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Abstract

Despite extensive research, there is little consensus on whether common monetary policy generates systematically asymmetric effects within the euro area. We argue that this ambiguity arises from failing to account for heterogeneity in local cyclical conditions at the time of policy changes, which leads state-dependent responses to obscure underlying cross-country differences. To address this, we construct a measure of country-specific monetary policy that internalizes local cyclical conditions. This adjustment reveals systematic asymmetries in policy transmission between core and periphery euro area countries that conventional methods overlook. We find that macroeconomic and financial variables respond more strongly in periphery countries. In contrast, credit and housing booms are largely absent in core countries. This differential response is consistent with the bank lending channel of monetary policy: banks in periphery countries ease mortgage lending standards following an expansionary shock, while those in core countries tighten them. Cross-border banking flow patterns further corroborate the importance of credit supply in explaining regional heterogeneity.

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1 Introduction

A growing literature examines the transmission channel of monetary policy in the euro area using exogenous changes in the ECB policy rate that apply uniformly across member states. A common practice in this literature is to estimate country- or group-specific response coefficients to the area-wide shock within a VAR or local projection framework and relate them to structural characteristics (e.g., Ciccarelli, Maddaloni and Peydró (2013); Barigozzi, Conti and Luciani (2014); Georgiadis (2015); Burriel and Galesi (2018); Corsetti, Duarte and Mann (2022); Mandler, Scharnagl and Volz (2022); Gefang, Hall, Tavlas and Wang (2025)). While these studies often highlight how structural differences—such as labor market frictions, mortgage market characteristics, industrial composition, and banking sector characteristics—drive cross-country heterogeneity in policy effects, the documented heterogeneity differs markedly across studies or appears inconsequential (e.g., Gefang et al. (2025)).

However, this approach abstracts from the possibility that a common monetary policy may systematically misalign with local macroeconomic conditions. When countries differ in their business cycle positions, a uniform interest rate may simultaneously be too expansionary for some and too contractionary for others (e.g., Barigozzi et al. (2014); Beckworth (2017)). Indeed, empirical evidence suggests that business cycle synchronization did not increase meaningfully after the adoption of the euro (e.g., Camacho, Perez-Quiros and Saiz (2006); Belke, Domnick and Gros (2017)), raising concerns about the appropriateness of a "one size fits all" policy framework (Nechio (2011); Gagnon and Gimet (2023)).

These concerns are especially relevant in light of the extensive evidence on the state-dependent effects of monetary policy (e.g., Tenreyro and Thwaites (2016); Burgard, Neuenkirch

and Nöckel (2019); Alpanda, Granziera and Zubairy (2021); Ascari and Haber (2022); Choi, Willems and Yoo (2024)). If member countries face different cyclical conditions, estimates based on common policy shocks may conflate structural heterogeneity with variation in the timing of shocks across the cycle. Moreover, the persistent divergence in macroeconomic conditions between core and periphery countries suggests that such cyclical misalignments may be systematic rather than transitory.

We address this concern by developing a simple measure of country-specific monetary policy shocks that captures how the common policy rate diverges from national cyclical needs. Specifically, we construct the *country-specific monetary policy gap* (CMPG), defined as the deviation of the ECB's policy rate (EONIA) from a counterfactual rate implied by a Taylor rule using country-level inputs. The CMPG quantifies how expansionary or contractionary the common policy is relative to a given country's economic conditions. We document substantial cross-country dispersion in the CMPG, particularly between core and periphery countries, confirming the presence of systematic asymmetries within the euro area.

To assess how accounting for these misalignments affects our understanding of the monetary transmission channel in the euro area, we estimate panel local projections using data for ten euro-area countries from 2003:Q1 to 2019:Q4. The sample includes five core countries (Austria, Belgium, Finland, France, and Germany) and five periphery countries (Greece, Ireland, Italy, Portugal, and Spain), which together account for about 90 percent of euro area GDP. We allow for country fixed effects and impose group-level slope homogeneity to focus on systematic regional differences between core and periphery countries while enhancing estimation efficiency.

We find that an increase in the CMPG—instances where the ECB policy rate is more accommodative than warranted by local fundamentals—generates significantly larger output responses in periphery countries. It also yields amplified macro-financial effects in the periphery, while comparable responses are muted in the core. By contrast, using standard measures of common monetary policy shocks fails to reveal this asymmetry, offering a poten-

tial explanation for the mixed findings in the literature on heterogeneous monetary policy transmission in the euro area.

Next, we explore whether the bank lending channel underlies this asymmetry, focusing on mortgage credit given its central role in macroeconomic fluctuations (e.g., Dell'Ariccia, Igan, Laeven and Tong (2014); Haltenhof, Lee and Stebunovs (2014); Jordà, Schularick and Taylor (2015); Mian, Sufi and Verner (2017)).[1] We show that bank mortgage credit expands sharply in periphery countries following an increase in the CMPG, with corresponding increases in residential investment and housing prices, while no comparable effects emerge in the core.

However, establishing a causal role played by the bank lending channel is empirically challenging because of the apparent endogeneity problem. While changes in credit are positively correlated with subsequent changes in output, credit demand effects confound credit supply effects (e.g., Bernanke, Lown and Friedman (1991); Peek, Rosengren and Tootell (2003); Jiménez, Ongena, Peydró and Saurina (2014)). To sharpen identification, we leverage data from the ECB's Bank Lending Survey, whose qualitative responses have been used to proxy supply and demand factors of bank credit in the euro area (e.g., Maddaloni and Peydró (2011); Ciccarelli, Maddaloni and Peydró (2015); Neuenkirch and Nöckel (2018)). Although loan demand increases in both regions, periphery banks ease lending standards while core banks tighten them. This sharp divergence in credit supply appears to drive regional differences in monetary policy transmission.

Finally, we explore the origin of credit supply shifts through the cross-border bank lending channel of monetary policy using bilateral banking flows. We find that core-country banks increase cross-border lending to periphery countries—but not to other core countries—following an increase in the CMPG. Simultaneously, domestic bank lending margins fall in core countries while remaining stable in periphery countries. These patterns suggest that core banks reallocate lending to riskier, higher-yield regions—such as the periph-

[1] Other explanations for regional divergence include external debt overhang (Arellano, Atkeson and Wright (2016)), lack of structural reform (Fernández-Villaverde, Garicano and Santos (2013)), capital misallocation (Gopinath, Kalemli-Özcan, Karabarbounis and Villegas-Sanchez (2017)), and the absence of stabilizing mechanisms in a monetary union (Lane (2012)). Our mechanism is complementary to these views.

ery—consistent with a search-for-yield motive. Thus, our findings are consistent with the bank risk-taking channel of monetary policy, including both domestic and cross-border dimensions (e.g., Delis and Kouretas (2011); Bruno and Shin (2015); Cesa-Bianchi, Ferrero and Rebucci (2018); Neuenkirch and Nöckel (2018); Albrizio, Choi, Furceri and Yoon (2020)).

Taken together, our results highlight the importance of accounting for structural imbalances and cyclical divergence when analyzing monetary policy transmission in a monetary union. Estimates based on common shocks alone may conflate important cross-country differences driven by persistent cyclical asymmetries. By introducing a simple approach to internalizing policy misalignment, we uncover a previously underappreciated bank mortgage credit supply as a key mechanism behind heterogeneous monetary policy effects in the euro area.

The remainder of the paper proceeds as follows. Section 2 outlines identification issues with common monetary policy shocks and motivates our approach. Section 3 describes the construction of the CMPG and the empirical framework. Section 4 presents the main results and robustness checks, and investigates the cross-border bank lending mechanism. Section 5 concludes.

2 Pitfalls of Estimating the Heterogeneous Effects of a Common Monetary Policy Shock

We formalize the identification strategy for estimating the effects of a common monetary policy shock in a monetary union comprising heterogeneous countries. In particular, we contrast estimates using a common monetary policy shock with those using a country-specific monetary policy shock. We demonstrate that, under state-dependent transmission of monetary policy, estimates of country-level heterogeneous effects using a common shock are generally biased unless the shock captures local cyclical conditions.

Setup. Suppose a monetary union consists of two countries (Home and Foreign) with a

share λ and $1-\lambda$, respectively. Let i_t denote the common nominal interest rate set by the union-wide central bank, and let ε_t denote a monetary policy shock common to all countries. Let ε_t^i denote a country-specific monetary policy shock, constructed as the deviation between the realized common interest rate i_t and the country-specific Taylor-rule-implied rate $i_t^{i,*}$:

$$\varepsilon_t^i = i_t - i_t^{i,*}, \quad \text{where} \quad i_t^{i,*} = \bar{r} + \phi_\pi \pi_t^i + \phi_x x_t^i$$

with π_t^i denoting the inflation rate and x_t^i the output gap. The parameters $\bar{r}$, ϕ_π, and ϕ_x are common across countries.

We are interested in estimating the heterogeneous effect of monetary policy shocks on a country-specific macroeconomic outcome y_{t+h}^i (e.g., output growth, credit growth, etc.) at horizon h using local projections by Jordà (2005).

Assumption 1 (Shock exogeneity)

The common shock ε_t is exogenous with respect to the structural residual e_t^i:

$$\mathbb{E}[\varepsilon_t \cdot e_{t+h}^i] = 0. \tag{1}$$

Assumption 2 (State-dependent effects)

The response to a monetary policy shock depends on the cyclical state of the country at the time of the shock. Define

$$\Delta_{t,h}^i(\varepsilon_t) \equiv \frac{\partial y_{t+h}^i}{\partial \varepsilon_t}\Big|_{\mathcal{F}_t},$$

where y_{t+h}^i is the macroeconomic outcome of interest in country i, and $\mathcal{F}_t$ denotes the information set at time t, including the country's cyclical state.

Let Z_t^i denote the state variable (e.g., output or inflation gap), with:

$$\Delta_{t,h}^i(\varepsilon_t) = \delta_h^{i,\text{rec}} \cdot \mathbb{1}\{Z_t^i < 0\} + \delta_h^{i,\text{exp}} \cdot \mathbb{1}\{Z_t^i \geq 0\}, \tag{2}$$

where $\delta_h^{i,\text{rec}}$ and $\delta_h^{i,\text{exp}}$ represent a state-specific impulse response coefficient—specifically, the effect of a monetary policy shock on country i's outcome at horizon h when country i is in a recession and expansion, respectively. However, any states (e.g., financial conditions or degree of uncertainty) can be applied without loss of generality.[2] Importantly, let us assume that $|\delta_h^{i,\text{rec}}| \neq |\delta_h^{i,\text{exp}}|$, which is supported by numerous studies on the state-dependent effects of monetary policy shocks (e.g., Tenreyro and Thwaites (2016); Burgard et al. (2019); Alpanda et al. (2021); Ascari and Haber (2022); Choi et al. (2024)).

Proposition 1 (Bias in estimation using a common shock)

Suppose we estimate a country-level local projection of the form:

$$y_{t+h}^i = \alpha^i + \beta_h^i \varepsilon_t + \text{controls} + u_{t+h}^i. \tag{3}$$

Then $\hat{\beta}_h^i$ is a biased estimator of the structural policy effect $\Delta_{t,h}^i$ whenever the state Z_t^i varies across observations and affects the response function.

In particular:

$$\hat{\beta}_h^i = \delta_h^{i,\text{rec}} \cdot \Pr(Z_t^i < 0) + \delta_h^{i,\text{exp}} \cdot \Pr(Z_t^i \geq 0), \tag{4}$$

which reflects endogenous exposure to the state-dependent response function. The bias arises because ε_t is identical across countries but the structural effect $\Delta_{t,h}^i$ varies with the country's cyclical state.

Proposition 2 (Unbiased estimation using country-specific shocks)

Suppose instead we estimate:

$$y_{t+h}^i = \alpha^i + \gamma_h^i \varepsilon_t^i + \text{controls} + \nu_{t+h}^i. \tag{5}$$

[2]Nevertheless, we frame our analysis around business cycle conditions, given empirical evidence that state dependence with respect to the business cycle tends to dominate alternative forms of state dependence documented in the literature (see Alpanda et al. (2021)).

Then under Assumption 1 and assuming ε_t^i is uncorrelated with ν_{t+h}^i, the estimator $\hat{\gamma}_h^i$ is unbiased:

$$\mathbb{E}[\hat{\gamma}_h^i] = \gamma_h^i. \tag{6}$$

Discussion. Since ε_t^i accounts for local macroeconomic conditions through the construction of $i_t^{i,*}$, it already internalizes the heterogeneity in the response function across states Z_t^i. Thus, it is orthogonal to omitted heterogeneity, unlike the common shock ε_t. ■

Proposition 3 (Bias cancels out in pooled estimation over full sample)

Suppose we estimate a pooled regression over N countries:

$$y_{t+h}^i = \alpha + \bar{\beta}_h \varepsilon_t + \text{controls} + u_{t+h}^i, \tag{7}$$

where y_{t+h}^i is the macroeconomic outcome in country i and the regression is pooled over all countries.

Let the true model be:

$$y_{t+h}^i = \delta_h^{i,\text{rec}} \cdot \varepsilon_t \cdot \mathbb{1}\{Z_t^i < 0\} + \delta_h^{i,\text{exp}} \cdot \varepsilon_t \cdot \mathbb{1}\{Z_t^i \geq 0\} + \text{controls} + e_{t+h}^i.$$

If business cycle states Z_t^i are independently distributed across countries and time, and if each country experiences both recessions and expansions with positive probability, then:

$$\mathbb{E}[\bar{\beta}_h] \approx \mathbb{E}\left[\Delta_{t,h}^i\right],$$

i.e., the bias due to state dependence cancels out in aggregate, yielding a consistent estimate of the average structural effect of monetary policy.

Discussion. Although individual country regressions using ε_t are biased due to correlation between the shock and the country's cyclical state, this correlation is not systematically one-

sided across countries and time. If countries randomly move in and out of recessions and expansions, the state-dependent bias terms tend to average out, especially as N becomes large and the time dimension increases.

Proposition 4 (Bias persists in pooled estimation over subsamples)

Now suppose we estimate the same pooled regression but over subsets of countries where business cycle states Z_t^i are not i.i.d. across countries and time within each subset (e.g., core and periphery):

$$y_{t+h}^i = \alpha^i + \beta_h^g \varepsilon_t + \text{controls} + u_{t+h}^i, \quad \text{for } i \in g \in \{\text{core, periphery}\}. \tag{8}$$

If group g is systematically in a specific state then

$$\mathbb{E}[\beta_h^g] \neq \mathbb{E}[\Delta_{t,h}^i].$$

Discussion. If countries within a group share persistent cyclical positions, then state-dependent responses do not average out within the group, and bias remains. Instead, the group-specific estimate is disproportionately weighted by responses occurring in a particular state. As a result, β_h^g reflects a distorted mix of effects and cannot be interpreted as an unbiased average treatment effect.

In summary, Proposition 1 shows that country-level regressions using common monetary policy shocks are subject to bias when countries differ in their cyclical positions and this heterogeneity is not explicitly addressed. Proposition 2 establishes that country-specific shocks—constructed to capture local deviations from the area-wide policy stance—yield consistent and interpretable estimates of heterogeneous effects, mitigating the bias inherent in common-shock approaches. Proposition 3 demonstrates that, in pooled regressions using the full country sample, the bias induced by state dependence tends to average out, provided

that business cycle conditions vary sufficiently across countries and over time. This result offers some justification for the common empirical practice of estimating aggregate effects of common monetary policy shocks using euro-area panel data, while also gaining estimation efficiency. Finally, Proposition 4 highlights that this cancellation does not hold in subsample regressions—such as when restricting the sample to core or periphery countries—if persistent cyclical asymmetries exist across groups. In such cases, caution is warranted when drawing contrasts in heterogeneous effects across country groupings. This caveat is particularly salient in the euro area, where macroeconomic divergence between core and periphery countries remains a defining feature of the monetary union.

3 Empirical Framework

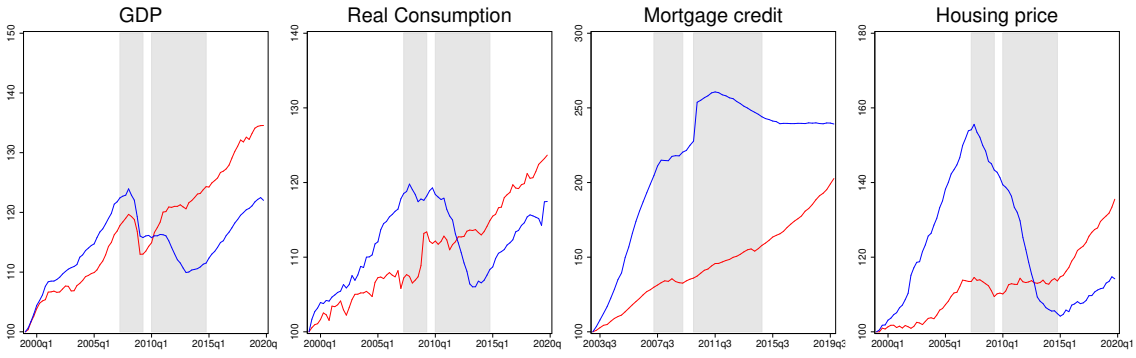
3.1. Data

Figure 1 presents the evolution of key macro-financial variables—real GDP, real consumption, real mortgage credit, and real housing prices—for five core countries (Austria, Belgium, Finland, France, and Germany) and five periphery countries (Greece, Ireland, Italy, Portugal, and Spain). For each region, we construct a GDP-weighted average of these indicators and normalize the series to 100 in the base period to facilitate visual comparison. The figure reveals stark divergences in dynamics across the two groups.

In particular, periphery countries experienced more pronounced boom-bust cycles relative to core countries, suggesting violations of the assumptions required for the consistent estimation of *heterogeneous* responses to common monetary policy shocks. This persistent asymmetry highlights the challenges facing the ECB in achieving simultaneous stabilization across member states and the importance of accounting for countries' cyclical positions in empirical analyses of heterogeneous monetary policy transmission.

Motivated by a growing literature highlighting the distinct macroeconomic implications of household credit relative to business credit (e.g., Büyükkarabacak and Valev (2010); Hal-

Figure 1: Evolution of key macro and financial variables: core vs. periphery countries



Note: The figure displays the trajectory of real GDP, real consumption, real mortgage credit, and real housing prices for the core (red) and periphery (blue) country groups. Each series is a GDP-weighted average of the group components and normalized to 100 in the base year. Shaded areas denote the global financial crisis (2007:Q4–2009:Q2) and the European sovereign debt crisis (2010:Q1–2014:Q4).

tenhof et al. (2014); Bahadir and Gumus (2016); Mian et al. (2017)), our empirical analysis centers on household mortgage credit as a potential source of regional heterogeneity in the transmission of monetary policy.[3] We define mortgage credit as the outstanding stock of loans for house purchases recorded on the balance sheets of Monetary Financial Institutions (MFIs).[4]

In addition to mortgage credit, we incorporate interest rates on outstanding mortgage loans. These rates are calculated as average effective rates applied to the stock of mortgage lending, and real terms are used for analysis. To assess downstream effects of household credit expansion, we also include residential investment and real housing price indices from the Bank for International Settlements (BIS).

A central contribution of our analysis is the incorporation of quarterly data from the ECB's Bank Lending Survey (BLS) to enhance identification of the bank lending channel of

[3]For example, Büyükkarabacak and Valev (2010) show that expansions in household credit are a stronger predictor of banking crises than those in business credit. Haltenhof et al. (2014) find that household access to bank loans plays a more significant role in U.S. employment dynamics than firm access. Bahadir and Gumus (2016) document that household credit growth is more strongly associated with economic expansions, real exchange rate appreciation, and trade deficits than business credit growth. Mian et al. (2017) show that household credit booms are systematically followed by economic contractions, whereas business credit booms are not.

[4]MFIs include the Eurosystem, credit institutions, and other financial institutions that accept deposits and either provide credit or invest in securities.

monetary policy. The BLS provides qualitative assessments of bank behavior based on responses from senior loan officers regarding recent and anticipated changes in credit standards and loan demand. These data are particularly valuable in environments where credit volumes or lending rates may not fully capture underlying credit market conditions due to regulatory constraints or price rigidities (e.g., Choi (2021)). Accordingly, survey-based responses on lending standards and loan demand offer granular information on credit supply and demand dynamics beyond what can be inferred from quantities or interest rates alone (e.g., Lown and Morgan (2006); Meeks (2012); Bassett, Chosak, Driscoll and Zakrajšek (2014); Ciccarelli et al. (2015); Wu and Suardi (2021)).[5]

Importantly, the BLS facilitates the separation of supply and demand factors, particularly in settings characterized by imperfect or heterogeneous pass-through from policy rates to lending conditions—an important feature of the euro area (e.g., Hristov, Hülsewig and Wollmershäuser (2014); Horvath, Kotlebova and Siranova (2018); Altavilla, Canova and Ciccarelli (2020)). This is especially relevant in light of ongoing financial fragmentation across euro-area countries (Mayordomo, Abascal, Alonso and Rodriguez-Moreno (2015); Claessens (2017)) and the structural differences in mortgage securitization relative to the United States (Wachter (2015)).[6]

To assess the role of mortgage credit, we collect survey data on loans for house purchases, which account for approximately 40% of private credit in the euro area. The survey has been conducted quarterly since 2003, which defines the start of our sample period. We construct a diffusion index (DI) for lending standards and loan demand for household mortgage credit.[7]

We further collect country-level macroprudential policy indicators to assess whether na-

[5]For further detail on the structure and coverage of the euro-area BLS, see Maddaloni and Peydró (2011); Ciccarelli et al. (2015); Neuenkirch and Nöckel (2018).

[6]Unlike in the United States, where mortgage debt is extensively securitized and removed from bank balance sheets, European mortgage markets are dominated by covered bonds. These instruments are secured by mortgage assets but remain on the issuer's balance sheet, leaving the originating bank liable for repayment.

[7]The diffusion index (DI) aggregates banks' qualitative assessments of changes in lending standards or loan demand. Responses are assigned weights as follows: 1 for "tightened considerably," 0.5 for "tightened somewhat," –0.5 for "eased somewhat," and –1 for "eased considerably." Responses of "basically unchanged" receive a weight of zero. The resulting DI ranges from –100 to +100, with positive values indicating net tightening and negative values indicating net easing.

tional policy actions contribute to the observed regional heterogeneity. As a summary measure, we use the Integrated Macroprudential Policy (iMaPP) database compiled by Alam, Alter, Eiseman, Gelos, Kang, Narita, Nier and Wang (forthcoming), which catalogs 17 categories of macroprudential instruments. Focusing on tools related to mortgage credit, we evaluate whether and how macroprudential responses vary across countries in reaction to monetary policy changes.

Lastly, to explore intra-regional sources of asymmetry in the monetary transmission channel, we incorporate data on current accounts and cross-border banking flows. Current account data are sourced from Eurostat and expressed as a share of nominal GDP. For bilateral cross-border banking flows, we rely on data from the BIS Locational Banking Statistics (LBS), which capture changes in external financial linkages that may mediate or amplify the domestic effects of monetary policy. Our analysis covers ten euro area countries for which the relevant data are consistently available. A full description of data sources and definitions is provided in Table 1.

Table 1: Definition and Sources of Data

Variables	**Definition**	**Time span**	**Data source**
Aggregate-level data			
Euro Overnight Index Average (EONIA)	EONIA rate of monetary policy decision date for every last month of its quarter	1999:Q1–2019:Q4	ECB Data Warehouse
Inflation (forecast)	Staff assessment of inflation rate	1999:Q1–2019:Q4	ECB Macroeconomic Projection Database
Real GDP growth (forecast)	Staff assessment of Real GDP growth	1999:Q1–2019:Q4	ECB Macroeconomic Projection Database

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Variables	Definition	Time span	Data source
Output gap (forecast)	Estimated data from the Output Gaps Working Group in the European Commission (annual)	1999–2019	European Commission
Country-level data			
Real GDP	Gross domestic product at market prices, constant prices (the base year of 2015), calendar-adjusted	1995:Q1–2019:Q4	Datastream
HICP	Quarterly average of the monthly Harmonised Indices of Consumer Prices (HICP) index (the base year of 2015), seasonally adjusted with X-12 ARIMA	2003:Q1–2019:Q4	ECB Data Warehouse, author's calculation
Output gap	Cyclical component of real GDP from Hamilton filter (Hamilton, 2018)	2003:Q1–2019:Q4	Author's calculation
Total consumption	GDP Expenditure approach, Private Final Consumption, Chained volume estimates, National reference year, Quarterly, SA	2003:Q1–2019:Q4	OECD statistics
Mortgage credit outstanding	Outstanding amounts of mortgage loans at the end of the period	2003:Q1–2019:Q4	ECB Data Warehouse
Mortgage interest rate	Quarterly average of the mortgage interest rate for outstanding loans	2003:Q1–2019:Q4	ECB Data Warehouse
Housing prices	Residential property price index from BIS statistics (the base year of 2010)	2003:Q1–2019:Q4	BIS
Residential investment	Gross fixed capital formation in the housing sector, constant prices	2003:Q1–2019:Q4	Datastream
Loan demand for mortgage loans	Diffusion index, the weighted difference between the share of banks reporting "substantially stronger" and "moderately stronger" and the share of "moderately weaker" and "substantially weaker" for mortgage loans in the percentage of the total number of banks	2003:Q1–2019:Q4	ECB's Bank Lending Survey data

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Variables	Definition	Time span	Data source
Lending standard for mortgage loans	Diffusion index, the weighted difference between the share of banks reporting "substantially tightened" and "moderately tightened" and the share of "moderately eased" and "substantially eased" for mortgage loans in the percentage of the total number of banks	2003:Q1–2019:Q4	ECB's Bank Lending Survey data
Macroprudential policy measure	Alam et al. (forthcoming): Dummy-type variables for 17 instruments of macroprudential policy.	2003:Q1–2019:Q4	Alam et al. (forthcoming)
Current accounts	External balance of goods and services and international transfers of capital	2003:Q1–2019:Q4	Eurostat
Cross-border bank flows	Bilateral cross-border claims, loans, and deposits	2003:Q1–2019:Q4	BIS Locational Banking Statistics

Note: This table provides the definition, time span, and sources of variables used in the analysis.

3.2. Estimation of country-specific monetary policy gap

Motivated by theoretical concerns about estimating heterogeneous effects of common monetary policy in a monetary union, we construct a country-specific monetary policy gap (CMPG) that internalizes each country's cyclical position. This process addresses potential bias induced by state-dependency in the effect of monetary policy, thereby resulting in clear identification of heterogeneous effects across core and periphery countries. Specifically, we define the CMPG as the difference between the actual euro area policy rate—the Euro Overnight Index Average (EONIA)—and the rate implied by a country-specific Taylor rule.[8]

To operationalize this concept, we begin by estimating the ECB's aggregate Taylor rule, which reflects the policy stance derived from euro area-wide macroeconomic conditions. We

[8]Under a standard Taylor rule, the policy rate responds to deviations of inflation from its target and output (or unemployment) from potential. While the precise coefficients may vary, the rule remains a widely used benchmark in empirical monetary policy analysis.

adopt EONIA as the relevant policy rate, given its responsiveness to nonstandard policy measures implemented during our sample period.[9] To mitigate endogeneity concerns, we follow (Coibion and Gorodnichenko (2012)) and employ real-time forecasts of inflation and output growth from the ECB staff macroeconomic projections.[10] The Taylor rule is estimated by embedding these forecasts in a forward-looking specification, which includes lagged interest rates to capture policy inertia. We do not estimate country-specific coefficients due to endogeneity concerns and instead apply the aggregate Taylor rule to country-level macroeconomic variables such as inflation, output gaps, and real GDP growth.[11]

Following Coibion and Gorodnichenko (2012) and Carvalho, Nechio and Tristao (2021), we estimate the ECB Taylor rule via Ordinary Least Squares (OLS) with Newey-West standard errors:

$$i_t = c + \delta i_{t-1} + \varphi_\pi E_{t-}\pi_{t+1,t+2} + \varphi_x E_{t-}x_t + \varphi_{\Delta y} E_{t-}\Delta y_t + \varepsilon_t, \tag{9}$$

where i_t is the EONIA rate, π_t is the year-over-year inflation rate based on HICP, x_t is the output gap, and Δy_t is quarterly real GDP growth. They all correspond to euro-area aggregates. The expectations operator E_{t-} denotes ECB staff forecasts made prior to the relevant policy meeting.[12] We estimate the rule using data from 1999:Q1 to 2016:Q1, prior to the effective lower bound on ECB policy rates.[13]

[9] Although the ECB adopted fixed-rate full-allotment operations in October 2008, the market-based EONIA rate continued to reflect the effective stance of policy, including unconventional measures (Ciccarelli et al. (2015)).

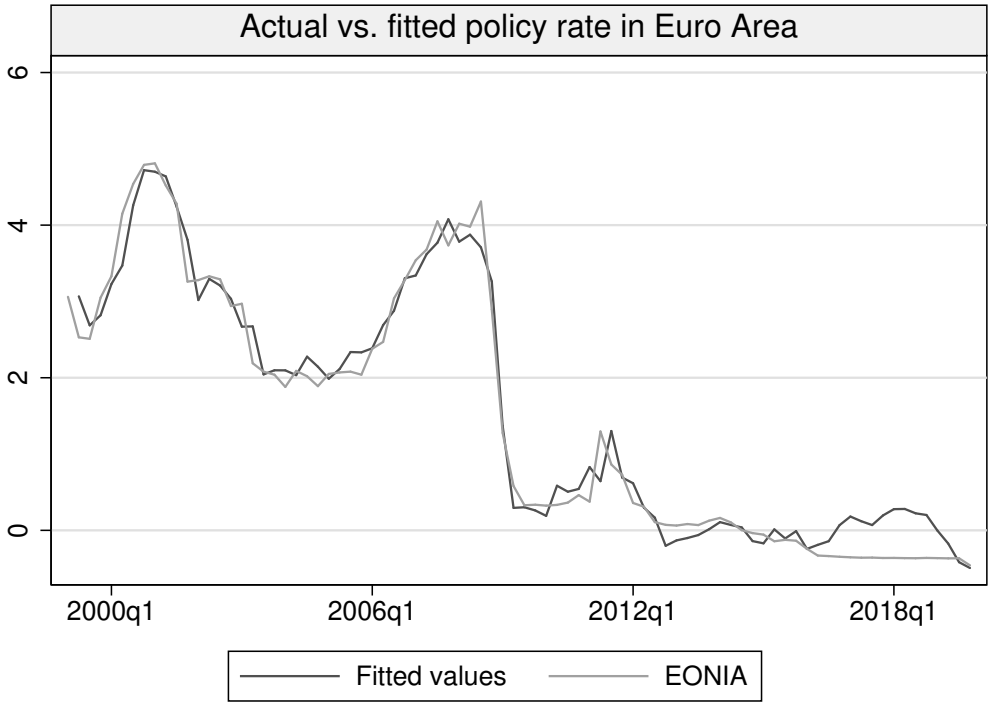
[10] The ECB releases its staff forecasts quarterly. These projections, finalized before Governing Council meetings, guide policy decisions and are publicly available at the end of each quarter.

[11] Output gaps are computed using the Hamilton filter (Hamilton (2018)) applied to real GDP data from 1995:Q1 to 2019:Q4.

[12] We follow Coibion and Gorodnichenko (2012) by using the average forecast of inflation for $t+1$ and $t+2$, and contemporaneous (pre-decision) forecasts for GDP growth. The press conference dates are used to align forecasts with decision timing.

[13] The ECB's Main Refinancing Operations (MRO) rate reached zero in March 2016. While our main analysis begins in 2003:Q1 due to BLS data availability, we extend the estimation window for the Taylor rule back to 1999:Q1 to enhance precision. Results are robust to using a shorter sample.

Figure 2: Actual vs. fitted policy rate in the euro area



Note: The light line shows the EONIA rate, and the dark line displays the fitted policy rate implied by the estimated Taylor rule. The estimation sample spans 1999:Q1 to 2016:Q1; out-of-sample forecasts are shown through 2019:Q4, as the official key interest rate of the ECB reached the Effective Lower Bound in March 2016.

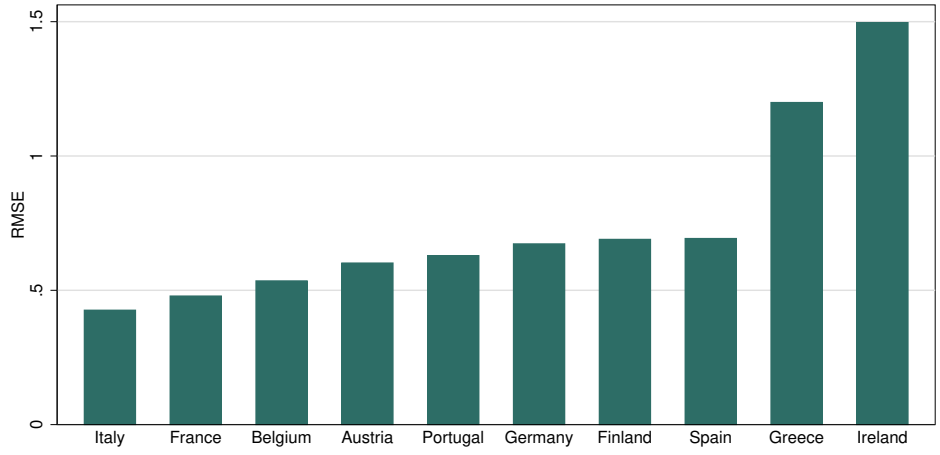
The estimated coefficients are presented in Equation (10):

$$i_t = -0.16 + \underset{(0.04)}{0.82^{***}}\, i_{t-1} + \underset{(0.06)}{0.20^{***}}\, E_{t-}\pi_{t+1,t+2} + \underset{(0.04)}{0.09^{**}}\, E_{t-}x_t + \underset{(0.17)}{0.53^{***}}\, E_{t-}\Delta y_t + \varepsilon_t. \tag{10}$$

All coefficients are statistically significant and exhibit expected signs. The large coefficient on the lagged policy rate reflects significant interest rate smoothing by the ECB (Christiano, Motto and Rostagno (2008)), while the long-run inflation coefficient satisfies the Taylor principle (i.e., greater than one). The model fits the data well, with an R^2 of 0.98. Figure 2 compares the fitted Taylor rule-implied policy rate to the observed EONIA.

Using the estimated coefficients, we compute the country-specific prescribed interest rate by inserting national macroeconomic conditions into the aggregate rule. The CMPG is then

Figure 3: Size of monetary misalignment across countries



Note: This figure presents the root mean squared errors (RMSEs) of each country's CMPG, quantifying the degree of deviation between country-specific prescribed interest rates and the common EONIA rate.

defined as the difference between this prescribed rate and the common EONIA rate:

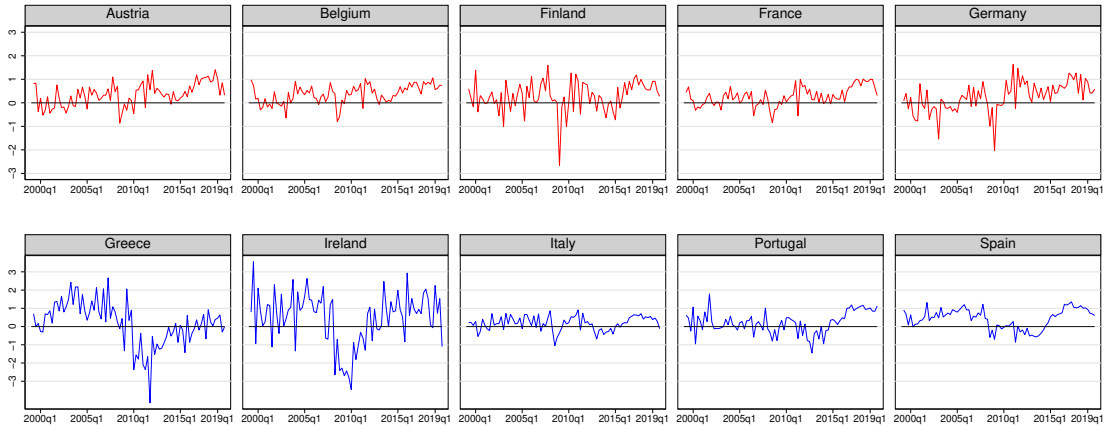
$$CMPG_t^i = \hat{i}_t^i - i_t \text{ and } \hat{i}_t^i = \hat{c} + \hat{\delta} i_{t-1} + \hat{\varphi}_\pi \pi_{t+1,t+2}^i + \hat{\varphi}_x x_t^i + \hat{\varphi}_{\Delta y} \Delta y_t^i, \tag{11}$$

where each of the coefficients in Equation (11) is taken from the estimated aggregate Taylor rule in Equation (10): $\hat{\varphi}_\pi$ refers to the estimated coefficient of the expected inflation, $\hat{\varphi}_x$ represents the coefficient of the output gap measure, and $\hat{\varphi}_{\Delta y}$ denotes the Taylor coefficient of the expected GDP growth rate term. Note that a positive value of the CMPG indicates that the common policy rate is more accommodative than the country-specific benchmark, implying a relatively expansionary stance given national economic conditions. Conversely, a negative value reflects a relatively contractionary stance.

Figure 3 reports the root mean squared errors (RMSEs) of each country's CMPG. The magnitudes vary considerably across countries. More notably, the RMSEs tend to be larger for periphery countries: the three countries with the largest errors are in the periphery, while the three with the smallest errors—except for Italy—belong to the core. This pattern points to systematic policy misalignment within the monetary union.

To further illustrate the time variation in monetary policy misalignment, Figure 4 displays

Figure 4: Evolution of country-specific monetary policy gap



Note: The first row represents the CMPG of core countries; the second row displays the CMPG of periphery countries. This time series starts in 2003:Q1 and ends in 2019:Q4.

the CMPG series for each country from 2003:Q1 to 2019:Q4. The figure reveals persistent deviations between the common policy stance and country-specific benchmarks, particularly in periphery economies, where ECB policy appears excessively expansionary during upswings and overly contractionary during downturns. These patterns lend support to the "one size does not fit all" critique of euro area monetary policy (e.g., Nechio (2011); Gagnon and Gimet (2023)).

As discussed in Section 2, if such systematic misalignment is not explicitly accounted for, state-dependent responses to monetary policy may obscure true cross-country heterogeneity, leading to potentially misleading inferences about the sources of variation in monetary policy transmission. In the following analysis, we examine how our bias-corrected country-specific measure of monetary policy interacts with regional household credit dynamics, offering novel insights into the operation of the bank lending channel in a monetary union.

3.3. Local projections

This section outlines the empirical framework used to estimate the effects of monetary policy in a monetary union. We employ the local projection method of Jordà (2005), which

is well-suited for our setting given the relatively short sample, the high dimensionality of variables, and our ultimate focus on regional heterogeneity. Relative to a standard vector autoregression (VAR), the local projection approach offers greater flexibility by accommodating a large set of regressors in a single-equation framework and enabling subsample heterogeneity through interaction terms rather than explicit sample splits. Accordingly, testing whether the estimated responses differ significantly between core and periphery countries is straightforward.

We estimate the dynamic response of key macroeconomic and financial variables to changes in the country-specific monetary policy gap (CMPG) using the following local projection specification. Motivated by the finite-sample improvements associated with long-difference estimators, as discussed in Piger and Stockwell (forthcoming), we employ a cumulative response framework:

$$\Delta y^i_{t+h} = \alpha^i + \beta_h CMPG^i_t + \Gamma_h \sum_{j=0}^{p} X^i_{t-j} + T_t + T_t^2 + crisis^i_t + e^i_{t+h}, \tag{12}$$

where Δy^i_{t+h} denotes the cumulative (log) change in the outcome variable from $t-1$ to $t+h$, that is, $y^i_{t+h} - y^i_{t-1}$; α^i is a country fixed effect; $CMPG^i_t$ is the country-specific monetary policy gap; X^i_t is a vector of controls that includes lags of $CMPG^i_t$, real GDP growth, inflation, and the lagged dependent variable of interest. The terms T_t and T_t^2 are included to flexibly control for time trends and slow-moving secular forces. To address potential confounding from episodes of financial stress, we include the crisis indicator $crisis^i_t$, based on the systemic banking crisis database of Laeven and Valencia (2020). Accordingly, the estimated response to monetary policy is not mechanically driven by crisis periods. The coefficient β_h captures the horizon-specific response and is used to construct the impulse response function.

Given a relatively short sample period since the introduction of the euro, we pool observations across countries to increase estimation efficiency while controlling for persistent

cross-sectional heterogeneity through country-fixed effects.[14] The baseline sample spans 2003:Q1 to 2019:Q4 and includes five core (Austria, Belgium, Finland, France, and Germany) and five periphery countries (Greece, Ireland, Italy, Portugal, and Spain), covering approximately 90 percent of euro area GDP. The country selection is guided by data availability and the need for a balanced panel, particularly with respect to the bank lending survey. We estimate the model with four lags ($p = 4$) and report 68% and 90% confidence intervals constructed using heteroskedasticity- and autocorrelation-robust (HAR) standard errors in the sense of Newey and West.

We also estimate the following specification to reveal regional heterogeneity across core and periphery countries:

$$\begin{aligned}\Delta y^i_{t+h} =& \alpha^i + D^i(\beta_h^{core} CMPG^i_t + \Gamma_h^{core} \sum_{j=0}^{p} X^i_{t-j}) \\ &+ (1 - D^i)(\beta_h^{peri} CMPG^i_t + \Gamma_h^{peri} \sum_{j=0}^{p} X^i_{t-j}) + T_t + T_t^2 + crisis^i_t + e^i_{t+h},\end{aligned} \tag{13}$$

where D^i is an indicator equal to one for core and zero for periphery countries. Given our interest in regional asymmetries, we allow for slope heterogeneity across regions but impose homogeneity within each group. Equation (13) reflects this through region-specific coefficients β_h^{core} and β_h^{peri}, as well as Γ_h^{core} and Γ_h^{peri}.

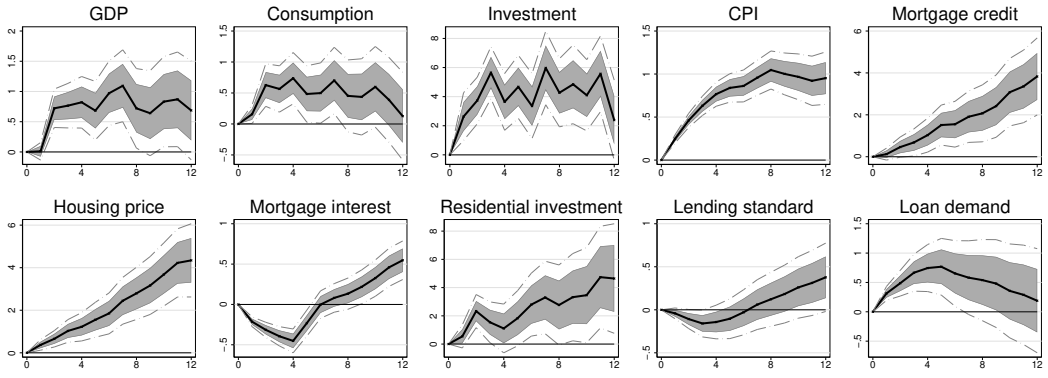
4 Empirical Findings

4.1. Main results

We begin by examining the average responses of key macroeconomic variables to an increase in the CMPG, estimated via Equation (12). This serves as a validation exercise to

[14] Although characteristics such as industrial composition or demographic structure may vary over time, they do so slowly. Given the quarterly frequency of our analysis, country fixed effects effectively absorb these differences.

Figure 5: Response of macro and financial variables to an increase in the CMPG



Note: This figure reports average impulse response functions to a one standard deviation increase in the CMPG for the sample of ten euro area countries. The horizontal axis denotes quarters. Shaded areas denote 68% and 90% confidence intervals.

assess whether the behavior of our bias-corrected monetary policy measure comports with theoretical predictions regarding the effects of expansionary monetary policy shocks.[15]

Figure 5 reports the estimated impulse responses. An increase in the CMPG—which we interpret as an expansionary monetary policy innovation relative to local cyclical conditions—generates broad-based increases in output, consumption, investment, and the price level, consistent with textbook expectations of monetary easing. These patterns lend support to the internal validity of our identification strategy.

To further assess the empirical validity of our identification strategy in light of the propositions developed in Section 2, we compare our baseline results to those obtained using two alternative measures of monetary policy shocks commonly employed in the literature (see Choi et al. (2024) for a comprehensive review of identification strategies for monetary policy shocks and their relative merits).

First, we construct Taylor residuals by substituting area-wide macroeconomic variables into the estimated Taylor rule from Equation (10), yielding a measure of deviations from systematic policy. Second, we utilize the high-frequency monetary policy surprises developed by Jarociński and Karadi (2020), which rely on sign restrictions for identification and

[15] All variables, except prices, are deflated using the Harmonized Index of Consumer Prices (HICP).

explicitly account for central bank information effects.[16]

Because both alternative shocks are common across member states, country-specific estimates based on these measures may be biased due to the interaction of state-dependent responses and heterogeneous local business cycle conditions. However, as Proposition 3 suggests, such biases tend to cancel out in pooled regressions covering the full set of countries.

Estimation results based on these alternative shock series are presented in Appendix Figures A1 and A2. Despite their distinct identification strategies, the estimated responses of key macroeconomic variables remain remarkably consistent across specifications, corroborating the implication of Proposition 3. Notably, the results using the high-frequency surprise series of Jarociński and Karadi (2020)—arguably among the most rigorous approaches in the literature in Figure A2—closely track those obtained from the simpler Taylor residual method in Figure A1. To the extent that exogeneity is well established for the Jarociński–Karadi shocks, this similarity reinforces confidence in the validity of our CMPG-based strategy and alleviates concerns about potential endogeneity in its construction.

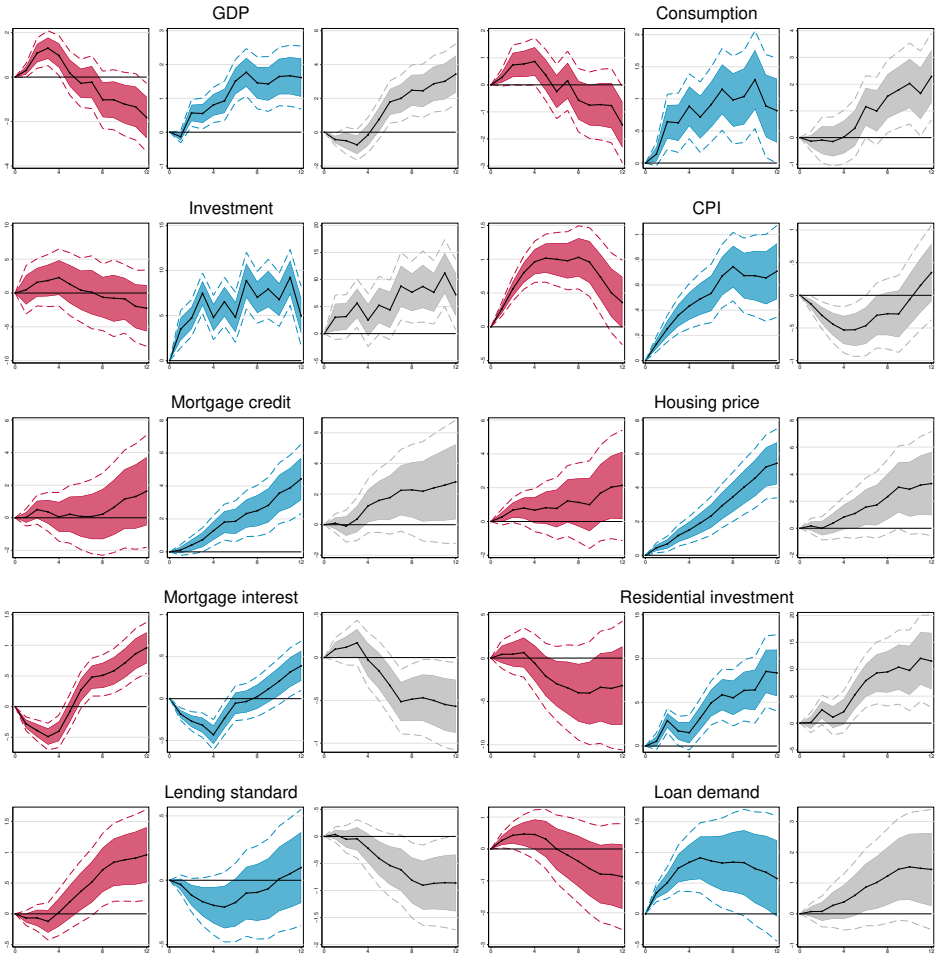
Taken together, the findings confirm that while accounting for cross-country cyclical heterogeneity is critical for identifying heterogeneous transmission effects, it does not substantially alter the estimated average (union-wide) effects of monetary policy.

Next, we assess whether the effects of monetary policy shocks differ systematically between core and periphery countries by allowing for heterogeneous responses to an increase in the CMPG, as specified in Equation (13). Because the CMPG adjusts for each country's cyclical position, any regional asymmetry in estimated responses cannot be attributed to differences in business cycle conditions at the time of the shock. Figure 6 presents region-specific impulse response functions, along with their cross-regional differences, where positive values indicate stronger responses in periphery countries.

The results reveal sizable and statistically significant regional asymmetries. Output, consumption, and investment respond more strongly in periphery countries, suggesting that

[16]Specifically, we use the component of monetary policy surprises orthogonal to central bank information shocks, aggregated from the meeting-level frequency to the quarterly level.

Figure 6: Response of macro and financial variables to an increase in the CMPG: core vs. periphery countries



Note: This figure reports the impulse response functions to a one standard deviation increase in the CMPG for core (the first and fourth columns) and periphery (the second and fifth columns) countries, respectively. The third and sixth columns show the cross-regional differences. The horizontal axis indicates quarters. Shaded areas denote 68% and 90% confidence intervals.

a comparable deviation from the optimal policy stance elicits a larger real response in those economies. This pattern points to a structural asymmetry in the monetary transmission mechanism. In contrast, the price response is not greater in periphery countries.

The divergence is particularly pronounced in credit and housing market responses. Mortgage credit and housing prices rise substantially in periphery countries, while showing muted or statistically insignificant responses in core economies. This suggests that the credit and housing channels play a more prominent role in monetary policy transmission for periphery

countries. Moreover, real mortgage rates decline more persistently in the periphery, despite stronger output and credit demand, pointing to a distinct role for the credit supply channel.

The most salient asymmetry emerges in bank lending standards. Following an increase in the CMPG, periphery banks ease lending standards, whereas core banks tighten them. This divergence helps explain the sharper credit and housing responses in the periphery and provides evidence that bank credit supply behavior amplifies regional heterogeneity in monetary transmission.

Although previous studies have documented the bank lending channel in the euro area (e.g., Gambacorta (2009); Delis and Kouretas (2011); Neuenkirch and Nöckel (2018)), few have explored its asymmetric operation across regions. To evaluate the incremental value of our CMPG-based approach, we re-estimate the heterogeneous effects using the two common monetary policy shock measures described earlier. Proposition 4 highlights that such regressions may suffer from bias when cyclical positions differ systematically across regions.

Figures A3 and A4 in the Appendix report the results. While both shocks generate expansionary effects consistent with theoretical predictions, the responses are broadly similar across regions. According to Proposition 4, this apparent symmetry does not necessarily imply the absence of true heterogeneity. Instead, it likely reflects systematic differences in business cycle positions between core and periphery countries that bias the estimates.

Taken together, these results highlight a key mechanism that remains obscured in conventional identification strategies. The CMPG-based approach reveals that regional differences in monetary transmission arise primarily through the supply side of credit markets: banks in core countries tighten lending standards, moderating credit growth and dampening housing market pressures. In contrast, periphery banks ease standards, amplifying mortgage credit expansion and macro-financial volatility. These findings speak to growing concerns over the destabilizing potential of monetary accommodation in the absence of appropriate credit intermediation safeguards (e.g., Grimm, Jordà, Schularick and Taylor (2023)). Whether monetary easing fuels financial instability ultimately depends on the nature of banks' lend-

ing responses—a theme we revisit in Section 4.3..

4.2. Robustness checks

This section presents a series of robustness exercises to confirm that our main findings from employing CMPG—namely, the systematic asymmetry between core and periphery countries and the role of the bank lending channel—are not driven by specific modeling choices. In particular, we examine the implications of the effective lower bound (ELB) constraint and unconventional monetary policy instruments in the construction of CMPG.

First, when estimating the euro area Taylor rule, we relied on forecast values of key macro aggregates to mitigate endogeneity concerns. However, due to data limitations, we used realized values for the estimation of country-specific Taylor rule coefficients. To assess the sensitivity of our findings to this discrepancy, we re-estimate the euro area rule using realized values and recompute CMPG. As shown in Figure A5, the impulse responses of key variables closely resemble those in the baseline, suggesting that any resulting bias is negligible. Notably, the divergence in mortgage lending standards across core and periphery countries remains pronounced, consistent with a bank lending channel of monetary policy.

Second, our baseline measure of CMPG uses the EONIA rate, which may insufficiently capture the stance of monetary policy in the presence of unconventional tools. We therefore substitute the shadow rate constructed by Wu and Xia (2017), which accounts for the ECB's ELB constraint through a term structure approach. As shown in Figure A6, the responses are robust to this alternative specification, indicating that the ELB does not materially affect our conclusions.

Third, although the results remain robust when accounting for the ELB, it is plausible that this rather unconventional macroeconomic environment drives the observed regional asymmetry—especially given the relatively short sample. We address this by restricting the estimation sample of local projections to 2003:Q1–2016:Q1. Our main findings persist (Figure A7).

Fourth, the baseline Taylor rule is estimated over the full sample through 2016:Q1. One concern is that including the post-2008 crisis period, which featured especially divergent economic trajectories between core and periphery countries, may induce overfitting. To address this, we re-estimate the rule using data only through 2007:Q4. As shown in Figure A8, the asymmetric response of core and periphery countries and the presence of the bank lending channel remain evident.

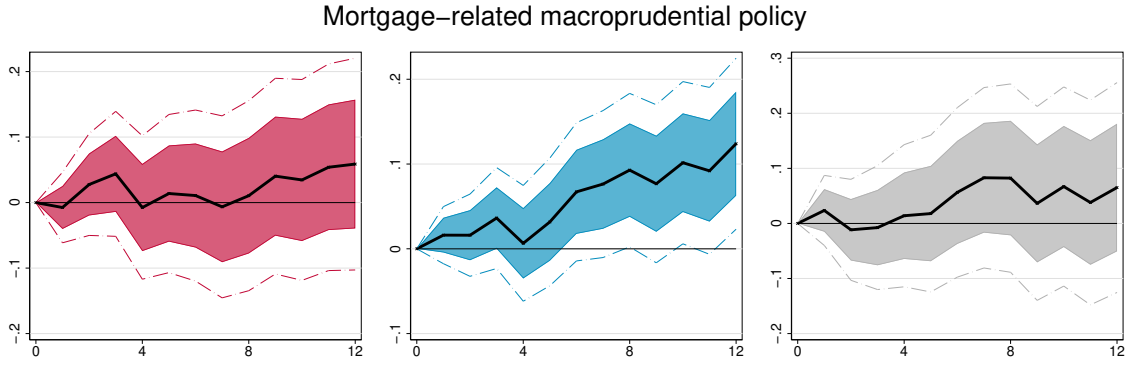
Lastly, given the endogenous response of macroprudential policies and their interplay with monetary policy (Kim and Mehrotra (2018)), we examine the role of macroprudential policy in explaining the asymmetric effects of CMPG. Drawing on the comprehensive database in Alam et al. (forthcoming), we focus on household mortgage-targeted measures, including loan-to-value (LTV) ratio, debt-service-to-income (DSTI) ratio, loan-to-deposit (LTD) ratio, and loan restrictions based on maturity, size, or interest rate structure.

Figure 7 presents the responses of these instruments to an increase in the CMPG, showing no meaningful difference between regions. If anything, macroprudential policy becomes marginally tighter in periphery countries, suggesting it cannot account for the divergence in mortgage lending standards or credit expansion. Including these controls in Equation (13) leaves our main results virtually unchanged (Figure A9).

4.3. Cross-border bank lending channel of monetary policy

We present robust evidence that mortgage lending standards respond in opposite directions to an increase in the CMPG across core and periphery countries. This striking asymmetry in the credit supply response highlights the importance of the bank lending channel in explaining heterogeneous transmission of monetary policy across member states of a monetary union. Crucially, we find that this asymmetry is not attributable to contemporaneous adjustments in domestic macroprudential policies aimed at household credit. These findings motivate further investigation into the cross-border dimension of the bank lending channel in shaping regional asymmetries (e.g., Bruno and Shin (2015); Baskaya, Di Giovanni, Kalemli-

Figure 7: Heterogeneous responses of mortgage-related macroprudential policy to expansionary CMPG Shocks



Note: This figure reports the impulse response functions to a one standard deviation increase in the CMPG for core (the first column) and periphery (the second column) countries, respectively. The third column shows the cross-regional differences. Mortgage-related macroprudential policy is defined as the sum of policy actions on the following household-targeted instruments: loan-to-value ratio caps (LTV), debt-service-to-income limits (DSTI), household loan restrictions (LoanR_HH), and credit growth limits for household loans (LCG_HH). These definitions follow the categorization in Alam et al. (forthcoming). The horizontal axis indicates quarters. Shaded areas denote 68% and 90% confidence intervals.

Özcan, Peydró and Ulu (2017); Albrizio et al. (2020); Correa, Paligorova, Sapriza and Zlate (2022)).

A well-established observation in the literature is that intra-euro area capital flows—particularly those originating from core and flowing to periphery countries—intensified following the adoption of the euro, fueling credit and housing booms in peripheral economies (Hobza and Zeugner (2014); Hale and Obstfeld (2016)). This motivates an inquiry into whether monetary policy systematically interacts with these regional capital flows, potentially amplifying divergent bank lending behavior across core and periphery countries.

As an initial step, we analyze current account responses to an increase in the CMPG, using them as a proxy for net capital flows. The first panel of Figure 8 shows that current accounts deteriorate significantly in periphery countries but remain stable in the core. This suggests that monetary easing induces sizable capital inflows into periphery economies—precisely those that simultaneously experience sharp credit and housing booms. These results align with evidence that rapid credit expansions combined with large current account deficits are predictive of systemic financial crises (Laeven and Valencia (2020)), particularly when

external borrowing is a key funding source (Davis, Mack, Phoa and Vandenabeele (2016)).[17]

While informative, Balance of Payments (BoP) statistics are limited to net flows and do not provide the granularity needed to identify bilateral exposures. To address this limitation, we turn to the dyadic structure of the BIS Locational Banking Statistics (LBS), which offer geographic detail on counterparties and currency composition. A key advantage of the LBS data is that they report bilateral cross-border claims and liabilities by counterparty country, thereby enabling the construction of granular measures of regional banking flows.[18]

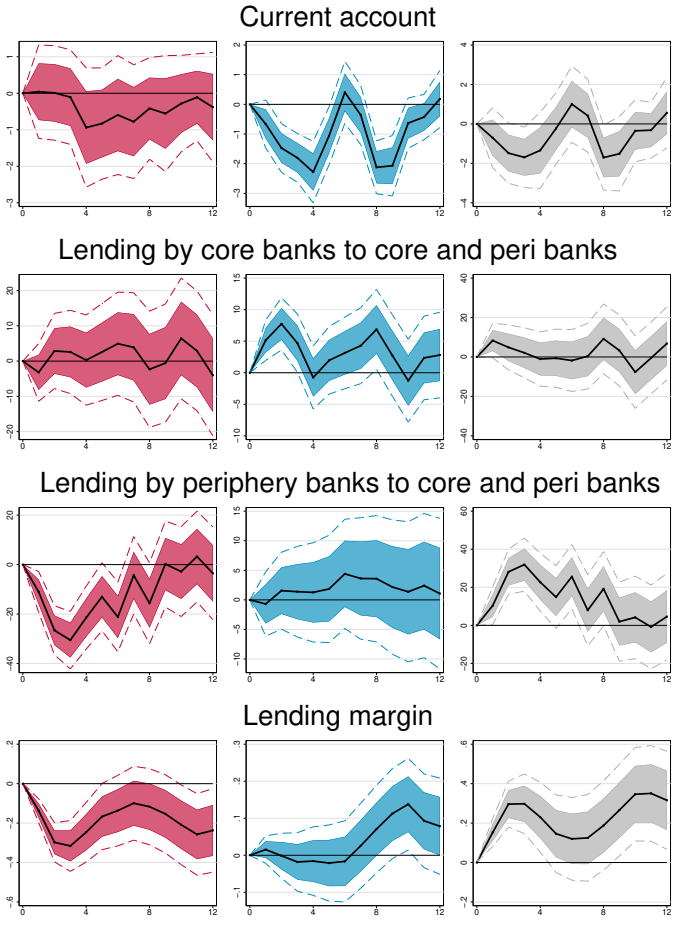
For each country, we aggregate cross-border claims of domestic banks and categorize them according to whether the counterparty belongs to the core or periphery group. For example, for German banks, we separately compute their lending to core and periphery countries. The resulting impulse responses, displayed in Figure 8, reveal that following an increase in the CMPG, banks in core countries significantly increase lending to periphery countries (panel 2×2), while their lending to other core countries remains unchanged (panel 2×1). In contrast, periphery banks do not expand cross-border lending to other periphery countries (panel 3×2), despite simultaneously increasing domestic mortgage credit. This pattern likely reflects the fragmented nature of euro area mortgage markets, where household borrowing is predominantly channeled through domestic banks (Rughoo and Sarantis (2014)). Taken together, these findings suggest that domestic credit booms in periphery countries are predominantly financed by capital inflows from core banks, rather than by intra-periphery banking flows.

To interpret these asymmetric patterns, we examine the response of bank profitability following an increase in the CMPG. The final panel of Figure 8 shows that bank lending

[17] In the pre-crisis period, euro area banks increasingly relied on wholesale funding to bridge the gap between domestic credit expansion and deposit growth. This funding structure involved issuing bonds and borrowing in short-term international money markets, giving rise to a strong correlation between credit growth and current account imbalances (Lane and McQuade (2014)).

[18] The BIS LBS data capture the cross-border positions of internationally active banks in 46 reporting countries vis-à-vis more than 200 partner countries. Data are collected on an unconsolidated basis—including intra-group positions—and follow the residency principle consistent with BoP statistics. LBS data cover approximately 95 percent of global cross-border interbank activity and offer breakdowns by sector, instrument, and currency denomination. See Ehlers and Wooldridge (2015) and Choi and Furceri (2019) for further discussion.

Figure 8: Response of current accounts, cross-border bank lending, lending margin



Note: This figure reports the impulse response functions to a one standard deviation increase in the CMPG for core (the first and fourth columns) and periphery (the second and fifth columns) countries, respectively. The third and sixth columns show the cross-regional differences. The current account is expressed as a share of quarterly GDP. The second and third rows display responses for core and periphery banks, respectively, based on BIS Locational Banking Statistics. Lending margin is defined as the spread between lending and deposit rates. The horizontal axis indicates quarters. Shaded areas denote 68% and 90% confidence intervals.

margins—defined as the spread between lending rates and a weighted deposit rate—decline in core countries but remain stable in the periphery. Given the stickiness of deposit rates in the euro area (Messer and Niepmann (2023)), this result is consistent with a "search-for-yield" mechanism: as profitability erodes in core banking systems, banks reallocate credit toward more profitable yet riskier regions, notably the periphery.

In sum, these results provide evidence that core banks channel monetary stimulus to periphery economies via cross-border lending, magnifying the asymmetric transmission of monetary policy. The distinct behavior of core and periphery banks—in terms of both

lending standards and geographic allocation of credit—plays a pivotal role in shaping regional divergence in monetary policy effects. These findings resonate with broader concerns that, in the absence of prudential safeguards, monetary easing can propagate financial imbalances via credit supply responses.

5 Conclusion

This paper develops a simple approach to identifying the heterogeneous effect of common monetary policy in a monetary union by constructing a country-specific monetary policy gap (CMPG)—the deviation of the common ECB policy rate from a counterfactual rate implied by each country's economic conditions. This framework captures systematic misalignments between union-wide policy and national business cycles. We show that these misalignments are substantial and persistent, especially between core and periphery countries in the euro area. An increase in the CMPG leads to significantly stronger macroeconomic and financial responses in the periphery, driven by credit supply amplification through household mortgage and cross-border bank lending.

Our findings have several implications for the design and evaluation of monetary policy in a monetary union. First, estimates based on common shocks may understate or obscure the heterogeneity of policy transmission, especially when member countries face systematically asymmetric cyclical conditions. Second, credit supply channels—particularly through banks' search-for-yield behavior—can serve as powerful amplifiers of monetary policy, even when macroprudential policies appear neutral. Finally, structural imbalances between regions can interact with monetary misalignment in ways that magnify divergence, highlighting the need for flexible tools beyond a one-size-fits-all policy rule.

Looking ahead, future research could extend our framework in several directions. A natural next step is to integrate financial stability considerations more explicitly, including spillover effects of capital reallocation and sovereign-bank linkages. In addition, it is pos-

sible to apply our approach to evaluate the effectiveness of other area-wide policies in a heterogeneous monetary union.

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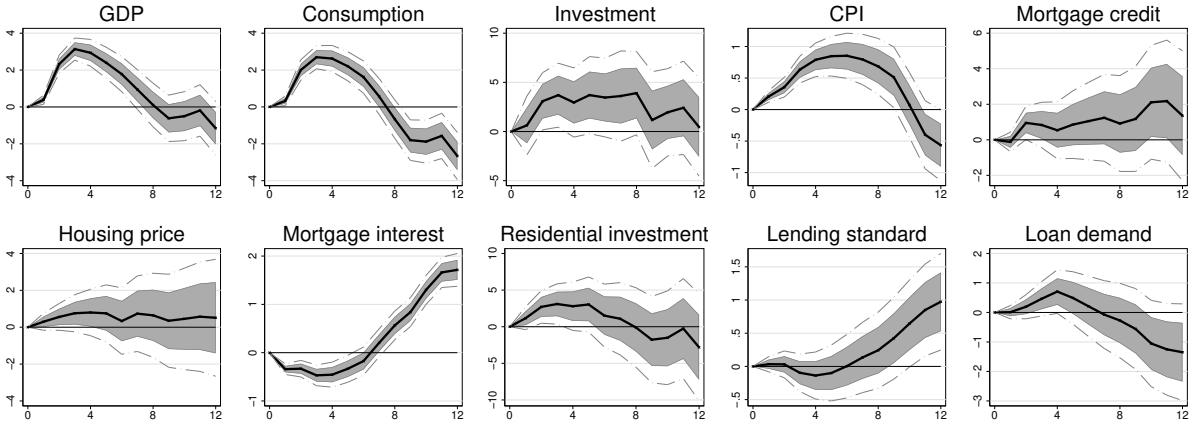
Appendix

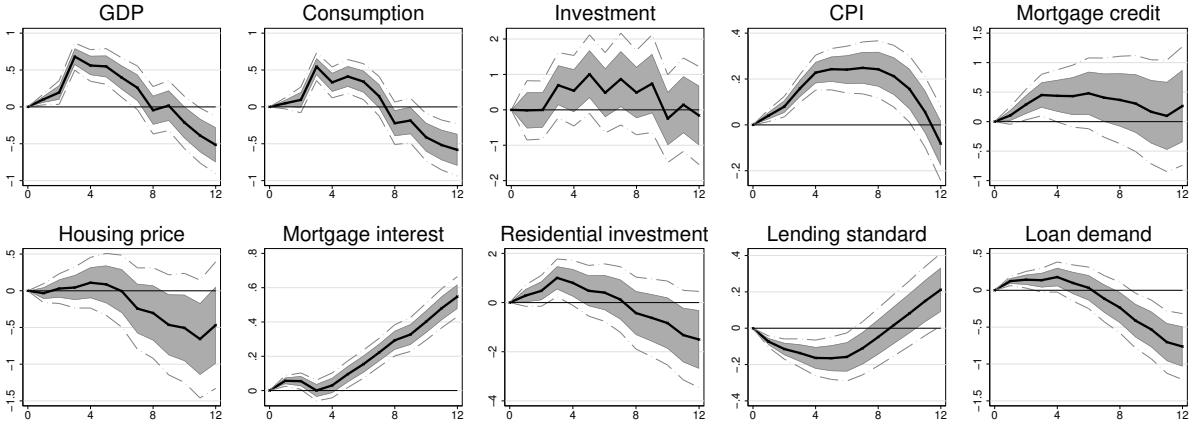
A Additional Results and Robustness Checks

Figure A1: Response of macro and financial variables to expansionary euro-area monetary policy shocks: using area-wide Taylor residuals



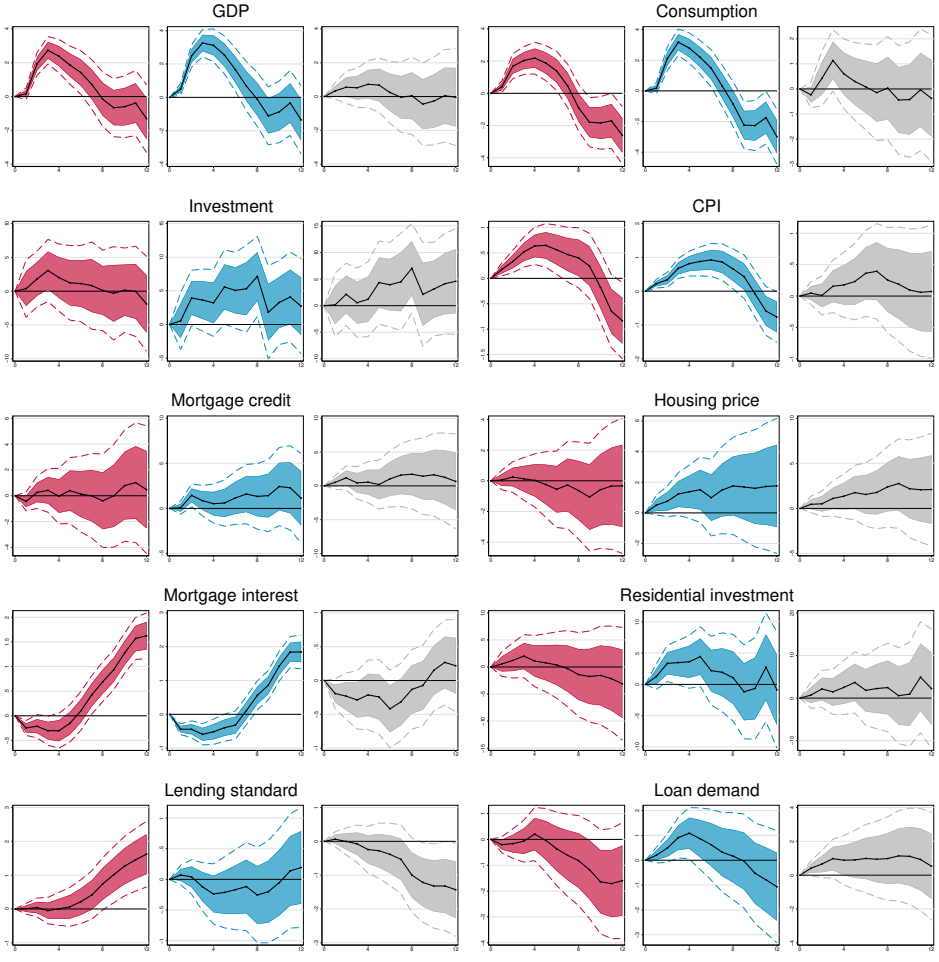
Note: This figure reports impulse response functions to a one standard deviation increase in the area-wide Taylor residuals for the full sample of ten euro area countries. The horizontal axis denotes quarters. Shaded areas denote 68% and 90% confidence intervals.

Figure A2: Response of macro and financial variables to expansionary monetary policy shocks: using Jarociński and Karadi (2020) approach



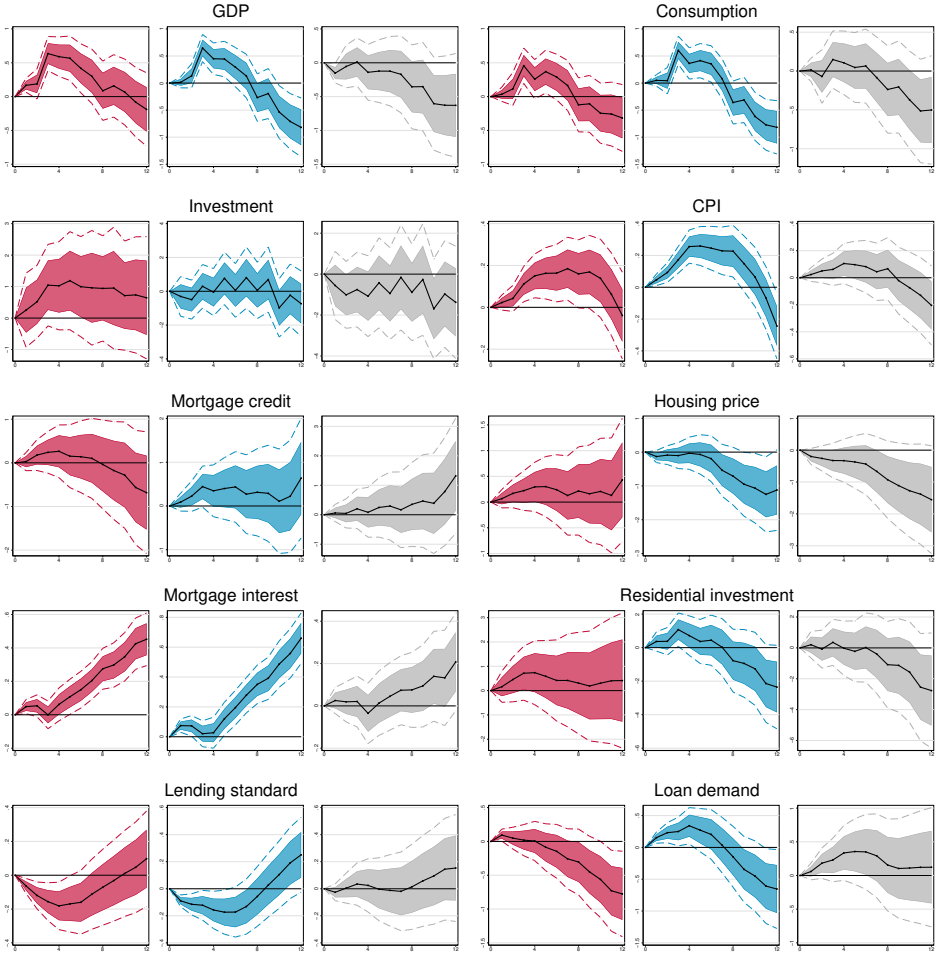
Note: This figure reports impulse response functions to a one standard deviation increase in the monetary policy surprise series orthogonal to the central bank information effect constructed by Jarociński and Karadi (2020) for the full sample of ten euro area countries. The horizontal axis denotes quarters. Shaded areas denote 68% and 90% confidence intervals.

Figure A3: Responses of macro and financial variables to expansionary euro-area monetary policy shocks: core vs. periphery using area-wide Taylor residuals



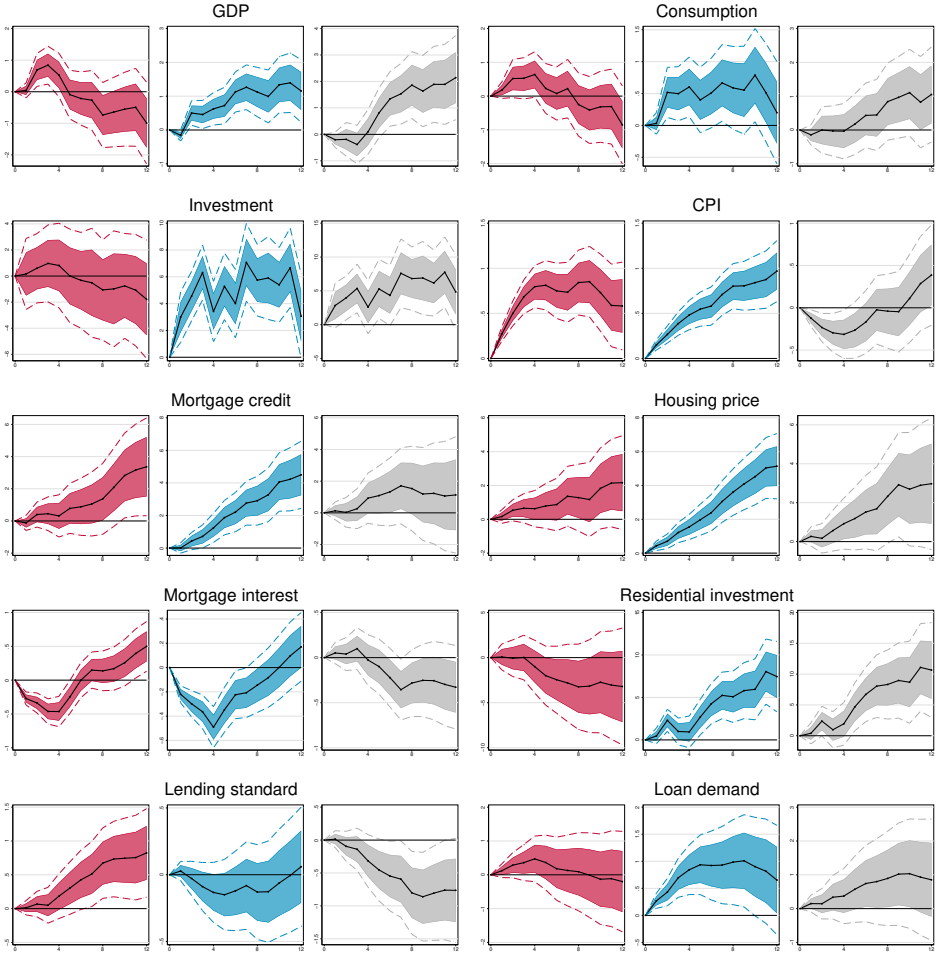
Note: This figure reports the impulse response functions to a one standard deviation increase in the area-wide Taylor residuals for core (the first and fourth columns) and periphery (the second and fifth columns) countries, respectively. The third and sixth columns show the cross-regional differences. The horizontal axis indicates quarters. Shaded areas denote 68% and 90% confidence intervals.

Figure A4: Responses of macro and financial variables to expansionary monetary policy shocks: core vs. periphery using Jarociński and Karadi (2020) approach



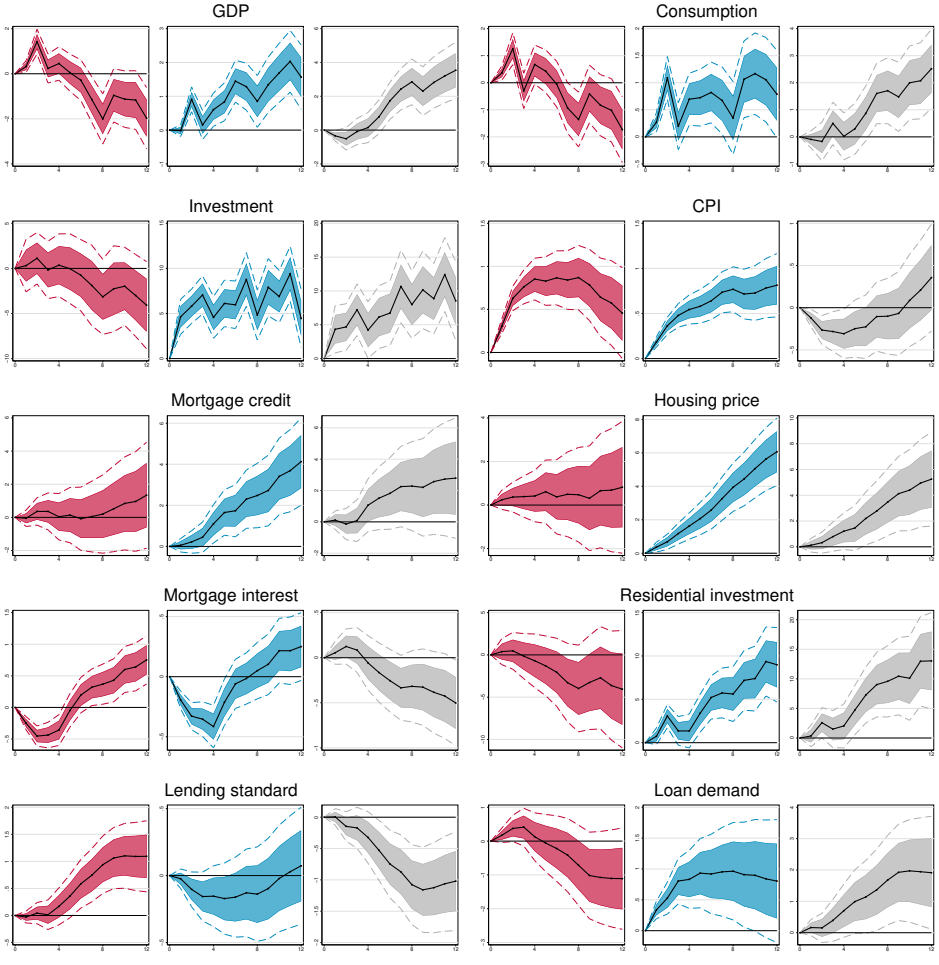
Note: This figure reports the impulse response functions to a one standard deviation increase in the monetary policy surprise series orthogonal to the central bank information effect constructed by Jarociński and Karadi (2020) for core (the first and fourth columns) and periphery (the second and fifth columns) countries, respectively. The third and sixth columns show the cross-regional differences. The horizontal axis indicates quarters. Shaded areas denote 68% and 90% confidence intervals.

Figure A5: Robustness check: estimating the ECB Taylor rule using realized values



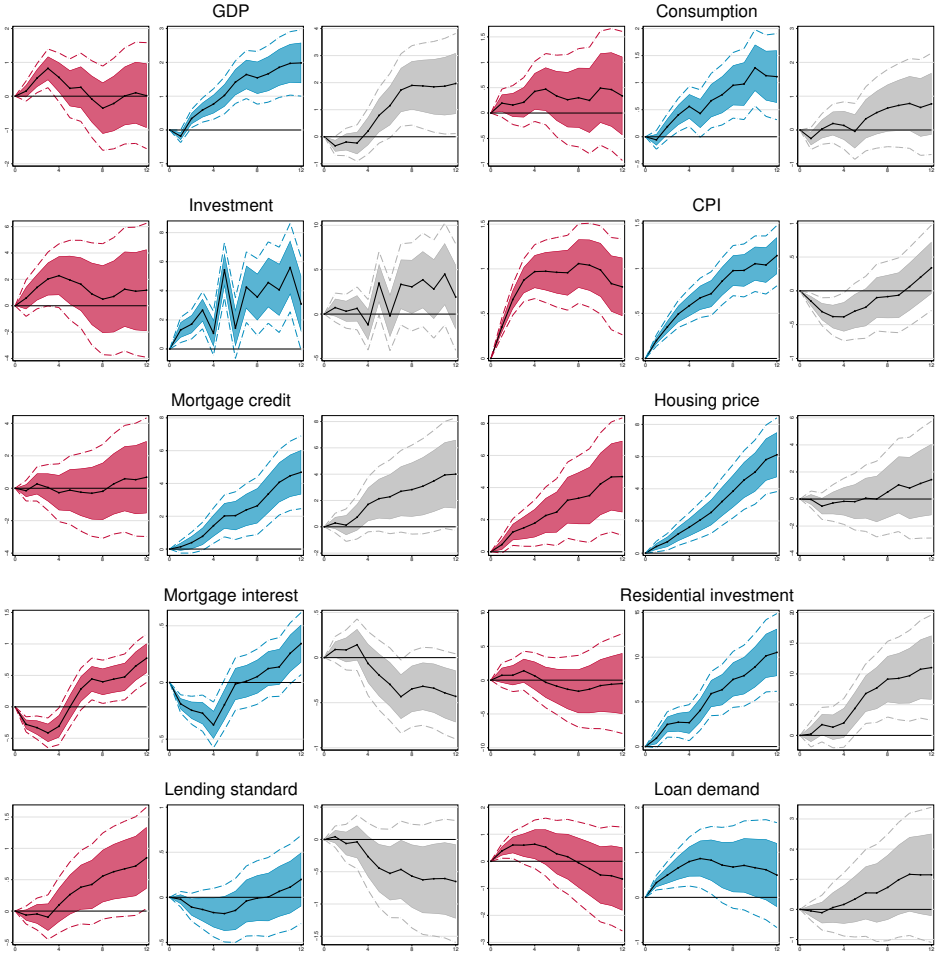
Note: This figure reports the impulse response functions to a one standard deviation increase in the CMPG (estimating the ECB Taylor rule using realized values instead of expected values of euro area aggregates) for core (the first and fourth columns) and periphery (the second and fifth columns) countries, respectively. The third and sixth columns show the cross-regional differences. The horizontal axis indicates quarters. Shaded areas denote 68% and 90% confidence intervals.

Figure A6: Robustness check: constructing a CMPG using the ECB shadow rate



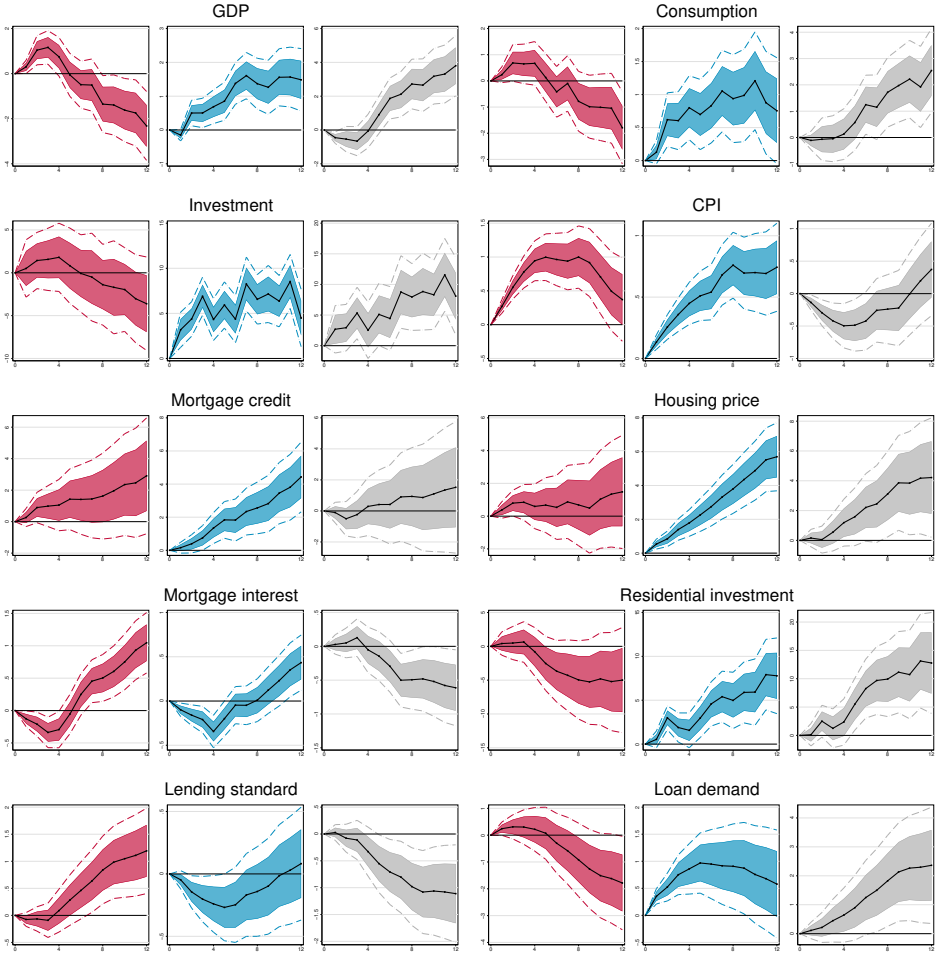
Note: This figure reports the impulse response functions to a one standard deviation increase in the CMPG (using the ECB shadow rate instead of the EONIA rate) for core (the first and fourth columns) and periphery (the second and fifth columns) countries, respectively. The third and sixth columns show the cross-regional differences. The horizontal axis indicates quarters. Shaded areas denote 68% and 90% confidence intervals.

Figure A7: Robustness check: local projections using a sample up to 2016:Q1 only



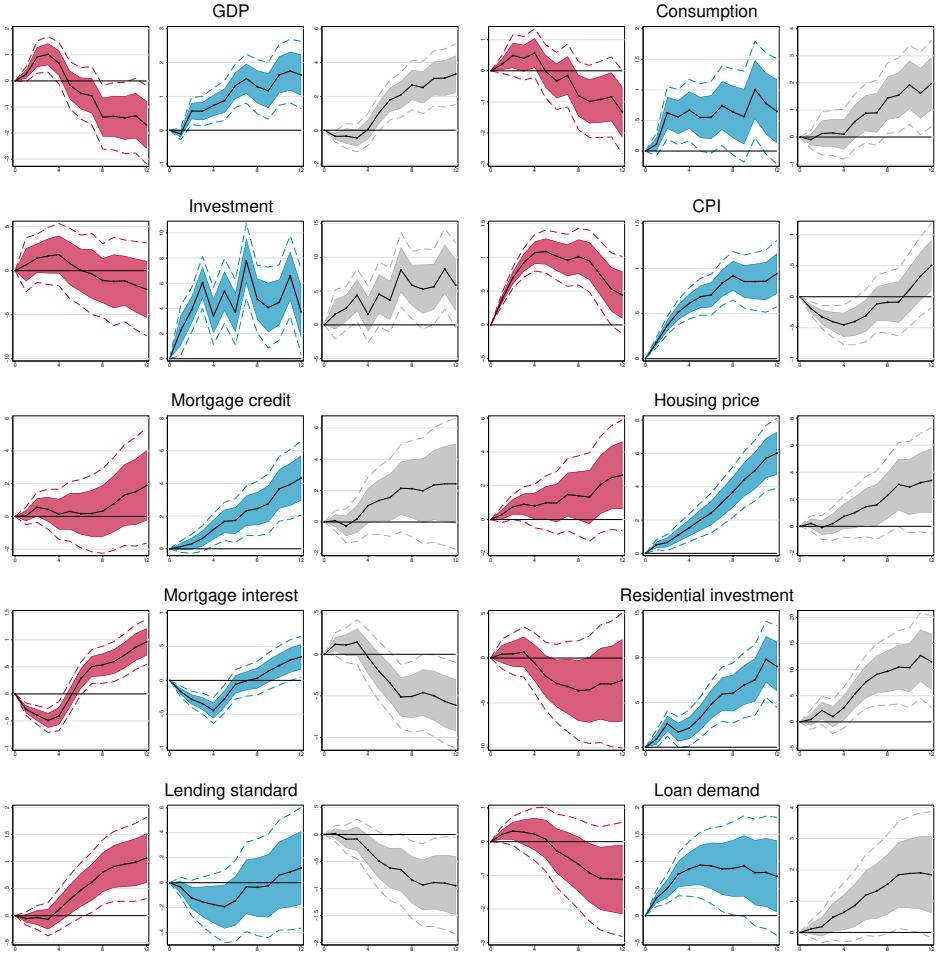
Note: This figure reports the impulse response functions to a one standard deviation increase in the CMPG (using the ECB shadow rate instead of the EONIA rate) for core (the first and fourth columns) and periphery (the second and fifth columns) countries, respectively. The third and sixth columns show the cross-regional differences. The estimation period is from 2003:Q1 to 2016:Q1. The horizontal axis indicates quarters. Shaded areas denote 68% and 90% confidence intervals.

Figure A8: Robustness check: estimating the ECB Taylor rule using a sample up to 2007:Q4 only



Note: This figure reports the impulse response functions to a one standard deviation increase in the CMPG (estimating the ECB Taylor rule using a sample up to 2007:Q4 only) for core (the first and fourth columns) and periphery (the second and fifth columns) countries, respectively. The third and sixth columns show the cross-regional differences. The horizontal axis indicates quarters. Shaded areas denote 68% and 90% confidence intervals.

Figure A9: Robustness check: controlling for country-specific macroprudential policy



Note: This figure reports the impulse response functions to a one standard deviation increase in the CMPG (while controlling for country-specific mortgage-related macroprudential policy taken from Alam et al. (forthcoming)) for core (the first and fourth columns) and periphery (the second and fifth columns) countries, respectively. The third and sixth columns show the cross-regional differences. The included categories are loan-to-value (LTV) ratio caps, debt-service-to-income (DSTI) limits, household loan restrictions (LoanR_HH), and credit growth limits for household loans (LCG_HH). The index takes the value of +1 for tightening actions, –1 for loosening actions, and 0 otherwise, and is aggregated to the quarterly frequency. The third and sixth columns show the cross-regional differences. The horizontal axis indicates quarters. Shaded areas denote 68% and 90% confidence intervals.