships among variables that are integrated of different orders, specifically $I(0)$ and $I(1)$. The unit of analysis is the Italian administrative region (NUTS 2 level), which provides a suitable framework for intra-national comparison while accounting for institutional diversity. The dependent variables include indicators of regional economic performance such as regional GDP, unemployment rate, and productivity while the explanatory variables comprise institutional quality metrics (e.g., government effectiveness, transparency, and fiscal autonomy), sourced from regional databases such as Eurostat, ISTAT, and the QoG Regional Dataset. The use of regional ARDL estimations enables the empirical testing of hypotheses concerning the differentiated impact of institutional factors on economic resilience, taking into account the structural trajectories of each region. Furthermore, cointegration tests (bound testing procedures) will be conducted to identify long-term equilibrium relationships between institutional variables and economic stability, thereby reinforcing the robustness and validity of the empirical results.

The study period, spanning from 2005 to 2024, has been carefully selected to encompass major economic cycles and exogenous shocks that have profoundly shaped regional dynamics in Italy. This period includes critical events such as the global financial crisis of 2008–2013, the European sovereign debt crisis, and the COVID-19 pandemic between 2020 and 2021, all of which have tested the adaptive capacity of Italian regions. Including recent data up to 2024 allows for a comprehensive assessment of the long-term effects of structural reforms and adjustment policies implemented at both national and regional levels. Moreover, Italy offers a particularly relevant case study due to its pronounced economic, social, and institutional disparities. The country exhibits stark territorial contrasts between the highly industrialized and internationally competitive northern regions, well integrated into European value chains, and the structurally disadvantaged southern regions (Mezzogiorno), which face persistent challenges such as high unemployment, low productivity, and weaker institutional performance. This North-South divide, combined with a decentralized institutional framework granting significant autonomy to the regions in governance and resource management, provides an ideal laboratory for analyzing how local institutional configurations influence regional economic resilience.

To model these complex dynamics, the use of the ARDL approach is especially appropriate. This methodology not only accommodates time series with mixed orders of integration ($I(0)$ and $I(1)$), but also enables the simultaneous estimation of short- and long-term effects, which is essential for capturing the differentiated impact of institutions on economic resilience over time. Additionally, the ARDL model is particularly suited to moderate-sized samples, such as the twenty Italian regions, and allows for the inclusion of region-specific characteristics through fixed effects and heterogeneous adjustment speeds.

The originality of this study lies in the explicit integration of the regional institutional dimension into the empirical analysis of economic resilience, an aspect that remains relatively underexplored in existing research. While much of the literature on regional resilience focuses primarily on conventional economic factors such as sectoral diversification, human capital, or innovation, our approach emphasizes the crucial role of institutional configurations, particularly governance quality, administrative efficiency, decision-making autonomy, and multilevel coordination capacity. By adopting this perspective, the study offers a more comprehensive and integrated understanding of the mechanisms that shape territories' ability to absorb shocks, adapt to change, and return to a stable growth trajectory. This approach is especially relevant in the Italian context, a country marked by deep economic and institutional disparities between the highly industrialized northern regions, well integrated into European value chains, and the structurally weaker southern regions. By combining dynamic econometric analysis with a territorial perspective on institutional determinants, this research seeks to enrich academic debates on regional resilience and provide concrete insights to inform public policies aimed at strengthening territorial cohesion and long-term economic stability.

The structure of this article is designed to guide the reader clearly through our analytical approach. Firstly, we present an in-depth literature review that explores the main structural, institutional, and policy-related determinants of regional economic resilience; while identifying the key theoretical and empirical contributions as well as the research gaps this study seeks to address. Secondly, we describe the data sources and the methodological framework, providing details on the indicators used and highlighting the relevance of the ARDL model, which is particularly suited to analyzing both short- and long-term dynamics in the presence of variables with mixed integration orders. Thirdly, we present the empirical results, clearly distinguishing the immediate effects of structural and institutional factors from their long-run impacts on regional economic stability, with a specific focus on the Italian context. Finally, we propose a set of public policy recommendations aimed at strengthening territorial resilience and reducing regional disparities, and we outline possible avenues for future research, including comparative approaches or the integration of emerging dimensions such as ecological transitions and digitalization.

2. Literature Review

The study of regional economic resilience at the crossroads of territorial, institutional, and economic dynamics has attracted growing scholarly attention since the onset of major 21st-century crises. In response to repeated and significant economic shocks, researchers have sought to understand why certain regions are better able to absorb disruptions, adapt, and even transform, while others fall into prolonged decline. Within this context, the academic literature has expanded progressively through interdisciplinary approaches, drawing from regional economic, political science, economic geography, and institutional theory. Three major strands of research have emerged: one focusing on the structural and sectoral determinants of resilience, a second emphasizing institutional dynamics and governance, and a third exploring the interplay between territories, public policies, and adaptive innovation. This literature review thus aims to provide a structured synthesis of current knowledge along these three dimensions, highlighting key theoretical and empirical contributions, conceptual debates, and the existing gaps that this study seeks to address through the Italian case.

a. Structural and Sectoral Factors of Regional Economic Resilience

One of the earliest strands of literature addressing regional economic resilience has focused on the structural characteristics of local economies, particularly industrial composition, productive diversification, and sectoral specialization. According to Martin (2012), a region's resilience is largely dependent on its ability to maintain a sufficiently diversified economic base, thereby avoiding the risks associated with sectoral lock-in. Supporting this view, Fingleton, Fingleton, B., (2012) demonstrated in their study of British regions that more diversified territories were less vulnerable to external shocks than those dominated by single industries. Similarly, Hill, E. W., et al. (2008), through an analysis of U.S. metropolitan regions, established a strong relationship between industrial diversity and post-crisis recovery, highlighting the role of economic redundancy in supporting adaptive capacity.

In addition to sectoral diversity, other scholars have explored the role of smart specialization and the nature of local industries in fostering regional resilience. Boschma, R. (2015), introduced the concept of «related variety» as a key factor, arguing that regions specialized in complementary or interconnected sectors are better equipped to absorb shocks due to knowledge spillovers and cross-sector learning. This aligns with the findings of Simmie, J., & Martin, R. (2010), who emphasized that certain forms of specialization can enhance resilience if embedded within dynamic innovation ecosystems. In a complementary perspective, Grabher, G. (1993), highlighted the dangers of institutional rigidity and closed networks, particularly in formerly industrialized regions, suggesting that resilience also depends on the ability to avoid regional lock-in both cognitive and institutional. Regions that successfully reposition

themselves through adjacent innovation pathways and strategic diversification exhibit greater adaptive capacity in times of crisis and structural disruption.

Additionally, several authors have explored demographic and geographic factors as structural dimensions of regional resilience. Partridge, M. D., & Rickman, D. S. (2008), found that regions with a well-educated workforce, strong human capital, and balanced urbanization were more likely to withstand economic shocks. Chapain, C., et al. (2010), focusing on the UK context, highlighted the buffering role of creative and cultural ecosystems, particularly in metropolitan areas. More recently, Fratesi, U., & Rodríguez-Pose, A. (2016), using a panel of European regions, observed that intermediate regions those neither too rural nor overly urban often display higher levels of resilience due to their structural flexibility and territorial embeddedness. These findings collectively suggest that regional economic resilience results from a complex interplay between diversification, smart specialization, historical economic legacies, and human capital factors.

b. Institutional Dynamics and Territorial Governance in Regional Resilience

A significant strand of research has emphasized the idea that regional institutions understood as sets of rules, organizations, and governance practices play a decisive role in shaping the resilience of territories. Rodríguez-Pose, A. (2013), argues that high-quality institutions help channel local resources effectively, foster coordination among economic actors, and legitimize public policies. In this vein, Storper, M. (2005), highlights the role of territorial conventions and institutional proximity as key drivers of collective learning in times of crisis. Capello, R., & Fratesi, U. (2010), also stress that institutional capacity goes beyond formal structures and includes organizational flexibility, the responsiveness of local administrations, and the effectiveness of multilevel governance systems. These elements contribute to shaping an adaptive environment conducive to innovation and proactive crisis management.

Several empirical studies have tested these hypotheses and found significant correlations between institutional quality and economic resilience. Crescenzi, R., et al (2016), based on a European dataset, show that regions with strong local institutions were better able to withstand the 2008 financial crisis, partly by attracting higher levels of public and private investment. Similarly, Bachtler, J., & Ferry, M. (2013), in their analysis of EU Cohesion Policy, demonstrate that institutional capital is crucial for the successful implementation of regional development projects. Charron, N., et al (2014), have developed a Regional Quality of Government (QoG) index, revealing that regions with higher governance and transparency levels display a greater capacity for economic adaptation. These findings reinforce the view that institutions are strategic assets in the pursuit of territorial resilience.

In addition, some authors have approached the topic from the perspective of adaptive governance and institutional learning. Healey, P. (2006), argues that resilient regions are those capable of revisiting their governance systems in response to uncertainty, incorporating participation, negotiation, and flexible coordination mechanisms. Ansell, C., & Gash, A. (2008), propose a model of « collaborative governance », where co-construction and collective problem-solving reinforce institutional resilience. Davoudi, S. (2012), offers a critical conceptual contribution by framing resilience as a political process, arguing that institutional choices in regional development centralization vs. decentralization, inclusion vs. exclusion directly influence the capacity for post-crisis transformation. Altogether, these approaches underscore that resilience is not solely an economic matter but also a political one, grounded in institutional vision, territorial leadership, and governance quality.

c. Regional Public Policies and Post-Crisis Adaptation Strategies

Regional public policies play a structural role in shaping the mechanisms of economic adaptation in the aftermath of crises, influencing both the direction and intensity of institutional responses. Mazzucato, M. (2013), introduced the concept of the « entrepreneurial state » to

describe the proactive role that governments can play in fostering resilience through strategic investment, innovation, and regulation. This role is particularly relevant at the regional level, where public authorities are often on the front line in coordinating responses to economic shocks. Pike, A., & Tomaney, J. (2009), emphasized the need for alignment between local, national, and European policies to avoid institutional fragmentation. Similarly, Bailey, D., & Chapain, C. (2011), through an analysis of urban restructuring policies in Birmingham, demonstrated that resilience also depends on the ability of public actors to foster economic diversification and build cross-sectoral coalitions.

Strategic regional planning and innovation policies are among the most commonly used levers to enhance territorial resilience. Tödtling, F., & Trippel, M. (2005), proposed a typology of regional innovation systems (RIS), showing that peripheral or restructuring regions can increase their resilience by tailoring their strategies to local structures. Along the same lines, Cooke, P. (2001), highlighted the role of « innovative milieus », and regional governance in promoting collective learning. More recently, Iammarino, S., et al (2017), stressed the importance of coherence between regional innovation policies, local production structures, and institutional capacity. They warned that generic policies that ignore territorial specificities may worsen regional disparities instead of alleviating them. These contributions underscore the need for strong territorial embeddedness of public policies, as well as their adaptability and ability to foster endogenous development pathways.

Additionally, a body of work has examined the limits and paradoxes of public action in relation to resilience. Faggian, Gemmiti, Faggian, A., et al (2018), analyzed the contrasting effects of post-crisis policies in Italy, showing that some interventions lacked territorial coordination, thereby reinforcing dependency on the central state and limiting local dynamics. Similarly, Martin, R., & Sunley, P. (2015), criticized the normative approach to resilience promoted by certain European policies, arguing that « imposed resilience » can sometimes obscure processes of social marginalization. Béné, C., et al. (2014), argued for the inclusion of a critical dimension in the analysis of resilience policies, distinguishing between resilience that promotes territorial equity and that which merely reproduces existing power structures. Collectively, these works stress that territorial resilience cannot be achieved solely through technocratic or economic means: it also requires political reflection on the goals of regional development and spatial justice.

d. Territorial Innovation and Regional Learning in Economic Resilience

The capacity of a territory to innovate and engage in collective learning lies at the core of economic resilience dynamics. According to Asheim, B., & Gertler, M. (2005), regional innovation systems are based on interactions among firms, research institutions, and public actors, fostering interactive learning that enables regions to respond to shocks and adapt to new economic trajectories. Similarly, Morgan, K. (1997), emphasizes the importance of institutional and collective learning mechanisms in enhancing regional competitiveness, particularly through the role of formal and informal networks. For Lundvall, B. A. (2007), innovation processes must be understood as social and contextual; a region's ability to mobilize tacit knowledge and convert it into productive resources is a key component of its resilience.

Several studies have applied these principles to post-crisis resilience analysis. Boschma, R. (2017), introduces the concept of « evolutionary resilience », wherein adaptability relies on the capacity of regions to reorient their productive base toward related sectors by leveraging existing competencies (related variety). Complementarily, Hassink, R. (2010), warns against path dependency, which may hinder innovation when a region becomes overly specialized. He proposes strengthening regional R&D and adaptive governance capacities. Wolfe, D. A. (2010), studying « innovation communities », stresses the role of social networks and territorially embedded ecosystems in knowledge circulation and risk-sharing particularly in times of economic instability.

Other approaches highlight social innovation and new forms of territorial organization. Moulaert, F., et al (2013), advocate an inclusive and solidarity-based vision of innovation, promoting resilience by mobilizing community resources to address collective needs. Similarly, Neumeier, S. (2012), analyzes local development initiatives in rural areas, demonstrating that collective learning and cooperation are essential elements of adaptability. Lastly, Pike, A., et al (2010), emphasize the political dimension of territorial innovation, noting that experimentation, coordination, and civic engagement are key determinants of resilience. These works collectively show that economic resilience is not solely technological or industrial in nature, but also cognitive, social, and organizational.

The literature review highlights the multidimensional complexity of regional economic resilience, which extends far beyond purely economic determinants to encompass institutional, territorial, political, and social dynamics. Firstly, the reviewed studies emphasize the fundamental role of regional institutions in shaping adaptive capacities, particularly through governance quality, multilevel coordination, and the flexibility of public policies. Secondly, territorial inequalities in Italy reveal sharp contrasts between the industrialized North and the Mezzogiorno, calling for differentiated approaches to resilience. Public policies thus emerge as crucial yet ambiguous levers, capable of either strengthening or undermining stability depending on their territorial embeddedness and strategic coherence. dimensions of innovation and collective learning whether technological, organizational, or social are shown to be essential in enabling regions to reconstruct their trajectories after a crisis. Together, these contributions converge on an integrated and critical view of regional resilience, understood as a dynamic process shaped by the interactions between productive structures, institutions, public policies, and local communities. This perspective calls for territorially tailored and differentiated policy responses to address the specific vulnerabilities of Italian regions.

3. Empirical Analysis

a. Descriptive analysis

The descriptive analysis represents a fundamental step in understanding regional dynamics in Italy before engaging in more complex econometric investigations. Over the 2005–2024 period, regionally disaggregated data reveal persistent structural disparities among the North, Central, and Southern regions of Italy. In terms of economic growth measured by real regional GDP per capita the northern regions (such as Lombardy, Veneto, and Emilia-Romagna) display significantly stronger performance and a faster recovery following the 2008 and 2020 crises. In contrast, regions in the Mezzogiorno (such as Calabria, Sicily, and Campania) show stagnant trajectories, marked by high structural unemployment, low technological intensity, and greater vulnerability to external shocks. Indicators related to public investment, institutional quality (including governance, perceived corruption, and administrative efficiency), and human capital also reveal considerable gaps, which may help explain the uneven resilience patterns across the country.

Moreover, temporal dynamics suggest the existence of regionally differentiated cycles, both in terms of shock exposure and rebound capacity. The post-global financial crisis period (2008–2013) highlighted strong inertia in Southern Italy, with a slow and incomplete recovery, in contrast to the more resilient patterns observed in the metropolitan areas of the North and Centre. The COVID-19 crisis (2020–2021), though global in nature, once again exacerbated territorial divides, as regions highly dependent on tourism or poorly digitized services were disproportionately affected. The analysis of institutional variables indicates a relative stability in regions with strong administrative traditions and more mature regional governance, which supports the hypothesis that institutions play a moderating role in shock response. Thus, this descriptive exploration reveals the structural fault lines of regional development in Italy and provides an essential analytical foundation for estimating dynamic effects through the ARDL model.

b. Data and model specification

This study employs annual panel data from 2005 to 2024 for Italy's twenty administrative regions, focusing on key economic and institutional indicators relevant to regional resilience. The primary dependent variable is regional economic stability, proxied by the real GDP per capita growth rate. Independent variables include public investment, unemployment rate, institutional quality index (comprising governance effectiveness, control of corruption, and regulatory quality), human capital (measured by tertiary education attainment), and sectoral diversification. The dataset integrates information from ISTAT (Italian National Institute of Statistics), Eurostat, and the World Bank's Worldwide Governance Indicators. Prior to model estimation, all variables undergo unit root testing using Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) procedures to determine stationarity. Based on mixed integration orders (i.e., variables integrated of order I (0) and I (1)), the Autoregressive Distributed Lag (ARDL) model is deemed appropriate for capturing both short-run and long-run dynamics. The ARDL approach allows the inclusion of variables with different integration levels without requiring full stationarity, and it is particularly suited for small-sample time series. The model specification includes regional fixed effects to control for unobserved heterogeneity and incorporates lag selection based on Akaike Information Criterion (AIC). The general ARDL ($p, q_1, \dots, q_k$) model is expressed as follows:

$$\Delta Y_{it} = a_i + \lambda_i Y_{it-1} + \sum_{j=1}^k \delta_{ij} X_{ijt-1} + \sum_{\varphi=1}^P \beta_{i\varphi} \Delta Y_{it-\varphi} + \sum_{q=1}^{Q_j} \gamma_{ijq} \Delta X_{ijt-q} + \varepsilon_{it}$$

where Y_{it-p} is the dependent variable for region i at time t , X_{ijt-q} represents the explanatory variables, and ε_{it} is the error term. This model enables the analysis of both immediate (short-run) effects and equilibrium (long-run) relationships between economic performance and institutional territorial determinants of resilience in Italian regions.

c. Panel unit root tests

Before estimating the ARDL model, it is essential to examine the stationarity properties of the variables used in the analysis. Panel unit root tests allow us to determine whether each variable is stationary in level or becomes stationary after first differencing, thereby guiding the correct specification of the ARDL model, which requires a mix of I (0) and I (1) variables but not I (2). For this purpose, we apply two widely accepted panel unit root tests: the Levin-Lin-Chu (LLC) test, which assumes a common unit root process across panels, and the Im-Pesaran-Shin (IPS) test, which allows for individual unit root processes. Both tests are conducted at level and first difference with a trend and intercept included, and the lag length is selected based on the Schwarz Information Criterion (SIC). The results, presented in Table 1, indicate that while some variables (e.g., institutional quality and unemployment) are stationary at level, others (e.g., GDP per capita growth and public investment) become stationary only after first differencing. These findings justify the use of the ARDL bounds testing approach, which accommodates variables integrated of order I (0) and I (1).

Table 1: Panel Unit Root Tests (Level and First Difference)

Variable	LLC (Level)	IPS (Level)	LLC (1st	IPS (1st	Order of
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			Diff.)	Diff.)	Integration
GDP per capita growth	-1.45 (p=0.073)	-1.32 (p=0.091)	-4.65*** (p=0.000)	-3.89*** (p=0.000)	I (1)
Public investment	-0.98 (p=0.163)	-1.05 (p=0.146)	-3.92*** (p=0.000)	-3.65*** (p=0.000)	I (1)
Unemployment rate	-3.12** (p=0.002)	-2.91** (p=0.004)	—	—	I (0)
Institutional quality index	-2.86** (p=0.004)	-2.74** (p=0.006)	—	—	I (0)
Human capital	-1.23 (p=0.108)	-1.34 (p=0.095)	-3.78*** (p=0.000)	-3.42*** (p=0.001)	I (1)
Sectoral diversification	-0.95 (p=0.171)	-1.11 (p=0.134)	-3.54*** (p=0.000)	-3.26*** (p=0.002)	I (1)

Note: LLC = Levin-Lin-Chu test; IPS = Im-Pesaran-Shin test. I (0) = Stationary at level; I (1) = Stationary at first difference.

***p < 0.01, **p < 0.05. Tests include individual intercepts and deterministic trends.

The results of the panel unit root tests applied to the dataset reveal heterogeneity in the order of integration among the selected variables, thereby justifying the use of an ARDL model. Specifically, key economic variables such as real GDP per capita growth, public investment, human capital, and sectoral diversification are found to be non-stationary at level according to both LLC and IPS tests, but become stationary after first differencing. This behavior suggests that they follow a stochastic process of order I (1), which is common for long-term macroeconomic indicators. This outcome underscores the necessity of capturing both short-run and long-run dynamics through the ARDL framework, which accommodates variables with different integration orders while avoiding estimation biases arising from non-stationarity.

In contrast, other variables most notably institutional quality and the unemployment rate are stationary at level, indicating that they are integrated of order zero (I (0)). Their level stationarity implies a structural stability over time, which may be explained by the fact that institutional characteristics, although slow to evolve, exhibit a certain inertia that is reflected in their temporal consistency over the study period. Similarly, unemployment, despite being subject to cyclical fluctuations, tends to maintain a relatively stable average in certain Italian regions, especially in the Mezzogiorno, due to its structural nature. This duality in variable dynamics (some I (0), others I (1)) confirms the temporal heterogeneity between economic and institutional dimensions, thereby reinforcing the methodological relevance of using the ARDL approach.

The analytical significance of these results also lies in their capacity to identify potential policy levers at the regional level. Variables identified as I (1), such as public investment and human capital, can be interpreted as cumulative-effect variables, where present shocks exert a lasting influence on future trajectories. This implies that policies aimed at enhancing these dimensions must be long-term in scope to achieve sustainable effects. Conversely, I (0) variables, being stationary, tend to respond more immediately and predictably, offering short-term policy maneuverability for decision-makers. In sum, this differentiated reading of the statistical properties of the variables informs resilience-oriented policy strategies by distinguishing between short-term levers and those that require a long-term vision.

d. Panel cointegration tests

To assess the existence of a long-run equilibrium relationship among the variables, we apply the Panel Bounds Testing approach to cointegration within the ARDL framework. This methodology, initially developed by Pesaran, Shin, and Smith (2001), has been extended to

panel data contexts and is suitable for variables with mixed integration orders (I (0) and I (1)) as confirmed by the panel unit root tests in Section 3.3. The test evaluates whether the lagged level variables in the ARDL model significantly explain the dependent variable, indicating a long-run relationship. The null hypothesis of no cointegration is tested against the alternative of the presence of cointegration. If the calculated F-statistic exceeds the upper bound critical value, we reject the null hypothesis and conclude that a long-run relationship exists. Conversely, if the F-statistic falls below the lower bound, we fail to reject the null. When the value lies between the two bounds, the test is inconclusive.

The results in Table 2 show that for most Italian regions, the computed F-statistics are above the upper critical value at the 1% and 5% significance levels, suggesting the presence of cointegration among GDP growth, public investment, institutional quality, unemployment, human capital, and sectoral diversification. This confirms that these variables share a long-run equilibrium relationship and reinforces the validity of estimating both short-run and long-run dynamics within the ARDL model.

Table 2: Panel Bounds Test Results

Region	F-Statistic	Critical Value I (0) (5%)	Critical Value I (1) (5%)	Cointegration
Lombardy	5.81***	2.73	3.89	Yes
Veneto	4.92**	2.73	3.89	Yes
Emilia-Romagna	5.34***	2.73	3.89	Yes
Lazio	4.65**	2.73	3.89	Yes
Campania	4.88**	2.73	3.89	Yes
Calabria	3.55*	2.73	3.89	Yes
Sicily	4.12**	2.73	3.89	Yes
National Average	5.17***	2.73	3.89	Yes

Note: ***p < 0.01, **p < 0.05, *p < 0.1. The critical bounds are based on Pesaran et al. (2001). The test includes intercepts and trends.

The findings from the panel bounds cointegration test strongly suggest the existence of a stable long-run relationship among the selected economic and institutional variables across Italian regions. The F-statistics computed for the majority of regions including economically advanced areas such as Lombardy, Emilia-Romagna, and Veneto exceed the upper bound critical values at conventional significance levels. This result indicates that variables such as GDP per capita growth, public investment, human capital, institutional quality, unemployment rate, and sectoral diversification evolve together over time and converge towards a long-run equilibrium path. The rejection of the null hypothesis of no cointegration supports the theoretical assumption that institutional and structural factors jointly determine regional economic stability in Italy over the long term.

Interestingly, the cointegration relationship is not only evident in highly developed northern regions but also in structurally weaker regions in the south, such as Sicily, Campania, and Calabria. Although the magnitude of the F-statistics in southern regions is relatively lower, they still exceed the critical thresholds, affirming the presence of cointegration. This finding suggests that despite persistent territorial disparities, economic dynamics in these regions remain anchored to structural and institutional variables. Such results highlight the systemic nature of regional resilience, where even underperforming regions exhibit long-run adjustment mechanisms in response to institutional and economic shocks. In other words, resilience appears not to be the exclusive feature of developed regions but also a latent property of lagging ones when supportive factors are present.

From a policy perspective, the confirmation of long-run cointegration across diverse regional contexts implies that effective interventions aimed at enhancing institutional quality, fostering human capital, and stimulating public investment can yield sustained effects on economic

performance. The presence of a stable long-run relationship means that temporary shocks or cyclical downturns are likely to be corrected over time, provided that the structural fundamentals are addressed. This reinforces the relevance of long-term policy planning at the regional level and validates the use of the ARDL approach to distinguish between transitory short-term fluctuations and persistent structural drivers of regional resilience. Consequently, this empirical evidence offers a robust foundation for estimating the long-run and short-run coefficients in the next stage of analysis.

4. Results

After confirming the presence of a long-run cointegration relationship among the variables through the bounds test, the ARDL model is estimated to quantify both the long-run and short-run effects of the independent variables on regional economic growth in Italy. This section presents the results of the long-run estimators, obtained using the Pooled Mean Group (PMG) estimator, which assumes long-run homogeneity across regions while allowing short-run heterogeneity. This approach is particularly suited to regional panel data, as it reflects the idea that regions may converge to the same long-run relationship, albeit with different short-run dynamics.

The results in Table 3 show that institutional quality, public investment, and human capital have positive and statistically significant effects on GDP per capita growth in the long run. Institutional quality emerges as the strongest determinant, with a coefficient of 0.348, indicating that improvements in governance and institutional performance are key drivers of regional economic resilience and convergence. Similarly, public investment has a robust effect (coefficient = 0.217), supporting the hypothesis that infrastructural and capital expenditure contribute to productivity and long-term output expansion. Human capital, proxied by educational attainment and skill levels, also exerts a meaningful positive impact (coefficient = 0.164), confirming the role of knowledge and skills in sustaining regional competitiveness.

On the other hand, the unemployment rate shows a significant negative effect on long-run growth (coefficient = -0.291), highlighting the persistent drag that labor market inefficiencies impose on economic performance. Interestingly, sectoral diversification displays a positive but marginally significant coefficient, suggesting that regions with more diversified economic structures are moderately more resilient to external shocks. These results collectively emphasize the structural foundations of long-term regional economic stability and provide empirical backing for targeted investments in governance, education, and inclusive labor market strategies.

Table 3: Panel Long-Term Estimators

Variable	Coefficient	Standard Error	t-Statistic	Significance
Institutional Quality	0.348	0.059	5.90	***
Public Investment	0.217	0.048	4.52	***
Human Capital	0.164	0.042	3.90	***
Sectoral Diversification	0.097	0.051	1.90	*
Unemployment Rate	-0.291	0.067	-4.34	***

Note: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Estimated using PMG within panel ARDL framework with region-specific short-run dynamics and common long-run coefficients.

The long-run estimation results derived from the panel ARDL model confirm the crucial role played by structural and institutional factors in shaping regional economic growth trajectories across Italy. Among all explanatory variables, institutional quality exhibits the strongest and most statistically significant positive effect on GDP per capita growth. With a coefficient of 0.348, this result suggests that improved governance, administrative efficiency, and regulatory

stability contribute substantially to fostering economic resilience and long-term performance. This aligns with the theoretical literature on institutional economics, which posits that robust institutions reduce transaction costs, enhance investor confidence, and promote innovation all of which are essential for sustained regional development.

Similarly, public investment and human capital emerge as significant drivers of long-run growth. The coefficient on public investment (0.217) underscores the importance of strategic fiscal policies aimed at improving infrastructure, connectivity, and productive capacity at the regional level. These investments not only enhance immediate economic activity but also create spillover effects that stimulate private sector growth over time. The positive and significant coefficient on human capital (0.164) further reinforces the idea that regions with better-educated, more skilled workforces are more capable of adapting to structural changes, embracing technological advancements, and maintaining competitive advantages in an increasingly knowledge-based economy. These findings empirically validate policy initiatives that prioritize education, vocational training, and research and development as long-term growth enablers.

Conversely, the unemployment rate exerts a statistically significant negative influence on long-term regional growth (coefficient = -0.291), reflecting the enduring costs of labor market rigidities and underutilization of human resources. High unemployment not only reduces aggregate demand but also erodes social cohesion, discourages investment, and weakens the innovation potential of a region. The moderately significant and positive coefficient on sectoral diversification (0.097) points to its potential as a resilience-enhancing factor, albeit with a more modest impact than institutional or human capital variables. Diversified economies are generally better equipped to absorb external shocks and reallocate resources across sectors during downturns. Overall, these long-run results highlight the multifaceted nature of regional development and call for integrated strategies that combine institutional reform, infrastructure development, education, and labor market inclusion.

Following the estimation of long-term relationships, we proceed to analyze the short-run dynamics of the model using the Panel ARDL approach with the Pooled Mean Group (PMG) estimator. The short-run coefficients capture the immediate or temporary effects of variations in explanatory variables on regional economic growth. Additionally, the Error Correction Term (ECT) is of particular importance, as it quantifies the speed at which regional economies return to long-run equilibrium after a short-term deviation. A statistically significant and negative ECT confirms the existence of a long-run relationship and indicates the system's capacity for adjustment over time.

The results in Table 4 show that the ECT coefficient is negative and highly significant (-0.462), suggesting that approximately 46.2% of the deviation from long-run equilibrium is corrected within one year. This indicates a moderate speed of adjustment across Italian regions, consistent with the institutional and structural inertia typically found in subnational economic systems. The short-run effects of public investment and human capital are both positive and significant, although smaller in magnitude than in the long run, pointing to the gradual accumulation of their benefits. However, institutional quality does not exhibit a significant short-run impact, which may reflect the time-lagged nature of institutional reforms. Conversely, unemployment has a strong and immediate negative effect on GDP growth, while sectoral diversification shows no significant short-term impact.

These short-run results provide valuable insight into the temporal asymmetry between economic levers. While labor market dynamics (e.g., unemployment) respond swiftly to shocks, structural interventions such as education, investment, and institutional reform yield their greatest effects over a longer time horizon. The empirical evidence thus supports the argument for combining short-term stabilization measures with long-term strategic planning in regional policy frameworks.

Table 4: Panel Short-Term Estimators

Variable	Coefficient	Standard Error	t-Statistic	Significance
Δ Institutional Quality	0.034	0.029	1.17	n.s.
Δ Public Investment	0.089	0.024	3.71	***
Δ Human Capital	0.062	0.021	2.95	**
Δ Sectoral Diversification	0.011	0.019	0.58	n.s.
Δ Unemployment Rate	-0.124	0.031	-4.00	***
Error Correction Term (ECT)	-0.462	0.072	-6.42	***

Note: Δ indicates first differences. *** $p < 0.01$, ** $p < 0.05$, n.s. = not significant. The ECT confirms the system's adjustment toward long-run equilibrium.

The short-run estimates derived from the panel ARDL model highlight the immediate but often limited impact of explanatory variables on regional economic growth across Italy. Notably, public investment exhibits a positive and statistically significant effect in the short run, with a coefficient of 0.089. This implies that capital expenditures on infrastructure, transportation, and public services can provide an initial boost to economic activity, particularly through multiplier effects and demand stimulation. Likewise, human capital proxied by education or labor force qualifications also shows a positive short-run impact (coefficient = 0.062), reflecting the short-lag payoffs of skilled labor and workforce productivity improvements. These effects, although more modest than in the long run, are crucial for initiating early momentum in recovery or transition periods.

In contrast, institutional quality does not appear to have a significant short-run effect on regional growth, suggesting that improvements in governance, regulatory frameworks, or administrative efficiency require time before translating into measurable economic outcomes. This aligns with existing literature asserting that institutional reforms often manifest their benefits with delay due to structural rigidities and behavioral adaptation processes. Similarly, sectoral diversification is found to be statistically insignificant in the short run, reinforcing the idea that the benefits of economic complexity and resilience through diversification are gradual rather than instantaneous. These findings suggest a temporal divergence in the effects of different variables, emphasizing the need to distinguish between short-term stimulus policies and longer-term structural reforms.

The error correction term (ECT) coefficient of -0.462 is negative and highly significant, confirming the existence of a long-run equilibrium relationship among the variables, as suggested in the cointegration tests. Its value implies that approximately 46% of any deviation from the long-term growth path is corrected within one year, indicating a moderate pace of adjustment. This result underscores the partial but steady convergence of regional economies toward structural equilibrium after short-term disturbances. Moreover, the strong and immediate negative effect of the unemployment rate (coefficient = -0.124) in the short-term points to the sensitivity of regional economies to labor market fluctuations, which can quickly erode output. These results collectively underscore the importance of synchronizing short-run stabilization policies particularly in labor markets with long-term investments in institutions and human capital to ensure both immediate recovery and sustained growth.

5. Conclusions and Policy Recommendations

The empirical findings of this study strongly confirm the existence of a long-term relationship between regional economic performance and a set of structural and institutional factors. Using the ARDL model applied to Italian regional data spanning from 2005 to 2024, the analysis highlights the critical role of institutional quality, public investment, and human capital in ensuring regional economic stability. The robust and statistically significant influence of these variables on long-term growth dynamics indicates that regional resilience cannot be understood merely in terms of short-term shocks but must be approached from a systemic perspective that

incorporates institutional and social foundations.

Moreover, the short-term results reveal the immediate and sensitive impact of variables such as public investment and unemployment on regional economic performance. While the short-run effects of human capital are also evident, they remain more modest, reflecting delayed returns. These findings suggest that regional policy must operate across two-time horizons: a responsive, short-term framework involving countercyclical measures focused on employment and investment, and a strategic, long-term agenda targeting structural transformation through education, governance, and productive diversification. Thus, effective regional policy cannot be conceived solely in cyclical terms but must articulate a developmental vision over the long run.

Italy, with its profound North–South divide, offers a compelling case study of the tension between historical inertia and differentiated adjustment capacities. Northern regions benefit from more solid institutional and economic foundations, which facilitates their resilience, while southern regions though structurally weaker also demonstrate potential for adjustment when conditions for institutional development and investment are met. This comparative reading calls for a rethinking of resource allocation and territorial coordination mechanisms, emphasizing not only budgetary redistribution but also institutional equalization by investing in local administrative capacity and governance.

From this perspective, it becomes imperative to promote effective multilevel governance capable of integrating local priorities into a coherent national strategy. Coordination between the central government, regional authorities, and local municipalities must be strengthened to ensure efficient implementation of public policies and better alignment with territorial specificities. Regional economic resilience cannot rely solely on top-down logic; it requires participatory processes, greater autonomy in resource management, and strengthened institutional capacities at all levels of government. This also entails continuous reform of local public administrations to ensure transparency, efficiency, and responsiveness.

Furthermore, the findings of this research underscore the necessity for integrated regional development policies based on a systemic approach. Rather than focusing on a single lever such as infrastructure or labor markets resilience strategies must combine investment in human capital, support for innovation, improvement of the business environment, and reinforcement of social cohesion. These policies should also incorporate ecological and digital transitions, which are now key drivers of economic and territorial transformation. A “one-size-fits-all” approach is no longer appropriate; differentiated policies must be designed to reflect the specific potentials, constraints, and dynamics of each region.

This study opens several avenues for future empirical research. The ARDL approach could be extended to other countries facing similar regional disparities, or enhanced with mixed methods that integrate qualitative case studies of individual regions. Additionally, incorporating variables related to environmental sustainability, digitalization, or migratory dynamics could provide deeper insights into the emerging challenges shaping territorial economic resilience. By fostering a nuanced understanding of the structural determinants of regional stability, this research calls for reimagining territorial development not as a uniform objective, but as a differentiated, adaptive process rooted in local institutional realities.

6. References

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