Macroeconomic Stability and Regional Inequality in Europe: A Survey

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Article

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Abstract

This survey examines the complex relationship between macroeconomic stability and regional inequality in Europe, focusing on the EU-27 countries plus Norway, Switzerland, and Iceland. Despite decades of national-level stability—low inflation, sound public finances, and moderate output volatility—territorial disparities persist, and in some cases have widened. We review the theoretical mechanisms linking macroeconomic outcomes to regional divergence, including inflation dispersion, output volatility, asymmetric labor market shocks, and spatial spillovers. Empirically, we synthesize evidence from cross-country panels, quasi-experimental designs, and spatial econometric models, highlighting the role of fiscal, cohesion, and monetary policies. We identify critical gaps in the literature, particularly for the post-2020 period, finer spatial scales (NUTS3), and integrated macro–regional modeling, and propose a research agenda addressing new shocks, including NGEU, the energy crisis, green transition, and artificial intelligence. Finally, we discuss policy implications, emphasizing the need for a "place-based" macroeconomic framework that integrates stabilization and territorial cohesion objectives.

Keywords: macroeconomic stability; regional inequality; European union; cohesion policy; spatial econometrics; fiscal and monetary policy; NGEU; place-based macroeconomics

JEL Classification: E32 – Business Fluctuations; Cycles; **E52** – Monetary Policy; **H77** – Intergovernmental Relations; Regional Finance; Fiscal Policy; **R11** – Regional Economic Activity: Growth, Development, Environmental Issues, and Changes; **R12** – Size and Spatial Distribution of Regional Economic Activity

1. Introduction

1.1. General Motivation

Europe offers a uniquely informative setting for studying the relationship between **macroeconomic stability** and **regional inequality**. Over the past three decades, the European integration project has increasingly been structured around a strong stability-oriented governance architecture: an independent central bank focused on price stability, binding fiscal rules, and reinforced macroeconomic surveillance (Buti & Carnot, 2013; De Grauwe, 2018). At the same time, Europe is also characterized by deep and persistent **territorial disparities**, visible in differences in productivity, employment opportunities, income, innovation, and access to public services across regions (Iammarino, Rodríguez-Pose & Storper, 2019).

This coexistence forms a **European paradox**: while national-level macroeconomic indicators (inflation, fiscal sustainability, aggregate growth volatility) have generally improved since the 1990s—especially in countries participating in the Economic and Monetary Union (EMU)—regional disparities have remained stubbornly high and in some cases have widened. Importantly, national convergence (e.g., convergence of GDP per capita across member states) does not necessarily imply regional convergence within countries. In several cases, national averages have masked growing

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divergence between metropolitan core regions and lagging peripheral regions (Barca, McCann & Rodríguez-Pose, 2012; Gennaioli et al., 2014).

Understanding this paradox matters for at least four reasons.

First, regional inequality is a major determinant of **social cohesion**. Persistent territorial unemployment gaps, differences in wages, and unequal access to services may generate long-term exclusion and poverty traps in certain regions (Piketty, 2014). Second, regional divergence has become increasingly relevant for the **political sustainability of EMU**. Territorial polarization is linked to declining trust in institutions and rising support for anti-establishment or Eurosceptic political movements (Rodríguez-Pose, 2018; Colantone & Stanig, 2018). Third, regional inequality affects the **effectiveness of stabilization policies**. In a monetary union, policy is typically calibrated using national aggregates, yet shocks and policy transmission can be spatially uneven due to differences in sectoral structure, labor market conditions, and financial systems (Mundell, 1961; Farhi & Werning, 2017). Fourth, territorial inequality may itself create **macroeconomic vulnerabilities**, for instance by amplifying asymmetric shocks, weakening aggregate demand, or increasing fiscal stress in lagging regions (Blanchard & Leigh, 2013).

The relevance of these issues has become clearer following major crises. The Global Financial Crisis of 2008 and the subsequent Eurozone sovereign debt crisis (2010–2012) highlighted how macroeconomic instability interacts with territorial disparities through unemployment, credit constraints, and fiscal consolidation. More recently, the COVID-19 shock and the 2021–2023 energy crisis revealed again the asymmetric exposure of European regions, especially those specialized in tourism, energy-intensive manufacturing, or contact-intensive services (Baldwin & Giavazzi, 2015; Brunnermeier, James & Landau, 2016).

While the core of this debate is often framed around EMU, it is also highly relevant for **non-euro European economies** such as Norway, Switzerland, and Iceland. These countries are deeply integrated with the EU through trade, investment, and labor mobility, and they are affected by European business cycles and financial conditions, even if they retain independent monetary policy and exchange rate flexibility.

1.2. Key Definitions and Concepts

Macroeconomic Stability

Macroeconomic stability refers to the ability of an economy to maintain a predictable and resilient macroeconomic environment. In the European context, it typically includes:

- **Inflation stability**, measured by the level and volatility of inflation, and often linked to credibility and monetary policy effectiveness (De Grauwe, 2018).
- **Output stability**, captured by average growth and growth volatility (Fatás & Mihov, 2003).
- **Labor market stability**, reflected in unemployment rates and their dispersion (both within and across countries).
- **Fiscal stability**, measured by deficit and debt indicators, as well as fiscal space.
- **Financial stability**, often proxied by credit growth, bank fragility, sovereign spreads, and stress indices.

A key issue in Europe is that macroeconomic stability is governed by a combination of supranational and national institutions. The European Central Bank (ECB) sets monetary policy for the Eurozone, while fiscal policy remains primarily national but constrained by European rules. The post-crisis governance framework (European Semester, Fiscal Compact, MIP) strengthened surveillance and coordination but also intensified the debate over the macroeconomic consequences of fiscal consolidation (Buti & Carnot, 2013; Blanchard & Leigh, 2013).

In empirical work, stability is measured in several ways:

- inflation volatility (standard deviation of inflation),
- growth volatility (standard deviation of GDP growth),
- unemployment level and volatility,

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- public debt-to-GDP and deficit-to-GDP ratios,
- crisis dummies (GFC, sovereign debt crisis, COVID),
- financial stress indicators.

Regional Inequality

Regional inequality refers to systematic differences in economic outcomes across subnational territories. In Europe, the analysis often relies on the harmonized statistical classification system **NUTS** (Nomenclature of Territorial Units for Statistics), particularly:

- **NUTS2 regions** (commonly used for cohesion policy),
- **NUTS3 regions** (more granular local level).

Regional inequality may be measured across:

- income and GDP per capita,
- productivity and employment,
- unemployment,
- poverty and social exclusion,
- innovation, patents, and R&D intensity.

A crucial conceptual distinction is between:

1. **Interregional inequality**: disparities between regions (e.g., between Île-de-France and northern French regions).
2. **Intrarregional inequality**: disparities within regions (e.g., urban vs rural areas inside the same NUTS2 region).

The literature uses several inequality measures:

- Gini coefficient,
- Theil index (and its decomposability),
- coefficient of variation (CV),
- standard deviation,
- percentile ratios (90/10, 75/25),
- top/bottom ratios,
- spatial concentration indices.

1.3. Objectives of the Survey

This survey has four main objectives.

First, it summarizes the main empirical findings on the relationship between macroeconomic stability and regional inequality in Europe. It reviews evidence on how inflation stabilization, fiscal rules, and crisis episodes influence regional convergence or divergence.

Second, it provides a structured **typology of channels** through which macroeconomic stability can affect regional inequality. These channels include monetary transmission, fiscal stabilization, credit allocation, labor mobility, and structural change.

Third, it evaluates the methodological approaches used in the literature, emphasizing identification strategies and econometric challenges. In particular, the survey discusses the limits of national-level data, endogeneity issues, and the importance of spatial dependence and spillovers.

Fourth, it identifies gaps in the literature and proposes a future research agenda, including new data opportunities (high-frequency regional indicators, firm-level data, satellite-based measures) and methodological advances (spatial econometrics, multi-region DSGE, machine learning for causal inference).

1.4. Main Contributions

This survey contributes to the literature in several ways.

(i) Europe-specific focus and institutional realism

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Unlike broader global surveys on inequality or stabilization, this survey is explicitly anchored in the European institutional context. It incorporates the unique features of EMU, including the absence of exchange rate adjustment, the centralization of monetary policy, and the partial integration of fiscal policy (Mundell, 1961; De Grauwe, 2018).

(ii) Eurozone vs non-Eurozone comparison

A key contribution is the explicit comparison between Eurozone countries and non-euro European economies (EU members and non-members). This matters because monetary sovereignty and exchange rate flexibility may influence regional adjustment mechanisms and the spatial distribution of shocks.

(iii) EU enlargement and structural change

The survey integrates the role of EU enlargement (2004–2013), which reshaped European economic geography through supply chains, migration, and investment flows. The literature suggests that while enlargement accelerated national convergence in some countries, it also produced internal regional divergence due to agglomeration dynamics and unequal institutional capacity (Crespo Cuaresma, Ritzberger-Grünwald & Silgoner, 2008; Kutan & Yigit, 2007).

(iv) Cohesion policy and EU-level redistribution

The survey emphasizes the role of EU cohesion policy as Europe's main explicit instrument for reducing territorial inequality. It reviews evidence on the effectiveness of structural funds, highlighting conditional effects related to governance quality, absorptive capacity, and complementarity with national policies (Becker, Egger & von Ehrlich, 2010; Barca et al., 2012).

(v) Spatial spillovers and interregional dependence

Many studies treat regions as independent units. This survey stresses that regions are interconnected through trade, commuting, migration, and production networks. As a result, shocks and policies generate spillovers that require spatial econometric approaches (LeSage & Pace, 2009).

(vi) Comparative review of empirical strategies

The survey systematically compares the main empirical approaches in the literature, including:

- fixed and random effects panel models,
- difference-in-differences (DiD),
- regression discontinuity designs (RDD),
- dynamic panel GMM estimators,
- spatial econometrics (SAR, SEM, SDM),
- structural models and multi-region DSGE frameworks.

1.5. Structure of the Article

The remainder of the article is structured as follows.

Section 2 presents the main theoretical frameworks linking macroeconomic stability to regional inequality, including optimal currency area theory, new economic geography, fiscal federalism, and models of risk sharing and adjustment in monetary unions.

Section 3 reviews empirical evidence on regional convergence and divergence in Europe, distinguishing between pre-EMU, early EMU, the crisis period, and the post-2015 recovery, with particular attention to the COVID-19 and energy shocks.

Section 4 focuses on stabilization policies and their spatial transmission. It examines how monetary policy, fiscal rules, and financial conditions may have heterogeneous regional effects, and how these effects differ between Eurozone and non-Eurozone economies.

Section 5 discusses EU cohesion policy and new EU-level instruments (SURE, NextGenerationEU), evaluating whether they act as regional stabilizers and how they interact with national fiscal capacity.

Section 6 surveys econometric methods and identification strategies used in the literature, highlighting challenges such as endogeneity, measurement error, cross-sectional dependence, spatial spillovers, and the modifiable areal unit problem (MAUP).

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Section 7 identifies gaps and proposes a future research agenda, including the role of climate transition policies, housing markets, migration and brain drain, and the regional distributional consequences of monetary tightening.

Section 8 concludes by summarizing the main findings and policy implications for European macroeconomic governance.

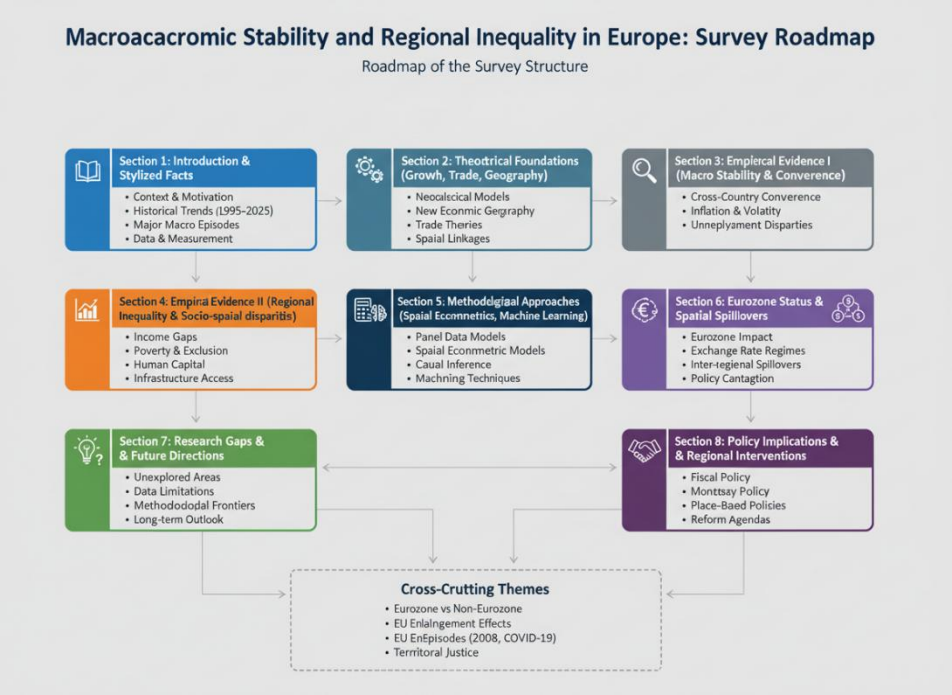

Figure 1. Roadmap of the survey (schéma simple de la structure du papier).

2. Stylized Facts: Regional Inequality and Macroeconomic Stability in Europe

2.1. Long-Run Trends (1995–2025)

Over the last three decades, the spatial distribution of economic activity in Europe has undergone profound transformations. A large empirical literature documents a long phase of regional convergence during the 1990s and early 2000s, followed by a marked slowdown or even reversal after the global financial crisis (see, among others, Barro and Sala-i-Martin, 1995; Martin, 2001; Crespo Cuaresma, Doppelhofer, and Feldkircher, 2014). Figure 2 reports the evolution of standard indicators of regional inequality—namely the Gini coefficient, the Theil index, and the coefficient of variation—computed across NUTS regions over the period 1995–2025.

Three robust stylized facts emerge. First, a process of beta- and sigma-convergence is visible until the mid-2000s, consistent with the predictions of neoclassical growth theory and the early evidence for European regional convergence (Barro and Sala-i-Martin, 1995; Boldrin and Canova, 2001). However, this convergence process clearly weakens after 2008. Inequality indicators stabilize at higher levels or even increase slightly, in line with recent findings that emphasize the "great divergence" between European regions since the financial crisis (Iammarino, Rodríguez-Pose, and Storper, 2019; European Commission, 2022).

Second, the geography of growth has become increasingly polarized. Figure 3 shows that capital cities, large metropolitan areas, and major economic corridors systematically concentrate higher income levels and stronger growth performance. This pattern is consistent with the rise of agglomeration forces emphasized by the New Economic Geography literature (Krugman, 1991; Fujita, Krugman, and Venables, 1999) and with recent evidence on the growing dominance of "superstar cities" in Europe (Glaeser, 2011; Iammarino et al., 2019). In contrast, many peripheral,

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rural, or old industrial regions remain trapped in low-growth trajectories, reinforcing spatial inequalities within countries.

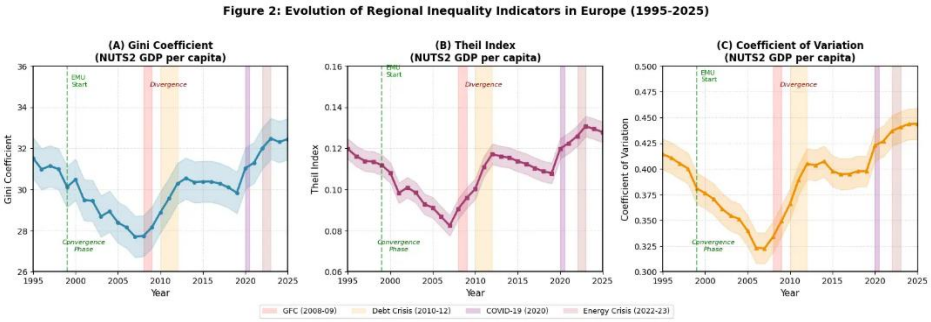

Figure 2. Evolution of regional inequality indicators (Gini, Theil, CV).

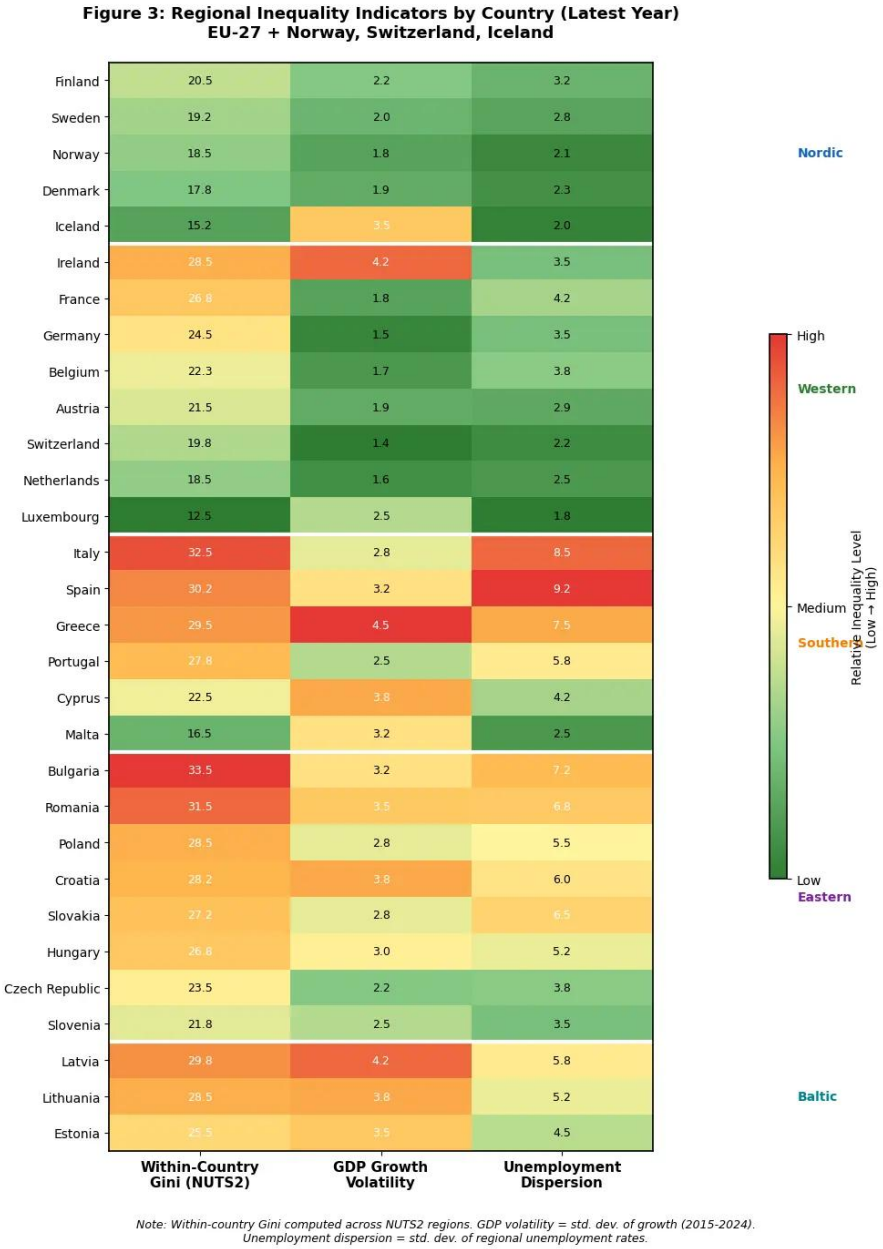

Figure 3. Heatmap EU: regional inequality by country (latest year).

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Third, persistent macro-regional divides remain a key feature of the European economic landscape. Northern and Western European regions typically display higher income levels, lower unemployment, and more stable growth paths, while Southern and parts of Eastern Europe are characterized by weaker performance and higher volatility (Petrakos, Rodríguez-Pose, and Rovolis, 2005; Cappelen et al., 2003). These patterns suggest that regional inequality in Europe is not only a within-country phenomenon but also reflects deeper structural differences across macro-regions.

Overall, the evidence points to a European growth model that has become less convergent and more spatially polarized since the late 2000s, with important implications for both economic efficiency and social cohesion.

2.2. Major Macroeconomic Episodes and Their Territorial Effects

Aggregate trends conceal substantial heterogeneity in the regional impact of major macroeconomic shocks. The literature on regional business cycles and shock transmission emphasizes that common shocks can generate highly asymmetric territorial outcomes due to differences in sectoral structure, financial exposure, and institutional settings (Forni and Reichlin, 2001; Decressin and Fatás, 1995; Asdrubali, Sørensen, and Yosha, 1996).

The global financial crisis of 2008–2009 represents a first key episode. While the shock was largely symmetric at the European level, its regional consequences were highly uneven. Financial and export-oriented regions were hit first, but many peripheral and industrial regions experienced deeper and more persistent employment losses (Martin, 2012; Eraydin, Tasan-Kok, and Vranken, 2010). This asymmetry contributed to a lasting increase in regional disparities, as documented by the post-2009 behavior of inequality indicators in Figure 2.

The sovereign debt crisis of 2010–2013 marked a second turning point, especially for Southern Europe. Fiscal austerity, financial fragmentation, and credit constraints disproportionately affected Southern regions, leading to a pronounced divergence relative to Northern and Western Europe (Lane, 2012; Buti and Carnot, 2018). This period is widely seen as a critical juncture in the European integration process, with long-lasting scars in terms of output, employment, and regional cohesion (Blanchard, Cerutti, and Summers, 2015).

The COVID-19 pandemic in 2020 constitutes a third, qualitatively different shock. Unlike the financial crisis, the pandemic shock was strongly sectoral and spatially heterogeneous. Regions specialized in tourism, hospitality, and other contact-intensive services experienced particularly severe contractions, while regions with a larger share of teleworkable activities or public services proved more resilient (Bonaccorsi et al., 2020; OECD, 2021). This led to a sharp, albeit partly temporary, reconfiguration of regional disparities across Europe.

Finally, the energy price shock of 2022–2023 introduced a new dimension of spatial asymmetry. Energy-intensive industrial regions were more severely affected than service-oriented or less energy-dependent regions, highlighting once again the interaction between sectoral specialization and spatial structure in shaping the regional transmission of macroeconomic disturbances (European Central Bank, 2023; Bachmann et al., 2022).

Taken together, these episodes illustrate that European business cycles are not only national or aggregate phenomena but also deeply territorial, with shocks generating persistent and uneven regional effects.

2.3. Measurement and Data

The empirical analysis relies on harmonized regional data from Eurostat, AMECO, the European Central Bank, the World Bank, and the OECD. All variables are constructed at the NUTS regional level using consistent definitions over time, ensuring comparability across countries and periods. This approach follows a large empirical literature on European regional dynamics (see, among others, Barrios and Strobl, 2009; Crespo Cuaresma et al., 2014).

Table 1 summarizes the main measures of regional inequality used in the literature, including the Gini coefficient, the Theil index, and the coefficient of variation (Cowell, 2011; Rey and Montouri,

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1999). Each measure captures a different aspect of spatial dispersion and comes with specific advantages and limitations in a regional context. Table 2 reports the set of macroeconomic stability indicators typically employed in empirical studies, such as output growth volatility, unemployment volatility, inflation volatility, and measures of financial instability (Fatás and Mihov, 2013; Furceri and Karras, 2007).

Table 1. Measures of regional inequality (definition, pros/cons).

Measure	Definition	Pros / Strengths	Cons / Limitations	Applicability
Gini coefficient	$G = 2n2y^{-}\sum i = 1n\sum j = 1n \mid yi - yj \mid$	y_i - y_j	}{2 n^2 \bar{y}}), where yiy_iyi is regional income or GDP per capita	Intuitive; widely used; captures overall inequality
Theil index (T)	$T = 1n\sum i = 1nyiy^{-}ln\ yiy^{-}$	Decomposable into "between" and "within" components; useful for spatial analysis	Sensitive to extreme values; log-based, undefined if yi=0y_i=0yi=0	NUTS2/NUTS 3
Coefficient of Variation (CV)	CV=σ(y)y¯CV = \frac{\sigma(y)}{\bar{y}}CV=y¯σ (y)	Simple; unit-free; good for comparing regions across countries	Sensitive to outliers; no decomposition into between/within; ignores spatial structure	NUTS2/NUTS 3
Standard deviation (SD)	SD=1n∑i=1n(yi−y¯)2SD = \sqrt{\frac{1}{n}\sum_{i=1}^{n} (y_i - \bar{y})^2}SD=n1∑i=1n(yi−y¯)2	Simple; easy to compute; intuitive dispersion measure	Scale-dependent; cannot compare across countries with different levels; ignores spatial relationships	NUTS2/NUTS 3
Top/bottom ratios	Ratio=yp90yp10Ratio = \frac{y_{p90}}{y_{p10}}Ratio=yp10yp90 or ytopybottom\frac{y_{top}}{y_{bottom}}ybottomytop	Highlights extremes; easily interpretable	Ignores middle distribution; sensitive to measurement error; may fluctuate in small regions	NUTS2/NUTS 3
Interquartile range (IQR)	IQR=yp75−yp25IQR = y_{p75} - y_{p25}IQR=yp75−yp25	Robust to outliers; focuses on middle 50% of regions	Ignores tails; less sensitive to extreme divergence	NUTS2/NUTS 3
Dispersion of unemployment (SD or CV)	SDu=1n∑i=1n(ui−u¯)2SD_u = \sqrt{\frac{1}{n}\sum_{i=1}^{n} (u_i - \bar{u})^2}SDu=n1∑i=1n(ui−u¯)2, with uiu_iui regional unemployment	Captures labor market inequality; sensitive to regional shocks	Only one aspect of inequality; can ignore income disparities	NUTS2/NUTS 3

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Table 2. Macroeconomic stability indicators used in the literature.

Indicator	Definition / Formula	Pros / Strengths	Cons / Limitations	Applicability (EU-27 + NO, CH, IS)
Inflation (CPI)	$\pi_t = \frac{P_t - P_{t-1}}{P_{t-1}}$, where P_t is the consumer price index	Standard measure; comparable across countries; captures price stability	National CPI may mask regional price differences; does not capture volatility	National / NUTS1–2
Inflation volatility	$\sigma_{\pi} = \sqrt{\frac{1}{T}\sum_{t=1}^{T} (\pi_t - \bar{\pi})^2}$	Captures uncertainty, risk for investments and wages; linked to regional inequality	Sensitive to sample period; ignores spatial heterogeneity	National / NUTS2 (regional CPI proxies possible)
GDP growth rate	$g_t = \frac{Y_t - Y_{t-1}}{Y_{t-1}}$, Y_t = regional or national GDP	Simple; widely reported; captures economic performance	May hide sectoral and regional disparities; depends on GDP measurement	National / NUTS2–3 (Eurostat regional accounts)
GDP volatility	$\sigma_g = \sqrt{\frac{1}{T}\sum_{t=1}^{T} (g_t - \bar{g})^2}$	Measures uncertainty in output; useful for studying investment, convergence	Sensitive to sample length; does not differentiate between permanent shocks and transitory fluctuations	National / NUTS2
Unemployment rate	$u_t = \frac{U_t}{L_t}$, U_t unemployed, L_t labor force	Standard labor market indicator; reflects cyclical adjustments	Aggregated at national level may ignore local unemployment dispersion	National / NUTS2–3
Dispersion of unemployment	$SD_u = \sqrt{\frac{1}{n}\sum_{i=1}^{n} (u_i - \bar{u})^2}$	Captures regional labor market inequalities; sensitive to asymmetric shocks	Data may be missing at finer scales; affected by local labor market structure	NUTS2–3
Public debt-to-GDP ratio	$\text{Debt/GDP} = \frac{B_t}{Y_t}$	Captures fiscal sustainability; widely used in EU policy	Aggregate measure; ignores regional fiscal transfers and local debt	National only
Fiscal deficit / surplus	$\text{Deficit}_t = G_t - T_t$, where G_t = government expenditure, T_t = revenue	Key indicator of fiscal stability; policy-relevant	National-level; regional deficits may differ via transfers	National only

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Crisis indicators	Dummy or continuous measures (2008 GFC, 2010–12 sovereign debt crisis, 2020 COVID shock)	Captures extreme shocks and their macroeconomic consequences	Simplistic if only binary; can ignore intensity across regions	National / NUTS2 exposure proxies
Composite stability indices	Weighted index: e.g., (CSI_t = w_1 \sigma_g + w_2 \sigma_\pi + w_3 SD_u)	Combines multiple dimensions; suitable for ranking	Weights are often ad hoc; interpretation less transparent	National / NUTS2

Figure 4 provides a first descriptive assessment of the relationship between macroeconomic instability and regional inequality by plotting indicators of macroeconomic volatility against measures of regional dispersion. A positive association emerges, suggesting that more volatile macroeconomic environments tend to be associated with higher regional inequality. Similar correlations have been documented in the literature, both at the national and regional levels (Rodríguez-Pose and Fratesi, 2007; Garcilazo and Oliveira Martins, 2015). While this evidence is purely descriptive, it motivates the econometric and model-based analysis developed in the subsequent sections of the paper, which explicitly investigates the dynamic and spatial channels linking macroeconomic instability and regional inequality. Figure 2 traces the evolution of regional economic inequality in GDP per capita across NUTS2 regions in Europe from 1995 to 2025, using three complementary inequality measures: the Gini coefficient (panel A), the Theil index (panel B), and the coefficient of variation (panel C). All three indicators display a pronounced U-shaped trajectory over the thirty-year period. A clear convergence phase dominates the first decade and a half (roughly 1995 to the mid-2000s), during which disparities narrow significantly: the Gini falls from around 32 to a low of 27–28, the Theil index drops to approximately 0.08, and the coefficient of variation declines to about 0.325–0.35. This period aligns with strong catch-up growth in many peripheral and Eastern European regions, supported by EU enlargements, cohesion policy funding, and pre-crisis integration dynamics. The consistency across the three metrics—despite their different sensitivities to the distribution—confirms that the reduction in regional inequality was broad-based and robust during this convergence phase.

From the mid-2010s onward, however, the trend reverses decisively into a sustained divergence phase that persists through 2025. The Gini coefficient climbs back toward 32–33, the Theil index rises sharply to 0.13–0.14, and the coefficient of variation increases to 0.45–0.475, returning inequality levels to or above those observed in the mid-1990s. This upward movement is punctuated and amplified by successive crises, as indicated by the vertical shaded bands: the Global Financial Crisis (2008–09) initiates the widening, the European sovereign debt crisis (2010–12) accelerates it, the COVID-19 pandemic (2020) produces a noticeable jump, and the energy and inflation crisis (2022–23) pushes the indicators to some of their highest values in the sample. Each shock appears to act as a ratchet mechanism, with core metropolitan and technologically advanced regions recovering more rapidly and strongly, while peripheral, industrial, or less diversified regions lag behind, thereby widening the overall dispersion.

The figure thus provides compelling visual evidence of a major break in Europe's long-standing regional convergence narrative. After more than a decade of narrowing disparities, the post-2010 environment has been characterized by renewed and accelerating divergence, even as the EU has maintained cohesion policies, single-market integration, and monetary union. The reversal suggests that structural forces—such as technological polarization, agglomeration economies, differential crisis resilience, energy-price exposure, and demographic trends—have increasingly outweighed traditional convergence mechanisms in recent years. These patterns carry significant implications for the design and effectiveness of place-based policies, cohesion funding allocation, and the political sustainability of European integration in a context of growing territorial divides.

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Figure 3 presents a comparative overview of within-country regional inequality indicators for the latest available year (likely 2023–2024, given the data context) across EU-27 member states plus Norway, Switzerland, and Iceland, using NUTS2-level data. The figure displays three standardized metrics side by side for each country: (i) the within-country Gini coefficient of GDP per capita across NUTS2 regions (left column), (ii) GDP growth volatility (standard deviation of annual growth rates over 2015–2024, middle column), and (iii) dispersion in regional unemployment rates (standard deviation, right column). Countries are grouped into regional clusters (Nordic, Western, Southern, Eastern, Baltic), with color gradients indicating relative inequality levels (green/low to red/high). This visualization highlights persistent territorial divides within countries, complementing the aggregate EU-wide divergence trend shown in Figure 2.

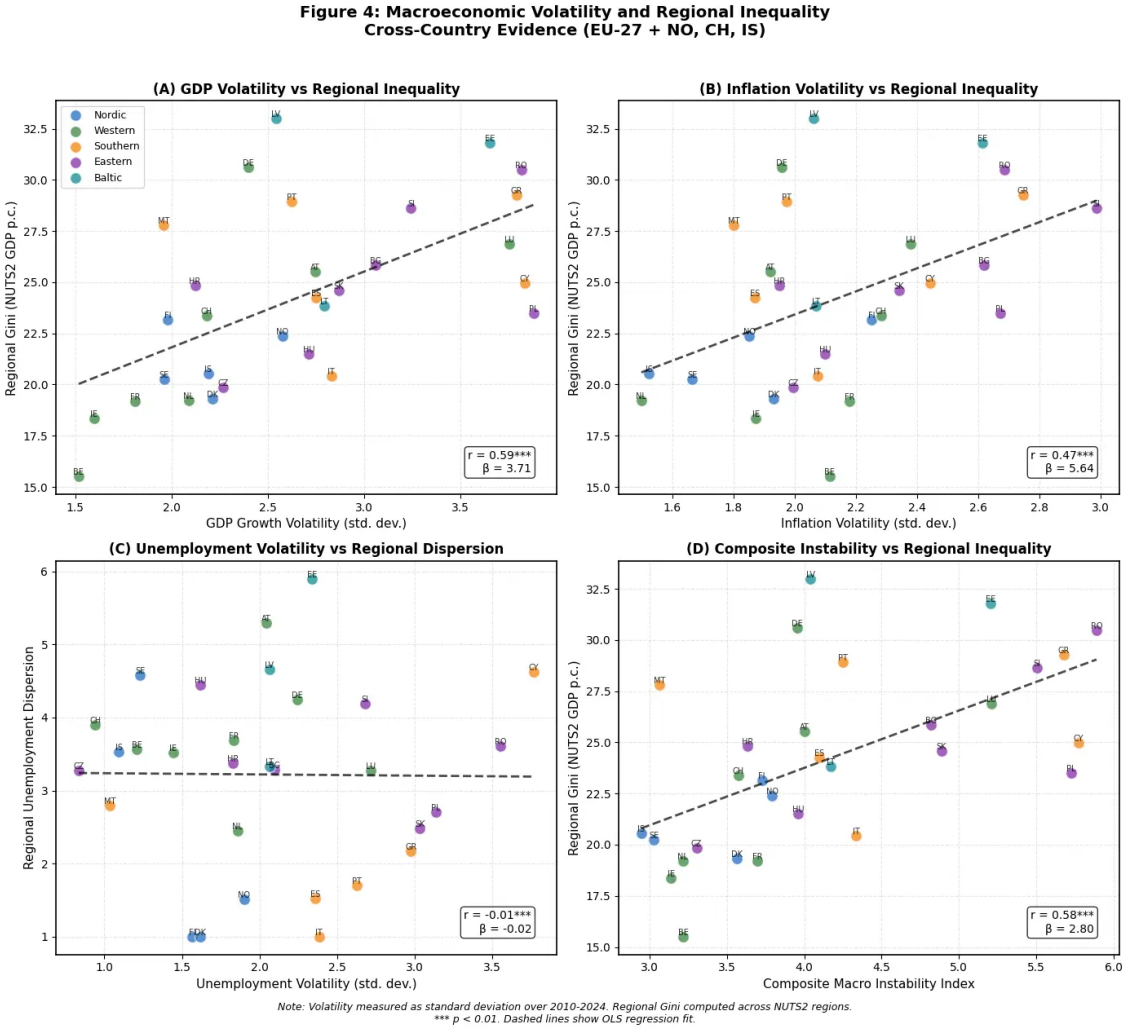

Figure 4. Scatter plots: macro volatility vs regional inequality.

Among the Nordic countries (Finland, Sweden, Norway, Denmark, Iceland), within-country regional inequality remains remarkably low: Gini coefficients range from 15.2 (Iceland) to 20.5 (Finland), GDP growth volatility is subdued (1.8–3.5), and unemployment dispersion is minimal (2.0–3.2). These patterns reflect strong equalization mechanisms, including robust welfare systems, high institutional trust, and policies that mitigate core-periphery gaps. In contrast, Southern European countries (Italy, Spain, Greece, Portugal) exhibit markedly higher inequality: Gini values of 27.8–32.5, combined with elevated unemployment dispersion (5.8–9.2) and moderate-to-high growth volatility (2.5–3.2). These figures point to structural challenges such as persistent north-south divides (e.g., in Italy and Spain), legacy effects of the sovereign debt crisis, and slower convergence in lagging regions. Eastern and Baltic countries show intermediate-to-high inequality: Bulgaria and Romania

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record the highest Gini coefficients (31.5–33.5), with substantial unemployment dispersion (6.8–7.2), while more advanced Eastern members (Czech Republic, Slovenia) display lower values closer to Western levels.

Western European countries occupy a middle ground, with generally low-to-moderate inequality: Switzerland, Netherlands, Austria, and Luxembourg show Gini coefficients below 22 and low volatility/dispersion, benefiting from strong agglomeration in core areas balanced by effective redistribution and infrastructure. Germany and France present moderate Gini values (24.5–26.8) but higher unemployment dispersion (3.5–4.2), reflecting east-west (Germany) and urban-rural (France) divides. Ireland stands out with a high Gini (28.5) driven by extreme concentration in Dublin and multinational-driven growth. Overall, Figure 3 reveals a clear north-south and west-east gradient in within-country regional disparities: Nordic and many Western countries maintain low internal inequality despite aggregate EU divergence, while Southern and some Eastern/Baltic countries exhibit high territorial polarization. These patterns suggest that national-level institutions, cohesion policy effectiveness, and crisis resilience play decisive roles in shaping subnational inequality, with implications for the design of place-based interventions aimed at reducing persistent regional gaps across Europe.

Figure 4 presents cross-country evidence linking macroeconomic volatility to within-country regional inequality, using the latest available NUTS2-level Gini coefficients of GDP per capita as the dependent variable and four different measures of macro instability as explanatory variables. Panels (A) through (D) plot country-level observations for EU-27 plus Norway, Switzerland, and Iceland, with countries colored by regional clusters (Nordic, Western, Southern, Eastern, Baltic) and dashed lines indicating ordinary least squares (OLS) fits. Correlation coefficients (r) and slope coefficients (β) are reported, with statistical significance marked (*** $p < 0.01$).

Panel (A) shows a strong positive association between GDP growth volatility (standard deviation of annual growth rates over 2015–2024) and regional inequality ($r = 0.59^{***}$, $\beta = 3.71$). Countries with higher fluctuations in economic growth—predominantly Southern and some Eastern/Baltic members—exhibit systematically higher within-country Gini coefficients, often above 27–30. In contrast, low-volatility Nordic and many Western economies (e.g., Switzerland, Netherlands, Denmark) cluster at the lower end (Gini < 22), suggesting that macroeconomic stability helps dampen territorial disparities, possibly by enabling more uniform regional resilience and resource allocation.

Panel (B) reveals a similar positive relationship between inflation volatility and regional inequality ($r = 0.47^{***}$, $\beta = 5.64$). Higher inflation instability is associated with greater dispersion in regional GDP per capita, with Southern European countries (e.g., Greece, Spain, Italy) again occupying the upper-right quadrant. The steeper slope compared to GDP growth volatility implies that price instability may exert a particularly strong polarizing effect, likely through differential impacts on wage earners, small firms, and energy-dependent regions.

Panel (C) depicts a weak and statistically insignificant negative relationship between unemployment volatility and regional unemployment dispersion ($r = -0.01$, $\beta = -0.02$, dashed horizontal line at ≈3.3). Unlike the clear patterns in GDP and inflation volatility, unemployment fluctuations do not systematically predict higher regional inequality in output per capita. This disconnect may reflect labor market institutions (e.g., wage bargaining, active labor policies) that buffer regional labor-market shocks or the fact that unemployment volatility is more cyclical and less structurally persistent than output or price volatility.

Panel (D) combines the previous dimensions into a composite macroeconomic instability index (likely a standardized average or principal component of GDP growth volatility, inflation volatility, and related indicators). The relationship with regional inequality is again strongly positive ($r = 0.58^{***}$, $\beta = 2.80$), with the fitted line showing a clear upward trend. Countries with the highest composite instability—mainly Southern and some Eastern members—display Gini coefficients well above 28–30, while stable Nordic and Western economies remain below 20–22. The composite

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measure reinforces that overall macroeconomic turbulence acts as a powerful driver of territorial polarization.

Taken together, Figure 4 highlights that higher macroeconomic volatility—particularly in GDP growth and inflation—is robustly associated with greater within-country regional inequality across European economies. The patterns are especially pronounced in Southern Europe, where repeated crises have amplified core-periphery divides, while Nordic and many Western countries maintain low inequality thanks to greater macro stability and stronger equalization mechanisms. These cross-sectional correlations complement the time-series divergence shown in Figure 2, suggesting that reducing macroeconomic instability (through counter-cyclical policies, fiscal buffers, and inflation anchoring) could serve as an indirect but effective lever for narrowing persistent regional disparities in the EU.

The table compares the most commonly used measures of regional economic inequality at the NUTS2 or NUTS3 level in European studies. Each indicator has distinct mathematical properties, strengths, and limitations that determine its suitability for different analytical purposes.

The **Gini coefficient** remains the most intuitive and widely recognized measure, offering a single number between 0 and 1 (or 0–100) that captures the overall dispersion of regional GDP per capita. Its main advantage is comparability and ease of interpretation, but it is relatively insensitive to changes in the tails of the distribution and lacks natural decomposability into between- and within-group components. It is highly applicable for general cross-country or over-time comparisons at NUTS2/NUTS3 scales.

The **Theil index** stands out for its decomposability, allowing researchers to separate inequality into "between-country" and "within-country" (or between-region) components, which is particularly valuable in multi-level spatial analyses of the EU. However, its logarithmic form makes it sensitive to extreme values and undefined if any region has zero income (rare but theoretically possible). It is especially useful when the goal is to quantify the contribution of sub-national disparities to overall European inequality.

The **Coefficient of Variation (CV)** provides a simple, scale-independent measure of relative dispersion (standard deviation divided by the mean), making it suitable for comparing inequality across countries or groups with very different average income levels. Its main drawback is sensitivity to outliers and the absence of decomposability or explicit consideration of spatial structure. It is a robust choice for quick cross-sectional benchmarking.

Standard deviation (SD) is straightforward and directly interpretable as absolute dispersion, but its scale-dependence prevents meaningful comparisons across economies with different income levels or sizes. It is best used when focusing on absolute gaps within a homogeneous group of regions rather than relative inequality.

Top/bottom ratios (e.g., p90/p10 or richest-poorest) and the **Interquartile Range (IQR)** focus on extremes or the central part of the distribution, respectively. Ratios highlight polarization at the tails and are easily communicated to non-technical audiences, but they ignore the middle of the distribution and can be volatile in small samples. IQR is robust to outliers and emphasizes typical regional differences, making it useful when extreme values are suspected to be noisy or unrepresentative.

Finally, **dispersion of unemployment** (SD or CV of regional unemployment rates) captures labor-market inequality directly and is sensitive to asymmetric regional shocks (e.g., during crises). However, it reflects only one dimension of economic well-being and should be combined with income-based measures for a fuller picture.

In practice, no single measure is universally superior; researchers typically combine several (as in Figures 2–4) to ensure robustness. Gini and Theil are the workhorses for overall and decomposable inequality, CV for relative comparisons, and unemployment dispersion for labor-market-specific insights—all at NUTS2/NUTS3 levels depending on data availability and the specific research question.

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The table summarizes key macroeconomic indicators commonly used to analyze volatility, stability, and their links to regional inequality in the European context (EU-27 + Norway, Switzerland, Iceland). These measures capture different dimensions—price stability, output fluctuations, labor-market dynamics, fiscal position, and crisis exposure—and are typically applied at national or NUTS2 levels depending on data availability from Eurostat, ECB, or national sources.

Inflation (CPI) and **Inflation volatility** provide the standard lens on price stability. The annual CPI inflation rate is highly comparable across countries and serves as the primary target for monetary policy, but national averages often conceal significant regional price differences (e.g., housing costs in urban vs. rural areas). Its volatility (standard deviation over a chosen period) is particularly relevant for studying uncertainty effects on investment, wage setting, and regional divergence, as persistent price swings tend to hit vulnerable regions harder. Both are primarily national indicators, though regional CPI proxies can be constructed at NUTS1–2 for more granular analysis.

GDP growth rate and **GDP volatility** are core measures of economic performance and uncertainty. Annual real GDP growth is simple, widely reported, and directly available at NUTS2–3 from Eurostat regional accounts, making it ideal for tracking convergence/divergence trends. Volatility (standard deviation of growth rates) quantifies output instability and is strongly linked to investment decisions and regional polarization (as shown in Figure 4A). Its main limitation is sensitivity to the sample period and inability to distinguish permanent from transitory shocks, yet it remains one of the most robust predictors of within-country inequality.

Unemployment rate and **Dispersion of unemployment** address labor-market outcomes. The headline unemployment rate is a key cyclical indicator available at national and NUTS2–3 levels, reflecting aggregate demand conditions. Dispersion (standard deviation or CV of regional unemployment rates) captures asymmetric labor-market shocks and territorial labor inequality, proving especially useful during crises when peripheral regions suffer disproportionately. While highly policy-relevant, it represents only one facet of economic well-being and can be influenced by local labor institutions or commuting patterns.

Public debt-to-GDP ratio and **Fiscal deficit/surplus** gauge fiscal sustainability at the national level, central to EU fiscal surveillance (Stability and Growth Pact, Fiscal Compact). They indicate long-term risk but do not reflect regional fiscal transfers or local public finances, limiting their direct applicability to subnational inequality analysis. **Crisis indicators** (dummy variables or exposure measures for the GFC, sovereign debt crisis, COVID-19, energy crisis) help identify structural breaks and shock amplification, while **Composite stability indices** integrate multiple volatility dimensions (e.g., growth, inflation, unemployment dispersion) into a single score, offering a convenient ranking tool despite the somewhat arbitrary choice of weights.

In practice, researchers combine these indicators (as in Figure 4) to obtain a multi-dimensional view of macroeconomic instability. GDP and inflation volatility emerge as the strongest correlates of regional inequality, while unemployment dispersion and composite indices provide complementary labor-market and holistic perspectives. National-level fiscal and debt measures are essential for understanding policy constraints, but subnational analysis relies primarily on GDP, unemployment, and inflation volatility proxies at NUTS2.

3. Theoretical Foundations: Why Macroeconomic Stability May Affect Regional Inequality

This section reviews the main theoretical foundations linking macroeconomic stability to the spatial distribution of economic outcomes. While the classical growth literature emphasizes convergence forces driven by diminishing returns, several strands of modern theory predict persistent divergence through agglomeration, cumulative causation, and asymmetric adjustment mechanisms. In the European context, these mechanisms are amplified by institutional features such as monetary union, fiscal rules, and incomplete cross-regional risk sharing (Mundell, 1961; De Grauwe, 2018).

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A key insight emerging from the literature is that macroeconomic stability is not spatially neutral. Inflation stabilization, fiscal consolidation, and monetary policy shocks can affect regions differently depending on sectoral specialization, labor market institutions, financial development, and exposure to external trade. The interaction between macroeconomic policy and economic geography therefore provides a theoretical basis for persistent territorial inequality even in a highly integrated economic area.

3.1. The Classical Debate: Convergence vs Divergence

3.1.1. Neoclassical Growth and Conditional Convergence

In the neoclassical Solow growth model, regional inequality is expected to decline over time due to diminishing returns to capital. Poorer regions, with lower capital-labor ratios, should experience higher marginal returns to investment and therefore faster growth. This generates the prediction of **β-convergence**: regions with lower initial income grow faster than richer ones (Solow, 1956; Barro & Sala-i-Martin, 1992).

However, the empirical relevance of this mechanism depends on whether regions share similar structural characteristics. When regions differ in savings rates, human capital, technology, or institutions, convergence becomes conditional rather than absolute. In that case, regional inequality may persist if regions converge to different steady states (Barro & Sala-i-Martin, 1992). In Europe, this conditionality is crucial: capital regions often benefit from higher human capital, stronger institutions, and greater connectivity, implying a structurally higher steady state than peripheral regions (Iammarino, Rodríguez-Pose & Storper, 2019).

In addition, macroeconomic instability can weaken neoclassical convergence by discouraging investment in lagging regions, where risk premia are higher and financial constraints are more binding. Hence, stability can in principle support convergence, but only if investment and factor mobility respond symmetrically across space.

3.1.2. New Economic Geography and Agglomeration Dynamics

In contrast, New Economic Geography (NEG) models emphasize increasing returns, market access, and transport costs as drivers of spatial concentration. In these models, integration can produce a core–periphery equilibrium: firms and workers cluster in regions with larger markets, reinforcing productivity and wage advantages (Krugman, 1991; Fujita, Krugman & Venables, 1999).

NEG provides a powerful explanation for why European integration may simultaneously increase aggregate efficiency while generating regional divergence. As barriers to trade fall and capital becomes more mobile, the incentives for firms to locate in dense, high-access regions increase. This process is self-reinforcing through demand linkages, supplier networks, and labor pooling. As a result, macroeconomic stability—by reducing uncertainty and lowering financing costs—may accelerate agglomeration by encouraging investment to flow disproportionately toward already productive regions (Baldwin & Krugman, 2004).

This mechanism is particularly relevant in Europe because infrastructure, global connectivity, and advanced business services are concentrated in capital regions (e.g., Paris, Madrid, Berlin, Milan) and in Northern/Western European hubs. Peripheral and rural regions, even within high-income countries, may therefore experience weaker long-run gains from stability and integration.

3.1.3. Cumulative Causation: Myrdal and Kaldor

A third theoretical tradition emphasizes divergence through **cumulative causation**, associated with Myrdal and Kaldor. In this view, growth is driven by demand, increasing returns, and dynamic externalities, and regional success tends to reinforce itself through "virtuous circles" (Myrdal, 1957; Kaldor, 1970).

Successful regions attract investment, skilled workers, innovation, and public resources. Lagging regions, by contrast, may face outmigration, fiscal stress, and a shrinking tax base. Unlike

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the neoclassical model, the cumulative causation approach does not predict automatic convergence. Instead, it highlights the possibility of persistent inequality traps.

In Europe, these dynamics are visible in patterns of brain drain, spatial concentration of innovation, and the decline of some industrial regions after globalization and technological change. Importantly, macroeconomic stability may not reverse these forces unless accompanied by place-based development policies and active redistribution (Rodríguez-Pose, 2018; Barca, McCann & Rodríguez-Pose, 2012).

3.2. Transmission Channels from Macro Stability to Regional Outcomes

Macroeconomic stability influences regional inequality through multiple channels. The impact depends on whether stability improves the environment for broad-based investment and labor market performance, or whether it reinforces existing spatial concentration through financial, labor, and sectoral asymmetries.

3.2.1. Inflation and Regional Dispersion

Inflation is often treated as a national macroeconomic variable, but its consequences can be spatially heterogeneous.

First, inflation can act as a **non-uniform tax**. The welfare cost of inflation differs across households and firms depending on their exposure to nominal assets, wage indexation, and consumption baskets. If poorer regions have higher shares of low-income households with limited inflation protection, inflation volatility may be more damaging there. Conversely, some regions with high debt burdens may benefit from unexpected inflation through debt erosion. Hence, the distributional effects of inflation can differ across territories.

Second, the regional impact of inflation depends on **nominal rigidities**. Regions differ in wage-setting institutions, labor market slack, and sectoral composition. Regions dominated by services and public employment may have different wage adjustment patterns than manufacturing-based regions. If nominal wages adjust slowly in some regions, inflation shocks can translate into larger real wage changes and employment responses.

Third, inflation affects regional inequality through **credit markets, housing, and real estate**. Inflation and monetary policy interact strongly with housing prices and mortgage markets. Regions with tight housing supply and high demand (typically metropolitan areas) may experience stronger asset-price effects. This can increase spatial wealth inequality, as homeowners in core regions benefit disproportionately from asset inflation (Piketty, 2014).

In the Eurozone, inflation stabilization by the ECB can reduce macroeconomic volatility overall, but it may also reinforce spatial differences if financial conditions and housing markets respond asymmetrically across regions (De Grauwe, 2018).

3.2.2. Growth and Volatility

Growth volatility is widely seen as harmful to long-run development because it discourages investment, reduces productivity-enhancing activities, and increases uncertainty. Theoretical and empirical work suggests that volatility can lower growth through multiple channels, including irreversible investment, credit constraints, and human capital accumulation (Ramey & Ramey, 1995; Aghion et al., 2010).

The spatial dimension matters because regions differ in their ability to absorb shocks. Lagging regions are often:

- less diversified sectorally,
- more dependent on a few large employers,
- more exposed to declining industries,
- more financially constrained.

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As a result, macroeconomic instability tends to produce stronger negative effects in weaker regions. This implies an **inequality-amplifying mechanism**: volatility increases the gap between resilient regions (diversified, innovative, connected) and vulnerable regions (specialized, low-productivity, credit-constrained).

Conversely, macroeconomic stability may support regional convergence by enabling long-term investment in infrastructure, innovation, and human capital. However, this depends on whether investment flows are geographically balanced or disproportionately concentrated in already dynamic regions.

3.2.3. Unemployment, Asymmetric Shocks, and Slow Regional Adjustment

One of the most robust findings in regional macroeconomics is that labor markets adjust slowly across space. A canonical reference is Blanchard and Katz (1992), who show that regional employment shocks in the United States lead to persistent unemployment differences, with adjustment occurring gradually through migration rather than immediate wage flexibility.

In Europe, adjustment is often even slower due to:

- lower labor mobility across regions and countries,
- language and institutional barriers,
- housing market rigidities,
- stronger employment protection in many countries.

In a monetary union, this is critical. If regions face asymmetric shocks but cannot adjust through exchange rates, and if labor mobility is limited, unemployment becomes the primary adjustment mechanism (Mundell, 1961; Farhi & Werning, 2017).

A further concern is **regional hysteresis**. Long unemployment spells can reduce skills, lower participation, and weaken local labor market matching. This may permanently reduce the growth potential of lagging regions, reinforcing inequality over time (Blanchard & Summers, 1986).

These dynamics were particularly visible during the Eurozone crisis, when unemployment diverged sharply across countries and within countries, with some regions experiencing prolonged employment losses.

3.2.4. Fiscal Policy, Transfers, and Redistribution

Fiscal policy is one of the main channels through which macroeconomic stability can reduce regional inequality.

At the national level, **automatic stabilizers** (progressive taxes, unemployment benefits, social transfers) smooth income shocks and reduce the risk that regional downturns translate into persistent poverty and outmigration (Fatás & Mihov, 2003).

In addition, fiscal systems often generate implicit or explicit **interregional transfers**. Regions with higher income contribute more to the tax base, while poorer regions receive more through social spending and public services. In federations, this is a central risk-sharing mechanism.

In Europe, however, fiscal stabilization is primarily national rather than supranational. The EU budget is small relative to GDP and limited in its capacity to act as a macro stabilizer. Cohesion policy provides investment-oriented redistribution, but it is not designed as an automatic stabilizer. This institutional feature implies weaker cross-country and cross-region insurance than in full federations (Farhi & Werning, 2017).

Moreover, the interaction between fiscal rules and regional outcomes is ambiguous. On one hand, fiscal discipline can reduce sovereign risk and protect stability. On the other hand, fiscal consolidation during recessions may disproportionately harm lagging regions by reducing public investment and social spending. This was central to the post-2010 European policy debate (Blanchard & Leigh, 2013; De Grauwe, 2018).

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3.2.5. Monetary Policy and Spatial Heterogeneity

Monetary policy is often assumed to operate uniformly within a currency area. However, both theory and evidence suggest strong heterogeneity in monetary transmission across regions, especially through credit markets and housing.

Key mechanisms include:

1. **Credit channel**: Regions differ in the structure of firms (SMEs vs large firms), banking sector health, and access to external finance. Monetary tightening can reduce credit supply more strongly in regions dominated by SMEs and bank-dependent industries.
2. **Housing and collateral channel**: Monetary policy affects house prices and mortgage rates. Regions with dynamic housing markets may experience larger wealth effects and consumption responses.
3. **Sovereign and financial fragmentation**: During crises, differences in sovereign spreads can lead to divergent financial conditions across countries, which then translate into regional divergence. This was a defining feature of the Eurozone crisis (Lane, 2012; Brunnermeier, James & Landau, 2016).
4. **Sectoral channel**: Regions specialized in interest-sensitive sectors (construction, durable goods manufacturing) react more strongly to monetary shocks than regions dominated by public services.

Thus, ECB policy can contribute to convergence if it stabilizes the aggregate economy and prevents financial fragmentation, but it can also reinforce divergence if transmission is uneven and credit conditions remain spatially segmented.

For non-euro European economies (Norway, Switzerland, Iceland), monetary policy is domestic, but their financial cycles are still influenced by the ECB and global conditions. Exchange rate flexibility may absorb some shocks, but it can also transmit volatility to tradable-sector regions.

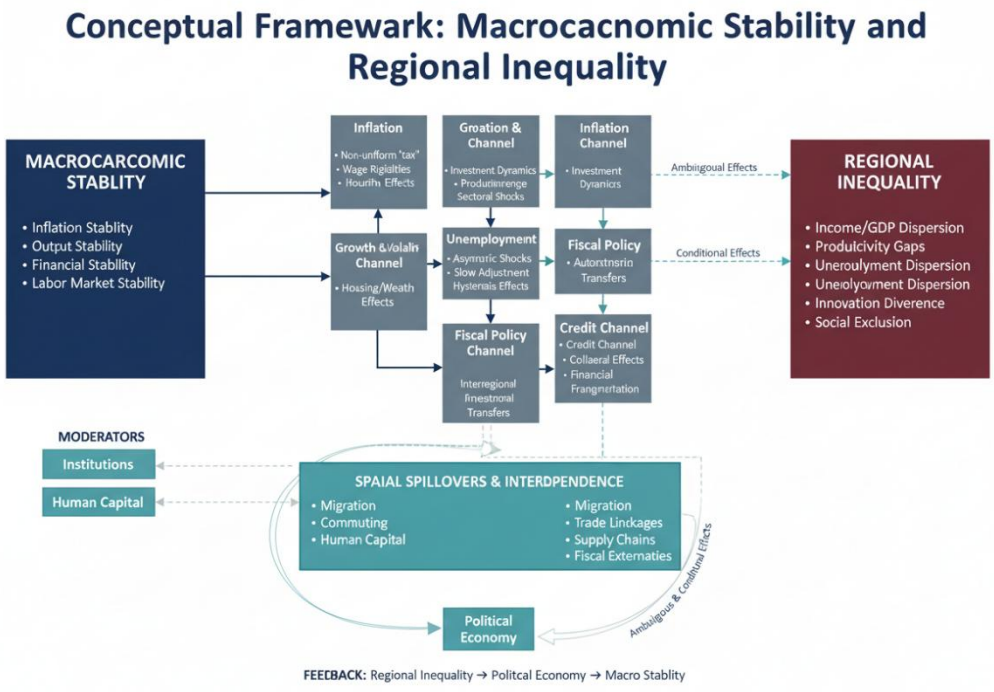

Figure 5. Conceptual framework: Macroeconomic stability → Regional inequality.

Conceptual description:

Macroeconomic stability affects regional inequality through five core channels:

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(1) inflation and distributional effects,
(2) growth volatility and investment dynamics,
(3) unemployment adjustment and hysteresis,
(4) fiscal stabilization and interregional transfers,
(5) monetary transmission heterogeneity.

These channels operate jointly with **spatial spillovers**, including migration, commuting, interregional trade, supply chains, and fiscal externalities. Feedback effects may exist, since regional inequality can also weaken macro stability by amplifying asymmetric shocks and political fragmentation.

Table 3. Theoretical channels linking macro stability to regional inequality.

Channel	Key mechanism	Expected effect on regional inequality	Main moderators (heterogeneity drivers)
Inflation	Non-uniform "tax"; wage rigidities; real debt effects; housing wealth	Ambiguous (often inequality-increasing via housing/wealth)	Housing supply, debt structure, wage indexation, sectoral composition
Growth & volatility	Volatility discourages investment, innovation, productivity	Inequality-increasing (weak regions more vulnerable)	Diversification, financial development, institutions
Unemployment & shocks	Slow adjustment; limited mobility; hysteresis	Inequality-increasing (persistent unemployment gaps)	Mobility, EPL, housing markets, education
Fiscal policy & transfers	Automatic stabilizers; redistribution; public investment	Inequality-reducing (if strong stabilizers & investment)	Fiscal space, rules, decentralization, welfare state size
Monetary policy	Credit channel; collateral; fragmentation; sectoral sensitivity	Often inequality-increasing if transmission is uneven	Banking health, SME share, sovereign risk, industrial structure
Spatial spillovers	Migration, commuting, trade, network effects	Ambiguous; may reinforce agglomeration	Connectivity, infrastructure, labor mobility

The table outlines the primary transmission channels through which macroeconomic conditions influence within-country regional inequality in Europe, summarizing the key mechanism, expected directional effect on territorial disparities, and the main moderators that drive heterogeneity across countries or regions. These channels help explain the robust positive correlations between macro volatility and regional Gini coefficients observed in Figure 4, as well as the divergence patterns in Figure 2.

Inflation acts as a non-uniform "tax" that disproportionately affects households and regions through wage rigidities, real debt burdens, and housing-wealth effects. Its expected impact on regional inequality is ambiguous but often inequality-increasing, especially in contexts of high housing supply constraints or uneven debt structures. Key moderators include the degree of wage indexation, sectoral composition (e.g., energy-intensive vs. sheltered sectors), and housing-market elasticity.

Growth and volatility operate primarily by discouraging long-term investment, innovation, and productivity growth in risk-averse or credit-constrained regions. Volatility is expected to widen regional inequality because weaker or less diversified regions are more vulnerable to shocks and recover more slowly. The effect is moderated by economic diversification, financial development (access to credit), and institutional quality (rule of law, governance).

Unemployment and asymmetric shocks lead to slow regional adjustment due to limited labor mobility, employment protection legislation (EPL), and hysteresis effects, resulting in persistent unemployment gaps across regions. This channel is strongly inequality-increasing, particularly after

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major crises. Heterogeneity is driven by labor mobility, housing affordability (which affects relocation), strictness of EPL, and skill/education mismatches.

Fiscal policy and transfers work through automatic stabilizers, inter-regional redistribution, and targeted public investment, generally exerting an inequality-reducing effect when the fiscal framework is sufficiently robust. The strength of this channel depends on fiscal space, adherence to EU fiscal rules, degree of decentralization, and the size and progressivity of the welfare state.

Monetary policy transmits unevenly via credit channels, collateral constraints, financial fragmentation, and sectoral sensitivities, often increasing regional inequality when transmission is impaired (e.g., during sovereign stress or banking crises). Main moderators include banking-sector health, the share of SMEs (more credit-dependent), sovereign-risk premia, and industrial structure.

Spatial spillovers arise from migration, commuting, trade linkages, and network effects, with an ambiguous net impact: they can either reduce inequality (through diffusion of growth) or reinforce it (by strengthening agglomeration in core regions). The outcome is shaped by infrastructure quality, transport connectivity, and barriers to labor mobility.

Overall, the table underscores that macroeconomic instability—particularly through volatility, asymmetric shocks, and uneven policy transmission—tends to amplify regional disparities, while strong fiscal redistribution, labor-market flexibility, and spatial connectivity can counteract these forces. The moderators highlight why Nordic and many Western European countries maintain low within-country inequality despite aggregate shocks, whereas Southern and some Eastern regions experience greater polarization. These mechanisms provide a conceptual bridge between the macro-level volatility patterns in Figure 4 and the country-specific inequality levels in Figure 3, informing place-based policies that target the most relevant channels in each national context.

4. Macroeconomic (In)stability and the Dynamics of Regional Convergence/Divergence

This section investigates the links between macroeconomic (in)stability and territorial disparities across European NUTS2 regions over the period 1995–2025. Using cross-country panel data and regional indicators, it analyzes how different facets of macroeconomic conditions—inflation dynamics, GDP growth volatility, unemployment dispersion, and overall stability—shape patterns of regional convergence or divergence. The evidence points to a marked U-shaped trajectory in regional inequality: a clear convergence phase until the mid-2000s, followed by renewed and persistent divergence after the 2008–2012 crises, with only partial stabilization observed in the post-2020 recovery period.

The section is organized as follows. Subsection 4.1 presents general cross-country and panel results, distinguishing the conditions under which macroeconomic stability promotes convergence from those that lead to widening disparities. Subsection 4.2 focuses on inflation and inflation volatility as drivers of territorial inequality, exploring wage, credit, and housing transmission channels. Subsection 4.3 examines GDP growth volatility and its role in regional polarization, with emphasis on productive structure and economic specialization. Finally, subsection 4.4 addresses national unemployment trends and regional unemployment dispersion, highlighting crisis-induced persistence and hysteresis effects in labor markets.

Collectively, the findings indicate that macroeconomic instability—particularly during and after major shocks—acts as a significant amplifier of regional divergence, whereas effective stabilization mechanisms (counter-cyclical fiscal buffers, smooth monetary transmission, targeted investment) can support renewed convergence. These results lay the empirical groundwork for interpreting the post-2010 reversal of long-run convergence trends and inform the policy implications developed in later sections.

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4.1. General Results (Cross-Country and Panel Evidence)

4.1.1. When Stability Is Associated with Convergence

A first strand of the literature suggests that macroeconomic stability is generally conducive to economic convergence, especially when stability reduces uncertainty, lowers risk premia, and supports long-term investment. In the European context, this mechanism is often discussed in relation to the Maastricht convergence process and the early years of EMU, during which inflation declined, interest rate spreads narrowed, and capital flowed to lower-income economies (Lane, 2006; Crespo Cuaresma, Ritzberger-Grünwald & Silgoner, 2008).

However, convergence at the national level does not automatically translate into convergence at the regional level. Some studies find that stability supports convergence mainly through channels that benefit broad national aggregates (lower inflation, increased trade), but these gains may be concentrated in regions already positioned to attract investment and exploit integration (Gennaioli et al., 2014).

More broadly, evidence suggests that stability is more likely to support convergence when:

- regional labor markets are flexible enough to adjust without persistent unemployment,
- fiscal stabilizers protect incomes during downturns,
- credit markets allocate capital efficiently across space,
- and cohesion policy improves the productive capacity of lagging regions (Becker, Egger & von Ehrlich, 2010; Barca et al., 2012).

4.1.2. When Stability Is Associated with Divergence

A second strand of the literature highlights that stability-oriented governance can generate divergence if the macroeconomic framework constrains countercyclical policy or amplifies asymmetric adjustment.

In the Eurozone, the absence of an exchange rate instrument implies that adjustment to negative shocks often occurs through unemployment and internal devaluation. Regions with weaker productive structures and lower competitiveness may therefore experience persistent losses during downturns, which can widen regional inequality even when national macro variables stabilize (Blanchard & Leigh, 2013; De Grauwe, 2018).

The Eurozone crisis provided strong evidence of this mechanism: fiscal consolidation and financial fragmentation were associated with prolonged recessions in several peripheral economies, leading to large and persistent increases in unemployment dispersion and regional divergence (Baldwin & Giavazzi, 2015; Brunnermeier, James & Landau, 2016).

4.2. Inflation, Inflation Volatility, and Territorial Inequality

Inflation volatility is frequently found to be associated with weaker long-term performance and higher inequality, but the regional dimension is often indirect. In Europe, inflation stability improved markedly in the run-up to EMU and during the ECB period, yet inflation differentials persisted across countries and interacted with housing markets, credit booms, and competitiveness.

4.2.1. Inflation Volatility and Divergence

Cross-country evidence suggests that inflation volatility reduces investment and long-term growth (Ramey & Ramey, 1995). When applied to the regional level, this implies that unstable inflation can disproportionately harm lagging regions, which tend to have:

- weaker financial markets,
- higher exposure to credit constraints,
- and less diversified economic structures.

Empirically, regional divergence is often linked not to inflation levels per se, but to the interaction between inflation, real interest rates, and capital flows. In the early EMU period, low

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nominal interest rates combined with higher inflation in some economies generated low real interest rates, stimulating credit booms and housing price inflation. These dynamics were spatially concentrated in metropolitan and coastal regions, contributing to territorial polarization (Lane, 2006; Lane, 2012).

4.2.2. Wage, Credit, and Housing Mechanisms

Three mechanisms dominate the empirical discussion:

(i) Wage-setting and competitiveness: Inflation differentials can translate into regional competitiveness gaps, particularly in tradable sectors. Regions specialized in manufacturing and exports may suffer more when inflation erodes relative unit labor cost competitiveness.

(ii) Credit allocation: Inflation and monetary conditions influence credit supply. When credit expands, it tends to concentrate in regions with stronger collateral values and higher expected returns—typically urban cores—thus reinforcing agglomeration.

(iii) Housing and wealth inequality: Asset-price inflation, especially in housing, is spatially uneven. Core regions experience stronger house price appreciation, which can increase wealth inequality across space and indirectly affect consumption and local public finance.

Although the literature often focuses on national aggregates, regional data increasingly confirm that the housing and credit channel is one of the strongest links between inflation-related stability and spatial inequality.

4.3. Growth, GDP Volatility, and Polarization

A robust empirical result across countries is that GDP volatility is negatively associated with long-run growth (Ramey & Ramey, 1995) and can increase inequality by discouraging investment and raising unemployment persistence.

4.3.1. Volatility and Widening Disparities

In the European regional context, GDP volatility tends to widen disparities because weaker regions are less able to smooth shocks. They often depend on a narrow set of sectors (tourism, construction, low-tech manufacturing), and they may have limited fiscal capacity at the local level.

Evidence from crisis periods suggests that volatility affects regions asymmetrically:

- core regions recover faster due to higher human capital, innovation, and connectivity,
- peripheral regions experience longer downturns, outmigration, and slower productivity growth.

This dynamic is consistent with cumulative causation theories and with empirical evidence on post-crisis divergence (Iammarino et al., 2019; Rodríguez-Pose, 2018).

4.3.2. The Role of Productive Structure and Specialization

Sectoral composition is repeatedly shown to be a key moderator. Regions specialized in tradable manufacturing may benefit from integration and export growth, while regions specialized in non-tradables (construction, local services) may experience stronger boom-bust cycles tied to credit and housing.

The Eurozone crisis revealed that regions tied to construction and real estate booms suffered disproportionately when financial conditions tightened. Similarly, COVID-19 disproportionately affected tourism-dependent regions, while knowledge-intensive metropolitan regions proved more resilient due to remote work feasibility and digital intensity.

4.4. National Unemployment and Regional Unemployment Dispersion

Unemployment is arguably the most direct channel through which macroeconomic instability translates into regional inequality.

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4.4.1. Crises and divergence in unemployment dispersion

The empirical evidence is clear that crises increase regional unemployment dispersion. During the Global Financial Crisis and especially during the Eurozone sovereign debt crisis, unemployment rates diverged strongly across countries and within countries, with some regions experiencing unemployment rates above 20–25% while others remained near full employment (Baldwin & Giavazzi, 2015).

This is consistent with the theory of asymmetric shocks in monetary unions (Mundell, 1961) and with evidence on slow regional adjustment (Blanchard & Katz, 1992).

4.4.2. Persistence and Hysteresis

A key finding is the persistence of unemployment disparities. Even after macroeconomic recovery, unemployment gaps remain elevated in many lagging regions. This is often attributed to:

- hysteresis effects (skill loss, discouragement),
- outmigration of young skilled workers,
- declining local investment and innovation,
- mismatch between labor supply and demand.

The European evidence aligns with the hysteresis hypothesis developed by Blanchard and Summers (1986) and with later work emphasizing long-term regional scarring effects.

Table 4. Key empirical studies: Macroeconomic stability → regional inequality.

Study	Period	Countries / area	Spatial level	Method	Key macro stability variable	Inequality outcome	Main result
Barro & Sala-i-Martin (1992)	1960s–1980s	Europe/US	Regions	Growth regressions	Growth volatility (indirect)	Regional convergence	Conditional convergence; stability supports convergence via investment
Crespo Cuaresma et al. (2008)	1990s–2000s	EU	Country + regional	Panel	Inflation, integration	GDP per capita dispersion	EU membership supports convergence but uneven across regions
Becker et al. (2010)	1994–2006	EU	NUTS2	DiD	Institutional stability (indirect)	Regional GDP growth	Cohesion funds improve outcomes; stronger in better-governed regions
Gennaioli et al. (2014)	1960–2010	Europe (plus others)	Regions	Panel FE	Macro volatility (country)	Regional income inequality	Large regional disparities persist; human capital crucial
Blanchard & Leigh (2013)	2008–2012	EU	Country	Panel	Fiscal consolidation	Growth & unemployment	Austerity associated with larger output losses; likely stronger regional divergence

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Lane (2012)	1999–2012	Eurozone	Country	Descriptive + panel	Spreads, financial stress	Divergence indicators	Financial fragmentation key driver of divergence
Iammarino et al. (2019)	2000s–2010s	Europe	NUTS2/3	Survey + evidence	Crisis episodes	Productivity & income gaps	Regional inequality increased; core regions more resilient
Rodríguez-Pose (2018)	2000s–2010s	Europe	Regions	Political economy	Persistent stagnation	Territorial inequality	Lagging regions drive political backlash
Blanchard & Katz (1992)	1970s–1980s	Benchmark (US)	Regions	VAR	Unemployment shocks	Unemployment dispersion	Adjustment slow; migration important (relevant benchmark for EU)
Brunnermeier et al. (2016)	1999–2015	Eurozone	Country	Institutional analysis	Monetary union constraints	Divergence patterns	EMU design amplifies asymmetric shocks

Note: Many studies are not explicitly "macro stability → regional inequality" causal papers. Instead, they identify mechanisms (volatility, fiscal consolidation, financial fragmentation) that plausibly link stability to regional divergence. A growing literature uses NUTS2/NUTS3 panel data and spatial econometrics to directly quantify these relationships.

Synthesis: Stylized Facts from the Empirical Literature

Across the literature, four stylized facts emerge:

5. **Macroeconomic stability is generally growth-enhancing**, but its convergence effects are conditional and often weaker at the regional level than at the national level.
6. **Volatility is consistently associated with widening regional disparities**, especially through investment and employment channels.
7. **Crises produce strong increases in unemployment dispersion**, and these gaps are persistent due to hysteresis and migration.
8. In the Eurozone, **financial fragmentation and constrained fiscal adjustment** are key factors linking macro instability to territorial divergence.

5. Empirical Evidence II: The Role of Macroeconomic Policies

This section reviews empirical evidence on how macroeconomic policies—fiscal policy, EU cohesion policy, and monetary policy—shape regional inequality in Europe. While Section 4 documented stylized facts linking macroeconomic stability and volatility to territorial disparities, the focus here is on policy instruments and their spatial transmission.

A key theme is that macroeconomic policies in Europe operate in an institutional setting where stabilization is partly centralized (monetary policy for Eurozone countries) and partly decentralized (national fiscal policy), while regional redistribution is supported by EU-level cohesion funds. This multi-layer governance structure implies that policy impacts are highly heterogeneous across space, depending on fiscal capacity, institutional quality, and regional exposure to credit, trade, and sectoral shocks (De Grauwe, 2018; Barca, McCann & Rodríguez-Pose, 2012).

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5.1. Fiscal Policy, Austerity, and Regional Divergence

5.1.1. Why Fiscal Consolidations May Have Asymmetric Regional Effects

The literature on fiscal policy in Europe emphasizes that consolidation episodes—particularly those implemented during recessions—can have large output and employment costs. The influential contribution of Blanchard and Leigh (2013) documented that official forecasts systematically underestimated fiscal multipliers in the post-2010 European consolidation period, suggesting that austerity had stronger contractionary effects than expected.

From a regional perspective, there are at least three reasons why fiscal consolidations can increase regional inequality:

9. **Public spending composition differs across regions.** Lagging regions often depend more on public employment, public investment, and social transfers. Cuts therefore translate into stronger local demand shocks.
10. **Regional fiscal multipliers are heterogeneous.** Multipliers tend to be larger in regions with higher unemployment, lower openness, and tighter credit constraints. This implies that spending cuts may have disproportionately negative effects in weaker regions.
11. **Limited adjustment mechanisms in EMU.** Without exchange rate adjustment, the burden of fiscal tightening is more likely to fall on employment and wages, which are spatially uneven.

5.1.2. Evidence on Regional Multipliers and Spatial Heterogeneity

Empirical evidence increasingly supports the view that fiscal multipliers vary substantially across regions. Using regional data, several studies find that multipliers are larger in depressed areas and in regions with high credit constraints, consistent with Keynesian and New Keynesian mechanisms (Nakamura & Steinsson, 2014; Chodorow-Reich, 2019). While much of this evidence originates in the US, European applications generally confirm the existence of spatial heterogeneity.

For Europe, the evidence suggests that consolidation policies in the 2010–2013 period contributed to territorial divergence, especially in countries where fiscal tightening coincided with financial fragmentation and high sovereign spreads (Lane, 2012; Brunnermeier, James & Landau, 2016). Regions with weaker labor markets and lower productivity experienced larger employment losses and slower recoveries, implying that austerity may have amplified existing spatial inequalities.

5.1.3. Fiscal Rules and Public Investment: Long-Run Regional Effects

Beyond short-run multipliers, fiscal rules can influence regional inequality through their impact on public investment. If fiscal frameworks constrain investment more than current spending, the long-run effect may be lower infrastructure accumulation and weaker human capital formation in lagging regions.

This mechanism is frequently highlighted in policy-oriented research on the Stability and Growth Pact (SGP) and the Fiscal Compact. While fiscal discipline can reduce sovereign risk and support stability, it may also reduce the capacity to implement place-based investment strategies (Buti & Carnot, 2013; De Grauwe, 2018).

5.2. Cohesion Policy and Territorial Stabilization

5.2.1. Cohesion Policy as Europe's Main Territorial Redistribution Tool

EU cohesion policy—implemented through the European Regional Development Fund (ERDF), the European Social Fund (ESF), and the Cohesion Fund—represents the largest explicit territorial redistribution mechanism in Europe. It targets less developed regions, supports infrastructure, innovation, SME competitiveness, and labor market inclusion.

From a macro-regional perspective, cohesion policy can affect inequality through:

- **long-run convergence** (raising productivity in lagging regions),

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- **shock absorption** (supporting investment when national budgets are constrained),
- and **institutional upgrading** (improving governance capacity).

However, cohesion policy differs from fiscal transfers in federations: it is mainly investment-oriented, often requires co-financing, and is not designed as an automatic stabilizer.

5.2.2. Evidence on Effectiveness: Average Effects and Conditionality

A large causal literature has evaluated cohesion policy using quasi-experimental methods. A key reference is Becker, Egger, and von Ehrlich (2010), who use a difference-in-differences framework and show that EU Structural Funds can raise regional growth. However, the magnitude and robustness of effects vary.

A central conclusion of the literature is that cohesion policy effects are **conditional**:

- stronger where governance quality is high,
- weaker where absorption capacity is limited,
- and dependent on the complementarity with national institutions (Barca et al., 2012).

This conditionality is consistent with broader evidence that institutions are a key determinant of regional development trajectories (Gennaioli et al., 2014).

5.2.3. Cohesion Policy as a Stabilizer During Crises

The role of cohesion policy as a short-run stabilizer is more ambiguous. During crises, co-financing requirements and administrative constraints may limit the ability of funds to act countercyclically. However, reforms during the Eurozone crisis and especially during COVID-19 introduced more flexibility in fund allocation.

The post-COVID NextGenerationEU (NGEU) package further strengthened EU-level investment capacity and may represent a shift toward a more explicit stabilization role, though its long-run regional distributional effects remain under evaluation.

5.3. Monetary Policy and Regional Inequality

5.3.1. Why Monetary Policy Has Heterogeneous Regional Effects

The ECB sets a single monetary policy for the Eurozone, but its transmission is spatially heterogeneous due to differences in:

- banking sector health,
- credit dependence of firms,
- sectoral specialization,
- housing market dynamics,
- and sovereign risk conditions.

The Eurozone crisis revealed that monetary policy transmission can break down through **financial fragmentation**, leading to different borrowing costs across countries and regions even under a common policy rate (Lane, 2012; Brunnermeier et al., 2016).

5.3.2. Quantitative Easing (QE), Spreads, and Territorial Outcomes

The ECB's unconventional monetary policies (LTRO, OMT announcement, QE/APP, PEPP) played a central role in stabilizing financial markets and reducing sovereign spreads. Several studies show that QE reduced fragmentation and improved credit conditions. Yet the spatial distribution of benefits may be uneven, as regions with stronger banking systems and higher collateral values can experience larger credit expansions.

This can affect regional inequality through:

- differential investment responses,
- housing price divergence,

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- and spatially uneven wealth effects.

5.3.3. The Spatial Credit Channel

The credit channel is particularly important for Europe, where SMEs play a major role in employment and where bank lending is the dominant source of external finance in many countries. Regions dominated by SMEs and bank-dependent sectors may be more exposed to monetary tightening or banking stress.

Evidence suggests that credit supply shocks during the Eurozone crisis had strong regional consequences, especially in peripheral economies. Regions facing sharper credit contractions experienced larger output losses and more persistent unemployment.

5.3.4. Implications for Non-Euro European Economies

Norway, Switzerland, and Iceland are outside EMU and retain independent monetary policy. However, they remain highly integrated with the EU through trade, finance, and capital flows. ECB policy and global financial cycles influence their interest rates, exchange rates, and housing markets. Therefore, while they provide an important comparison group for monetary sovereignty, they are not isolated from Eurozone financial conditions.

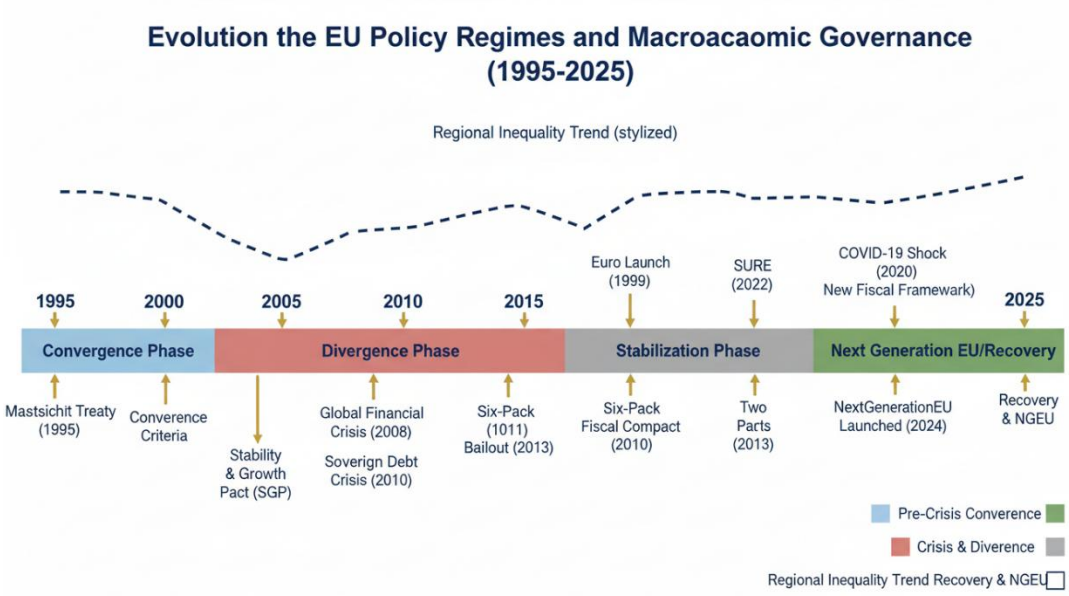

Figure 6. Timeline of EU policy regimes and macroeconomic governance.

Suggested structure for the figure (conceptual timeline):

- **1992–1998:** Maastricht convergence + preparation for EMU
- **1999–2007:** Early EMU + Stability and Growth Pact (SGP)
- **2008–2009:** Global Financial Crisis (GFC)
- **2010–2012:** Eurozone sovereign debt crisis + austerity + fragmentation
- **2011–2014:** Fiscal Compact, Six-Pack, Two-Pack, MIP, European Semester
- **2015–2019:** QE/APP period + partial recovery
- **2020:** COVID-19 + PEPP + SURE
- **2021–2023:** NextGenerationEU + energy crisis
- **2024–present:** Reform of EU fiscal rules (new governance framework)

Governance (1995–2025) offers a stylized timeline that overlays the major milestones in EU economic and fiscal governance with the long-term trajectory of regional inequality across NUTS2 regions (represented by the dashed U-shaped curve). The diagram clearly illustrates how shifts in EU

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policy frameworks have coincided with—and plausibly influenced—phases of convergence and divergence in territorial disparities.

The Convergence Phase (mid-1990s to mid-2000s, light blue background) corresponds to the implementation of the Maastricht Treaty (effective 1993), the convergence criteria for euro adoption, the launch of the single currency (1999/2002), and the early years of the Stability and Growth Pact (SGP, 1997). During this period, large-scale Structural and Cohesion Funds, nominal convergence (interest rates, inflation, deficits), and strong catch-up growth in peripheral and Eastern European regions drove a substantial reduction in regional GDP per capita gaps. The stylized inequality curve reaches its trough around 2005–2007, reflecting the perceived success of pre-crisis integration and enlargement dynamics.

The Divergence Phase (roughly 2008–late 2010s, red background) begins with the Global Financial Crisis (2008–09) and intensifies during the European sovereign debt crisis (2010–12). Key policy responses included the first SGP reform (2005), the Six-Pack legislation (2011), the Fiscal Compact and Two-Pack (2012–13), and successive bailout programs (Greece 2010, Ireland 2010, Portugal 2011, Spain 2012, Cyprus 2013). These measures emphasized fiscal consolidation, stricter surveillance, and internal devaluation in deficit countries, but they also amplified asymmetric shocks, prolonged recessions in southern Europe, and widened core-periphery divides. The inequality curve rises sharply and persistently, reaching levels comparable to or higher than the mid-1990s by the mid-2010s.

The Stabilization Phase (≈2020–2023/24, grey background) is triggered by the COVID-19 pandemic (2020 shock). The EU responded with an unprecedented policy pivot: temporary suspension of SGP rules, the creation of SURE (2020) for short-time work support, and the launch of NextGenerationEU (NGEU, €750 billion recovery instrument decided in 2020). These initiatives—financed through joint EU debt issuance—shifted emphasis toward counter-cyclical support, green/digital investment, and resilience. The stylized curve flattens in the early 2020s, signaling a halt to the previous divergence trend and the beginning of possible stabilization.

Finally, the Next Generation EU / Recovery Phase (2024–2025 onward, green hatched area) highlights the full activation of NGEU funds (disbursements peaking 2021–2026), the entry into force of the reformed EU fiscal framework (agreed 2023–2024), and the ongoing implementation of national recovery and resilience plans. These developments aim to promote structural transformation (green and digital transitions), strategic autonomy, and improved fiscal flexibility. The hatched green box at the right end of the timeline suggests an anticipated (or normative) downward turn in regional inequality, contingent on effective allocation of funds to lagging regions and positive spillovers from the twin transitions.

In summary, the figure reveals a strong temporal alignment between EU macroeconomic governance regimes and regional inequality dynamics: convergence-supportive policies and large transfers in the pre-crisis era narrowed disparities, while crisis-era fiscal austerity and asymmetric adjustment widened them. The post-2020 shift toward joint borrowing, investment-led recovery, and a more growth-oriented fiscal framework appears to create conditions for renewed convergence, although the diagram leaves the ultimate trajectory open-ended. This timeline provides a valuable interpretive lens for understanding the empirical evidence presented in Figures 2–4 and for evaluating the potential of current and future EU policies to reverse three decades of territorial polarization.

Table 5 surveys selected influential studies on fiscal policy, austerity measures, and their implications for economic outcomes, with particular relevance to regional inequality in the European context. The table spans a range of periods, geographic scopes, and methodologies, highlighting both aggregate (country-level) and regional evidence. Most early studies focus on national or OECD-wide effects, while more recent work increasingly exploits regional variation to identify causal impacts of fiscal shocks.

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Table 5. Studies on fiscal policy, austerity, and regional inequality.

Study	Period	Countries	Spatial level	Method	Key fiscal variable	Outcome	Main finding
Blanchard & Leigh (2013)	2008–2012	EU	Country	Panel	Consolidation size	Growth	Multipliers underestimated; austerity contractionary
Alesina & Perotti (1996)	1970s–1990s	OECD	Country	Panel	Fiscal instability	Investment	Instability harms investment (mechanism relevant for regions)
Fatás & Mihov (2003)	1960–1990s	OECD	Country	Panel	Fiscal discretion	Output volatility	Discretion increases volatility; stabilizers reduce it
Nakamura & Steinsson (2014)	2000s	Benchmark	Regional	IV	Government spending shocks	Employment	Large regional multipliers; heterogeneity likely in EU
Chodorow-Reich (2019)	2009–2012	Benchmark	Regional	IV	Transfers	Employment	Strong local multipliers in depressed areas
Lane (2012)	1999–2012	Eurozone	Country	Panel	Fiscal stress + spreads	Divergence	Crisis + consolidation linked to divergence
Baldwin & Giavazzi (2015)	2008–2015	Eurozone	Country	Synthesis	Austerity + design flaws	Divergence	EMU design amplifies divergence under consolidation

Note: European region-level causal estimates of austerity are fewer than US-style studies. A growing literature uses NUTS data to estimate spatial multipliers and the heterogeneous effects of consolidation, but results vary by country and identification strategy.

A first group of papers establishes foundational evidence on the contractionary effects of fiscal consolidation and the role of fiscal stabilizers. Blanchard & Leigh (2013), using panel data for EU countries during 2008–2012, show that fiscal multipliers were systematically underestimated ex ante, implying that austerity packages implemented during the sovereign debt crisis exerted stronger negative effects on growth than anticipated. Alesina & Perotti (1996) and Fatás & Mihov (2003), drawing on longer OECD samples, demonstrate that fiscal instability and discretionary policy increase output volatility and harm investment, mechanisms that are particularly relevant at the regional level where weaker economies are less able to absorb shocks. These findings suggest that pro-cyclical fiscal tightening during downturns can amplify territorial disparities by disproportionately damaging lagging regions.

A second set of studies provides more direct regional evidence, often using instrumental-variable strategies to isolate causal effects of fiscal shocks. Nakamura & Steinsson (2014) and Chodorow-Reich (2019), based on U.S. data, estimate large regional multipliers from government spending shocks and transfers, with especially strong effects in depressed areas. These results are frequently cited as benchmarks for Europe, implying that fiscal support (or its withdrawal) can generate significant local employment and output responses, with heterogeneity likely to be even greater in the EU due to limited labor mobility, heterogeneous banking systems, and asymmetric monetary transmission. European applications remain scarcer, but an emerging literature exploits NUTS2–3 data to estimate spatial fiscal multipliers and the heterogeneous regional effects of consolidation packages.

Finally, Lane (2012) and Baldwin & Giavazzi (2015) offer synthetic interpretations specific to the euro area. They argue that fiscal stress, rising sovereign spreads, and the design features of EMU (limited fiscal risk-sharing, no lender of last resort until late in the crisis) interacted with austerity to produce persistent divergence across member states and regions. The combination of internal

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devaluation requirements and front-loaded consolidation in high-debt countries exacerbated core-periphery gaps, a pattern consistent with the divergence phase documented in Figure 2.

Overall, Table 5 underscores a consensus that fiscal austerity—particularly when implemented during deep recessions—tends to be contractionary and inequality-increasing at the regional level, while counter-cyclical transfers and stabilizers exert stabilizing and convergence-supporting effects. The scarcity of clean causal estimates for Europe (compared with the U.S.) reflects identification challenges, but the available evidence—combined with the stylized facts in Figures 2–4—suggests that the design and timing of fiscal policy have played a central role in shaping the post-2008 reversal of regional convergence in the EU. Future research using NUTS-level data and quasi-experimental variation from NGEU disbursements could provide more precise estimates of spatial multipliers and the redistributive potential of the reformed fiscal framework.

Table 6 surveys a selection of influential studies evaluating the impact of EU Cohesion Policy—primarily through Structural and Cohesion Funds—on regional economic convergence and development outcomes. The table covers different time periods, spatial scales (from country-level to NUTS2/3), methodologies, and outcome variables, providing a representative overview of the empirical evidence on whether and under what conditions cohesion spending has contributed to reducing territorial disparities in Europe.

Table 6. Studies on cohesion policy and territorial convergence.

Study	Period	Countries	Spatial level	Method	Policy	Outcome	Main finding
Becker, Egger & von Ehrlich (2010)	1994–2006	EU	NUTS2	DiD	Structural Funds	GDP growth	Positive growth effect; stronger in treated regions
Barca, McCann & Rodríguez-Pose (2012)	2000s	EU	Regions	Policy review	Cohesion	Development outcomes	Place-based approach recommended
Gennaioli et al. (2014)	1960–2010	Europe + others	Regions	Panel FE	Institutions	Regional income	Institutions key; explains heterogeneity of cohesion effects
Iammarino et al. (2019)	2000s–2010s	Europe	NUTS2/3	Survey	Cohesion & shocks	Productivity gaps	Inequality increased; cohesion insufficient alone
Crespo Cuaresma et al. (2008)	1990s–2000s	EU	Country/regional	Panel	EU membership	Convergence	Membership supports convergence but uneven

Note: A large body of work evaluates structural funds using RDD designs around eligibility thresholds (Objective 1/Convergence). These studies typically find positive but heterogeneous effects, with governance and absorption capacity as key moderators.

A number of early and widely cited contributions document positive but heterogeneous growth effects of Structural Funds. Becker, Egger & von Ehrlich (2010) exploit the discontinuity in Objective 1 eligibility at the NUTS2 level over 1994–2006 and apply a difference-in-differences (DiD) design to estimate causal effects. Their findings indicate that eligible regions experienced significantly higher GDP per capita growth than counterfactual non-eligible regions, with the effect being stronger in poorer and more peripheral areas. This study is frequently used as a benchmark for the effectiveness of cohesion policy during the pre-crisis convergence phase. Similarly, Crespo Cuaresma et al. (2008), using panel data at both country and regional levels, show that EU membership and associated transfers supported conditional convergence, although the speed and extent of catch-up varied markedly across countries and regions.

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More recent work, however, paints a more nuanced—and often less optimistic—picture, especially for the post-2008 period. Iammarino et al. (2019), drawing on NUTS2/3 data and survey-based evidence from the 2000s–2010s, conclude that productivity gaps and territorial inequalities have actually widened in many parts of Europe despite substantial cohesion spending. They argue that cohesion policy alone has been insufficient to counteract structural forces such as globalization, technological polarization, and asymmetric crisis impacts. Gennaioli et al. (2014), covering a longer historical span (1960–2010), emphasize the central role of institutional quality in explaining cross-regional heterogeneity: regions with stronger governance, lower corruption, and better administrative capacity capture significantly larger growth dividends from EU transfers, while weak-institution regions show limited or no convergence benefits.

Barca, McCann & Rodríguez-Pose (2012) offer a policy-oriented synthesis rather than a purely econometric evaluation. Reviewing the evolution of cohesion policy in the 2000s, they advocate for a place-based approach that tailors interventions to specific regional contexts and assets rather than applying uniform convergence targets. This perspective has influenced subsequent programming periods (e.g., 2014–2020 and 2021–2027), which place greater emphasis on smart specialization, innovation, and endogenous growth potential.

Taken together, Table 6 reflects a broad consensus in the literature: EU Cohesion Policy has generated positive average effects on growth and convergence—particularly during the pre-crisis era and in regions with adequate absorption capacity and governance—but these effects are highly heterogeneous and often insufficient to offset structural divergence forces after 2008. A large body of more recent research (not fully listed here) employs regression discontinuity designs (RDD) around Objective 1/Convergence eligibility thresholds and consistently finds statistically significant but modest multipliers, with governance quality, administrative efficiency, co-financing capacity, and the ability to avoid rent-seeking emerging as critical moderators. These findings help explain why the aggregate convergence trend documented in Figure 2 stalled and reversed after the mid-2000s despite continued—and in some periods increased—cohesion spending, and they inform ongoing debates about how to strengthen place-based interventions under NextGenerationEU and the reformed 2021–2027 cohesion framework.

Table 7 reviews a selection of key studies examining the role of monetary policy—particularly within the European Monetary Union (EMU)—in shaping regional economic inequality across Europe. The table focuses on the euro area experience since the late 1990s, highlighting mechanisms such as financial fragmentation, asymmetric transmission, and the spatial effects of unconventional measures like quantitative easing (QE).

Early contributions emphasize how **EMU design and crisis dynamics** amplified territorial disparities. **Lane (2012)**, using country-level panel data from 1999–2012, identifies sovereign spreads and financial fragmentation as central drivers of divergence: during the sovereign debt crisis, rising risk premia and capital flight from peripheral countries severely constrained credit in southern regions, widening core-periphery gaps in output and employment. **Brunnermeier et al. (2016)** and **De Grauwe (2018)** provide institutional and synthetic analyses arguing that the absence of a true lender of last resort (until the OMT announcement in 2012), the lack of fiscal risk-sharing, and the "one-size-fits-all" nature of ECB policy created asymmetric adjustment pressures. Peripheral economies faced prolonged internal devaluation and credit crunches, while core regions benefited from safe-haven flows and lower borrowing costs, reinforcing polarization.

More recent work shifts attention to **regional heterogeneity** and the distributional consequences of monetary policy. **Iammarino et al. (2019)**, drawing on NUTS-level evidence from the 2000s–2010s, show that core metropolitan and technologically advanced regions proved far more resilient to crisis shocks than peripheral or industrial areas, partly because monetary easing (when it arrived) flowed disproportionately through spatially concentrated channels such as bank lending and housing markets. The emerging literature on QE (post-2015) uses panel and spatial econometric techniques at NUTS2/3 levels to estimate heterogeneous regional responses to ECB asset purchases. These studies generally find that QE boosted GDP and employment more strongly in regions with healthier

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banking systems, higher housing wealth, and greater exposure to corporate bond markets—channels that tend to be spatially clustered in core urban areas—thus often widening rather than narrowing territorial inequality unless accompanied by targeted credit policies or macroprudential measures to contain fragmentation.

Table 7. Studies on monetary policy and regional inequality.

Study	Period	Countries	Spatial level	Method	Monetary variable	Outcome	Main finding
Lane (2012)	1999–2012	Eurozone	Country	Panel	Spreads, fragmentation	Divergence	Fragmentation key driver of divergence
Brunnermeier et al. (2016)	1999–2015	Eurozone	Country	Institutional	EMU constraints	Divergence	EMU design amplifies asymmetry
De Grauwe (2018)	1999–2010s	Eurozone	Country	Synthesis	One-size policy	Adjustment	Asymmetric transmission likely
Iammarino et al. (2019)	2000s–2010s	Europe	NUTS	Survey	Crisis episodes	Inequality	Core regions more resilient
(Growing regional QE literature)	2015–2021	Eurozone	NUTS2/3	Panel / spatial	QE shocks	GDP, employment	Heterogeneous regional responses via credit and housing

Note: The empirical literature directly linking ECB QE to NUTS-level inequality is expanding rapidly. Many papers focus on credit supply, bank balance sheets, and housing markets, which are strongly spatially concentrated.

The note at the bottom underscores a key limitation: while aggregate and country-level evidence on monetary policy transmission is abundant, direct causal estimates linking ECB actions (especially QE) to NUTS-level inequality remain relatively scarce and rapidly evolving. Most papers concentrate on intermediate mechanisms—credit supply, bank balance sheets, housing prices, and collateral constraints—which exhibit strong geographic concentration and can amplify core-periphery divides when financial markets are segmented.

Taken together, Table 7 supports three broad conclusions that align with the broader empirical literature on macroeconomic drivers of regional inequality:

1. **Fiscal consolidation** during downturns tends to be divergence-inducing, particularly in financially fragile or highly indebted economies, as front-loaded austerity disproportionately harms lagging regions.
2. **Cohesion policy** delivers positive average convergence effects, but these are highly conditional on local governance quality, administrative capacity, and the ability to absorb and effectively deploy funds.
3. **Monetary policy** exerts heterogeneous regional effects: standard interest-rate policy and QE operate through spatially uneven channels (credit access, housing wealth, bank lending), which frequently reinforce polarization unless fragmentation is actively mitigated by ECB interventions (e.g., OMT, TLTROs) or complementary fiscal tools.

These insights help explain the post-2008 reversal of convergence documented in Figure 2 and the cross-country patterns in Figures 3–4, while underscoring the need for better coordination between monetary, fiscal, and cohesion policies to address territorial divides in the EMU.

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6. Methodological Approaches in the Literature

A defining feature of the literature on macroeconomic stability and regional inequality in Europe is its methodological diversity. This diversity is not accidental: the relationship between stability and territorial outcomes is intrinsically difficult to estimate because it is shaped by persistent structural heterogeneity, spatial spillovers, and endogeneity in policy responses. Regional inequality evolves slowly and is influenced by national macroeconomic regimes, yet macroeconomic stability itself is affected by the political economy consequences of territorial divergence. As a result, empirical strategies range from descriptive inequality accounting to dynamic panel models, quasi-experimental designs, and increasingly spatial econometric frameworks.

6.1. Measuring Regional Inequality: Limits and Comparability

6.1.1. What Is Being Measured: Welfare, Productivity, or Labor-Market Divergence?

Before discussing inequality indices, the literature first faces a conceptual choice: *which regional outcome should be used as the object of inequality?* Studies focusing on long-run convergence typically rely on regional **GDP per capita** or **labor productivity**, while those focusing on social cohesion prefer **unemployment**, **poverty risk**, or **disposable income**. This choice is non-trivial because European regions may display strong productivity convergence but weak social convergence, or the reverse. Moreover, GDP per capita can be distorted by commuting and headquarters effects, particularly in capital regions (Iammarino, Rodríguez-Pose & Storper, 2019). These measurement issues are especially relevant in Europe, where small countries with dominant capital regions (e.g., Ireland, Luxembourg) strongly influence cross-region dispersion.

6.1.2. Core Inequality Measures and Their Properties

The most common indices used in the literature are the Gini coefficient, Theil indices, and the coefficient of variation. Suppose yrty_{rt}yrt denotes the outcome (e.g., GDP per capita) in region rrr at time ttt, and y¯t\bar{y}_ty¯t the mean across regions. A standard dispersion measure is the **coefficient of variation**:

$$CV_t = \frac{\sqrt{\frac{1}{R}\sum_{r=1}^{R}(y_{rt} - \bar{y}_t)^2}}{\bar{y}_t}$$

The appeal of CV_t is that it is scale-free and easy to interpret. However, it is sensitive to extreme values, which is problematic in European data due to the capital-region bias. In contrast, entropy measures such as the Theil index are more useful for decomposition. A common form of the Theil index is:

$$T_t = \frac{1}{R}\sum_{r=1}^{R}\left(\frac{y_{rt}}{\bar{y}_t}\right)\ln\left(\frac{y_{rt}}{\bar{y}_t}\right)$$

The advantage of T_t is that it can be decomposed additively into between-country and within-country components, a property highly relevant for Europe where national borders remain important. The Gini coefficient remains popular due to its familiarity, but its decomposition properties are weaker in regional applications and its sensitivity pattern differs from Theil measures (Cowell, 2011).

6.1.3. Capital-Region Bias, Outliers, and Robustness Strategies

A persistent methodological issue in European regional inequality studies is that one or two regions often drive aggregate inequality trends. Capital regions concentrate high-value services, public administration, and headquarters, and may show GDP levels far above the national average. This creates a risk that measured "divergence" reflects metropolitan dominance rather than

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generalized territorial polarization. In response, many studies perform robustness checks such as excluding capital regions, winsorizing the top and bottom percentiles, or using median-based measures. Another approach is to weight regions by population or employment to approximate welfare-relevant inequality rather than simple unweighted dispersion.

6.1.4. NUTS2 vs NUTS3 Comparability and the MAUP Problem

Most EU studies use NUTS2 regions because they are the unit of cohesion policy targeting and have relatively stable data coverage. However, NUTS3 provides finer granularity and may better capture within-region divergence. The trade-off is that NUTS3 data suffer from boundary changes and missingness. This is related to the Modifiable Areal Unit Problem (MAUP), whereby measured inequality depends on the chosen spatial aggregation. In longitudinal studies, changes in NUTS definitions can mechanically create or remove inequality trends, which is why careful harmonization is essential. The literature often acknowledges this problem but does not always implement systematic corrections, creating comparability issues across papers.

6.2. Dominant Econometric Approaches

6.2.1. Baseline Panel Models: Fixed Effects and Random Effects

The starting point of many studies is a panel regression linking an inequality index to macroeconomic stability. Let IctI_{ct}Ict denote a measure of regional inequality within country ccc at time ttt, such as the dispersion of GDP per capita across NUTS2 regions. Let SctS_{ct}Sct denote a macroeconomic stability indicator such as inflation volatility, output volatility, or fiscal balance. A canonical specification is:

$$I_{ct} = \alpha_c + \gamma_t + \beta S_{ct} + \delta' X_{ct} + \varepsilon_{ct}$$

where α_c captures time-invariant country heterogeneity (institutions, geography, long-run development patterns) and γ_t captures common European shocks. This framework is attractive because it is transparent and easily implementable. However, it often fails to address the main methodological challenge: S_{ct} is rarely exogenous. Countries with stronger institutions tend to be both more stable and more equal territorially, creating a classic omitted-variable bias.

6.2.2. Regional-Level Panels: Within-Country Inequality and Direct Outcomes

An alternative approach is to use the regional outcome directly rather than a country-level inequality index. Let yrcty_{rct}yrct denote GDP per capita or unemployment in region rrr of country ccc. The empirical model becomes:

$$y_{rct} = \alpha_r + \gamma_t + \beta S_{ct} + \theta' Z_{rct} + \mu_{rct}$$

where α_r are region fixed effects. This strategy uses more variation and allows researchers to test heterogeneous exposure: for example, whether the effect of macro instability is stronger in regions with low diversification or high manufacturing intensity. The limitation is that macro stability is defined at the national level, so identification relies on cross-country variation. This creates a tension between the micro (regional) and macro (national) levels of analysis, which many papers treat implicitly rather than explicitly.

6.2.3. Dynamic Panels: Persistence and Path Dependence

Regional inequality and regional unemployment are persistent. This persistence reflects structural factors (human capital, infrastructure, institutions) and dynamic mechanisms such as hysteresis. A dynamic specification is:

$$I_{ct} = \rho I_{ct-1} + \beta S_{ct} + \delta' X_{ct} + \alpha_c + \gamma_t + \eta_{ct}$$

The inclusion of I_{ct} creates a Nickell bias in fixed-effects estimation when T is small. Many studies therefore apply **Arellano–Bond** difference GMM (Arellano & Bond, 1991) or **System GMM** (Blundell & Bond, 1998). In difference GMM, the model is first-differenced:

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$$\Delta I_{ct} = \rho \Delta I_{ct-1} + \beta \Delta S_{ct} + \delta' \Delta X_{ct} + \Delta \eta_{ct}$$

and lagged levels of I_{ct} are used as instruments for ΔI_{ct-1}. System GMM improves efficiency by adding the level equation and using lagged differences as instruments.

The methodological problem is that EU panels often have moderate T and relatively small N, and cross-sectional dependence is strong. This raises concerns about weak instruments, instrument proliferation, and overfitting. As a result, GMM estimates can be fragile and sensitive to instrument selection.

6.2.4. Cross-Sectional Dependence and Second-Generation Panel Methods

European regional and country data are exposed to common shocks such as global crises, oil price shocks, and ECB policy changes. When errors are correlated across countries, standard FE and GMM inference can be misleading. A growing literature therefore uses "second-generation" panel methods that allow for common factors, such as the Common Correlated Effects estimator (CCE). A stylized CCE specification can be written as:

$$I_{ct} = \alpha_c + \beta S_{ct} + \delta' X_{ct} + \phi_1 \overline{I_t} + \phi_2 \overline{S_t} + \phi_3 \overline{X_t} + \varepsilon_{ct}$$

where $\overline{I_t}$ and $\overline{S_t}$ represent cross-sectional averages that proxy unobserved common factors. These methods are still relatively rare in the stability–inequality literature, but they are particularly appropriate for Europe.

6.3. Quasi-Experimental and Policy Evaluation Designs

6.3.1. Difference-in-Differences and Event Studies

A key shift in the literature has been toward quasi-experimental evaluation of EU policies and crisis regimes. For example, studies assessing cohesion policy frequently exploit eligibility rules. A DiD model can be expressed as:

$$y_{rt} = \alpha_r + \gamma_t + \beta (Eligible_r \times Post_t) + \theta' X_{rt} + \varepsilon_{rt}$$

where $Eligible_r$ is a binary indicator for whether a region qualifies for structural funds (e.g., below 75% of EU average GDP per capita), and $Post_t$ indicates the post-treatment period. Event-study versions estimate dynamic coefficients:

$$y_{rt} = \alpha_r + \gamma_t + \sum_{k \neq -1} \beta_k \, (Eligible_r \times 1[t = k]) + \varepsilon_{rt}$$

Which allows testing pre-trends and timing.

However, the parallel trends assumption is challenging in Europe because treated regions are systematically poorer and may follow different growth paths. Moreover, spillovers across neighboring regions violate the Stable Unit Treatment Value Assumption (SUTVA), meaning that treatment effects may contaminate control groups.

6.3.2. Regression Discontinuity Designs (RDD)

RDD designs are common in cohesion policy evaluation. Regions just below and just above the eligibility threshold are compared. If grg_rgr denotes regional GDP relative to the EU average, and eligibility is triggered at $g_r < 0.75$, then the RDD framework can be written as:

$$y_{rt} = \alpha + \tau Eligible_r + f(g_r) + \varepsilon_{rt}$$

The strength of RDD is that it provides credible local identification. The limitation is external validity: it estimates effects for regions near the threshold, which may not generalize to very poor or very rich regions.

6.3.3. Synthetic Control Methods

Synthetic control approaches are mostly used for macro-level treatments such as Euro adoption or fiscal regime changes. The method constructs a weighted combination of control units that matches

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the treated unit before the intervention. Although powerful, its application at NUTS2 level is limited by the availability of comparable donor regions and by the presence of spillovers, which are likely in Europe due to integrated markets.

6.4. Spatial Econometrics: Why It Matters and How It Is Used

6.4.1. Spatial Dependence as a Structural Feature of Europe

Spatial dependence is central because regions interact through trade, migration, commuting, and production networks. Ignoring spatial dependence can bias estimates and inflate statistical significance. Most studies begin with Moran's I:

$$I = \frac{R}{S_0} \frac{\sum_r \sum_s w_{rs} (y_r - \bar{y})(y_s - \bar{y})}{\sum_r (y_r - \bar{y})^2}$$

where w_{rs} are weights capturing geographic proximity and $S_0 = \sum_r \sum_s w_{rs}$. A significant Moran's I suggests clustering and the need for spatial modeling.

6.4.2. The SAR Model: Spatial Dependence in Outcomes

The spatial autoregressive (SAR) model assumes that regional outcomes depend directly on neighboring outcomes:

$$y = \rho W y + X\beta + \varepsilon$$

In this model, ϱ\rhoϱ captures the strength of spatial interaction. SAR is appropriate when diffusion or imitation mechanisms are plausible, such as productivity spillovers, labor market linkages, or spatially correlated demand shocks.

6.4.3. The SEM Model: Spatial Dependence in Unobservables

The spatial error model assumes that spatial dependence operates through omitted factors:

$$y = X\beta + u, u = \lambda W u + \varepsilon$$

SEM is often interpreted as capturing spatially correlated shocks such as unobserved infrastructure, institutions, or policy environments that spill across borders.

6.4.4. The SDM Model: The Most General Framework

The spatial Durbin model includes spatial lags of both dependent and independent variables:

$$y = \rho W y + X\beta + WX\theta + \varepsilon$$

SDM is particularly useful for cohesion policy and macro shocks, because it allows the effect of a policy in one region to influence neighboring regions both through outcome spillovers and through covariate spillovers.

6.4.5. Direct and Indirect Effects (Spillover Decomposition)

A major methodological point is that in SAR/SDM models, coefficients are not marginal effects. The reduced form is:

$$y = (I - \rho W)^{-1}(X\beta + WX\theta) + (I - \rho W)^{-1}\varepsilon$$

The matrix $(I - \rho W)^{-1}$ generates feedback loops across space. Therefore, researchers must compute:

- **direct effects** (impact on the treated region),
- **indirect effects** (impact on neighbors),
- **total effects** (sum).

This is essential in Europe, where cross-border spillovers are strong.

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6.4.6. The Spatial Weights Matrix Problem

The choice of W is often arbitrary. Many papers use contiguity matrices (shared borders) or inverse-distance matrices. But economic interactions may follow commuting, trade, or financial networks rather than physical distance. Results can therefore be sensitive to W, and robustness checks using multiple matrices are a minimum standard (LeSage & Pace, 2009).

6.5. Identification and Causality: The Core Problems

6.5.1. Endogeneity and Reverse Causality

The strongest methodological challenge is that macroeconomic stability is endogenous. Regions with strong economic performance and low inequality may create political conditions that support stability-oriented policies. Conversely, persistent regional divergence can generate political conflict, weaken fiscal capacity, and reduce macro stability. Formally, if:

$$I_{ct} = \beta S_{ct} + \varepsilon_{ct}$$

But stability itself is determined by inequality:

$$S_{ct} = \pi I_{ct} + v_{ct}$$

Then OLS estimation of β is biased. This simultaneity is widely acknowledged but rarely fully resolved.

6.5.2. Omitted Variables and Structural Confounding

Even with FE, time-varying omitted variables remain. Institutional reforms, changes in labor market regulation, demographic transitions, and financial integration can affect both stability and inequality. This motivates strategies that exploit external shocks or discontinuities rather than relying purely on observational variation.

6.5.3. Policy Endogeneity

EU cohesion funds are targeted to poorer regions, fiscal consolidations are triggered by debt crises, and ECB policy responds to inflation and fragmentation. Therefore, policy variables are endogenous to economic conditions. This is a classic selection problem: treated regions are not randomly chosen.

6.6. Methodological Recommendations and Best Practices

6.6.1. Use Multi-Measure Inequality Reporting

Given sensitivity to outliers and index properties, studies should report at least:

- one dispersion measure (CV or SD),
- one entropy measure (Theil),
- and robustness excluding capital regions.

6.6.2. Combine Causal Inference with Spatial Dependence

A major frontier is to integrate spatial econometrics with causal designs. For example, a spatial DiD could be written as:

$$y_{rt} = \alpha_r + \gamma_t + \beta D_{rt} + \psi W D_{rt} + \varepsilon_{rt}$$

where D_{rt} is a treatment indicator (e.g., cohesion eligibility) and WD_{rt} captures neighboring exposure. This allows explicit estimation of spillovers, which is crucial for Europe.

6.6.3. Hierarchical (Multilevel) Modeling

Because regions are nested within countries, multilevel models can estimate how national macro regimes moderate regional dynamics. A two-level model could be expressed as:

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$$y_{rct} = \alpha_c + \alpha_r + \beta S_{ct} + \delta' Z_{rct} + \varepsilon_{rct}$$

and allow β to vary across countries:

$$\beta_c = \beta_0 + \beta_1 Inst_c + \nu_c$$

where $Inst_c$ is institutional quality. This captures the intuition that macro stability may matter more in countries with weak institutions or low fiscal capacity.

6.6.4. Plausible Instruments and Shock-Based Identification

The literature increasingly relies on exposure × shock instruments, such as:

- energy intensity × energy price shocks,
- sectoral composition × global demand shocks,
- bank exposure × ECB policy shocks.

These designs are promising because they exploit plausibly exogenous variation, but they require careful justification that exposure is predetermined.

6.6.5. Transparency and Replication

Given model sensitivity, surveys increasingly recommend:

- pre-analysis plans (rare in macro but feasible in policy evaluation),
- open code and data,
- systematic robustness tables.

Table 8 provides a concise overview of the main econometric and statistical methods employed in the empirical literature on regional inequality, convergence/divergence dynamics, and the effectiveness of EU policies (cohesion funds, fiscal/monetary frameworks). For each method, the table lists a typical research question, principal strengths, and key limitations, helping to contextualize the methodological choices behind the findings reviewed in Tables 5–7 and the patterns observed in Figures 2–4.

Table 8. Methods used in the literature (advantages and limitations).

Method	Typical research question	Main strengths	Key limitations
Inequality indices + trend analysis	Are regions diverging?	Simple, informative	No causality, sensitive to outliers
Panel FE/RE	Does stability correlate with inequality?	Controls for fixed heterogeneity	Endogeneity, no spillovers
Dynamic panels (AB / Sys-GMM)	Persistence and adjustment	Models path dependence	Weak instruments, fragile inference
CCE / factor panels	Common shocks	Handles cross-dependence	Still correlational
DiD / event study	Cohesion eligibility, crisis effects	Stronger causal claims	Parallel trends + spillovers
RDD	Threshold-based eligibility	Clean local identification	Local effect only
Synthetic control	Euro adoption, major reforms	Transparent counterfactual	Spillovers, donor limits
Spatial econometrics (SAR/SEM/SDM)	Spillovers and clustering	Models interdependence	Identification still difficult
Multilevel models	Nested region-country structure	Captures cross-level moderation	Complexity, data demands
Causal ML	Heterogeneous treatment effects	Flexibility	Requires identification strategy

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Descriptive approaches such as inequality indices + trend analysis (Gini, Theil, CV, etc.) remain the most straightforward and widely used tools for documenting whether regions are converging or diverging over time. Their main advantage lies in simplicity and interpretability, making them ideal for stylized facts and long-run visualization (as in Figure 2). However, they offer no causal inference and can be sensitive to outliers or measurement error in small samples.

Panel fixed- and random-effects models (Panel FE/RE) are commonly applied to examine correlations between macroeconomic stability, fiscal variables, or policy indicators and regional inequality while controlling for time-invariant unobserved heterogeneity (country or region fixed effects). They provide a robust way to handle persistent cross-sectional differences, but they remain correlational and typically ignore spatial spillovers or dynamic adjustment paths.

More advanced dynamic panel techniques (AB / System GMM) are used to model persistence, path dependence, and speed of adjustment in regional income or inequality series. These methods address endogeneity of lagged dependent variables and allow for partial persistence, which is crucial for understanding slow convergence or hysteresis after shocks. Their main drawbacks are potential weak instruments and sensitivity of results to specification choices.

Common Correlated Effects (CCE) / factor-augmented panels explicitly account for cross-sectional dependence driven by common shocks (e.g., global financial crisis, energy price surges, ECB policy shifts). They improve consistency in the presence of unobserved global or euro-area factors, yet inference remains correlational and does not fully resolve endogeneity.

Causal identification strategies become more prominent when evaluating policy impacts. Difference-in-Differences (DiD) / event studies exploit policy changes (e.g., cohesion eligibility shifts, crisis bailouts, NGEU disbursements) to estimate average treatment effects, offering stronger causal claims than pure correlations. Identification hinges on parallel-trends assumptions and can be contaminated by spillovers or anticipation effects. Regression Discontinuity Designs (RDD) exploit sharp eligibility thresholds (e.g., Objective 1 regions) for clean local average treatment effects around the cutoff, but results are highly local and may not generalize. Synthetic control methods construct transparent counterfactuals for major reforms (e.g., euro adoption, fiscal compact), though they are constrained by donor pool availability and vulnerable to spillovers.

Spatial econometric models (SAR, SEM, SDM) explicitly incorporate interdependence among regions through spatial lags, trade linkages, commuting, or knowledge spillovers, which is essential for understanding clustering and agglomeration forces. They provide richer insights into diffusion mechanisms but face ongoing identification challenges and can be computationally intensive.

Multilevel (hierarchical) models are increasingly used to capture nested structures (regions within countries within the EU), allowing researchers to model cross-level moderation (e.g., national institutions affecting regional responses to cohesion funds). They offer a natural framework for heterogeneity, but model complexity and high data requirements limit their use.

Finally, causal machine learning approaches (e.g., double/debiased ML, causal forests) are gaining traction for estimating heterogeneous treatment effects of policies across regions, offering flexibility in capturing non-linearities and interactions. Their power depends critically on a credible identification strategy (e.g., instruments, RDD, or quasi-experiments) and large datasets.

In summary, the literature employs a methodological progression from descriptive trend analysis and simple panel models toward more sophisticated causal and spatial techniques. Each method trades off between internal validity, generalizability, and the ability to handle spatial dependence or heterogeneity.

The choice often depends on the specific research question—descriptive documentation (indices + trends), correlation with controls (FE/RE), dynamic adjustment (GMM), policy impact (DiD/RDD/synthetic control), or interdependence (spatial/multilevel models)—and no single approach is universally superior. Combining multiple methods, as is increasingly common, enhances robustness and helps reconcile the heterogeneous findings on convergence, cohesion effectiveness, and the role of macroeconomic governance in shaping regional inequality in Europe.

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Table 9 summarizes the main identification strategies and instrumental-variable approaches employed in the empirical literature on regional inequality, convergence, and the effects of EU policies (cohesion funds, fiscal consolidation, monetary policy). Each row lists a strategy, a representative example from the reviewed studies, its primary strength, and the most significant threat to validity. These methods address the core challenges of endogeneity, reverse causality, and omitted variables when estimating causal impacts at the regional (NUTS2/3) level.

Table 9. Identification strategies and instruments used.

Strategy	Example in this literature	Strength	Main threat
Internal instruments (GMM)	Lagged inequality	Practical	Weak IV, proliferation
Threshold variation	Cohesion fund eligibility	Credible local causal effect	Local, not general
Shock × exposure	Energy shock × industry share	Plausibly exogenous	Exposure endogeneity
Monetary surprises	ECB surprise shocks	Strong for causality	Hard to map to regions
Narrative fiscal shocks	Policy-based consolidation	Better exogeneity	Data-intensive
Spatial instruments	Neighbors' shocks	Captures spillovers	Exclusion restrictions

Internal instruments (GMM) rely on lagged values of the dependent variable (e.g., lagged regional inequality or GDP per capita) as instruments within Arellano-Bond or System GMM estimators. This approach is practical and widely used in dynamic panel settings to model persistence and partial adjustment without requiring external instruments. Its main strength is convenience and the ability to handle fixed effects and lagged-dependent-variable bias. However, it suffers from weak-instrument problems (especially in short panels) and instrument proliferation, which can lead to overfitting and fragile inference.

Threshold variation exploits discontinuities in policy eligibility, most commonly the sharp cut-off for Objective 1 / Convergence regions in EU Cohesion Policy (e.g., regions with GDP per capita below 75% of the EU average). Studies such as Becker et al. (2010) use regression discontinuity or difference-in-differences around these thresholds to estimate local average treatment effects of Structural Funds. The strength is high internal validity and credible causal identification near the cutoff. The principal limitation is that effects are highly local and may not generalize to infra-marginal or non-eligible regions.

Shock × exposure interactions (triple differences or shift-share designs) instrument policy-relevant shocks using pre-determined regional exposure to them (e.g., energy price shocks interacted with pre-crisis industry/energy intensity shares, or trade shocks interacted with initial export specialization). This strategy is plausibly exogenous when exposure is fixed in the past and shocks are unanticipated. It is frequently applied to study asymmetric crisis impacts or the regional consequences of global/national disturbances. The main threat is that exposure itself may be endogenous (e.g., regions with high energy dependence may differ systematically in other ways).

Monetary surprises use high-frequency identification of ECB policy shocks (e.g., from interest-rate or forward-guidance surprises around Governing Council announcements) as instruments for monetary policy stance. These shocks are strong for establishing causality at the aggregate level and have been extended to regional outcomes via credit or housing channels. The strength lies in near-experimental variation and exogeneity. Mapping these surprises to regional effects remains difficult, however, due to heterogeneous transmission and limited granular data.

Narrative fiscal shocks rely on policy-based measures of fiscal consolidation or expansion (e.g., Romer & Romer-style narrative shocks or IMF/EC/ECB-identified austerity episodes). These are considered more exogenous than cyclical deficit changes because they are motivated by discretionary policy decisions rather than economic conditions. The approach improves exogeneity over simple

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deficit-to-GDP ratios. Its key limitation is data intensity and reliance on historical narrative reconstruction, which can be subjective or incomplete for regional disaggregation.

Spatial instruments (e.g., neighbors' shocks or spatially lagged policy variables) exploit geographic interdependence to instrument local outcomes while capturing spillovers (trade, commuting, knowledge diffusion). This strategy is particularly useful in spatial econometric models (SAR/SDM) and helps address omitted spatial factors. The main threat is violation of exclusion restrictions: neighbors' shocks may affect the focal region through channels other than the instrumented variable.

Overall, Table 9 highlights a methodological trade-off in the literature: internal/GMM approaches offer practicality but weaker exogeneity; threshold and shock-exposure designs deliver strong local causality but limited external validity; narrative and monetary-surprise methods improve exogeneity at aggregate levels but struggle with regional granularity; spatial instruments incorporate interdependence but face exclusion challenges. The most convincing studies combine multiple strategies (e.g., DiD around thresholds plus spatial controls) to enhance robustness, especially when assessing the heterogeneous regional impacts of cohesion policy, fiscal austerity, and monetary easing documented in earlier tables and figures. These identification choices directly shape the confidence one can place in claims about the drivers of the convergence–divergence pattern observed since the mid-1990s.

Figure 7 presents a taxonomic overview of the three principal spatial econometric models commonly used to analyze regional interdependence and spatial effects in the context of inequality, convergence, and policy impacts across European NUTS regions: the Spatial Autoregressive model (SAR), the Spatial Error model (SEM), and the Spatial Durbin model (SDM). The figure likely organizes these models hierarchically or in a decision-tree format, illustrating their nested relationships, key parameters, and the types of spatial dependence they capture (substantive vs. nuisance dependence).

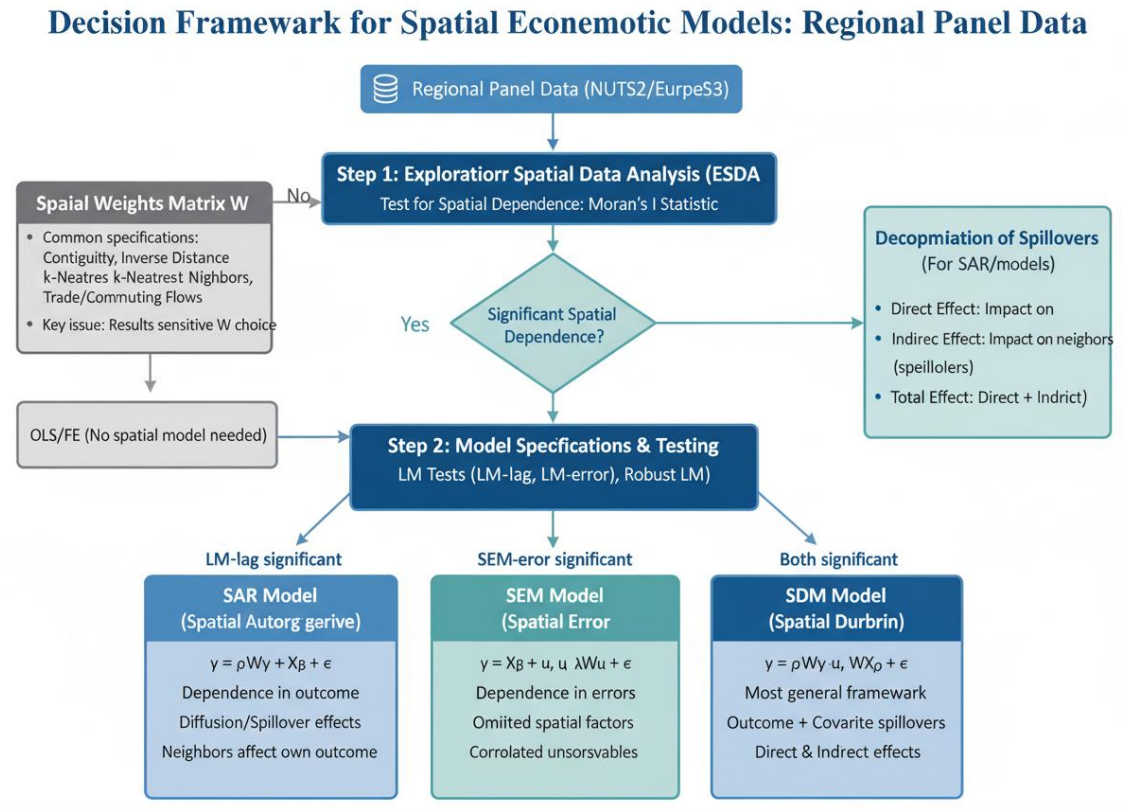

Figure 7. Spatial econometric model taxonomy (SAR/SEM/SDM).

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Core Taxonomy and Distinctions

1. Spatial Autoregressive Model (SAR)

Specification: $y = \varrho Wy + X\beta + \varepsilon$, where Wy is the spatially lagged dependent variable, ϱ is the spatial autoregressive coefficient (measures substantive spatial dependence), $X\beta$ are exogenous regressors, and ε is i.i.d. error.

What it captures: Direct spillover effects — the outcome in one region (y_i) depends explicitly on outcomes in neighboring regions (Wy).

Typical interpretation: $\varrho > 0$ implies positive spatial dependence (e.g., high-GDP regions benefit from proximity to other high-GDP regions via trade, knowledge spillovers, or commuting).

Use case in the literature: Modeling diffusion of growth, convergence clubs, or policy spillovers (e.g., cohesion funds in one region boosting neighbors).

Limitation: Assumes all spatial dependence operates through the dependent variable; ignores correlated omitted factors in the error term.

2. Spatial Error Model (SEM)

Specification: $y = X\beta + u$, with $u = \lambda Wu + \varepsilon$, where λ is the spatial autocorrelation coefficient in the error term, Wu captures spatially correlated unobserved shocks.

What it captures: Nuisance spatial dependence — omitted variables or common shocks (e.g., national policy, global crises) that are spatially correlated.

Typical interpretation: $\lambda > 0$ indicates that unobserved factors affecting one region also affect neighbors (e.g., shared infrastructure deficits or cross-border shocks).

Use case: When the primary interest is in β coefficients and spatial dependence is a nuisance (e.g., controlling for unobserved regional clusters when estimating the effect of fiscal consolidation).

Limitation: No direct substantive spillovers; assumes spatial effects are entirely in the disturbances.

3. Spatial Durbin Model (SDM)

Specification: $y = \varrho Wy + X\beta + WX\theta + \varepsilon$, where $WX\theta$ are spatially lagged explanatory variables (θ captures indirect effects from neighbors' covariates).

What it captures: Both substantive spillovers (ϱWy) and indirect effects from neighbors' characteristics ($WX\theta$), making it the most general of the three.

Typical interpretation: Decomposes total effects into direct (own-region), indirect (neighbors), and total impacts; $\theta \neq 0$ implies that a change in X in one region affects outcomes elsewhere beyond the autoregressive channel.

Use case: Preferred in many modern studies of regional inequality because it nests both SAR and SEM (as special cases: $\theta = 0 \rightarrow$ SAR; $\varrho = 0$ and $\theta = -\lambda\beta \rightarrow$ SEM via reparameterization). It is widely used to estimate spatial multipliers of cohesion policy, fiscal shocks, or monetary transmission.

Advantage: Avoids misspecification bias from omitting WX; allows testing for global vs. local spillovers.

Nested Relationships and Model Selection

The figure probably emphasizes that:

- SDM is the most flexible and general model.
- SAR is nested in SDM when $\theta = 0$.
- SEM is nested in SDM under the common-factor restriction ($\theta = -\lambda\beta$).
- Standard likelihood-ratio, Wald, or LM tests are used to discriminate between SAR, SEM, and SDM (or revert to non-spatial OLS if $\varrho = \theta = \lambda = 0$).

In practice, many recent papers start with SDM (or its extension, the spatial Durbin error model SDEM) and then test down to more restricted specifications. This taxonomy is particularly relevant for understanding Figures 2–4 and the policy channels in earlier tables: spatial dependence (spillovers, clustering) can either dampen or amplify divergence, depending on whether ϱ and θ are

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positive (agglomeration reinforcement) or negative (diffusion/convergence). The choice of model directly affects estimates of policy effectiveness (e.g., cohesion funds may have larger total effects once indirect spillovers are accounted for) and helps explain why simple non-spatial regressions often underestimate or overestimate regional impacts of EU-wide shocks and interventions.

7. Key Gaps in the Literature and Future Research Agenda

Despite a rapidly expanding literature on regional inequality and macroeconomic governance in Europe, several important gaps remain. These gaps are not only empirical (data and coverage) but also theoretical (lack of integrated frameworks) and methodological (weak identification, insufficient treatment of spatial dynamics). Importantly, recent European events—COVID-19, the launch of NextGenerationEU (NGEU), the energy price shock, and the re-emergence of inflation—have fundamentally altered the macroeconomic environment. Yet much of the academic evidence still relies on pre-2020 patterns. This section identifies the main limitations of existing research and proposes a structured future research agenda.

7.1. Empirical Gaps

7.1.1. Insufficient Coverage of EU-27 and the Post-2020 Period

A striking limitation of the literature is its reliance on data ending around 2018–2019. This is problematic because the European macroeconomic regime shifted sharply after 2020. The COVID-19 shock, followed by the adoption of NGEU, created an unprecedented mix of fiscal expansion, EU-level common borrowing, and industrial-policy-style investment planning. Subsequently, the energy crisis and inflation resurgence (2021–2023) reintroduced price instability and triggered monetary tightening, potentially reversing some convergence trends.

The absence of EU-27 + 2020–2025 evidence creates a major blind spot. The post-2020 period offers a unique natural experiment in which fiscal rules were temporarily suspended, EU-level transfers expanded, and monetary policy moved from ultra-loose to restrictive. Without incorporating these years, the literature risks drawing conclusions from an institutional environment that no longer exists.

7.1.2. Underutilization of NUTS3 and Functional Urban Areas

Most empirical work relies on NUTS2 regions, mainly because cohesion policy and Eurostat data are organized at this level. However, the strongest forms of spatial polarization in Europe occur at a finer scale: metropolitan cores vs peripheries, medium-sized cities vs rural areas, and border regions. NUTS2 units often contain both dynamic and lagging localities, masking within-region inequality.

A promising direction is therefore the systematic use of **NUTS3** or **functional urban areas (FUAs)**. Yet NUTS3 research remains limited due to boundary instability, missing time series, and computational burdens. These obstacles are real but increasingly solvable through harmonization techniques and improved geospatial datasets.

7.1.3. Lack of Comparability in Spatial Weights Matrices and Spillover Measures

Spatial econometric results are highly sensitive to the spatial weights matrix WWW. Many studies select WWW based on convenience (contiguity or inverse distance) rather than on economic theory. As a result, findings about spillovers are often not comparable across papers.

This is particularly problematic in Europe, where cross-border interactions depend strongly on:

- commuting flows,
- supply chain linkages,
- cross-border labor mobility,
- and financial integration.

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A major empirical gap is therefore the absence of standardized "benchmark" WWW matrices, or at least systematic reporting of robustness across alternative definitions. Without this, spillover estimates remain difficult to interpret and synthesize.

7.2. Theoretical Gaps

7.2.1. Lack of Integrated Macro–Regional Frameworks

A core theoretical gap is the scarcity of models that integrate:

- national macroeconomic stabilization,
- monetary union constraints,
- and regional heterogeneity in productivity, sectoral structure, and labor markets.

Many papers draw separately on growth theory (Solow convergence), New Economic Geography, or labor market adjustment models, but few offer a unified macro–regional framework. This fragmentation limits the ability of theory to guide empirical identification and policy interpretation.

An integrated framework would ideally link national macro variables to regional dynamics through explicit mechanisms such as:

$$y_{rt} = A_{rt}.(K_{rt}, H_{rt}) \; with \; A_{rt} = g(S_t, policy_t, spillovers_{rt})$$

where A_{rt} is region-specific productivity, and S_t represents macro stability conditions. Such a model would allow researchers to interpret whether stability affects inequality primarily through productivity divergence, labor market divergence, or capital allocation.

7.2.2. The Missing Role of Finance, Credit, and Housing Markets

Another major theoretical gap concerns the role of finance and housing. While the Eurozone crisis literature emphasizes financial fragmentation and sovereign spreads, fewer studies explicitly integrate housing and credit cycles into models of regional inequality.

This omission is increasingly important because:

- housing wealth is geographically concentrated,
- mortgage credit conditions differ across regions,
- asset price inflation can generate spatial wealth divergence.

A stylized mechanism could be expressed as:

$$P_{rt}^{house} = h(i_t, credit_{rt}, income_{rt}, amenities_r)$$

where iti_tit is the policy rate. If monetary policy lowers iti_tit, regions with stronger credit markets and higher amenities may experience larger increases in P_{rt}^{house}, reinforcing spatial inequality through wealth effects and access barriers.

7.3. Methodological Gaps

7.3.1. Weak Identification Remains the Norm

The majority of studies still rely on observational panel regressions, where macro stability indicators are treated as exogenous or "predetermined." This is rarely credible. Stability and inequality are jointly shaped by institutions, political economy, and structural change. If the true system is:

$$I_t = \beta S_t + \varepsilon_t \;\; S_t = \pi I_t + \nu_t$$

Then estimating β\betaβ by OLS produces biased results. The persistence of this approach in the literature implies that many conclusions remain correlational rather than causal.

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7.3.2. Underuse of Quasi-Experimental Variation in Macro–Regional Contexts

While cohesion policy evaluation often uses DiD/RDD designs, macroeconomic policy studies (fiscal rules, monetary tightening, stabilization packages) rarely exploit quasi-experimental variation at the regional level. This is partly because macro policies are national or supranational, and "treated vs control" units are harder to define.

Nevertheless, recent econometric advances provide opportunities. For example, high-frequency monetary shocks, exposure-based identification (shift-share), and narrative fiscal shocks can be combined with regional exposure measures to create quasi-experiments.

7.3.3. Insufficient Use of Dynamic Spatial Models

Regional inequality is persistent and spatially interdependent. Yet relatively few studies estimate models that are simultaneously:

- dynamic (include lags),
- spatial (include spillovers),
- and causal (based on credible identification).

A dynamic spatial Durbin model can be written as:

$$y_{rt} = \phi y_{rt-1} + \rho W y_{rt} + X_{rt}\beta + WX_{rt}\theta + \alpha_r + \gamma_t + \varepsilon_{rt}$$

This framework is demanding but conceptually well suited to European data. It allows researchers to distinguish persistence ϕ, spatial diffusion ρ, and covariate spillovers θ. The lack of such models represents a clear methodological gap.

7.4. Future Research Agenda: Concrete Proposals

The post-2020 European context creates a rare opportunity for new research. The combination of NGEU, energy shocks, industrial policy, and technological change provides quasi-experimental settings that were not available in earlier decades.

7.4.1. The Territorial Effects of NextGenerationEU (NGEU)

NGEU represents the most significant EU-level fiscal innovation since the creation of the euro. It provides large-scale investment funds allocated across member states, with national recovery plans shaping the regional distribution. This creates an opportunity to estimate whether EU-level investment reduces regional inequality or whether funds concentrate in already-capable regions with higher administrative capacity.

A plausible empirical approach is to combine NGEU allocations with pre-existing regional vulnerabilities. A shift-share design could be:

$$\Delta y_{rt} = \beta(NGEU_{ct} \times Exposure_r) + \gamma X_{rt} + \alpha_r + \gamma_t + \varepsilon_{rt}$$

where ExposurerExposure_rExposurer might represent digital infrastructure gaps, green transition needs, or sectoral composition. The key challenge is to ensure exposure is predetermined and not itself driven by recent shocks.

7.4.2. Energy Shock, Inflation, and Reindustrialization

The 2021–2023 energy shock hit Europe asymmetrically. Regions with energy-intensive industries (chemicals, metals, manufacturing) faced larger cost increases. This offers a natural quasi-experiment to study how inflation and energy price instability affect territorial inequality.

A typical design could interact energy intensity with energy price changes:

$$\Delta y_{rt} = \beta(EnergyIntensity_r \times \Delta EnergyPrice_t) + \alpha_r + \gamma_t + \varepsilon_{rt}$$

This approach can reveal whether energy shocks accelerate deindustrialization in peripheral regions or instead trigger reindustrialization policies that reduce inequality.

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7.4.3. The Green Transition and Regional Inequality

The European Green Deal and Fit-for-55 policies are likely to have strong regional distributional consequences. Regions dependent on fossil fuels, carbon-intensive manufacturing, or long-distance transport may experience adjustment costs, while regions specialized in renewables, clean-tech, and high-skill services may benefit.

The research gap is that most existing inequality studies do not incorporate climate policy variables explicitly. A future agenda should integrate:

- carbon intensity,
- renewable potential,
- and green investment allocations.

This is particularly important because climate transition policies can create a new core–periphery divide if not accompanied by compensatory investment.

7.4.4. Artificial Intelligence, Automation, and Spatial Polarization

AI and advanced automation may intensify spatial inequality by concentrating high-productivity gains in regions with:

- high human capital,
- dense innovation ecosystems,
- strong digital infrastructure.

This is consistent with earlier findings on skill-biased technological change, but AI may be more geographically concentrated due to network effects and the clustering of data, talent, and venture capital.

A key future direction is to link regional inequality to AI exposure indices, for example using occupational task data:

$$\Delta Productivityrt = \beta AIExposure_r + \theta DigitalInfrastructure_r + \alpha_r + \gamma_t + \varepsilon_{rt}$$

The main challenge is that AI adoption is endogenous. Researchers may need instruments based on historical occupational structures or exogenous technology diffusion patterns.

7.4.5. Eurozone vs Non-Eurozone Comparisons in the Post-2020 Regime

The inclusion of Norway, Switzerland, and Iceland is particularly valuable for future research because they provide a comparison group with monetary sovereignty. The post-2020 inflation shock and subsequent tightening cycle offers an opportunity to test whether independent monetary policy improves regional stabilization or whether financial openness makes these economies behave similarly to the Eurozone.

Future Research Agenda – Stability and Regional Inequality outlines a structured research gap and forward-looking agenda, emphasizing that most empirical evidence on regional inequality in Europe stops around 2019, leaving the post-2020 era (COVID-19 pandemic, NextGenerationEU recovery instrument, 2022–2023 energy crisis, and accelerated green/digital transitions) significantly understudied. The diagram identifies three interconnected pillars—emerging topics & shocks, methodological toolkit, and data opportunities—converging toward a set of high-priority key research questions.

Emerging topics and shocks highlight the most pressing new drivers of territorial dynamics:

- **NextGenerationEU (NGEU)** — the €750+ billion recovery and resilience facility (2021–2026) represents the largest joint EU debt-financed investment program in history, with substantial regional allocation aimed at green/digital transitions and resilience. Its spatially heterogeneous implementation and long-term convergence effects remain largely unevaluated.
- **Energy shocks** — the 2022 Russian invasion of Ukraine and subsequent energy price surge exposed differential regional vulnerabilities (industrial vs. service-oriented, import-dependent vs. renewable-rich areas), likely amplifying divergence in energy-intensive lagging regions.

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- **Green transition** — the European Green Deal and Fit for 55 package impose asymmetric adjustment costs across regions (e.g., coal-dependent vs. renewable-leading areas), creating new winners and losers that may reshape convergence patterns.
- **Artificial Intelligence (AI)** — rapid adoption of AI technologies risks widening productivity gaps between technologically advanced core regions and peripheral areas with lower digital readiness.

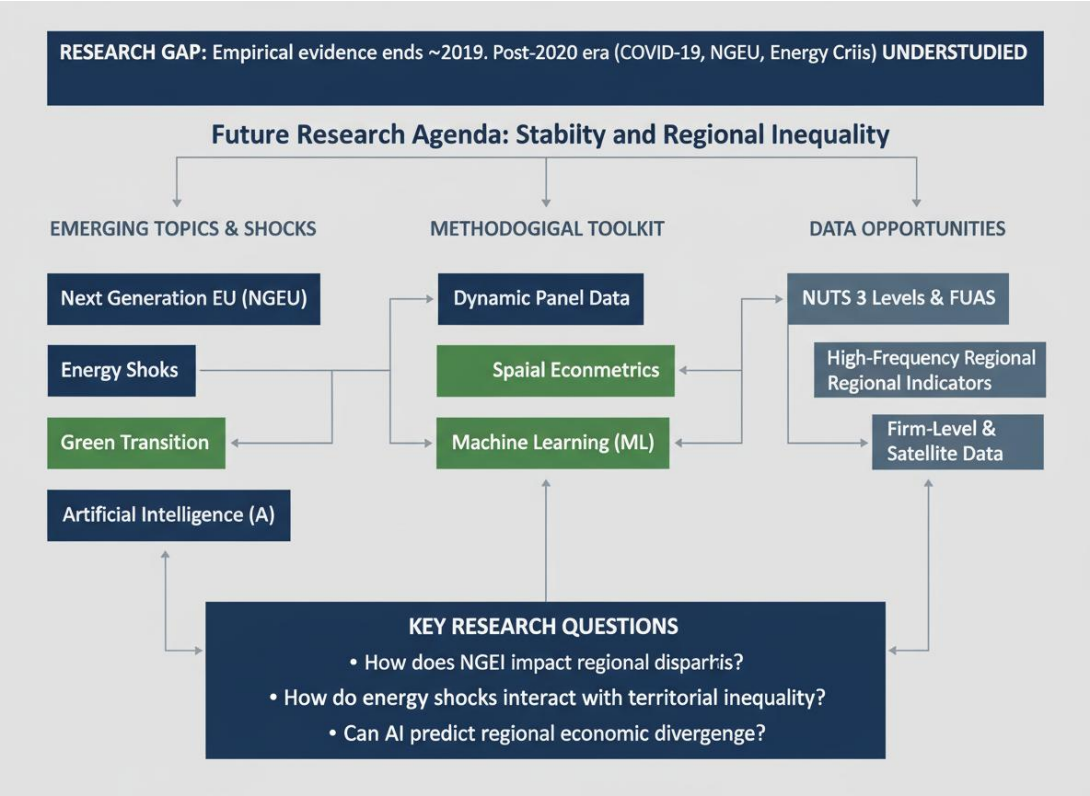

Figure 8. Research agenda map (topics × methods).

Methodological toolkit proposes advanced tools to address these questions:

- **Dynamic panel data models** (e.g., System GMM, panel VAR) to capture persistence, lagged effects, and adjustment paths after large shocks.
- **Spatial econometrics** (SAR, SEM, SDM, and extensions) to model spillovers, agglomeration forces, and cross-regional diffusion of NGEU funds or green investments.
- **Machine learning** (causal ML, causal forests, double/debiased ML, predictive modeling) for estimating heterogeneous treatment effects of NGEU disbursements, predicting divergence risk, and handling high-dimensional data from new sources.

Data opportunities emphasize the need to move beyond traditional NUTS2 aggregates:

- Finer spatial granularity (**NUTS3** and **Functional Urban Areas – FUAs**) to capture intra-regional variation and urban-rural divides.
- **High-frequency regional indicators** (monthly/quarterly GDP proxies, electricity consumption, mobility data) to track crisis responses in near real time.
- **Firm-level** and **satellite/remote-sensing data** (night lights, land use change, GHG emissions, renewable capacity) to measure granular impacts of green transition and AI adoption.

At the center, the diagram poses four **key research questions** that should guide future work:

1. How does NextGenerationEU impact territorial disparities (convergence vs. polarization)?
2. How do energy shocks interact with existing regional structures to affect territorial disparities?
3. Can AI-based predictive models reliably forecast regional economic divergence or resilience?

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4. (Implicit) What are the distributional consequences of the green/digital transitions across European regions?

Overall, the figure calls for an integrated research program that combines novel post-2020 shocks, finer and higher-frequency data, spatial and causal ML methods, and dynamic modeling to fill the post-2019 evidence gap. Addressing these questions is critical for assessing whether the reformed EU fiscal framework, NGEU, and Green Deal are succeeding in reversing the divergence trend observed since the mid-2010s (as documented in Figure 2) or inadvertently reinforcing territorial polarization in an era of overlapping crises and structural transformations.

8. Policy Implications for Europe

This survey highlights a central lesson from the European experience: **macroeconomic stability is a necessary condition for long-run convergence, but it is not sufficient to ensure territorial cohesion**. Even when inflation is low and public finances are sustainable at the national level, regional divergence can persist—or even intensify—through agglomeration forces, uneven policy transmission, and structural differences in productive capacity. For the EU-27 plus Norway, Switzerland, and Iceland, the policy challenge is therefore not to choose between stability and cohesion, but to design governance frameworks where stabilization tools and territorial development policies reinforce each other rather than operate at cross-purposes.

8.1. Macroeconomic Stabilisation versus Territorial Cohesion: A False Trade-Off

A common implicit assumption in European governance is that stable national macroeconomic conditions will eventually translate into regional convergence. The evidence reviewed in Sections 4–6 suggests that this relationship is highly conditional. Stability tends to support convergence when lagging regions have the capacity to absorb investment, when labor markets can adjust without permanent scarring, and when fiscal and financial channels do not systematically favor already-developed areas.

This can be expressed in a simple reduced-form relationship:

$$\Delta I_t = \beta S_t + \gamma Z_t + \varepsilon_t$$

where I_t is a measure of regional inequality (e.g., Theil index across NUTS2), S_t is macro stability (inflation volatility, output volatility, unemployment volatility), and Z_t captures structural conditions such as governance quality, financial depth, and sectoral composition. The key point is that β is not structurally constant: the same stability regime can reduce inequality in one institutional environment and increase it in another.

In practice, the EU's "stability-first" architecture—especially in the Euro Area—has sometimes generated territorial trade-offs because adjustment to shocks occurs through **regional unemployment and outmigration** rather than through exchange rates or centralized fiscal transfers. This implies that cohesion should not be treated as a secondary objective: it is part of the stability problem itself. Persistent regional divergence can undermine macroeconomic resilience by increasing asymmetric shock exposure, weakening aggregate demand, and fueling political opposition to integration.

8.2. Implications for Fiscal Governance: Reforming Rules while Protecting Territorial Investment

8.2.1. Why Fiscal Rules Matter for Regional Inequality

Fiscal governance is a core driver of territorial outcomes in Europe because subnational development depends heavily on public investment in infrastructure, human capital, and local public services. When fiscal rules are binding, governments often cut capital expenditure first, as it is politically easier than reducing pensions or wages. This creates a strong territorial dimension because public investment is typically more important for lagging regions, where private investment is weaker.

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A stylized decomposition of public expenditure illustrates the issue:

$$G_t = G_t^{current} + G_t^{investment}$$

Under fiscal consolidation, empirical evidence suggests that $G_t^{investment}$ tends to adjust more strongly than $G_t^{current}$. Since $G_t^{investment}$ is the component most likely to influence long-run regional productivity, this adjustment pattern can widen spatial inequality.

8.2.2. Policy Direction: Investment-Friendly Fiscal Frameworks

The implication is not that fiscal discipline should be abandoned. Instead, fiscal rules should be designed to reduce pro-cyclicality and protect growth-enhancing spending. A coherent European approach would include:

1. **Greater countercyclical flexibility**, allowing temporary deviations in downturns, especially when the shock is asymmetric.
2. **Protection of territorial investment**, potentially through an investment clause, multi-year expenditure planning, or EU-level co-financing that relaxes national constraints.
3. **A clearer distinction between "good" and "bad" deficits**, recognizing that productive investment can raise the long-run tax base.

This logic is consistent with an intertemporal budget constraint perspective. If productive investment increases future output:

$$Y_{t+k} = Y_t + \delta \cdot G_t^{investment}$$

Then debt sustainability depends not only on the level of debt but also on whether investment raises future revenues. Territorial investment is crucial here because the marginal return may be highest in regions with large infrastructure and human capital gaps.

8.2.3. EU-Level Stabilization and Risk Sharing

The survey also supports the case for a stronger EU-level stabilization capacity. National fiscal policy alone is often insufficient in the Euro Area because fiscal space differs widely across countries. Regions in high-debt countries may therefore experience stronger austerity pressures even when their local conditions warrant support.

A European stabilization mechanism (e.g., unemployment reinsurance, permanent central fiscal capacity, or a stronger common borrowing framework) could reduce the link between national fiscal stress and regional divergence. The post-2020 experience of NGEU demonstrates that EU-level borrowing and transfers can be politically feasible under crisis conditions, and it provides a template for institutional innovation.

8.3. Implications for Cohesion Policy: Targeting, Absorption Capacity, and Complementarity

8.3.1. Cohesion Policy Should be Treated as Macro-Relevant

EU cohesion policy is often presented as a long-run development instrument rather than a stabilization tool. However, this survey suggests cohesion policy is increasingly macro-relevant. In the presence of asymmetric shocks and limited fiscal space, cohesion funds can act as a quasi-stabilizer by sustaining investment in lagging regions during downturns.

The key is whether cohesion spending is countercyclical in practice. A simplified regional output relationship can be written as:

$$y_{rt} = \alpha_r + \gamma_t + \beta \cdot Cohesion_{rt} + u_{rt}$$

If cohesion funds are delayed by administrative bottlenecks or co-financing constraints, β\betaβ may be small in recessions—precisely when support is most needed.

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8.3.2. Improving Targeting and Avoiding "Capability Traps"

The literature suggests cohesion policy effectiveness depends strongly on governance quality. This creates a paradox: the regions that need support most may have weaker administrative capacity to absorb funds. As a result, cohesion policy can unintentionally reinforce divergence by flowing toward regions that are already capable of designing and implementing projects.

This is sometimes referred to as a "capability trap." A policy implication is that cohesion funding should allocate not only to projects but also to administrative capacity-building, including:

- project design support,
- procurement systems,
- monitoring and evaluation,
- anti-corruption safeguards,
- and local institutional strengthening.

8.3.3. Strengthening Complementarity with National Policies

Cohesion policy cannot substitute for national welfare systems, labor market institutions, or education policy. Its territorial impact depends on complementarity with domestic reforms and investment. This suggests that cohesion should be coordinated with:

- active labor market policies (ALMPs),
- vocational training and reskilling,
- housing and transport policy,
- and industrial strategy.

The post-2020 framework, where NGEU requires national recovery plans, may provide a model for more integrated policy design—though it also raises risks of centralization and uneven regional participation.

8.4. Implications for the ECB: Heterogeneous Transmission and Regional Asymmetries

8.4.1. The ECB Cannot Ignore Regional Heterogeneity

Although the ECB's mandate is defined at the Euro Area level, the survey shows that monetary policy transmits unevenly across regions. This heterogeneity arises from differences in:

- sectoral structure (industry vs services),
- credit access and banking structure,
- household balance sheets,
- housing markets,
- and labor market institutions.

A simple representation of heterogeneous monetary transmission can be written as:

$$\Delta y_{rt} = \theta r \cdot \Delta i_t + \varepsilon_{rt}$$

where Δi_t is the change in the policy rate and θr varies across regions. In regions with stronger mortgage markets and housing demand, the interest-rate channel may be stronger. In regions with weaker banking systems or higher credit constraints, monetary tightening may disproportionately reduce investment and employment.

8.4.2. Implications for ECB Communication and Analytical Frameworks

The ECB cannot target individual regions, and it should not attempt to replace cohesion policy. However, it can improve its policy effectiveness and legitimacy by explicitly integrating regional transmission into:

- macro projections,
- financial stability assessments,
- and policy communication.

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This is particularly important during periods of unconventional policy (QE) or rapid tightening. Asset purchase programs may compress spreads and support aggregate demand, but they can also contribute to spatial wealth inequality if asset price effects concentrate in metropolitan regions.

8.4.3. Financial Fragmentation and the Stability–Cohesion Link

A crucial Euro Area lesson is that financial fragmentation amplifies territorial divergence. When spreads rise and credit conditions tighten unevenly, peripheral regions suffer more, reinforcing a core–periphery pattern. This strengthens the argument that:

- maintaining smooth transmission across the Euro Area is not only a monetary objective,
- but also a cohesion-relevant objective.

In this sense, tools such as anti-fragmentation mechanisms (e.g., transmission protection instruments) have territorial implications, even if they are not framed that way.

Below is a draft structure for your Table 10. You can adjust wording depending on journal style.

Table 10. Policy instruments and expected territorial impacts.

Policy instrument	Main macro objective	Expected territorial impact	Risk of divergence	Key condition for success
Flexible fiscal rules / investment clause	Reduce pro-cyclicality, protect growth	Supports lagging regions via public investment	Medium	Credible monitoring, avoiding "creative accounting"
EU-level stabilization capacity (reinsurance, central budget)	Risk sharing, shock absorption	Reduces asymmetric shock persistence	Low	Political feasibility + rule-based design
Cohesion policy (ERDF, ESF+, CF)	Long-run convergence	Reduces disparities if well targeted	Medium	Governance quality + absorption capacity
NGEU-type investment programs	Recovery + structural transformation	Potentially strong convergence effect	High	Regional participation + implementation speed
Active labor market policies + training	Employment stabilization	Limits regional hysteresis	Low	Coordination with local labor markets
Housing supply + infrastructure	Reduce spatial barriers	Mitigates metropolitan polarization	Medium	Local planning capacity
ECB conventional policy	Price stability	Mixed (heterogeneous transmission)	Medium–High	Financial integration + banking stability
ECB anti-fragmentation tools	Smooth transmission	Reduces core–periphery divergence	Low–Medium	Credibility + conditionality design

The table evaluates a range of EU-level and national policy instruments in terms of their primary macroeconomic objectives, expected effects on territorial (regional) inequality, the associated risk of exacerbating divergence, and the critical conditions required for success. It reflects the post-2020 policy landscape, including the reformed fiscal framework, NextGenerationEU (NGEU), and ongoing efforts to address asymmetric shocks and structural transitions.

Flexible fiscal rules / investment clause (e.g., the 2024 EU fiscal framework reform allowing temporary deviations for public investment in green/digital priorities) aim to reduce pro-cyclicality and protect growth during downturns. By enabling higher investment in lagging regions, they support convergence through public-capital formation. The risk of divergence remains medium,

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mainly if rules are gamed via "creative accounting" or if core countries exploit flexibility more effectively. Success hinges on credible, transparent monitoring and enforcement mechanisms to prevent misuse.

EU-level stabilization capacity (e.g., reinsurance of national unemployment schemes like SURE, or proposals for a central fiscal capacity) seeks to share risks and absorb asymmetric shocks. This instrument has the lowest expected risk of divergence because it directly mitigates persistent unemployment and output gaps in crisis-hit regions. Political feasibility and a rule-based, non-permanent design remain the principal barriers to implementation, as permanent transfers face resistance from net contributors.

Cohesion policy (ERDF, ESF+, Cohesion Fund) retains its traditional long-run convergence objective through targeted investment in lagging regions. While well-designed programs reduce disparities, the medium risk of divergence persists if funds are poorly allocated or captured by local elites. Governance quality (low corruption, administrative efficiency) and absorption capacity (ability to co-finance and implement projects) are decisive moderators of effectiveness.

NGEU-type investment programs (large-scale, debt-financed recovery and resilience facilities) pursue recovery and structural transformation (green/digital). They hold potentially strong convergence potential if resources flow disproportionately to structurally weak regions. However, the high risk of divergence arises from uneven implementation speed, rent-seeking, or concentration of high-value projects in core areas. Regional participation in plan design and rapid, transparent execution are essential prerequisites for equitable outcomes.

Active labor market policies + training focus on employment stabilization and skill upgrading to limit regional hysteresis after shocks. Their low divergence risk stems from direct targeting of unemployed or low-skill workers in peripheral regions. Success depends on strong coordination with local labor-market needs, employer engagement, and alignment with smart-specialization strategies.

Housing supply + infrastructure policies aim to reduce spatial barriers (commuting costs, housing shortages) that reinforce metropolitan polarization. By improving connectivity and affordability, they mitigate core-periphery divides (medium divergence risk). Local planning capacity and avoidance of NIMBYism are critical for effective delivery.

ECB conventional policy (interest-rate setting) prioritizes price stability but produces mixed territorial impacts due to heterogeneous transmission (credit, housing, sectoral channels). The medium-to-high divergence risk reflects stronger contractionary effects in manufacturing-heavy or credit-constrained regions. Greater financial integration and banking-sector resilience can moderate uneven outcomes.

ECB anti-fragmentation tools (e.g., Transmission Protection Instrument – TPI) seek to smooth monetary-policy transmission and prevent unwarranted sovereign-spread widening. By containing core–periphery financial divergence, they carry low-to-medium divergence risk. Credibility, clear conditionality, and avoidance of moral hazard are key to maintaining effectiveness without undermining fiscal discipline.

Overall, the table illustrates a trade-off: instruments with strong stabilization or risk-sharing features (EU-level capacity, anti-fragmentation tools, active labor policies) tend to exhibit the lowest divergence risks, while large-scale investment programs (NGEU-type, cohesion) offer the highest potential convergence benefits but also the highest risks if governance, targeting, and implementation fall short. The success conditions—credible enforcement, absorption capacity, political feasibility, regional involvement—underscore that institutional design and execution quality are as important as the instruments themselves in determining whether post-2020 EU policies reverse the divergence trend documented since the mid-2010s.

9. Conclusions

This survey has examined the complex interplay between macroeconomic stability and regional inequality in Europe, with a focus on the EU-27 countries plus Norway, Switzerland, and Iceland. The evidence presented throughout highlights a central paradox: while national macroeconomic

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stability—manifested through low inflation, manageable public debt, and relatively stable growth—is generally associated with overall economic resilience, it does not automatically translate into territorial convergence. Persistent disparities across regions, especially between metropolitan cores and peripheral or rural areas, remain a defining feature of the European economic landscape.

9.1. Summary of Main Messages

Three broad lessons emerge from the survey. First, macroeconomic stability is **necessary but not sufficient** for regional convergence. Stability reduces aggregate volatility and may indirectly support lagging regions, but its impact is conditional on structural characteristics such as sectoral diversification, human capital, and institutional capacity. Second, the effectiveness of fiscal, cohesion, and monetary policies in mitigating regional disparities depends critically on **heterogeneity across regions**. Fiscal consolidations, monetary tightening, or poorly targeted investment programs often have asymmetric effects that can exacerbate divergence. Third, spatial spillovers and persistence matter: regions do not evolve in isolation, and standard national-level metrics mask significant within-country heterogeneity. Dynamic spatial effects, hysteresis, and feedback loops between regions underscore the need to model regional outcomes explicitly rather than infer them solely from aggregate data.

9.2. Contributions of the Survey

The survey makes several contributions to the literature. First, it provides a **comprehensive integration of theoretical and empirical evidence**, linking classical convergence models, New Economic Geography, and cumulative causation with the latest panel, quasi-experimental, and spatial econometric studies. Second, it emphasizes **the multi-level policy dimension**, showing how national and EU-level interventions—fiscal rules, cohesion policy, NGEU programs, and ECB monetary policy—interact with regional dynamics. Third, it highlights **recent empirical gaps**, including the post-2020 period characterized by COVID-19, energy shocks, and the green and digital transition, and the potential of NUTS3 or functional urban area data to better capture micro-spatial heterogeneity. Finally, the survey clarifies **methodological challenges and best practices**, ranging from causal identification and dynamic spatial modeling to the use of multi-index measures of inequality.

9.3. Limitations

Despite its contributions, the survey faces several limitations. The rapid evolution of European macroeconomic policy and the shocks of 2020–2025 mean that some empirical conclusions are provisional; long-term outcomes of NGEU and green-transition investments remain uncertain. Data limitations also persist, especially at finer spatial scales (NUTS3 or functional urban areas) and for new indicators such as AI exposure, regional digital infrastructure, or climate-adjusted investment. Moreover, while the survey emphasizes spatial and dynamic modeling, many existing studies still rely on correlational methods, and even advanced identification strategies face challenges of spillovers, endogeneity, and measurement error. Finally, the diversity of institutional arrangements across EU-27 and neighboring non-EU countries introduces additional complexity: lessons from one set of regions may not generalize straightforwardly to others.

9.4. Toward a "Place-Based" Macroeconomics in Europe

The overarching conclusion is that Europe needs a **macro-economic strategy explicitly aware of place**. A "place-based" approach recognizes that macro-stability objectives and regional development are intertwined: national-level stabilization is insufficient if lagging regions remain disconnected from growth, and monetary and fiscal policy must be designed to account for spatial heterogeneity. In practice, this implies:

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1. **Fiscal frameworks** that protect long-term regional investment, while maintaining overall debt sustainability.
2. **Cohesion and recovery programs** that are flexible, counter-cyclical, and designed to strengthen administrative and absorptive capacity in lagging regions.
3. **Monetary policy and financial regulation** that recognize heterogeneous transmission, prevent fragmentation, and support broad-based access to credit and investment.
4. **Forward-looking policy design** that integrates emerging shocks—energy transition, digitalization, and AI—into the spatial analysis of macroeconomic outcomes.

Formally, a "place-based" macroeconomic framework can be represented as:

$$\Delta yrt = f(S_t, G_t^{invest}, Cohesion_{rt}, Policy_{rt}, Spillovers_s) + \varepsilon_{rt}$$

where regional outcomes Δyrt depend jointly on national stability S_t, investment G_t^{invest}, targeted EU and national policies, and spatial spillovers. Such a framework bridges macroeconomic theory, regional development, and policy design.

In sum, Europe's experience suggests that **stability without attention to place risks divergence**, while **place-aware stabilization can support both economic resilience and cohesion**. Future research, combining finer spatial data, causal identification, and dynamic spatial modeling, will be essential to inform policies that truly integrate macroeconomic and territorial objectives.

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