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Economic Resilience to Inflationary and Geopolitical Shocks in the Euro Area: A Comparative Macroeconomic Analysis

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Abstract

This paper provides a comparative, descriptive assessment of macroeconomic adjustment dynamics within the euro area in response to the inflationary and crisis-related disturbances of the 2015Q1–2024Q4 period, with particular attention to the COVID-19 pandemic and the geopolitical shock associated with the Russia–Ukraine conflict. Using a Vector Error Correction Model (VECM) framework estimated separately for the euro-area aggregate and four representative core and peripheral economies (Germany, France, Spain, and Greece), the analysis characterizes long-run equilibrium relationships and short-run adjustment dynamics among output, inflation, public debt, and unemployment. Rather than identifying structurally causal transmission, the study interprets the estimated cointegration structures, error-correction speeds, and impulse-response patterns as reduced-form indicators of how differently national systems absorb common disturbances. The comparative evidence points to substantial heterogeneity: core economies display comparatively more contained and coordinated adjustment, whereas peripheral economies exhibit stronger fiscal sensitivity, more persistent labor-market adjustment, and greater macroeconomic interdependence. Read together, these patterns suggest that resilience within the monetary union is better understood not solely as equilibrium restoration, but as the persistence, coordination, and stability of the broader adjustment process—and that asymmetric adjustment structures persist despite a common monetary framework.

Keywords: economic resilience; euro area; Vector Error Correction Model (VECM); inflationary shocks; macroeconomic adjustment

1. Introduction

In recent years, the euro area has faced major macroeconomic disturbances, including the COVID-19 pandemic and the geopolitical and inflationary pressures associated with the Russia–Ukraine conflict. These events have renewed academic and policy interest in the concept of economic resilience, particularly regarding the capacity of economies to absorb external shocks, maintain macroeconomic stability, and restore equilibrium following periods of severe disruption. Within the context of a monetary union characterized by substantial structural heterogeneity, resilience has become increasingly relevant for understanding why member states respond differently to common macroeconomic disturbances.

Despite operating under a common monetary framework, member states displayed heterogeneous responses in terms of output stabilization, labor-market adjustment, fiscal deterioration, and inflation persistence. These developments renewed interest in the concept of economic resilience, particularly regarding the extent to which macroeconomic



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systems are able to absorb external disturbances and restore equilibrium following periods of severe instability.

Despite this growing interest, the existing literature remains fragmented across three largely separate strands. A first strand conceptualizes and measures resilience primarily through composite indices or regional case studies (e.g., [Briguglio et al., 2006](#); [Martin & Sunley, 2015](#); [Ringwood et al., 2019](#)), offering rich conceptual typologies but limited integration with the dynamic time-series behavior of macroeconomic systems. A second strand examines how economies respond to exogenous and crisis-related shocks (e.g., [Doran & Fingleton, 2014](#); [Czeczeli et al., 2020](#); [Dzigbede et al., 2023](#)), yet typically focuses on single episodes or cross-sectional comparisons rather than on the joint long-run and short-run adjustment dynamics through which shocks are absorbed. A third, more policy-oriented strand analyzes euro-area heterogeneity and the institutional response to recent crises, particularly the Recovery and Resilience Facility ([Mazzucato et al., 2023](#); [Michels et al., 2025](#)), without providing a consistent econometric characterization of differential adjustment across member states. As a result, there is limited evidence that systematically positions core and peripheral euro-area economies within a single, comparable dynamic framework linking long-run equilibrium relationships, short-run error-correction behavior, and impulse-response persistence over a period encompassing both the COVID-19 pandemic and the Russia–Ukraine conflict. The present study addresses this gap. Recent contributions have begun to address specific facets of these dynamics—for instance, the amplification of euro-area inflation by geopolitical and energy-price shocks ([Marangoz, 2025](#)), the role of economic-policy uncertainty as the predominant inflationary force in the euro area ([Tedeschi, 2026](#)), and the disproportionate burden of the Russia–Ukraine war on member states closer to the conflict ([Capoani & Martini, 2026](#))—yet a unified comparative assessment of core–periphery adjustment remains lacking.

This paper contributes to the literature in several ways. First, it provides an updated comparative assessment of macroeconomic resilience within the euro area using recent data that encompass both the COVID-19 pandemic and the Russia–Ukraine conflict. Second, it examines resilience through a unified Vector Error Correction framework that explicitly links long-run equilibrium relationships, short-run adjustment dynamics, and impulse-response behavior to broader macroeconomic stabilization mechanisms. Third, by comparing core and peripheral euro-area economies within a consistent econometric structure, the analysis highlights the presence of heterogeneous adjustment regimes and asymmetric transmission dynamics, providing empirical evidence on the differing stabilization capacities that characterize member states within the monetary union.

The structure of the paper is as follows: the Section 2 presents the existing literature on economic resilience, followed by the Section 3. After that, the results are discussed, and finally, the conclusions are presented.

2. Literature Review

2.1. Definition of Resilience

Resilience is most often invoked in relation to disruptive events—crises or disasters—that interrupt the normal functioning of a system. Yet the concept resists a single definition, and the definitional choice is far from neutral: it determines what is subsequently measured. Two emphases can be distinguished. A first, recovery-oriented view treats resilience as the capacity to return to a prior equilibrium: [Briguglio et al. \(2006\)](#), for instance, frame it as the ability to recover and adapt under shocks, and operationalize it through a composite index of macroeconomic stability and market efficiency.

A second, broader view shifts attention from recovery to absorption and prevention: [Bakhtiari and Sajjadih \(2018\)](#), analyzing resilience at both micro and macro levels, define

it as the ability to endure a shock, absorb its effects, and, where possible, forestall future disruptions. As Modica and Reggiani (2015) observe, these divergences are not accidental but follow from the analytical framework and level of analysis adopted. This plurality is consequential: whether resilience is understood as speed of return or as capacity to absorb determines the empirical strategy through which it can be assessed—the issue taken up next.

2.2. Measuring Resilience

Because no consensus definition exists, measurement strategies diverge along the same conceptual fault lines. The dominant approach is index-based, combining variables selected from theory or prior literature and weighted through techniques such as principal component, cluster, or factor analysis. The transparency of this approach is also its limitation: the weighting embeds the analyst's prior conceptual choice, and the resulting measure is typically static and aggregative. Wang and Wei (2021) underline a related difficulty—because resilience is highly context-specific, the indicators appropriate to one type of shock need not transfer to another, so that a system's apparent stability without structural change is informative only relative to the disturbance considered.

Ringwood et al. (2019) further show that the choice of variables—GDP, employment, and income, or regional features such as economic diversity and local networks—itself encodes which dimension of resilience is being captured. Taken together, these contributions reveal a common gap: index-based measures characterize cross-sectional differences in resilience capacity but say little about the dynamic process through which shocks are actually absorbed over time. This motivates a complementary, time-series perspective.

2.3. Dimensions of Economic Resilience

A more structured account treats resilience as multidimensional rather than as a single trait. Martin and Sunley (2015) provide the typology that organizes much of this literature, distinguishing engineering resilience (the speed of return to a pre-shock equilibrium), ecological resilience (the capacity to absorb shocks without shifting to a qualitatively different state), and adaptive or transformative resilience (the longer-term reconfiguration of a system in response to structural change). Rose (2007) complements this by framing resilience as a cost-reducing mechanism, foregrounding the minimization of direct and indirect losses and thereby linking the concept to preparedness and policy. At the institutional level, the European Union's Recovery and Resilience Facility and the broader NextGenerationEU initiative embody this policy turn, treating resilience as an explicit governance objective.

Building on this typology, the present study operationalizes resilience by mapping each of its conceptual dimensions onto a specific, observable property of the Vector Error Correction framework. Engineering resilience—the speed with which a system returns to its pre-shock equilibrium—is captured by the magnitude and sign of the error-correction (adjustment) coefficients: a larger absolute, correctly signed loading implies a stronger restoring force and therefore faster equilibrium restoration following a disturbance. Ecological resilience—the capacity of a system to absorb shocks without shifting to a qualitatively different state—is reflected in the existence and stability of the cointegrating relationships: the persistence of long-run equilibria across alternative specifications indicates that the system retains its structural configuration rather than breaking down under stress. Finally, the persistence and shape of the impulse responses provide a descriptive profile of how disturbances are absorbed over time, complementing the equilibrium-restoration and structural-stability dimensions.

It is important to distinguish this interpretation from mere dynamic interdependence. The existence of cointegration, taken alone, establishes only that variables share common

stochastic trends; it does not, by itself, indicate resilience. A system may be strongly interdependent yet poorly resilient if its adjustment toward equilibrium is slow, weak, or non-convergent. Accordingly, resilience is not equated here with the number of cointegrating relationships—a higher rank denotes greater structural coupling, not greater resilience—but is inferred jointly from the configuration of long-run relationships, the strength and direction of error-correction, and the persistence of the dynamic responses. These econometric features are therefore treated as reduced-form, interpretive indicators of resilience rather than as structural measures, consistent with the comparative and descriptive scope of the analysis.

2.4. Economic Response to Shocks

How economies respond to disturbances has attracted sustained attention since the 2007–2008 financial crisis, organized around a central question: whether a shock's effects are transitory or permanent. [Doran and Fingleton \(2014\)](#) show that output shocks need not dissipate but may settle the economy at a persistently lower path—a hysteresis outcome incompatible with full recovery. The source of the shock matters as well: [Czeczeli et al. \(2020\)](#), studying 25 European economies during the COVID-19 pandemic, find that disturbances originating outside the economic system carry less predictable short-term effects than internally generated ones. Recent evidence quantifies the uneven European exposure to the Russia–Ukraine war, with sizeable output, employment, and inflationary effects ([Almazán-Gómez et al., 2024](#)), while episodes of political instability have themselves been shown to transmit to consumer confidence, unemployment, and inflation ([Saleemi, 2026](#)).

A second line of work stresses that outcomes are conditioned by institutions. [Bănică et al. \(2020\)](#) document that disasters can, under effective institutional management, yield favorable long-run results, while [Dzigbede et al. \(2023\)](#) show that fiscal transparency and credible fiscal governance are associated with stronger resilience, particularly where effective frameworks predate the shock. The policy-oriented analyses of [Mazzucato et al. \(2023\)](#) and [Michels et al. \(2025\)](#) extend this institutional emphasis to the euro area's recent crisis response.

A further consideration, central to the present study, arises specifically within a monetary union: a common shock need not produce a common response. [Georgiadis \(2015\)](#) demonstrates that even a shared monetary impulse is transmitted asymmetrically across euro-area members, with the asymmetries traceable to structural characteristics such as labor-market rigidities and industrial composition. Consistent with this, the [European Central Bank \(2024\)](#) documents that the pandemic and the war in Ukraine, though common disturbances, generated marked dispersion in national inflation responses, while the persistence of energy-driven inflation proved a particular challenge for the euro area.

This literature establishes that heterogeneity is the rule rather than the exception, yet it has largely relied on monetary-transmission or single-shock frameworks, leaving comparatively underexplored the joint long-run and short-run adjustment dynamics through which member states absorb such shocks—the dimension this study addresses.

A growing body of recent research examines how inflationary and geopolitical disturbances propagate across European economies. Using a time-varying-parameter VAR, [Marangoz \(2025\)](#) finds that energy-price and geopolitical shocks—particularly those tied to the Russia–Ukraine war—amplified inflation in selected European economies. [Tedeschi \(2026\)](#), employing a structural VAR, shows that economic-policy uncertainty remains the predominant inflationary force in the euro area, whereas climate-related uncertainty dominates in the United States. From a spatial perspective, [Capoani and Martini \(2026\)](#) apply a gravity framework and document a robust “proximity penalty” for GDP growth, with more

nuanced inflation effects once energy and trade channels are controlled for. Complementary evidence is provided by Köse et al. (2026), who find via a dynamic SVAR for Germany that oil-price shocks significantly raise inflation and industrial production, and by Hoque et al. (2026), who show that geopolitical-risk shocks propagate to major euro-area economies through financial-stress channels.

3. Data and Methodology

3.1. Data

This study examines macroeconomic resilience within the euro area during a period characterized by substantial external disturbances and heightened macroeconomic uncertainty. The analysis focuses on the 2015Q1–2024Q4 period, which encompasses both the post-sovereign debt-crisis recovery phase and the major exogenous shocks associated with the COVID-19 pandemic and the Russia–Ukraine conflict.

The empirical framework employs quarterly macroeconomic data for the euro-area aggregate and four representative member states: Germany and France as core economies, and Spain and Greece as peripheral economies. The selected variables capture key dimensions of macroeconomic adjustment and resilience within the monetary union. Specifically, the analysis includes Gross Domestic Product (GDP), unemployment rate (UNEMP), general government gross debt as a percentage of GDP (DEBT), and the Harmonized Index of Consumer Prices (HICP).

Real GDP and HICP are expressed in logarithmic form, while unemployment and debt-to-GDP ratios are maintained in percentage terms. All variables are seasonally adjusted and obtained directly from Eurostat to ensure consistency and comparability across economies. The selected indicators reflect central dimensions of macroeconomic resilience, including output performance, labor-market adjustment, fiscal stability, and inflation dynamics. All series for the euro-area aggregate and the four member states are obtained directly from the Eurostat database. The euro-area aggregate corresponds to the official Eurostat euro-area series and is not constructed through any author-side aggregation procedure. Real GDP and the HICP are transformed into logarithms; no further transformation is applied.

To account for major external disturbances during the sample period, the empirical specification incorporates two exogenous dummy variables. The first corresponds to the COVID-19 pandemic and takes the value of 1 during the period 2020Q2–2021Q2 and 0 otherwise. The second captures the geopolitical and inflationary disturbances associated with the Russia–Ukraine conflict, taking the value of 1 during the period 2022Q1–2023Q4 and 0 otherwise. These variables are introduced in order to control for periods of exceptional macroeconomic disruption within the estimated systems. Both crisis dummies are included concurrently, as exogenous regressors, within a single system rather than estimated separately so that each equation is estimated with both dummies simultaneously.

The exogenous variables associated with the COVID-19 pandemic and the Russia–Ukraine conflict are incorporated primarily as controls for periods of exceptional macroeconomic disruption rather than as fully structurally identified shocks. Accordingly, the empirical framework is not intended to establish strict causal transmission mechanisms in the sense of structurally identified VAR approaches. Instead, the objective is to examine how the inclusion of major crisis episodes affects the broader adjustment dynamics and long-run equilibrium relationships within euro-area economies.

Given the relatively short sample period and the exceptional nature of the shocks under consideration, this specification is considered more appropriate for a comparative analysis of macroeconomic adjustment behavior than for precise structural identification. The analysis therefore focuses on the stability of equilibrium relationships, the speed and direction of error-correction dynamics, and the heterogeneity of resilience patterns across

countries. The additional robustness checks conducted under alternative lag structures, deterministic assumptions, and alternative exogenous-variable settings indicate that the broader empirical findings remain qualitatively stable across specifications.

3.2. Methodology

This paper uses a Vector Error Correction Model (VECM) to examine the dynamic relationship between key macroeconomic variables in the euro area during periods of significant external disturbance. The VECM framework is particularly appropriate when the variables under study are non-stationary in levels but cointegrated, meaning that they share a long-run equilibrium relationship despite short-term deviations.

The model allows us to separate the analysis into two components:

The short-run dynamics, which capture how quickly and in what way variables respond to shocks;

The long-run relationship, which reflects the stable underlying structure among them.

This dual perspective is useful when studying economic resilience, as it provides insight into both immediate reactions and the economy's ability to return to equilibrium over time.

The variables included in the analysis are:

- GDP;
- Unemployment rate;
- General government gross debt as a percentage of GDP;
- Harmonized Index of Consumer Prices (HICP).

In estimation, real GDP and the HICP enter in logarithmic form, as defined above, whereas the unemployment rate and the debt-to-GDP ratio are kept in percentage terms. These indicators were selected based on their ability to reflect core dimensions of resilience, such as output performance, labor-market stability, fiscal capacity, and inflationary pressures. Quarterly data from 2015 to 2024 were used, covering the period of the COVID-19 pandemic and the Russia–Ukraine conflict. The data source is the Eurostat database.

The empirical analysis is based on the (4×1) vector of endogenous variables:

$$Y_t = [\ln GDP_t, UNEMP_t, DEBT_t, \ln HICP_t]', \quad (1)$$

where real GDP and the HICP enter in logarithmic form and the unemployment rate and debt-to-GDP ratio are expressed in percentage terms. All four variables are treated as endogenous, with no a priori dependent/independent partition imposed.

Given a cointegration rank r , the system admits the Vector Error Correction representation:

$$\Delta Y_t = \alpha \beta' Y_{t-1} + \sum_{i=1}^{p-1} \Gamma_i \Delta Y_{t-i} + \Phi D_t + c + \varepsilon_t, \quad (2)$$

where β is the $(4 \times r)$ matrix of cointegrating vectors and $\beta' Y_{t-1}$ represents the r error-correction terms; α is the $(4 \times r)$ matrix of adjustment coefficients; Γ_i are (4×4) short-run coefficient matrices over $p - 1$ lagged differences; $D_t = [D\{\text{COVID}\}_t, D\{\text{WAR}\}_t]'$ is the vector of exogenous crisis dummies with coefficient matrix Φ ; c is an unrestricted intercept, corresponding to the linear deterministic trend assumption (Johansen Case 3) with no trend term imposed in the cointegrating equations; and ε_t is a vector of white-noise innovations.

For the euro-area aggregate ($r = 2$, lag interval 1–2):

$$\Delta Y_t = \alpha \beta' Y_{t-1} + \Gamma_1 \Delta Y_{t-1} + \Gamma_2 \Delta Y_{t-2} + \Phi D_t + c + \varepsilon_t. \quad (3)$$

The same representation is estimated separately for each economy $j \in \{DE, FR, ES, GR\}$, all using a baseline lag interval of 1–2 (two lagged differences) and the linear deterministic trend specification, with country-specific cointegration rank r_j :

$$\Delta Y_{jt} = \alpha_j \beta_j' Y_{jt-1} + \Gamma_{j1} \Delta Y_{jt-1} + \Gamma_{j2} \Delta Y_{jt-2} + \Phi_j D_t + c_j + \varepsilon_{jt}, \quad (4)$$

with $r_j = 1$ (Germany, France), $r_j = 2$ (Spain), and $r_j = 3$ (Greece). For Spain, where the trace and maximum-eigenvalue tests diverge, the rank of two follows the more conservative maximum-eigenvalue criterion, as detailed in the Results section below.

Prior to estimating the VECM systems, all variables were tested for stationarity using Augmented Dickey–Fuller (ADF) tests. The results indicate that the majority of the series integrated correspond to an order of one, supporting the use of a cointegration-based framework. Johansen cointegration tests were subsequently applied in order to determine the number of long-run equilibrium relationships within each system.

For the euro-area aggregate, the Johansen procedure indicates a cointegration rank of $r = 2$. Accordingly, the aggregate system is estimated using a Vector Error Correction specification with two lags in first differences, selected according to the Schwarz Information Criterion (SIC). At the country level, the estimated cointegration structures are heterogeneous across economies. Germany and France exhibit a single cointegrating relationship, while Spain displays two cointegrating vectors and Greece exhibits three cointegrating relationships, indicating comparatively stronger macroeconomic interdependence within the estimated system.

To ensure comparability across economies, country-level models are estimated using common variable transformations and consistent deterministic assumptions. Real GDP and HICP enter the system in logarithmic form, while unemployment and debt-to-GDP ratios are maintained in percentage terms. All systems are estimated under the linear deterministic trend assumption (Johansen Case 3): an unrestricted intercept is included, with no trend term imposed in the cointegrating relations.

Estimation was performed in EViews 10 using Vector Error Correction specifications with lag structures selected according to standard information criteria while maintaining comparable econometric structures across countries. The empirical framework therefore prioritizes consistency and comparability in order to identify heterogeneous adjustment dynamics and asymmetric resilience mechanisms across euro-area economies under common external disturbances.

Given the relatively limited sample period and the exceptional nature of the shocks examined, the empirical findings should be interpreted with appropriate caution. The period under investigation is characterized by heightened macroeconomic instability associated with the COVID-19 pandemic and the geopolitical disruptions following the Russia–Ukraine conflict. For this reason, the analysis does not aim to establish strict causal relationships or structurally identified transmission mechanisms. Instead, the VECM framework is employed as a comparative dynamic approach that allows the identification of heterogeneous adjustment patterns, equilibrium-correction mechanisms, and differentiated macroeconomic responses across euro-area economies under common external disturbances.

To enhance comparability across countries and reduce specification sensitivity, the empirical analysis adopts a consistent modeling framework, including common variable transformations, deterministic assumptions, and comparable lag structures. Although alternative specifications could produce quantitative differences in estimated coefficients, the broader comparative findings regarding asymmetric adjustment dynamics and differentiated resilience patterns remain qualitatively consistent across the estimated systems.

3.3. Robustness Analysis

To assess the stability of the estimated systems, a series of robustness checks was conducted along two dimensions. First, the lag structure was varied with a reduced lag interval of 1–1, relative to the baseline interval of 1–2. Second, the deterministic specification was varied across alternative Johansen cases, relative to the baseline linear-deterministic-trend specification. Second, the lag structure was varied by re-estimating all systems with a reduced lag interval of 1–1, as an alternative to the baseline interval of 1–2. The analysis additionally examined the sensitivity of the cointegration relationships to the inclusion versus exclusion of the crisis-related exogenous dummies.

For the euro-area aggregate, the long-run structure proved highly stable: both the trace and maximum-eigenvalue statistics consistently supported two cointegrating relationships across alternative lag intervals and deterministic assumptions. The removal of the exogenous dummies did not eliminate the underlying long-run relationships, although their inclusion improved the interpretability and sharpness of the adjustment dynamics during periods of heightened instability.

At the country level, the robustness analysis revealed substantial heterogeneity. Germany and France exhibited stable equilibrium structures across all tested specifications, consistent with relatively parsimonious and less specification-sensitive adjustment mechanisms. By contrast, the peripheral economies displayed greater sensitivity: in Greece, the baseline identified three cointegrating relationships, while the reduced lag structure lowered the estimated rank to two; in Spain, the alternative lag structure expanded the estimated cointegration space. Importantly, none of the alternative specifications eliminated the existence of long-run relationships in either economy.

Overall, the robustness analysis indicates that the broader comparative findings remain qualitatively stable across alternative econometric specifications. While the euro-area aggregate and the core economies exhibit relatively stable and parsimonious equilibrium structures, the peripheral economies display more specification-sensitive and crisis-dependent adjustment dynamics—a pattern consistent with the study’s central interpretation of heterogeneous resilience.

4. Empirical Results

4.1. Stationarity and Unit Root Tests

Prior to estimating the dynamic systems, the time-series properties of the variables were examined using Augmented Dickey–Fuller (ADF) unit root tests for both the euro-area aggregate and the country-specific datasets. Automatic lag selection based on the Schwarz Information Criterion (SIC) was employed throughout the analysis. The results indicate that most variables are non-stationary at levels, particularly public debt and inflation (HICP), while first-difference transformations generally produce stationary series. Overall, the findings support the use of a cointegration-based framework and suggest predominantly I(1)-consistent macroeconomic dynamics across the sample.

At the same time, the unit-root results reveal non-negligible cross-country heterogeneity. In France and Greece, unemployment exhibits evidence of level stationarity, while inflation displays weaker first-difference stationarity properties in several economies, particularly within the periphery. GDP also presents borderline level stationarity in Germany and France, suggesting differences in the persistence and adjustment characteristics of national macroeconomic systems. Rather than undermining the empirical framework, these differences are consistent with the broader hypothesis that macroeconomic resilience within the euro area is characterized by heterogeneous adjustment structures and asymmetric stabilization mechanisms.

Building on the unit-root analysis, Johansen cointegration tests were implemented in order to examine the existence of long-run equilibrium relationships among GDP, public debt, unemployment, and inflation dynamics. For the euro-area aggregate, both trace and maximum-eigenvalue statistics support the presence of two cointegrating vectors, indicating the existence of relatively stable long-run macroeconomic interdependencies. At the country level, the results reveal substantial variation in equilibrium structures across economies. Germany and France each exhibit a single cointegrating relationship, suggesting comparatively parsimonious long-run adjustment mechanisms within the core economies. For Spain, the trace and maximum-eigenvalue tests do not fully coincide: the trace statistic supports three cointegrating relationships, whereas the maximum-eigenvalue statistic supports two. The more conservative maximum-eigenvalue criterion is adopted, and the Spanish system is therefore estimated with a cointegration rank of two. Greece exhibits the most complex equilibrium structure, with three cointegrating relationships identified within the estimated system.

The observed variation in cointegration ranks across countries suggests that macroeconomic adjustment processes within the monetary union are not fully homogeneous. Consequently, the empirical framework adopts country-specific VECM specifications while maintaining a common methodological structure in order to preserve cross-country comparability. Given the relatively limited sample period and the exceptional macroeconomic conditions associated with the post-pandemic and geopolitical environment, the cointegration results should be interpreted as indicative evidence of long-run adjustment tendencies rather than as definitive estimates of stable structural equilibrium relationships.

The results of the Augmented Dickey–Fuller (ADF) unit root tests are summarized in Table 1, providing evidence regarding the stationarity properties and integration order of the macroeconomic variables included in the analysis.

Table 1. Summary of Augmented Dickey–Fuller (ADF) Unit Root Test Results.

Economy	Variable	Level: t-Stat (<i>p</i>)	First Diff.: t-Stat (<i>p</i>)	Integration
Euro Area	GDP	−3.413 (0.064)	−7.950 (0.000)	I(1) a
	DEBT	−2.157 (0.499)	−4.155 (0.002)	I(1)
	HICP	−2.855 (0.189)	−2.419 (0.144)	I(1) b
	UNEMP	−2.167 (0.494)	−7.045 (0.000)	I(1)
Germany	GDP	−3.452 (0.059)	−8.040 (0.000)	I(1) a
	DEBT	−2.047 (0.558)	−3.787 (0.006)	I(1)
	HICP	−1.036 (0.927)	−4.627 (0.001)	I(1)
	UNEMP	−2.000 (0.583)	−6.316 (0.000)	I(1)
France	GDP	−3.612 (0.042)	−7.869 (0.000)	I(0) c
	DEBT	−1.807 (0.682)	−5.355 (0.000)	I(1)
	HICP	−3.347 (0.076)	−1.834 (0.358)	I(1) b
	UNEMP	−4.024 (0.016)	−10.926 (0.000)	I(0)
Spain	GDP	−2.864 (0.185)	−7.688 (0.000)	I(1)
	DEBT	−1.705 (0.730)	−3.624 (0.010)	I(1)
	HICP	−2.019 (0.571)	−2.014 (0.280)	I(1) b
	UNEMP	−2.634 (0.269)	−2.284 (0.182)	I(1) b
Greece	GDP	−2.350 (0.399)	−6.526 (0.000)	I(1)
	DEBT	−1.189 (0.899)	−2.947 (0.049)	I(1)

Table 1. Cont.

Economy	Variable	Level: t-Stat (<i>p</i>)	First Diff.: t-Stat (<i>p</i>)	Integration
	HICP	−2.487 (0.332)	−2.568 (0.109)	I(1) b
	UNEMP	−4.603 (0.004)	−10.469 (0.000)	I(0)

Notes: Levels tested with constant and trend; first differences with constant. Automatic lag selection by SIC (maxlag = 4). *p*-values (MacKinnon, 1996) in parentheses. a = Borderline non-stationary at levels; b = weak first-difference stationarity (Δ not si = not significant at 5%); c = borderline level-stationary. Source: Author's calculations based on Eurostat data.

The unit-root results reveal a degree of heterogeneity in the integration properties of the series. While most variables are I(1), the unemployment rate appears level-stationary in France and Greece, output is borderline level-stationary in France, and the first-difference stationarity of inflation is weak in several economies. These features reflect the short sample period and its exceptional volatility rather than a failure of the framework. The variables are retained in levels for all systems to preserve cross-country comparability and because the Johansen procedure remains informative when a subset of series is stationary; accordingly, the cointegration and error-correction results are interpreted as indicative of comparative adjustment dynamics rather than as definitive structural estimates.

Table 2 presents the results of the Johansen cointegration tests for the euro-area aggregate and the selected country-specific systems, highlighting the heterogeneous long-run equilibrium structures observed across economies.

Table 2. Johansen Cointegration Rank Results.

Economy	H0	Trace	Trace 5% CV	Max-Eigen	Max-Eig 5% CV	Selected r
Euro Area	$r = 0$	90.434	47.856	49.206	27.584	2
	$r \leq 1$	41.228	29.797	37.276	21.132	
	$r \leq 2$	3.952	15.495	3.850	14.265	
Germany	$r = 0$	56.466	47.856	34.368	27.584	1
	$r \leq 1$	22.098	29.797	14.521	21.132	
France	$r = 0$	63.412	47.856	38.310	27.584	1
	$r \leq 1$	25.101	29.797	16.741	21.132	
Spain	$r = 0$	133.028	47.856	78.082	27.584	2 d
	$r \leq 1$	54.946	29.797	38.415	21.132	
	$r \leq 2$	16.531	15.495	13.606	14.265	
Greece	$r = 0$	97.943	47.856	50.838	27.584	3
	$r \leq 1$	47.105	29.797	30.478	21.132	
	$r \leq 2$	16.627	15.495	15.628	14.265	

Notes: Trend assumption = linear deterministic trend (unrestricted intercept, no trend in the cointegrating equations); lag interval 1–2 (first differences); COVID-19 and Russia–Ukraine dummies included as exogenous regressors. Bold = test statistic exceeds the 5% critical value. *p*-values: MacKinnon et al. (1999). d = For Spain, the trace test indicates three relationships while the maximum-eigenvalue test indicates two; the more conservative maximum-eigenvalue criterion ($r = 2$) was adopted. Source: Author's calculations based on Eurostat data.

4.2. Vector Error Correction Model Estimation

Building on the evidence of two cointegrating relationships for the euro-area aggregate, the system is estimated according to the Vector Error Correction specification of Equations (2) and (3), with cointegration rank $r = 2$ and a lag interval of 1–2. An unrestricted intercept is included in the system under the linear deterministic trend assumption (Johansen Case 3), with no trend term imposed in the cointegrating equations. In addi-

tion, two exogenous dummy variables are incorporated to account for the timing of major external disturbances, namely the COVID-19 pandemic and the Russia–Ukraine conflict. Estimation was performed in EViews 10 using Vector Error Correction specifications with lag structures selected according to standard information criteria. For the euro-area aggregate, the preferred specification includes two lags in first differences and a cointegration rank of $r = 2$.

4.2.1. Euro Area Aggregate

The VECM estimates for the euro-area aggregate indicate the presence of meaningful long-run adjustment dynamics across the macroeconomic system. The error-correction terms suggest that deviations from the long-run equilibrium are gradually absorbed through output, inflation, and labor-market adjustment mechanisms, supporting the existence of active equilibrium-restoration processes within the monetary union.

The GDP equation exhibits a negative adjustment coefficient associated with the first cointegrating relationship, indicating that output dynamics respond systematically to disequilibrium conditions. This finding suggests that the euro-area economy retains an operative long-run correction mechanism following macroeconomic disturbances, although the adjustment process unfolds gradually over time rather than instantaneously. Inflation dynamics also display equilibrium-correction behavior, implying that price adjustments remain closely linked to broader macroeconomic imbalances within the system.

Labor-market adjustment appears particularly important within the estimated framework. The unemployment equation exhibits strong error-correction effects, indicating that labor-market conditions react persistently to deviations from long-run equilibrium. This result is broadly consistent with the interpretation that employment adjustment within the euro area constitutes a central channel through which macroeconomic stabilization occurs following inflationary and crisis-related disturbances.

By contrast, fiscal adjustment dynamics appear comparatively slower and more persistent. Although public debt responds to long-run disequilibrium conditions, the adjustment process is less immediate and exhibits stronger lag dependence relative to output and labor-market variables. This pattern suggests that fiscal stabilization within the euro area operates through more gradual mechanisms, particularly under the exceptional macroeconomic conditions associated with the post-pandemic and geopolitical environment.

The exogenous dummy variables further reinforce the importance of crisis-related disturbances during the sample period. The COVID-19 dummy exerts a strong and statistically significant effect on output dynamics and fiscal adjustment, highlighting the extent to which the pandemic period altered macroeconomic stabilization patterns across the euro area. Overall, the VECM results support the interpretation that euro-area resilience is characterized by multidimensional and asymmetric adjustment processes involving differentiated responses across output, labor-market, fiscal, and inflation dynamics.

4.2.2. Country-Level Comparative Adjustment Dynamics

The German VECM results indicate a comparatively parsimonious and stable long-run adjustment structure. Consistent with the Johansen findings, the estimated system identifies a single cointegrating relationship linking output, inflation, unemployment, and public debt dynamics. Labor-market adjustment emerges as the dominant equilibrium-correction mechanism, while GDP adjustment remains comparatively weaker. Fiscal dynamics display moderate persistence, and the COVID-19 shock generates significant output contraction alongside higher public debt. Overall, the German economy exhibits relatively contained transmission effects and smoother stabilization dynamics compared to the peripheral economies.

The French results also support the presence of a single cointegrating relationship, although the adjustment process appears more broadly distributed across the macroeconomic system. Statistically significant correction effects are observed in the GDP, inflation, and debt equations, suggesting a more reactive stabilization mechanism relative to Germany. Fiscal dynamics display greater sensitivity to inflationary disturbances, while the COVID-19 shock exerts strong negative effects on output and significant upward pressure on public debt. The war dummy also contributes positively to inflation dynamics, indicating stronger exposure to post-pandemic price transmission mechanisms.

The Spanish VECM estimates indicate a more persistence-driven and interconnected adjustment structure relative to the core economies. Consistent with the preferred $r = 2$ specification, fiscal adjustment emerges as the dominant equilibrium-correction channel, with public debt responding strongly to disequilibrium conditions. Output dynamics also react systematically to long-run imbalances, while inflation and unemployment adjustment remain comparatively persistent. The COVID-19 shock exerts substantial effects on output, debt, and labor-market conditions, supporting the interpretation that the Spanish economy exhibits more asymmetric and longer-lasting adjustment costs following macroeconomic disturbances.

Among the examined economies, Greece exhibits the most adjustment-intensive and interconnected macroeconomic structure. The estimated system identifies three cointegrating relationships, indicating a comparatively high degree of long-run interdependence among output, inflation, public debt, and unemployment dynamics. Strong equilibrium-correction effects are observed particularly in the GDP and debt equations, suggesting highly responsive fiscal and output adjustment mechanisms. Labor-market dynamics also remain persistent, while the COVID-19 shock generates pronounced effects on output, debt, and unemployment conditions. Overall, the Greek economy appears characterized by highly reactive stabilization dynamics and stronger adjustment sensitivity following large external disturbances.

Table 3 reports the estimated adjustment (loading) coefficients for each economy, together with the coefficients on the crisis-related dummies; t-statistics are given in brackets and coefficients significant at the 5% level are shown in bold. The adjustment coefficients capture the speed and direction with which each variable responds to deviations from the estimated long-run equilibria—the central quantity in the error-correction interpretation of resilience—while the dummy coefficients summarize the short-run impact of the COVID-19 and Russia–Ukraine disturbances. The estimates confirm the comparative patterns described above: stronger and faster equilibrium restoration in the core economies, and more persistent, fiscally driven adjustment in the periphery.

Table 3. Comparative Summary of VECM Adjustment Dynamics.

Economy	Equation	α (CE1)	α (CE2)	α (CE3)	COVID	WAR
Euro Area	D(GDP)	−2.117 [−3.14]	0.002 [1.62]		−0.134 [−8.36]	−0.005 [−0.51]
	D(DEBT)	1.299 [0.03]	−0.152 [−1.69]		6.738 [6.36]	0.167 [0.25]
	D(HICP)	0.625 [2.64]	0.002 [4.27]		−0.001 [−0.22]	0.008 [2.14]
	D(UNEMP)	−9.847 [−2.41]	−0.020 [−2.36]		−0.092 [−0.95]	0.098 [1.60]

Table 3. Cont.

Economy	Equation	α (CE1)	α (CE2)	α (CE3)	COVID	WAR
Germany	D(GDP)	0.354 [0.87]			−0.053 [−2.83]	−0.004 [−0.50]
	D(DEBT)	−10.744 [−0.48]			3.355 [3.24]	−0.224 [−0.49]
	D(HICP)	0.524 [2.16]			−0.014 [−1.22]	0.004 [0.75]
	D(UNEMP)	−9.434 [−4.28]			0.165 [1.62]	0.036 [0.80]
France	D(GDP)	−0.212 [−4.27]			−0.128 [−5.32]	−0.011 [−0.71]
	D(DEBT)	7.944 [2.12]			6.859 [3.77]	1.515 [1.25]
	D(HICP)	−0.030 [−3.16]			−0.008 [−1.81]	0.008 [2.63]
	D(UNEMP)	−0.870 [−1.86]			−0.627 [−2.76]	0.143 [0.94]
Spain	D(GDP)	0.000 [0.13]	−1.355 [−3.46]		−0.228 [−8.63]	0.000 [0.01]
	D(DEBT)	−0.369 [−5.03]	−57.078 [−2.56]		11.200 [7.47]	−0.286 [−0.39]
	D(HICP)	0.002 [3.53]	0.106 [0.74]		−0.012 [−1.27]	0.000 [0.02]
	D(UNEMP)	−0.003 [−0.19]	5.743 [1.30]		0.947 [3.18]	0.270 [1.88]
Greece	D(GDP)	−1.444 [−4.68]	0.001 [0.87]	0.828 [2.16]	−0.121 [−6.10]	0.002 [0.13]
	D(DEBT)	−15.626 [−0.41]	−0.562 [−3.80]	−158.269 [−3.36]	6.181 [2.52]	2.013 [1.41]
	D(HICP)	−0.285 [−1.26]	−0.002 [−2.08]	−0.705 [−2.53]	−0.017 [−1.15]	0.008 [0.96]
	D(UNEMP)	21.664 [2.92]	0.030 [1.05]	7.594 [0.83]	1.844 [3.86]	0.315 [1.14]

Notes: Entries are adjustment (loading) coefficients with t-statistics in brackets; bold = significant at 5% ($|t| \geq 1.96$). CE1–CE3 denote the cointegrating relationships (number equals the selected rank r). Normalization: Euro Area, Germany, Greece on GDP (CE1); France on HICP; Spain on DEBT (CE1) and GDP (CE2); Greece CE2 on DEBT and CE3 on HICP. COVID and WAR are the exogenous crisis dummies. Full short-run coefficients are available in the EViews output. Source: Author's calculations based on Eurostat data.

4.3. Impulse-Response Analysis

The impulse-response analysis is interpreted primarily as a comparative representation of dynamic adjustment patterns rather than as a source of precise statistical inference regarding the magnitude of shock transmission. Confidence intervals for the VECM impulse responses are not reported, as the standard EViews implementation used in the analysis does not provide impulse-response standard errors for Vector Error Correction specifications. Consequently, the emphasis is placed on the relative persistence, direction, and stability of the estimated responses across economies under common external disturbances.

4.3.1. Euro-Area Aggregate Responses

Figure 1 presents the impulse responses of the euro-area aggregate economy to an inflationary shock within the estimated VECM framework. Overall, the responses suggest that the euro-area system exhibits a relatively contained and structured adjustment pattern, although stabilization dynamics remain uneven across macroeconomic variables and unfold gradually over time.

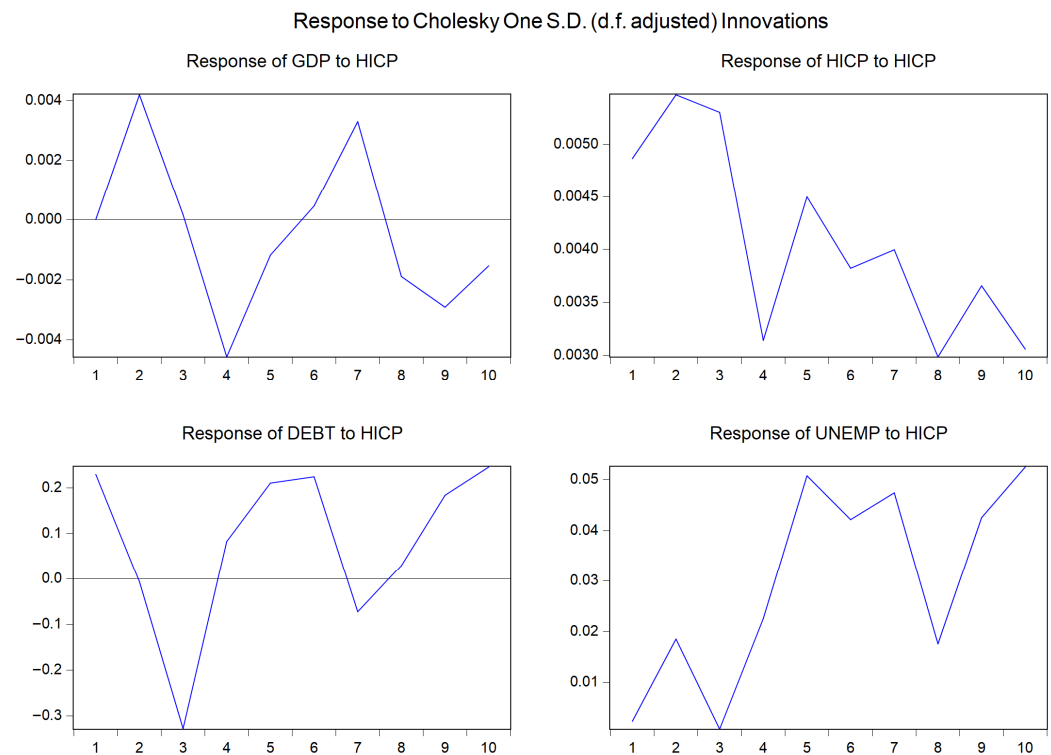


Figure 1. Euro area—impulse responses to a one-standard-deviation inflation (HICP) shock.

GDP displays a moderate short-run contraction following inflationary disturbance, with output deviations remaining relatively limited in magnitude and converging progressively toward the baseline path. This pattern suggests that, at the aggregate level, the euro-area economy retains a degree of stabilization capacity against inflationary shocks despite the adverse macroeconomic conditions characterizing the sample period. Public debt responses appear more persistent, remaining elevated for a prolonged horizon before gradually stabilizing, indicating slower fiscal adjustment relative to output dynamics. The strongest output contraction emerges around the fourth period following the initial shock, while debt deviations remain visible throughout nearly the entire forecast horizon. Labor-market responses also exhibit substantial persistence, with unemployment failing to fully converge back toward baseline conditions within the ten-period adjustment window. Labor-market adjustment also exhibits delayed mean reversion, implying that inflationary disturbances continue to affect employment conditions even after output stabilization begins to emerge.

Inflation dynamics themselves display gradual convergence without evidence of explosive behavior at the aggregate level, although mild oscillatory tendencies remain present throughout the adjustment process. Taken together, the impulse responses indicate that the euro-area aggregate economy follows a relatively coordinated equilibrium-restoration path characterized by moderate output sensitivity but more persistent fiscal and labor-market effects. At the same time, the aggregate responses appear considerably smoother than

the country-specific dynamics presented below, reinforcing the importance of examining heterogeneous national adjustment mechanisms within the monetary union.

4.3.2. Comparative Country Responses

Figures 1–5 reveal substantial asymmetries in national adjustment dynamics following inflationary shocks. Germany exhibits the most contained response profile among the examined economies. Output deviations remain comparatively moderate, unemployment responses display lower persistence, and fiscal dynamics stabilize more gradually without pronounced volatility. The largest negative output response emerges around the fourth period, after which gradual stabilization becomes visible toward the latter part of the forecast horizon. Compared to the peripheral economies, unemployment responses remain relatively contained throughout the adjustment process. Overall, the German responses are consistent with a relatively organized adjustment regime characterized by smoother equilibrium restoration and more coordinated stabilization mechanisms.

France occupies an intermediate position within the adjustment spectrum. Although the overall stabilization process remains broadly orderly, GDP and labor-market responses display greater persistence relative to Germany, while debt dynamics remain elevated for a longer horizon. Inflation responses also exhibit moderate oscillatory tendencies, suggesting a more reactive and less contained adjustment structure compared to the German economy. The adjustment process remains comparatively less smooth than in Germany, with both output and fiscal responses displaying repeated reversals throughout the forecast horizon rather than monotonic convergence toward equilibrium.

By contrast, Spain exhibits substantially more persistent adjustment dynamics, particularly in the fiscal and labor-market dimensions. Output deviations remain visible over an extended horizon, while unemployment responses display slower mean reversion relative to the core economies. Public debt dynamics also remain prolonged following the inflationary disturbance, indicating delayed fiscal stabilization and greater macroeconomic sensitivity to inflation shocks. In particular, both fiscal and labor-market deviations remain clearly visible even toward the final periods of the adjustment horizon, suggesting slower stabilization dynamics relative to the core economies. These findings are broadly consistent with the VECM results, which identified stronger interdependence across fiscal, output, and labor-market adjustment channels within the Spanish economy.

The Greek economy displays the strongest persistence and the most adjustment-intensive response pattern among the examined cases. Inflationary disturbances generate prolonged deviations in output, elevated labor-market persistence, and highly sensitive fiscal responses over the forecast horizon. Public debt dynamics remain particularly pronounced relative to both the core economies and the euro-area aggregate, while the overall adjustment process appears less coordinated across macroeconomic variables. The adjustment process also exhibits repeated oscillatory movements across output and fiscal variables, with no clear convergence pattern emerging within the ten-period response horizon. Compared to the smoother stabilization patterns observed in Germany and, to a lesser extent, France, the Greek responses suggest a substantially more reactive adjustment structure characterized by stronger macroeconomic interdependence and greater sensitivity to external disturbances.

Overall, the impulse-response analysis confirms the presence of asymmetric resilience dynamics within the euro area. While the core economies generally exhibit more contained and coordinated stabilization mechanisms, the peripheral economies display stronger persistence, greater fiscal sensitivity, and more prolonged labor-market adjustment following inflationary shocks. These differences suggest that macroeconomic resilience within the monetary union depends not only on the existence of equilibrium-restoration mechanisms,

but also on the stability, persistence, and coordination of the broader adjustment processes through which shocks are absorbed over time.

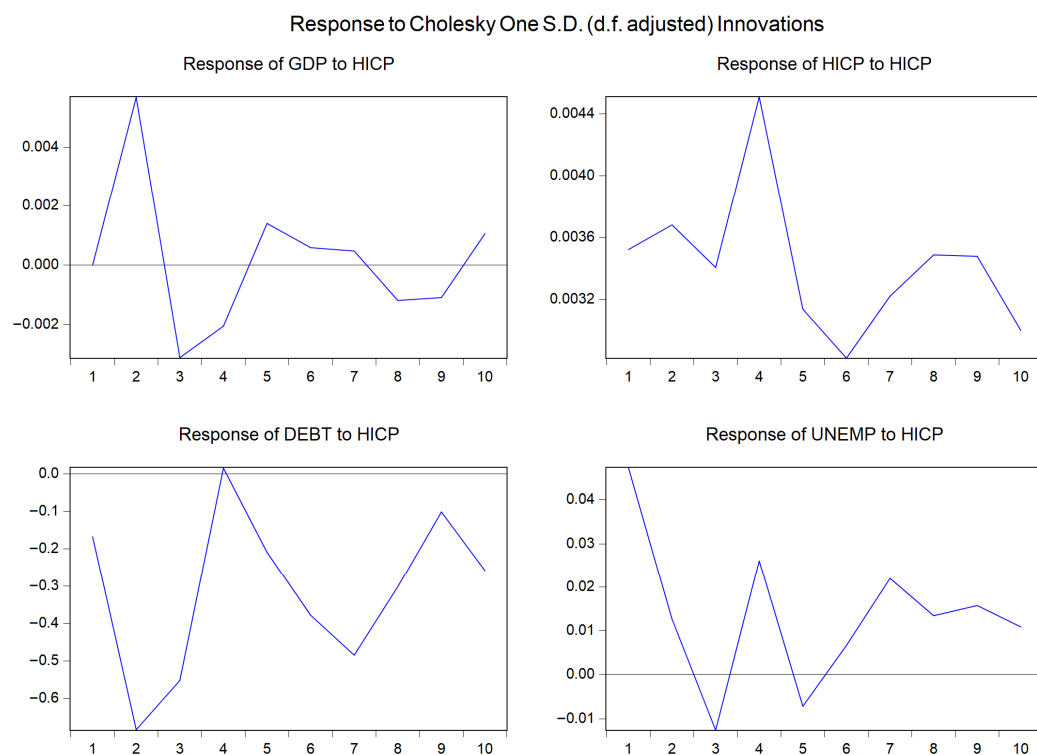


Figure 2. Germany—impulse responses to a one-standard-deviation inflation (HICP) shock.

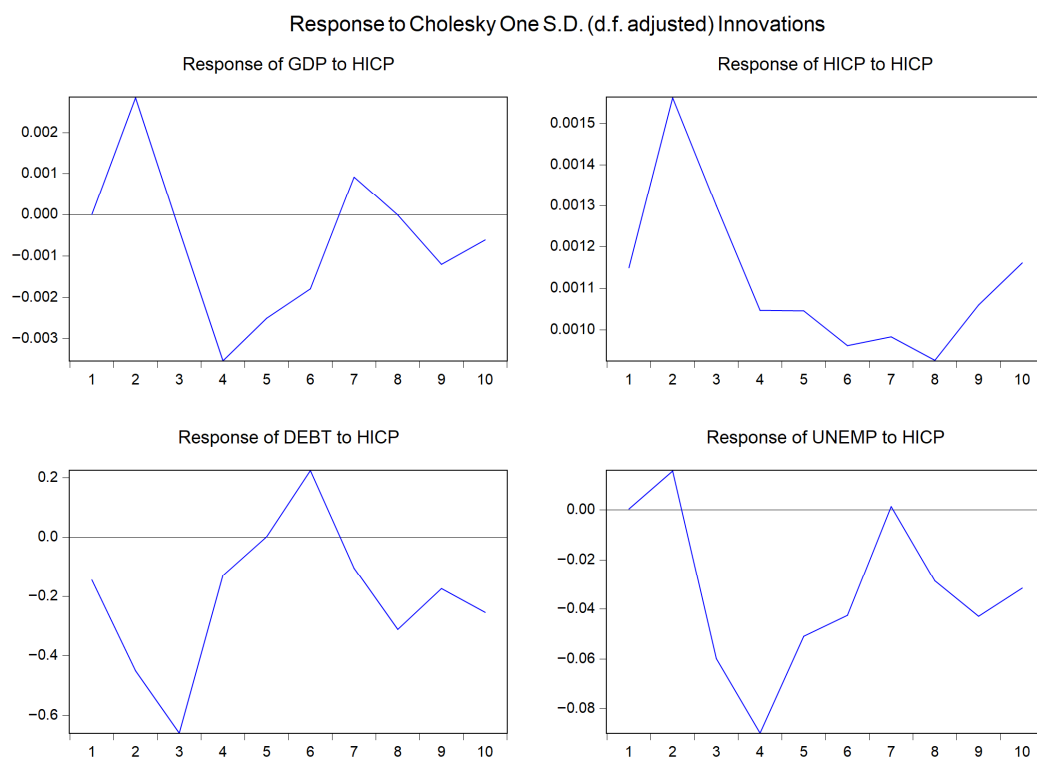


Figure 3. France—impulse responses to a one-standard-deviation inflation (HICP) shock.

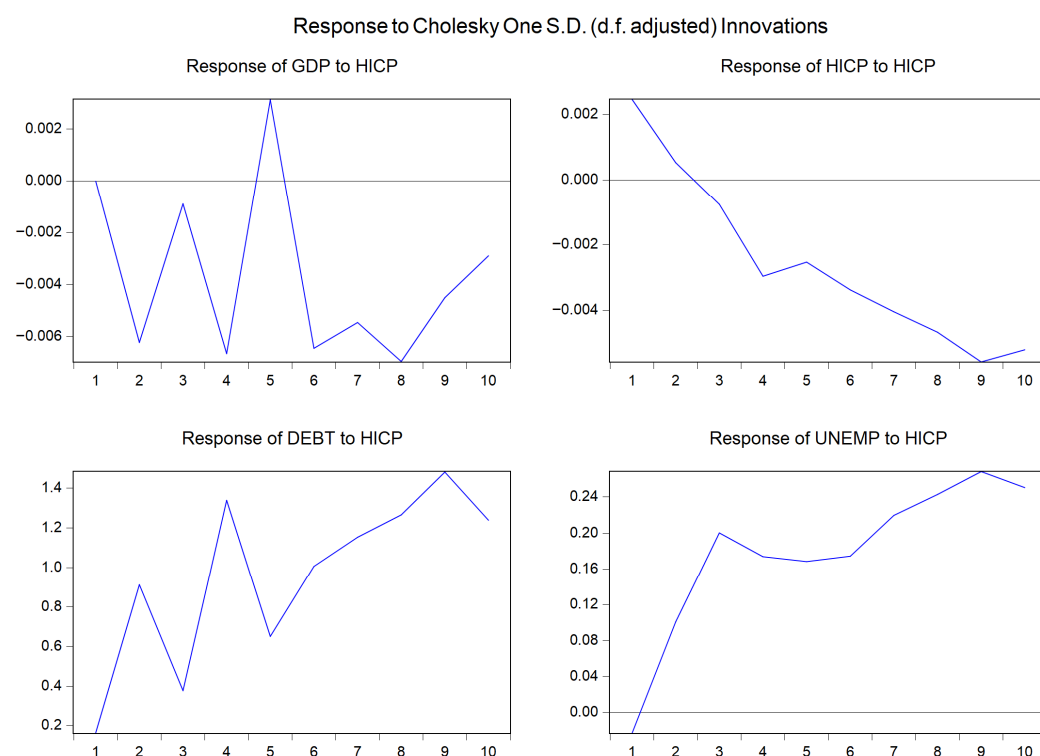


Figure 4. Spain—impulse responses to a one-standard-deviation inflation (HICP) shock.

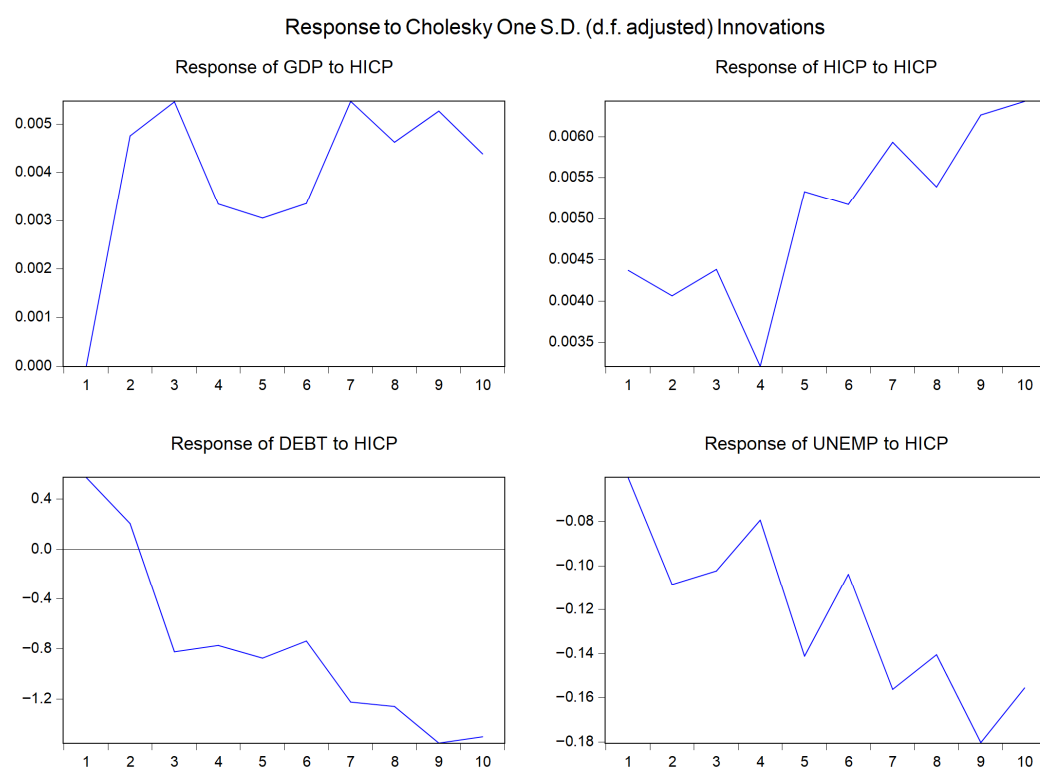


Figure 5. Greece—impulse responses to a one-standard-deviation inflation (HICP) shock. Source: Authors' calculations based on Eurostat data, estimated in EViews.

4.4. Comparative Synthesis of Adjustment Dynamics

Taken together, the empirical findings reveal substantial cross-country differences in macroeconomic adjustment dynamics across the euro area. Although all examined economies display some degree of long-run equilibrium correction following inflationary

disturbances, the structure, persistence, and coordination of these adjustment mechanisms differ considerably between core and peripheral member states.

The core economies, particularly Germany, exhibit comparatively parsimonious and more contained stabilization structures. Adjustment processes operate through relatively coordinated labor-market and output channels, while fiscal responses remain comparatively moderate and less persistent over time. France occupies a more intermediate position within the core group, displaying greater macroeconomic sensitivity and stronger fiscal adjustment pressures, yet still maintaining comparatively orderly stabilization dynamics relative to the peripheral economies.

By contrast, the peripheral economies exhibit substantially more interconnected and persistence-driven adjustment mechanisms. Spain demonstrates stronger fiscal and labor-market persistence, while Greece displays the highest degree of macroeconomic interdependence and the most adjustment-intensive equilibrium structure within the sample. In both cases, inflationary shocks propagate through multiple transmission channels simultaneously, generating longer-lasting deviations in output, debt, and labor-market conditions relative to the core economies.

These differences suggest that resilience within the monetary union cannot be interpreted solely in terms of the existence of equilibrium-restoration mechanisms. Rather, resilience appears to depend critically on the speed, coordination, persistence, and stability of the broader macroeconomic adjustment process through which shocks are absorbed over time. Economies characterized by smoother and more coordinated stabilization dynamics appear better able to contain the persistence of inflationary disturbances, whereas economies with stronger fiscal sensitivity and more persistent labor-market adjustment face greater difficulty in restoring macroeconomic equilibrium following large external shocks.

Overall, the findings support the interpretation that the euro area remains characterized by asymmetric macroeconomic resilience despite the presence of a common monetary framework. The results therefore highlight the importance of considering heterogeneous national adjustment structures when evaluating stabilization capacity within the monetary union, particularly during periods of elevated inflationary pressure and external macroeconomic disruption.

These findings can be read alongside recent comparative evidence. The heterogeneous, periphery-concentrated adjustment documented here—where fiscal and debt channels dominate the equilibrium correction in Spain and Greece—echoes the uneven cross-country burden of recent geopolitical shocks reported by [Capoani and Martini \(2026\)](#). The prominent role of inflationary disturbances in the impulse-response analysis is consistent with [Marangoz \(2025\)](#) and [Köse et al. \(2026\)](#), who document significant macroeconomic effects of energy- and geopolitically driven price shocks, while the comparatively muted core-economy inflation responses align with [Tedeschi \(2026\)](#), who attributes euro-area inflation primarily to economic-policy uncertainty. Taken together, these comparisons reinforce the central finding that euro-area resilience to inflationary and geopolitical shocks is structurally asymmetric across core and periphery regions.

5. Policy Implications

The empirical findings carry several implications for macroeconomic stabilization within the euro area, which should be read in light of the study's descriptive and comparative scope. The central and robust pattern is that adjustment following inflationary disturbances is heterogeneous across member states: despite a common monetary framework, the speed, persistence, and coordination of equilibrium restoration differ systematically between core and peripheral economies. This pattern is consistent with the view that

stabilization capacity within the union depends not only on centralized monetary policy, but also on national structural and adjustment characteristics.

The comparatively smoother adjustment observed in Germany and, to a lesser extent, France, and the more persistent fiscal and labor-market responses observed in Spain and Greece, are descriptive regularities of the estimated systems. Because the model does not include institutional or structural variables, the present analysis does not establish the mechanisms underlying these regularities. A plausible interpretation, consistent with the literature on euro-area heterogeneity (e.g., [Georgiadis, 2015](#)), is that differences in labor-market flexibility, fiscal credibility, and transmission structures contribute to these divergent adjustment profiles. This interpretation, however, is offered as a hypothesis for future, structurally identified research rather than as a finding of the present study.

With this caveat in mind, the results are broadly consistent with policy priorities frequently emphasized in this literature: maintaining credible fiscal frameworks capable of limiting the persistence of debt-related disequilibrium during periods of elevated inflation, and improving labor-market adjustment capacity in economies where employment responses to shocks are most persistent. These priorities follow from the observed persistence patterns rather than from any directly estimated institutional effect.

More broadly, the analysis is consistent with the proposition that a common monetary policy may produce uneven transmission across structurally heterogeneous economies, so that union-wide stabilization may depend on complementary national fiscal and structural policies. Strengthening coordination between monetary, fiscal, and labor-market policies may, on this reading, improve the union's resilience to future inflationary and geopolitical shocks—a conjecture that the descriptive evidence presented here motivates but cannot, on its own, confirm.

6. Conclusions

This study examined macroeconomic resilience within the euro area through a comparative Vector Error Correction framework focusing on inflation, output, public debt, and unemployment dynamics across the euro-area aggregate and selected core and peripheral economies. By combining cointegration analysis, VECM estimation, and impulse-response functions, the analysis investigated both the long-run equilibrium relationships and the dynamic adjustment mechanisms through which inflationary shocks propagate across different macroeconomic systems.

The empirical findings indicate substantial cross-country differences in macroeconomic adjustment dynamics across the monetary union. Although all examined economies exhibit some degree of equilibrium restoration following inflationary disturbances, the structure, persistence, and coordination of these adjustment processes differ considerably between core and peripheral member states. Germany displays the most contained and parsimonious adjustment structure, characterized by relatively coordinated stabilization mechanisms and smoother macroeconomic responses. France exhibits a more reactive but still comparatively stable adjustment regime, particularly through stronger fiscal and inflation-related transmission channels. By contrast, Spain and Greece demonstrate substantially more persistence-driven and interconnected adjustment dynamics, with inflationary shocks generating stronger fiscal sensitivity, prolonged labor-market effects, and more persistent deviations from equilibrium conditions.

The results further suggest that macroeconomic resilience within the euro area cannot be interpreted solely in terms of the existence of equilibrium-correction mechanisms. Rather, resilience depends critically on the broader characteristics of the adjustment process itself, including the speed, persistence, coordination, and stability through which macroeconomic systems absorb external disturbances over time. Economies characterized by smoother

and more coordinated stabilization dynamics appear better able to contain inflationary pressures and limit the persistence of macroeconomic disequilibrium, whereas economies displaying stronger fiscal dependence and delayed labor-market adjustment experience more prolonged stabilization costs following major shocks.

The analysis also highlights the importance of distinguishing between common and asymmetric disturbances within the monetary union. The COVID-19 shock generated strong and systematic effects across virtually all examined economies, particularly through output contraction and fiscal deterioration. By contrast, the geopolitical shock associated with the Russia–Ukraine conflict produced more heterogeneous transmission effects across countries, reinforcing the importance of national structural characteristics in shaping macroeconomic adjustment capacity under conditions of external stress.

Taken together, the findings support the interpretation that the euro area remains characterized by asymmetric adjustment structures despite the presence of a common monetary framework. Consequently, the effectiveness of macroeconomic stabilization policies may depend not only on centralized monetary interventions, but also on the capacity of national fiscal, labor-market, and institutional structures to absorb and coordinate adjustment following inflationary and crisis-related disturbances.

Several limitations follow directly from the study's design and bound the interpretation of its results. First, the analysis is deliberately reduced form: the VECM characterizes adjustment dynamics and equilibrium relationships but does not impose the identifying restrictions of a structural model, so the estimated responses describe how the system co-moves rather than isolate causal transmission. Second, the two crisis episodes are treated as exogenous dummy controls rather than as structurally identified shocks; this is appropriate for marking periods of exceptional disruption but precludes precise statements about shock magnitudes. Third, the sample period (2015Q1–2024Q4) is short and dominated by exceptional volatility, which limits the precision of the cointegration estimates and counsels caution in extrapolation. Fourth, the standard EViews implementation does not provide impulse-response confidence intervals for the Vector Error Correction specifications used here, so the impulse responses are interpreted as qualitative comparative patterns rather than as point estimates with measured uncertainty. Finally, the mapping from econometric features to resilience is interpretive: cointegration rank, error-correction speed, and response persistence are treated as reduced-form indicators of resilience rather than as structural measures of it, and the analysis covers a limited set of representative economies. These limitations define the scope of the contribution—a transparent, comparative characterization of adjustment heterogeneity—and point to clear extensions: longer samples, structurally identified shocks, bootstrap or Monte-Carlo inference for the impulse responses, and a broader cross-section of member states.

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