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Cinthia de Souza

Sovereign Bondholders and the Eurozone core-periphery Divide: from the Debt Crisis to the Quantitative Tightening

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Sovereign Bondholders and the Eurozone core-periphery Divide: from the Debt Crisis to the Quantitative Tightening

Cinthia de Souza[a]

[a]*Department of Economics and Statistics, University of Siena, Italy.*

Abstract: This paper analyses the role of sovereign investor groups in shaping financial instability and asymmetries within the Eurozone and their interaction with its institutional framework. It proposes a framework to assess the impacts of government debt outflows on countries' financial fragility under varying scenarios, including different paces of Quantitative Tightening (QT) and evolving investor group dynamics. Our findings indicate that foreign investors play a potential asymmetrical role in the Eurozone, exhibiting destabilising behaviour towards peripheral government debt. This uneven role can be exacerbated by a market-based institutional approach to public debt or mitigated by appropriate support for these state liabilities. By combining the impacts of QT with the potential reemergence of foreign flow asymmetries in sovereign markets, our findings highlight that such dynamics could further deepen the Eurozone's core-periphery divide.

Keywords: Sovereign Debt; Government Bondholders; Financial Asymmetries; Eurozone.

JEL Classification: H63; G15; E58.

1 Introduction

The absence of a common "safe asset" in the Eurozone – akin to US Treasury bonds – is often linked to regional fragilities and fragmentation (Bibow, 2016; Brunnermeier et al., 2017). While ECB members today view this absence[1] as "problematic" (Bletzinger, Grief, & Schwaab, 2023), any alternative must ensure that "the disciplining effect of financial markets is not undermined" (Schnabel, 2024). This institutional backdrop places public debt in a contradictory position: it must be safe, as it is "vital to the functioning of the financial system," yet not "too safe, since that would eliminate the role of market discipline" (Cœuré, 2016).

[1] The recent developments on Eurobonds with the Next Generation EU were exceptional and strictly related to the pandemic, therefore not breaking with the structural lack of a European safe asset (van Riet, 2024; Claeys, 2023; Grund & Waibel, 2023; Janse, 2023).

During the Eurozone debt crisis, private bondholders' risk assessments heavily influenced member states' funding costs, primarily due to the lack of a lender of last resort in the government debt market (De Grauwe, 2013; Lavoie, 2022a, 2022b; Papadimitriou & Wray, 2012). To mitigate bondholders' "too risky" perception, the Eurozone enacted significant policy changes during the debt crisis and COVID-19 pandemic. Central to countering fragmentation was the Eurosystem's emerging role as a major holder of government securities, mirroring the ECB effectively supporting member state's liabilities (De Grauwe & Ji, 2022; Ehnts & Wray, 2024). However, the post-pandemic shift toward reinforcing market discipline highlights that "too safe" remains undesirable to Eurozone institutions. As part of this shift, the move to Quantitative Tightening (QT) reintroduces concerns about fragmentation (Claeys, 2023; De Grauwe & Ji, 2022), potentially enhancing bondholders' influence in shaping regional disparities.

This paper analyses the role of sovereign investor groups in shaping financial instability and asymmetries in the European Monetary Union (EMU) and their interplay with its institutionality. The objective is twofold: first, to examine how regional asymmetries are reflected and reinforced by these investor groups from the Global Financial Crisis (GFC) to the post-pandemic era. This involves a descriptive and statistical analysis of the Eurozone investor base. Second, the paper assesses the potential impacts of QT on financial fragility in the Eurozone countries by proposing a framework for evaluating its potential effects under varying scenarios. The analysis focuses on Austria, Belgium, Germany, Finland, France, the Netherlands, Ireland, Italy, Portugal, Greece, and Spain[2], with the last four representing the Eurozone periphery.

This article draws on and contributes to several literature streams. Studies on EMU government bondholders have mainly focused on the debt crisis, not fully exploring their connection to the institutional approach to government debt (Dell'Erba, Hausmann & Panizza, 2013; Arslanalp & Tsuda, 2012; Merler & Pisani-Ferry, 2012; Farhi & Tirole, 2018; Arslanalp & Poghosyan, 2016; Andritzky, 2012). While much research highlights the ECB's role as a lender of last resort in preventing fragmentation (De Grauwe & Ji, 2015; Febrero & Xuo, 2023; Filoso et al., 2021; Lavoie, 2022a), the interaction between private investor groups and institutional changes remains underexplored. This paper shows that while domestic banks tend to exhibit more homogeneous behaviour, foreign investors play an asymmetrical role in the EMU. We argue that

[2] These are the countries covered by the quarterly data from the IMF Sovereign Debt Investor Base for Advanced Economies and that were part of the EMU from its early years.

the institutional approach to government debt – whether by strengthening market discipline through uncertainty about the ECB's support for government securities, or by explicitly backing these assets – is key in amplifying or mitigating foreign investors' asymmetrical role.

Additionally, studies in political economy often emphasise the influence of bondholders on economic policy (Rommerskirchen, 2019) and distributional outcomes (Arbogast, 2020; Hager, 2016; 2015; 2014). We contribute to this field by demonstrating that, in the EMU, bondholder empowerment is institutionally shaped and not only affects economic policy but also reinforces regional asymmetries.

Since the risk of fragmentation resurfaces with post-pandemic "normalisation," understanding investor base behaviour and its link to institutional changes becomes crucial. By analysing the potential impacts of QT under various scenarios, this paper contributes to the emerging literature on QT's effects (Du, Forbes & Luzzetti, 2024; Shchapov, 2024; Claeys, 2023). To assess financial fragility in these scenarios, the framework proposed here also innovates methodologically, adapting Arslanalp and Tsuda's (2012; 2014) model on homogeneous foreign outflows to include central banks outflows and refining it to allow for uneven foreign investor flows in sovereign markets. We highlight the likely uneven impacts of QT progression in the EMU, exploring the possibility that its impacts could be exacerbated by the reemergence of foreign investors' asymmetric flows.

The paper is organised as follows. Section 2 reviews relevant literature. Section 3 discusses historical shifts in the Eurozone bondholder structure and compares it across member states. Section 4 examines net purchases by investor groups during the debt crisis and pandemic, assessing asymmetric patterns. Section 5 performs a cross-correlation analysis between net purchases and government bond yields, approaching differences regarding the risk-return sensibility of each investor group. Section 6 proposes a framework for evaluating vulnerability to government debt outflows, in line with the QT. The last section concludes.

2 The empowerment of government bondholders in the Eurozone

The political economy literature explores how the disciplinary power of finance over states is channelled through ownership of government securities (Hager, 2014; 2015; 2016; Streeck, 2014; Sotiropoulos et al., 2013; Mosley, 2003). Streeck (2014) characterises this as a shift towards a "consolidation state," where the entanglement between states and financial markets forces

governments to prioritise investor confidence in public debt solvency over public welfare. Financial markets – and government bondholders, more directly – affect a state's funding costs based on solvency risk assessments, depending on the capacity of (supra)national institutions to counteract such pressures. In the absence of institutional support, higher borrowing costs enforce neoliberal policies, aligning economic strategies with bondholders' interests[3] (Sotiropoulos et al., 2013).

Bondholder influence varies depending on investor composition and debtor country. Countries with weaker currencies and less resilient institutions are more vulnerable to bondholders' pressure, especially developing economies (Mosley, 2003; Hardie, 2012; Brooks, Cunha & Mosley, 2015). Conversely, advanced economies typically retain more "room to move" from financial market pressures (Mosley, 2000). At the same time, certain investor groups wield more influence due to their higher exit potential (Cohen, 2003). Foreign investors, given their higher exit capacity, can be particularly destabilising for emerging economies (Hardie, 2012), while domestic banks often display greater "loyalty" during market stress (Rommerskirchen, 2019).

The Eurozone presents a unique case where the "room to move" for advanced economies is constrained by EMU institutional constraints. The primacy of creditors is reinforced through regional integration, shaping the EMU into an "asymmetrical fiscal stabilization regime" (Streeck, 2017, p.27). This internalisation of bondholders' interests is illustrated in strict government spending limits and public debt thresholds[4], which compel governments to adopt austerity and privatization measures (Pataccini, 2017). Market discipline has also been bolstered by price mechanisms, notably through the ECB's prohibition on direct purchases of government securities under the Maastricht Treaty and persistent uncertainty around secondary market interventions, thereby amplifying private bondholders' power to discipline states. By ceding monetary sovereignty to market discipline, Eurozone nations have "placed themselves in a predicament where markets can actually force them into default" (Sotiropoulos et al., 2013, p. 206).

[3]A feature that is also boosted by the financialisation of the state, redirecting economic policies to comprise fiscal austerity and reduction in social areas public spending (Schwan et al., 2021; Streeck, 2013), comprising privatisation plans and the turn of public goods into financial tradable assets (Karwowski, 2019; Adisson & Halbert, 2022), and the turn of public debt management towards reducing the cost of debt (Fastenrath et al, 2017; Trampusch, 2019).

[4] According to Streeck (2017), fiscal consolidation is an interest of creditors since it relies on austerity measures and the primacy of debt service over public services. However, as Streeck notes, this creates a contradiction as creditors seek both fiscal consolidation and economic growth – objectives that often conflict to safeguard their investments.

Under an institutional framework combining strict economic policy constraints, free capital mobility, and the absence of a common safe asset as the cornerstone of the financial system, government bondholders play a crucial role in driving fragmentation in the EMU. Germany benefits from its status as a regional safe haven, while peripheral Eurozone nations face speculative and pro-cyclical debt demand (Gourinchas & Rey, 2016; van Riet, 2017; Gabor and Vestergaard, 2018). Asymmetries are reinforced by risk perceptions that reflect not just economic fundamentals but also investor practices of grouping countries into categories such as “core” and “peripheral” Eurozone (Brooks, Cunha, and Mosley, 2015).

The literature highlights how different investor groups contributed to financial fragility and asymmetries in the Eurozone, especially during the debt crisis. The role of foreign investors is ambiguous: while linked to lower yields in the EMU (Arslanalp & Poghosyan, 2016; Andritzky, 2012), they also introduce volatility due to their “less sticky” nature (Andritzky, 2012). Evidence suggests foreign investors played an asymmetrical role during the debt crisis, reducing exposure to peripheral countries (Arslanalp & Tsuda, 2014; Arbogast, 2020), which raised yields and volatility in the periphery while lowering yields in Germany (Arslanalp & Poghosyan, 2016; Ferreira, 2022). However, some argue that global investment funds helped stabilise the region by offsetting spreads (Longaric, Cera, Georgiadis & Kaufmann, 2023).

Regarding domestic bondholders, research suggests that domestic banks’ holdings of national government securities can exacerbate distress, forming a "doom loop" between banks and governments (Merler & Pisani-Ferry, 2012; Farhi & Tirole, 2018). This feature prompted calls for regulations comprising domestic banks’ holdings of public debt (Brunnermeier et al., 2017; Cooper & Nikolov, 2018). However, the role played by domestic banks is ambiguous since they are shock absorbers, having a stabiliser behaviour by acting as net buyers during crises (Tabellini, 2018; Saka, 2020; Merler & Pisani-Ferry, 2012). Additionally, ECB purchases have been shown to reduce yields, especially in peripheral nations, narrowing spreads (Krishnamurthy, Nagel & Vissing-Jorgensen, 2018; Eijffinger & Pieterse-Bloem, 2023).

3 Sovereign investor base in the Eurozone

This section provides an overview of the Eurozone government debt investor base, outlining how it evolved from 2008Q1 to 2023Q4 (Figure 1) in the context of crisis and regional institutional developments.

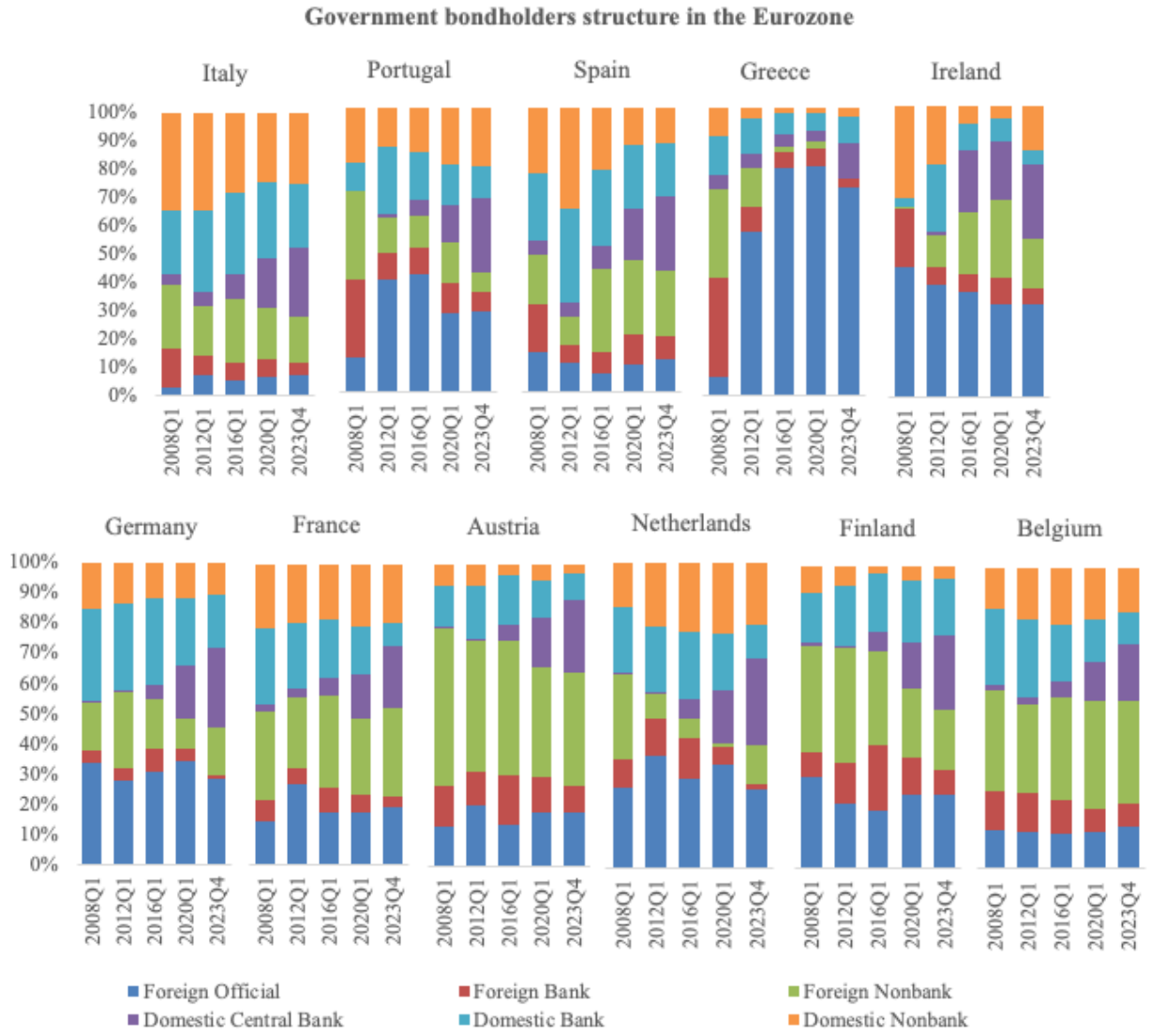

Figure 1 – Data: IMF/ Sovereign Debt Investor Base for Advanced Economies.

Foreign banks and non-banks

The ECB's market-based approach to government debt in the early years after the euro's launch fostered favourable market expectations, leading investors to treat member states' government securities as nearly equivalent (Gabor, 2016; Gabor & Ban, 2016). This contributed to rising foreign ownership across countries from the EMU's inception until the GFC (Arbogast, 2020; Merler & Pisani-Ferry, 2012). The debt crisis, however, exposed the limitations of the ECB's pro-cyclical approach and of the lack of a lender of last resort to governments, resulting in

fragmentation in the sovereign market (De Grauwe, 2013; Gabor & Ban, 2016). This was reflected in investor dynamics, with foreign banks and non-banks significantly reducing their holdings in the periphery, while declines were less pronounced in core countries. Germany, notably, saw an increase in foreign holdings post-crisis.

The worsening debt crisis required institutional and policy shifts. Following Draghi's 2012 "whatever it takes" pledge and subsequent ECB interventions post-2014, the share of foreign investors in peripheral countries stabilised or increased[5] until the pandemic in 2020. Between 2020 and 2023, during the second phase of Quantitative Easing (QE) and the initial phase of QT, foreign ownership remained stable in most core countries, while the periphery saw a more moderate decline compared to the debt crisis.

Foreign official holders and domestic central banks

Core-periphery differences are also evident in foreign official holdings, reflecting institutional responses to the debt crisis. From 2010 to 2012, foreign official holdings[6] rose sharply in peripheral countries involved in SMP or Troika programmes, especially in Greece and Portugal, due to substantial fiscal packages. In core countries, such holdings were primarily due to securities held by foreign central banks as foreign exchange reserves.

The rise of National Central Banks (NCBs) as major holders of government securities marked a shift in the ECB's approach to such assets (Figure 1). This trend followed the Asset Purchase Programme (APP) launched in 2014 and the Pandemic Emergency Purchase Programme (PEPP) during the COVID-19 pandemic. Greece stands out as an exception, with significant NCB holdings only appearing in 2020, due to its exclusion from the Public Sector Purchase Programme (PSPP) under the APP. Given that QT began in 2023, ECB and NCB participation as public debt holders has gradually decreased since then.

Domestic banks and domestic non-banks

Domestic banks in peripheral countries increased their holdings of government securities during the debt crisis, contributing to the 'doom loop' between domestic banks and sovereign

[5] The exception is Greece, where foreign investors decreased their share in total holdings until late 2023.
[6] The foreign official holdings consist of i) government securities held by foreign central banks as foreign exchange reserves; ii) government securities held by foreign central banks within the Eurosystem as part of the Securities Markets Program (SMP)[6]; and (iii) foreign official loans.

states. The literature identifies possible drivers of this process: government pressure on banks via ownership links (Becker & Ivashina, 2018); incentives for carry trades offering higher returns with limited risk exposure (Acharya, Drechsler, & Schnabl, 2014; Andreeva & Vlassopoulos, 2016; Cesaratto, 2020; Arbogast, 2020); and banks' preference for domestic government debt to hedge against euro break-up risk by aligning assets and liabilities at the domestic level (Battistini, Pagano, & Simonelli, 2014). After 2012, changes in domestic bank participation in the periphery were less significant.

Domestic non-bank investors – such as insurance companies, pension funds, investment funds, households, and non-financial corporations – generally reduced their participation in peripheral countries. Conversely, core countries experienced a steady decline in domestic bank holdings from 2008 to 2021, while domestic non-banks maintained a stable share of government debt.

4 Bondholders' role in shaping asymmetries and ECB`s approach to government securities

This section shifts the focus from the relative participation of investor groups to their net acquisition of government securities over time, comparing such purchases during the two most intense EMU crises: the debt crisis and the pandemic.

Figure 2 shows the accumulated net government debt purchases during the debt crisis (2010Q1–2012Q2) and the first year of the pandemic (2020Q1–2020Q4). In both crises, domestic banks in core and peripheral countries similarly increased their acquisition of national government debt. Domestic non-banks played a significant role as net buyers in specific cases, such as Ireland.

The primary distinction among countries lay in the behaviour of foreign investors (banks and non-banks), who were net sellers in the periphery but net buyers in core countries during both crises. The debt crisis saw significant outflows from foreign banks and non-banks, particularly impacting Greece and Portugal. During the pandemic, foreign outflows in the periphery were smaller, involving mainly non-banks. In contrast, during these moments of distress, foreign investors bought core government securities, such as those from Germany, underscoring their role in reinforcing public debt hierarchies and Germany's safe-haven status (Gourinchas & Rey, 2016).

This empirical evidence aligns with literature describing the destabilising role of foreign investors in peripheral Eurozone countries, while domestic banks act more as stabilisers (Arbogast,

2020; Arslanalp & Tsuda, 2014; Ferreira, 2022). However, an underexplored question in the literature is the Eurozone's institutional role in reinforcing or mitigating these trends.

Figure 3 illustrates the net purchase of government securities by private foreign investors as z-scores, indicating how foreign purchases in a given period and country diverged from their average in standard deviations. Arslanalp and Tsuda (2014) provided a similar analysis from 2008 to 2011 for advanced economies, underlying that foreign investors started to differentiate among the advanced countries with the emergence of the debt crisis. According to the authors, the causes of such stratification were the 'emergence of credit risk', the 'large-scale sovereign downgrades for high-spread euro area countries', and the 'unusually high volatility of yields' (Arslanalp and Tsuda, 2014, p. 452-453). A critical omission in their analysis is the role of the ECB's policies during the debt crisis in driving this discrimination. This becomes clearer when examining a broader period encompassing various ECB monetary policy phases (Figure 3).

By not acting as a purchaser of last resort and adopting a market-based approach to government debt as collateral during the debt crisis, the ECB reinforced the perception that peripheral government securities were risky (Gabor & Ban, 2016; Van't Klooster, 2023; Lavoie, 2022a; De Grauwe, 2013). Foreign investors saw this risk as not worth taking and began selling

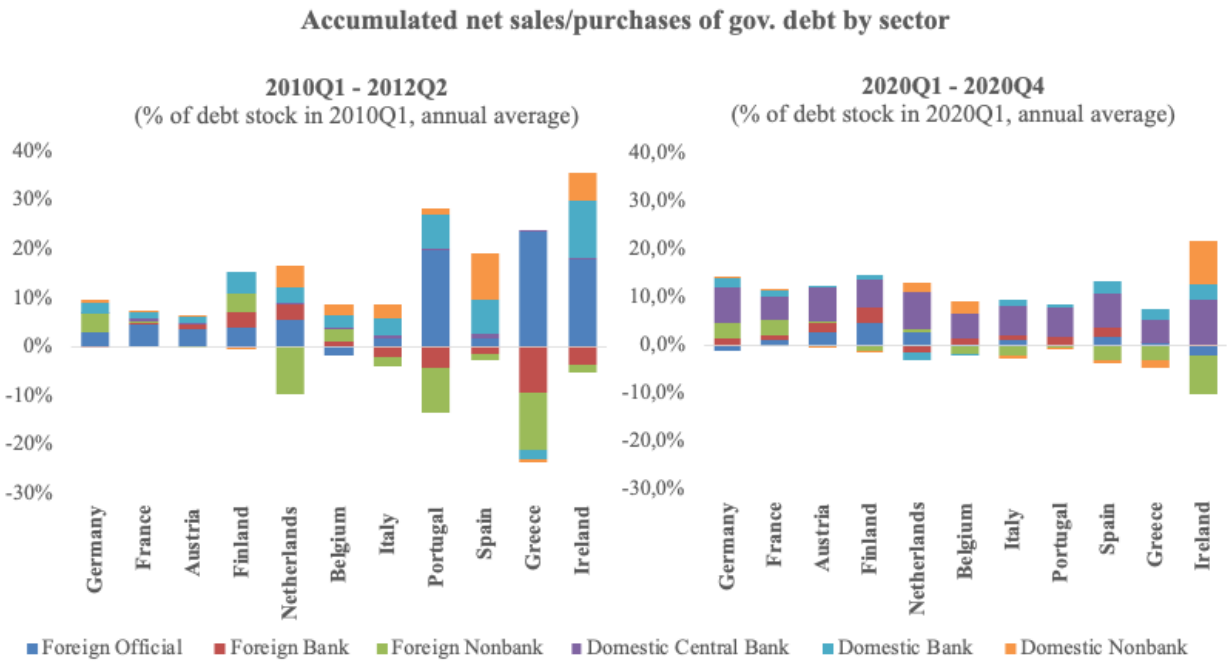

Figure 2 – Data: IMF/ Sovereign Debt Investor Base for Advanced Economies.

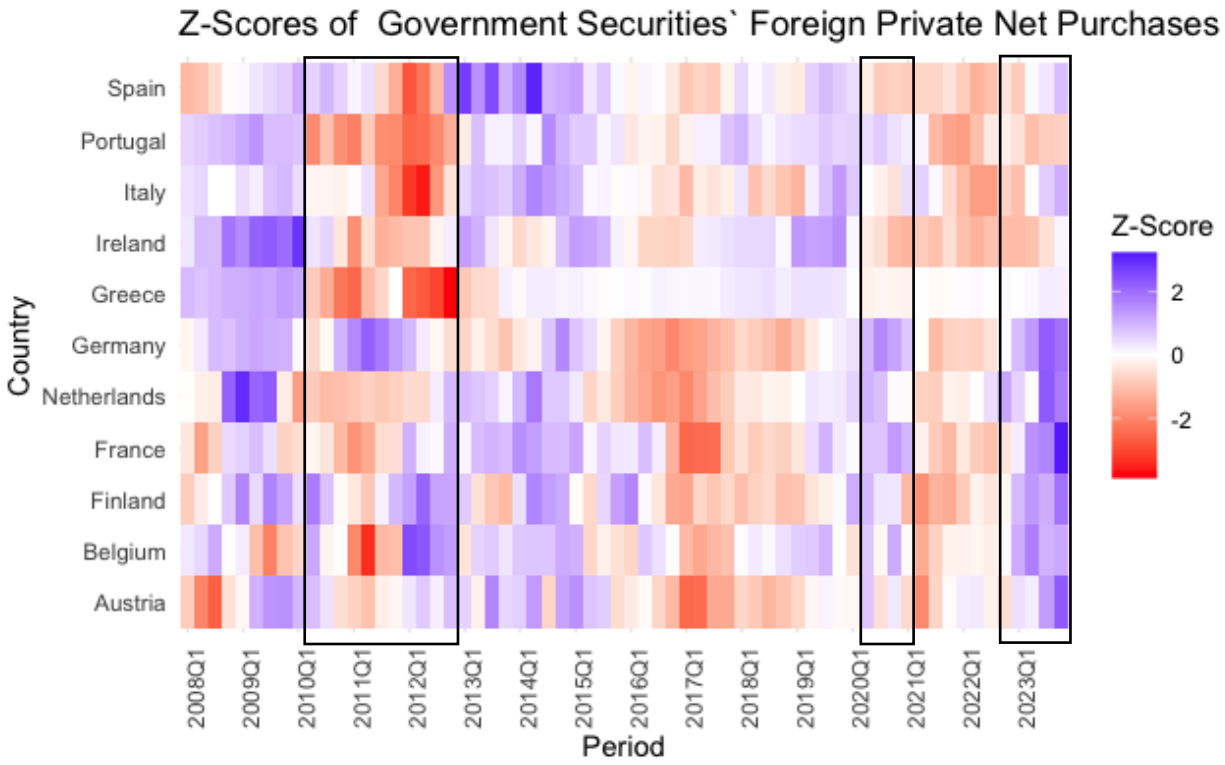

Figure 3. The table values show the foreign private (bank and non-bank) net purchases of government debt as four-moving quarter averages normalized as z-scores from 2008Q1 to 2023Q4. The four-moving average is the average value of foreign private net purchases in the current and last three periods. By subtracting the foreign net purchases from the average values of each country and dividing it by its standard deviation to the whole time-spam data available (2005Q1 – 2023Q4), we arrive at the z-scores provided in the table.

(or buying at below-average levels) peripheral bonds while purchasing core securities from 2010 to 2012, illustrated by the red values in Figure 3. These sales peaked in early 2012 as the crisis escalated in Italy and Spain. Greece was most affected by foreign investor discrimination, reflecting the severe impact of the debt crisis. In contrast, core countries saw less intense net sales. Germany's bonds benefited from their safe-haven status during most of the debt crisis, as shown by net foreign purchases (blue values).

After Draghi's "Whatever it takes" speech in 2012Q3, foreign investors ceased discriminating against peripheral bonds, reflected by the shift from dark red to blue in Figure 3. Draghi`s speech favoured a softening in the foreign investor's asymmetrical role, by alleviating fears of government insolvency. It also came together with a reversal of the foreign investor`s purchases of the German government securities. As a result, the distinction between core and peripheral countries in terms of the role played by foreign investors as government debt holders became more uniform from 2013 to 2015. The APP`s initiation in 2014Q4 led to foreign investors

shifting from net buyers to net sellers in some countries, primarily core ones. This active monetary policy, involving large-scale government securities purchases, reduced foreign investor discrimination to the benefit of the periphery, demonstrating that the institutional approach to public debt is crucial in shaping whether and how the asymmetric role played by bondholders manifests.

In the pandemic's early stages, Lagarde's initial statement that the ECB did not see closing spreads as part of its role, followed by the launch of the PEPP in 2020Q2, caused a brief asymmetry in foreign purchases. However, this asymmetry was less pronounced than during the debt crisis and quickly dissipated. Unlike in the debt crisis, the ECB acted as a purchaser of last resort from the outset (De Grauwe & Ji, 2022; Ehnts & Wray, 2024), mitigating the asymmetrical role of foreign investors. Therefore, this temporary shift in the institutional approach to government securities contributed to explaining the easing in foreign purchases asymmetries.

During the initial phases of QT after 2023, foreign investors have become a significant group purchasing securities in the Eurozone (Ferrara et al., 2024). According to Schnabel (2024) purchases by foreign investors have been crucial in preventing "bottlenecks" in bond absorption. However, foreign purchases also exhibited some asymmetry: core countries experienced significant net purchases, while the periphery initially faced net sales, followed by modest net purchases, reflected in z-scores (Figure 3). The possibility that this asymmetrical role may be exacerbated in the future – whether due to the next stages of QT or external shocks – could prove fundamental in impacting regional fragmentation, given the turn towards a more passive approach to government securities.

These features underscore the unique dynamics of the EMU within the broader context of financial discipline over states, enforced through the ownership of government securities (Hager, 2014; 2015; 2016; Streeck, 2014; Sotiropoulos et al., 2013; Mosley, 2003). In the EMU, bondholders' power to discipline states is amplified by the persistent uncertainty surrounding the ECB's role in safeguarding the safe-asset status of individual national debts. This shapes hierarchies within the government securities market, most prominently reflected in foreign investor flows. Shifts in ECB policy have significantly influenced these patterns, with the absence of a purchaser of last resort historically associated with greater foreign investor discrimination against peripheral countries. These dynamics highlight the pivotal role of the ECB in either mitigating or exacerbating regional financial asymmetries.

5 Investor groups` risk-return sensibility

In previous sections, it was shown that both the relative participation of investor groups and their net acquisition of government securities reflect regional asymmetries, a characteristic linked to the institutional approach to sovereign debt. This section further examines the role of different investor groups by analysing their net purchases in relation to the risk-return trade-off in sovereign debt. A cross-correlation analysis is conducted between 10-year government yields and net purchases by private investor groups as a share of total debt across different periods. Assuming that these yields reflect the risk-return trade-off, the correlations serve as proxies for each group's risk aversion. Selling a country's government securities amid rising yields may indicate an unattractive risk-return profile for that investor group, and the role played by different investors regarding the same asset can signal which groups act as stabilisers or destabilisers during rate hikes. This analysis aims to uncover asymmetrical or symmetrical correlation patterns between core and peripheral Eurozone countries, tracing changes alongside shifts in the ECB's monetary policy.

Figure 4 presents the cross-correlation between 10-year bond yields and net purchases by investor groups (2008–2023, quarterly). Strong blue values indicate a higher negative correlation, implying greater risk aversion by the investor group toward the respective government bond; pink values suggest the opposite. In most countries – except Greece – domestic banks have acted as stabilisers, with net purchases (sales) of government bonds linked to rising (falling) interest rates. The domestic bank sector may interpret an increase in the yields as an opportunity for higher returns. Risks reflected in higher yields for their domestic government securities are worth taking

for such investors. Domestic non-banks also show a stabilising influence in some countries, albeit less uniformly, especially in Spain, Italy, and the Netherlands.

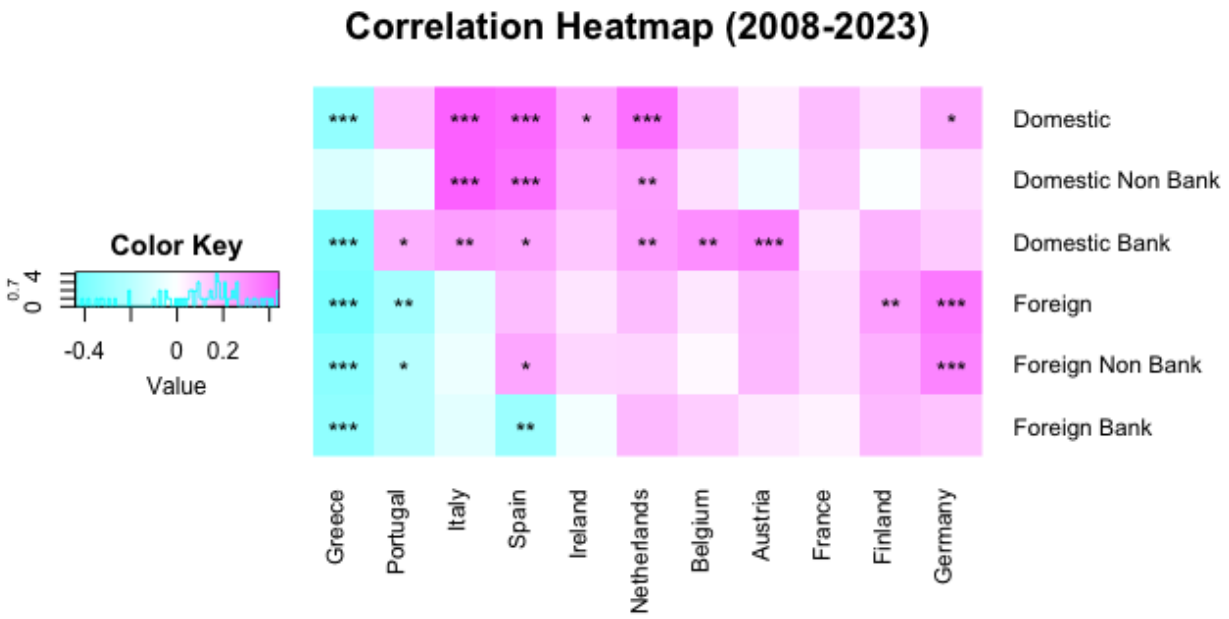

Figure 4 - Correlation heatmap (2008-2023) between the net purchases relative to the total government securities of each investor group and the 10-year government bond yields. Data: FRED and IMF/Sovereign Debt Investor Base for Advanced Economies.

Foreign investors, both banks and non-banks, play an asymmetric role across the analysed countries, generally acting as destabilisers in the periphery and stabilisers in the core. Greece, Portugal, Spain, Italy, and Ireland display negative correlations for at least one group of foreign investors, particularly pronounced in Greece and Portugal. Conversely, core countries show positive but mild correlations, stronger and significant only in Germany and Finland, indicating that foreign investors are less deterred by rising yields in core nations. This suggests that foreign investors could view most peripheral countries as inherently riskier during periods of rising yields, making such investments less appealing. In contrast, rising yields in Germany are seen as opportunities for higher returns, given the safe-haven status of its securities. Decreasing yields tend to improve perceptions of peripheral government bonds while reducing the appeal of core securities.

Figures 5, 6, and 7 present sub-period analyses addressing shifts in investors' risk-return sensibilities during times of financial distress and changes in ECB policy. Figure 5 covers 2008–2012Q2, from the GFC until Draghi's "whatever it takes" speech, when the ECB maintained a passive stance on government securities. During this period, the destabilising role played by foreign investors, especially foreign non-banks, was stronger and statistically significant in all peripheral countries. The analysis below gives evidence that, in the absence of robust action from the ECB, the asymmetrical role played by foreign investors during moments of distress is expected to be substantial. In the absence of the ECB acting as a purchaser of last resort, the increase in the yields is interpreted by foreign investors as a risk that is not worth taking in the periphery. In core countries, the correlations were very weak and not statistically significant, indicating that other

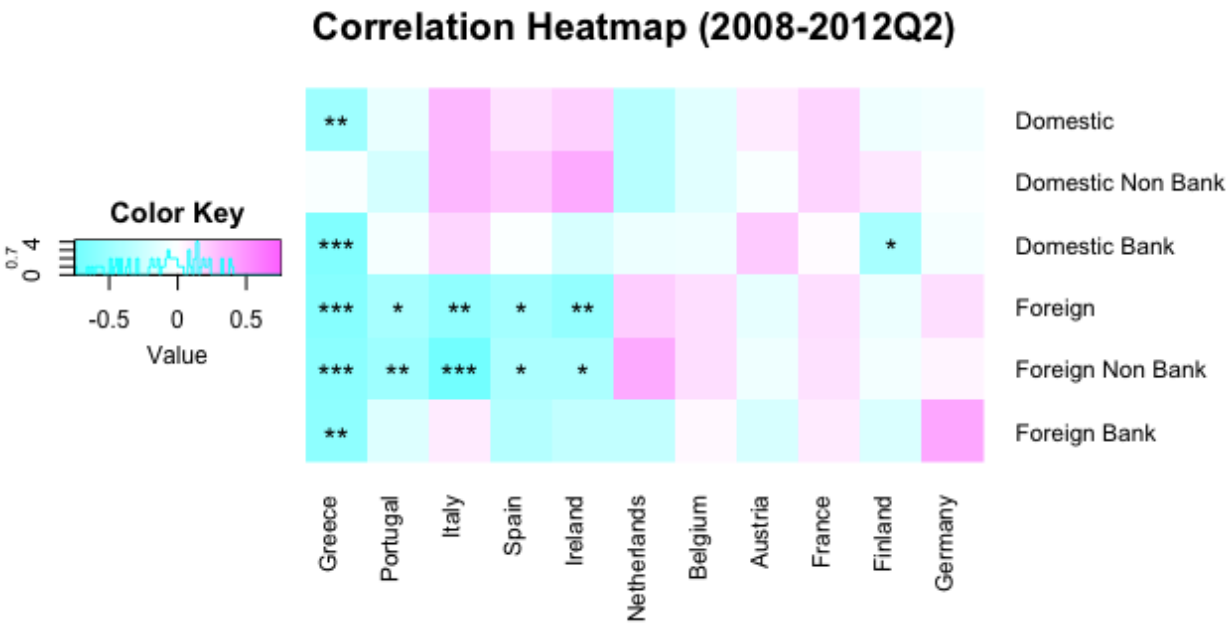

Figure 5 - Correlation heatmap (2008-2012Q2) between the net purchases relative to the total government debt of each investor group and the 10 years government bond yields. Data: FRED and IMF/Sovereign Debt Investor Base for Advanced Economies.

elements – such as the structural safe-haven status of their government securities – guided foreign investors' purchases rather than yields. Domestic groups generally showed low, insignificant correlations, except in Greece, where rising yields negatively impacted even domestic banks.

Figures 6 and 7 show cross-correlation results for 2012–2019 and 2020–2023. In both periods, the ECB's more active role as a purchaser of last resort reduced foreign investors' asymmetrical behaviour. From 2012Q3 to 2019, with the implementation of Outright Monetary Transactions (OMT) and, subsequently, the APP, foreign investor correlations were generally lower. Foreign investors' correlations remained, in general, lower, with Spain and the Netherlands

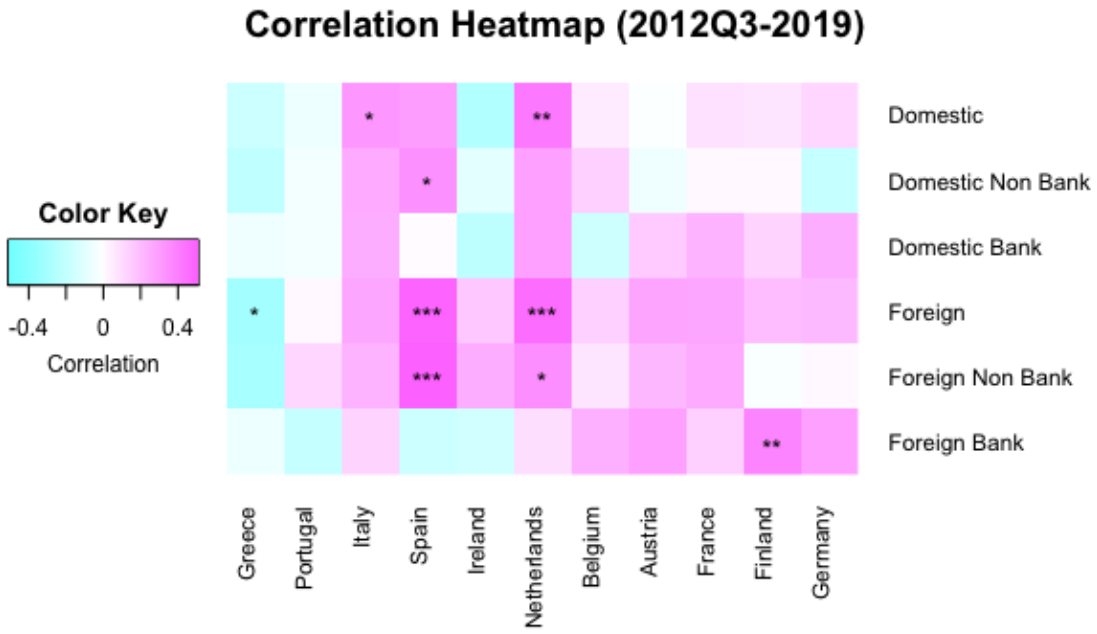

Figure 6 - Correlation heatmap (2012Q3 - 2019) between the net purchases relative to the total government debt of each investor group and the 10-year government bond yields. Data: FRED and IMF/Sovereign Debt Investor Base for Advanced Economies.

presenting positive and significant correlations (Figure 6). After the debt crisis, Greece, the only country excluded from government securities purchases under the PSPP/APP, was also the only one with a significant negative correlation. Therefore, countries being supported by the ECB showed soft or positive correlations of foreign net purchases and yields, indicating that risk perception regarding interests shifted to the relative benefit of the periphery. Domestic investors remained, in general, with low correlations.

During the pandemic, the launch of the PEPP and temporary fiscal relief led to further correlation softening across all countries, resulting in greater homogeneity among both foreign and domestic investor groups (Figure 7). Domestic investors also showed lower correlations, with exceptions like Portuguese and Italian domestic non-banks. This softening mirrored the unprecedented fiscal and monetary support provided by European institutions during this period (De Grauwe & Ji, 2022).

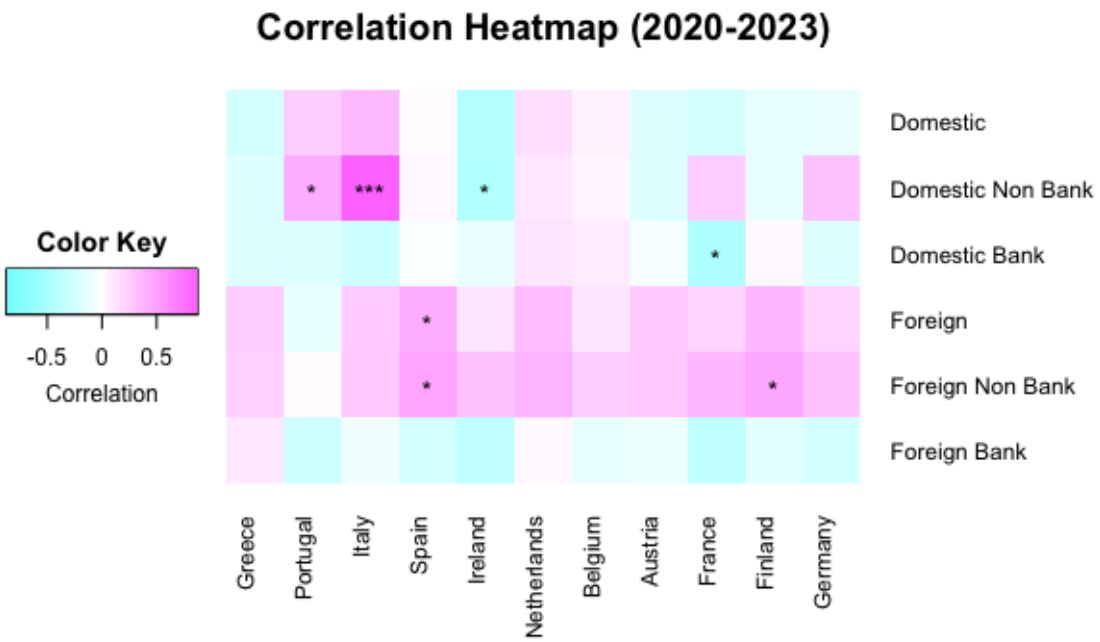

Figure 7 - Correlation heatmap (2020 - 2023) between the net purchases relative to the total government debt of each investor group and the 10-year government bond yields. Data: FRED and IMF/Sovereign Debt Investor Base for Advanced Economies.

In conclusion, the analysis underscores four main points: (1) throughout the period, the domestic banking sector consistently acted as a stabilizer, potentially offsetting outflows (or complementing foreign inflows) during higher risk-return scenarios; (2) foreign investors display a potential asymmetrical role in the Eurozone, to the detriment of peripheral countries; (3) such asymmetry is likely to become substantial during distresses that are matched by the institutional reinforcement of market discipline, particularly when the ECB does not act as a purchaser of last resort; (4) proper ECB support for government securities can offset these asymmetries, to the relative benefit of the periphery.

The possibility that foreign investors might once again play an asymmetrical role in the Eurozone is particularly relevant as the ECB shifts towards QT, raising concerns about fragmentation. Future outcomes will depend on the pace of QT and the role private investors will play as market discipline strengthens.

6 Central bank outflows and foreign shocks on government debt holdings

The previous sections illustrated, first, the role of bondholders in regional asymmetries and, second, their connections with the peculiarities of the Eurozone's institutional structure. This section combines these two aspects to explore how they might interact in the future, proposing a

framework to assess scenarios involving central bank outflows and varying investor group behaviour. This exercise is motivated by, but not limited to, the ECB's shift towards QT and its future reinforcement that is planned with the end of reinvestments under the PEPP, also covering the possibility of asymmetries reemergence in foreign investor flows.

The ECB can conduct further QT`s steps at diverse paces of balance sheet reduction, with different investor groups behaving in diverse ways. They could either step in to support the government securities market or be negatively affected by the policy change or external shocks. Given the previous evidence that a more passive approach to government securities is likely to reinforce the uneven role played by foreign investors, this possibility deserves attention when assessing the possible impacts of central bank outflows. Exploring various combinations of central banks outflows and bondholders' reactions shed light on the complex and delicate balance that is needed to counteract financial instability and fragmentation.

The Quantitative Tightening: political and economic rationality

In early 2023, the ECB's monetary policy shifted from QE to QT, defended as a complementary tool to combat inflation and for reducing the Eurosystem balance sheet. From the outset, the ECB provided more information than an explanation regarding this move. Lagarde (ECB, 2022a) asserted that QT is only a "complementary tool" and that there is "no element of monetary policy stance, so to speak, associated with the reduction of the size of our balance sheet." In a study commissioned by the European Parliament, Claeys (2023) stated that "the most compelling reasons to do QT in the euro area are political and legal," as it reinforces that QE was intended as a temporary policy, thereby complying with EU Treaties.

The ECB began to elaborate on its motivations for QT, as outlined in Schnabel's (2023) speech, which cited three reasons: first, to "regain policy space"; second, to "mitigate the negative side effects associated with a large central bank balance sheet"; and third, to "withdraw policy accommodation to support our intended monetary policy stance." Regarding the first reason, the ECB has not adequately explained why or how the absence of QT would limit policy space. For example, the ECB's expanded balance sheet from 2014 to 2018 did not impede its ability to implement significant QT in 2020. The third reason was previously described as a limited and complementary function of QT, with only a "limited impact on the inflation outlook" (ECB, 2023).

Elucidative of the political and economic importance of the QT is what is behind the second reason addressed by Schnabel, regarding the negative effects of large balance sheets. Two negative effects are mentioned: one, ‘it could jeopardise central bank`s credibility by giving rise to accusations of financial and fiscal dominance’; and second, a scarcity of high-quality assets in the repo and bond market, in the sense that QT will be ‘efficient in alleviating general asset scarcity’. By defending its policies during the QE, the ECB repeatedly stated that there was no fiscal or financial dominance and that the “disciplinary function of the markets has not been lost” (Schnabel, 2020). Now, however, with a sleight of hand, the ECB uses the same argument it deemed wrong for a time. The second concern addresses the importance of government securities to liquid financial markets. The increase in high-quality asset availability is done by transferring from the ECB to the markets a big power in impacting the state`s cost of funding. Still, the availability of such assets is constrained by the several limitations on fiscal policy reinforced by the EMU institutions. These contradictions underscore that QT's rationale reflects the reinforcement of the Eurozone towards an asymmetric fiscal stabilisation regime, in line with Streeck's (2017) concept of the EMU consolidation state.

Fears about potential negative impacts from fragmentation have shaped the cautious initial approach to QT. On 16 December 2021, the Governing Council decided to end net purchases under the PEPP in March 2022, fully reinvesting maturing assets until mid-2024, and gradually reducing reinvestments by €7.5 billion per month until their cessation at the end of 2024. The APP ended net asset purchases in July 2022, with full reinvestments until March 2023, followed by a €15 billion monthly reduction until July 2023. The APP reinvestments were discontinued in July 2023, while the PEPP reinvestments have been the ECB's primary tool against fragmentation risks in the region.

According to the ECB (2023), there were differing opinions within the Governing Council about the appropriate pace for QT. Some of its members “expressed a preference for reducing the APP portfolio at a faster pace or for terminating reinvestments altogether (ECB, 2023). However, the fear that a faster pace of reduction “could lead to the re-emergence of bond market fragmentation which could make further interest rate increases more difficult to pursue” (ECB, 2023) determined the adoption of a moderate pace of balance sheet reduction. The flexibility of PEPP reinvestments and the introduction of the Transmission Protection Instrument (TPI) have helped prevent significant fragmentation in the government debt market.

With the end of PEPP reinvestments scheduled for early 2025 (Schnabel, 2024) and uncertainty regarding the ECB's support for government securities, the situation may change. PEPP reinvestments have been the ECB's primary defence against fragmentation (ECB, 2022a), and their cessation would remove a key mechanism. The newly established TPI will remain the ECB's only tool to counteract fragmentation. Unlike QE, the TPI is conditional, targeting countries with deteriorating financing conditions 'not warranted by country-specific fundamentals', with eligibility criteria including compliance with the EU fiscal framework (ECB, 2022b). These conditionalities and constraints add uncertainty about the ECB's commitment to supporting government securities markets, which may affect bondholders' risk-return perceptions.

It is also unclear whether the end of reinvestments will be a permanent and final measure or if the ECB intends to pursue more aggressive QT steps in the future. Key market participants, such as S&P Global Ratings, predicted a potential shift from passive to active QT, contingent on inflation trends.[7] This would mean the ECB might begin selling assets from its balance sheet rather than simply refraining from reinvesting maturing securities (Charnay, Hollegien, Broyer, & Guez, 2023).

Given these uncertainties, we will explore the impacts of various combinations of different QT speeds and diverse investor group responses on financial fragility and fragmentation in the Eurozone.

Framework and Scenarios

The framework proposed here extends and refines the methodology developed by Arslanap and Tsuda (2012; 2014) for homogeneous foreign private outflows in the government securities market. We extend the methodology to cover the case of outflows in sovereign markets by the domestic central banks, and we refine it by allowing for asymmetrical behaviour by different investors groups, such as the uneven role that can be played by foreign investors. The proposed framework allows to assess the possible impacts of market discipline reinforcement via QT in the Eurozone, and to consider that bondholders` asymmetries might be boosted by increasing uncertainty regarding the ECB`s role as a purchaser of last resort.

[7] The inflation has declined at a faster pace than it was expected by the ECB, achieving in March 2024 a projection of 2,3% to 2024 (Lane, 2024). However, the future path of inflation remains uncertain. Adrian (2024) argues that there is evidence that disinflation may have stalled in some countries in the beginning of 2024, as is the case of France, Germany and Italy.

In line with our empirical evidence that the domestic bank sector is the most stabilizing sector among the government securities holders in the Eurozone, our goal will be to determine the amount of additional debt that this sector would have to take to offset outflows. Following Arslanap and Tsuda (2014; 2012), we are going to use two indexes of financial fragility to assess vulnerability to government debt outflows. The first one (1) is the total additional debt ($\Delta\text{DebtDB}_{i,t+1}$) that the domestic banking sector would need to step in to offset such outflows as a share of its assets ($\text{AssetsDB}_{i,t}$)[8]. Countries with a higher share of additional debt to bank assets might experience a situation in which banks could face difficulties in absorbing the remaining debt, possibly leading to an increase in bond yields. The second one (2) is the total debt ($\Delta\text{Debt}DB_{t+1} + DB_t$) that would be held by domestic banks after absorbing such government securities as a share of its assets, which is a proxy to a possible doom loop between government and domestic banks.

$$\frac{\Delta\text{DebtDB}_{i,t+1}}{\text{AssetsDB}_{i,t}} \quad (1)$$

$$\frac{(\Delta\text{Debt}DB_{t+1}+DB_t)}{\text{AssetsDB}_{i,t}} \quad (2)$$

The scenarios we are going to stipulate assume that outflows can be conducted by the Eurosystem (EuroOutflow) and by foreign investors (Foutflow). The Eurosystem will reinvest ω under both APP and PEPP of maturing securities ($\text{EuroM}_{i,\,t+1}$) and sell a share equal to λ of the remaining government debt, where $\text{PS}_{i,\,t}$ is the total public sector securities held under both programmes. Outflows by the Eurosystem will be:

$$EuroOutflow_{i,t+1} = (1-\omega)EuroM_{i,t+1} + \lambda(PS_{i,t} - EuroM_{i,t+1}) \quad (3)$$

The foreign investors' outflows ($\text{Foutflow}_{i,\,t+1}$) will be determined by equation 4. β_i represents the share of maturing debt held by foreign investors that is rolled of maturing securities under their portfolio ($FM_{i,t+1}$) and γ_i is the share that is sold of the total foreign securities holdings ($FS_{i,t}$) after subtracting maturing securities.

$$\text{Foutflow}_{i,\,t+1} = (1-\beta_i)FM_{i,t+1} + \gamma_i[FS_{i,t} - (1-\beta_i)FM_{i,t+1}] \quad (4)$$

[8] Each country's domestic bank assets are on 2022 values according to IMF/International Financial Statistics Data.

The additional debt to be held by the domestic banks will be determined by equation 5. Domestic banks will finance the deficit ($D_{i,t+1}$) in proportion to the total domestic government debt holdings ($DB_{i,t}$) as a share of total private holdings of national public debt ($TP_{i,t}$). The domestic nonbank sector will absorb the total amount of additional debt by an additional percentage of φ_i over the share of government securities holdings of the domestic nonbank ($\frac{DNB_{i,t}}{TD_{i,t}}$) in each country. Foreign investors will finance the deficit proportionally to their participation in debt held by private agents if $a_i = 0$ and will stop financing the deficit if $a = 1$. Therefore, the additional debt to be held by the domestic banks in each country is:

$$\Delta\text{DebtDB}_{i,t+1} = (D_{i,t+1}\frac{DB_{i,t}}{TP_{i,t}}) + [(\text{FPoutflow}_{i,t+1} + \text{EuroOutflow}_{i,t+1} + a_i(D_{i,t+1} * \frac{F_{i,t}}{TP_{i,t}})] [1 - (\varphi_i + \frac{DNB_{i,t}}{TD_{i,t}})] \quad (5)$$

To determine each of the above variables and equations we adopted a set of assumptions[9]. The Eurosystem will not finance the deficit, in line with its legal framework; we are going to suppose that foreign official holdings will remain constant; as we do not have access to data for the maturity per investor group, we are going to suppose that each private investor`s maturing debt over the next year[10] will be proportional to their share in total debt; maturing debt under the Eurosystem portfolio for each country is not available, and it will be stipulated based on the Weighted Average Maturity (WAM) of PEPP and APP securities for each country as published by the ECB[11]; the overall deficit will be assumed to evolve as IMF/WEO database projections[12] – a conservative assumption, given that Eurosystem or foreign outflows might worsen the deficit via impacts on the interest rate.

We are going to construct scenarios to determine the magnitude of the additional and total debt that the domestic bank ($\Delta\text{DebtDB}_{i,t+1}$) would need to take to counterbalance the outflows under different scenarios. We are going to set different shares of reinvestments and sales of

[9] Aside from these assumptions, we do not consider the potential impacts of sovereign outflows on the private sector. This is a conservative approach, as such impacts may be self-reinforcing and asymmetrical (van Riet, 2022). Additionally, QT is being implemented alongside other economic policy shifts that might also have self-reinforcing impacts and are not covered here. For example, the recently approved reform of the Stability and Growth Pact is likely to exacerbate asymmetries (Heimberger et al., 2024), adding to those analysed here.

[10] Data on short-term debt in 2023, the last available data, is from the Eurostat and ECB Data on government debt residual maturity (less than 1 year), with data for Greece obtained from its public debt management agency.

[11] More details in Appendix A.

[12] In our scenarios we are using the deficit projected by the IMF for 2025.

government securities by the foreign investors (β and γ, respectively) and the Eurosystem (ω and λ, respectively), and also the share of outflows that would be absorbed by the domestic non-banking system over the share of government securities held by this sector (φ). We are also going to allow for the differentiation of parameters β, γ, a and φ across the countries based on the empirical evidence found in the previous sessions. Our scenarios will be four, named A, B, C, and D. More details about the equations utilized in each scenario can be found in Appendix A.

Scenario A assumes that the ECB will continue with the policy of not reinvesting the maturing securities for the APP, and will stop reinvesting also for the PEPP, in line with what the Governing Council intends to do at the end of 2024 (Schnabel, 2024). It supposes there are no foreign investors' outflows.

The Eurosystem will not reinvest maturing securities for APP nor for PEPP and will not sell remaining government securities. Parameters will be $\omega = 0$ and $\lambda = 0$. Foreign investors will finance their share of the deficit, not sell any debt, and roll over all the maturating debt. Parameters will be $a = 0,\ \beta = 1$ and $\gamma = 0$. The domestic non-banks will buy the additional debt in proportion to their share of total debt, and so $\varphi = 0$.

Scenario B mimics a possible evolution of events if a more severe stance prevails within the ECB, in line with important financial market agent expectations of a shift from a passive to an active QT by the ECB (Charnay et al., 2023). Here, it is assumed that the ECB will not reinvest securities of both programs, and it will additionally sell 10% of its portfolio`s government securities yearly, resulting in a QT approximately twice as fast as scenario A in terms of balance sheet reduction. Foreign investors and domestic nonbanks are assumed to behave in the same way as in scenario A. The only change comparatively to Scenario A is that $\gamma = 0{,}1$.

Under **Scenarios C and D**, we are going to suppose that foreign investors will react – as a response to the shift in monetary policy or to an external factor – by reallocating a share of their portfolio from countries they perceive as riskier to the ones they perceive as safer. Our findings in the previous sections indicate that during moments of distress and mostly when there is uncertainty regarding the ECB's role as a purchaser of last resort, foreign investors tend to play an asymmetrical role in the Eurozone. Countries will be grouped in clusters given their similarities regarding each investor`s group risk aversion, measured as its correlations between net purchases

and yields based on the hierarchical clustering with complete linkage[13]. Figure 8 shows evidence that there are three clusters at closer levels of similarity from 2008-2019, given by the vertical distance of the lines grouping the countries. The pandemic period was excluded here, given the unprecedented efforts in terms of risk sharing, softening of fiscal rules and supporting government securities. Cluster 1 comprises Greece and Portugal, with negative and significant correlations for foreign investors, while a negative but less significative correlation to the domestic groups. Spain, Ireland and Italy are part of Cluster 2, with negative but in general non-significant correlations for foreign investors, while strong and positive correlations for domestic investors, both banks and non-banks. In cluster 3 core countries were grouped, having, in general, soft positive correlations to foreign investors and strong positive correlations to domestic banks.

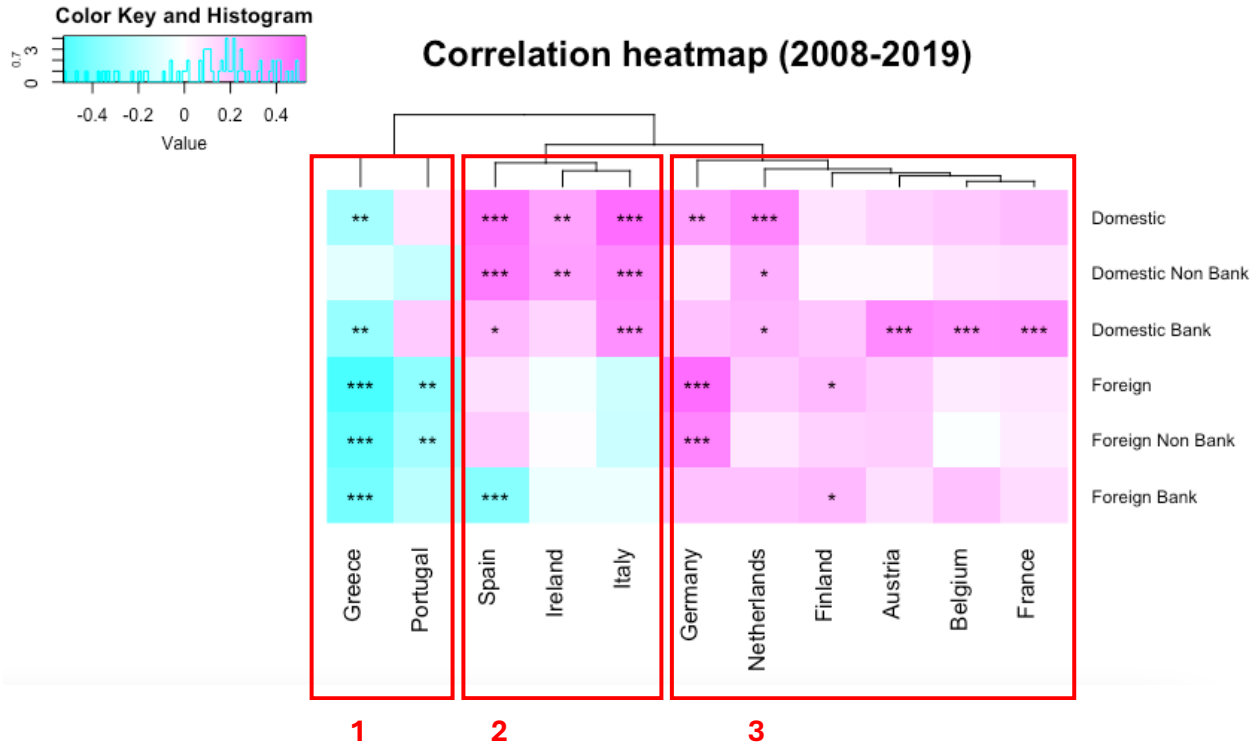

Figure 8 - Correlation heatmap (2008 - 2019) between the net purchases relative to the total government debt of each investor group and the 10-year government bond yields and hierarchical clustering with complete linkage based on such correlations. Data: FRED and IMF/Sovereign Debt Investor Base for Advanced Economies.

[13] Complete linkage clustering is a type of hierarchical clustering in which the distance between two groups is determined by the largest distance overall possible pairs. This approach tends to create clusters that are more compact and spherical by minimizing the worst-case distance within a cluster.

In **Scenario C** it is assumed that the ECB adopts a moderate QT, equal to the one conducted under Scenario A, and investors groups will behave asymmetrically, according to the cluster they belong.

In Scenario C, the yearly share of government securities net sales in the foreign investor's portfolio that will be sold/purchased (γ_1, γ_2 and γ_3) will be equal to the average value of such shares during the pandemic and the debt crisis for each of the specific clusters of countries. For example, cluster 1 has $\gamma_1 = 0{,}2345$ because it faced an annual average net sale of 23% of government securities held by foreign investors during the most intense periods of the debt crisis and the pandemic (2010Q2-2012Q3; 2020Q1-2020Q4). The foreign investors will stop financing the deficit and stop rolling over maturing debt to the countries that they are selling the debt (groups 1 and 2). Therefore, the parameters for foreign investors will be:

$$a_1 = a_2 = 1; \quad a_3 = 0;$$

$$\beta_1 = \beta_2 = 0; \quad \beta_3 = 1$$

$$\gamma_1 = 0{,}235; \quad \gamma_2 = 0{,}057; \quad \gamma_3 = -0{,}079$$

Additionally, domestic non-banks will absorb more than their participation in total debt for cluster 2, given that the sector has a particularly stronger stabilizer role in such countries. Given that 7,6% beyond their share in total debt was the average value of the contribution to absorb debt during both crises in Cluster 2[14], we are going to use this value as a reference to φ_2. Therefore:

$$\varphi_1 = \varphi_3 = 0; \quad \varphi_2 = 0{,}076$$

In **Scenario D** the ECB adopts an active QT, equal to the one conducted under scenario B, and investors groups will behave asymmetrically according to the cluster they belong. This scenario represents the case of an aggressive quantitative tightening that comes together with an intense differentiation of investors' behaviour across the clusters. The only difference with respect to Scenario C, is that $\lambda = 0{,}1$.

Parameters to private agents in the three clusters ($a_i, \beta_i, \gamma_i, \varphi_i$) to Scenario D remains the same than Scenario C.

The two indexes of financial fragility in the three proposed scenarios are illustrated in Table 1 and 2. More details can be found in Appendix A.

[14] 7,6% was the average value in Cluster 2 of annual net purchases by domestic non-banks as a percentage of total securities variation, subtracted from the share of domestic non-banks in the country`s total debt during 2010Q2-2012Q3 and 2020Q1-2020Q4. In other words, the value is the average of the share of the increase in total debt that was absorbed by the domestic non-bank beyond their share in total debt.

Additional gov. debt to be held by domestic banks (% bank assets)				
Country	Scenario A	Scenario B	Scenario C	Scenario D
Spain	1,6%	3,0%	4,7%	5,9%
Italy	1,6%	2,8%	4,4%	5,5%
Portugal	1,2%	2,6%	3,9%	5,3%
Greece	1,2%	2,3%	2,6%	3,7%
Belgium	1,2%	2,1%	-0,1%	0,8%
Austria	1,0%	2,0%	-0,3%	0,7%
Finland	1,0%	1,8%	0,4%	1,2%
Germany	0,9%	1,6%	0,6%	1,3%
France	0,6%	1,1%	0,0%	0,6%
the Netherlands	0,6%	1,1%	0,4%	1,0%
Ireland	0,2%	0,5%	0,7%	1,0%

Table 1 - Additional government debt to be held by domestic banks in Scenarios A, B, C and D to analysed countries.

Total gov. debt to be held by domestic banks (% bank assets)				
Country	Scenario A	Scenario B	Scenario C	Scenario D
Italy	18,0%	19,2%	20,8%	21,9%
Spain	11,6%	13,0%	14,6%	15,9%
Greece	11,6%	12,7%	13,0%	14,1%
Portugal	7,8%	9,3%	10,6%	12,0%
Finland	6,1%	6,9%	5,5%	6,3%
Belgium	6,3%	7,2%	4,9%	5,8%
Germany	5,2%	6,0%	4,9%	5,7%
Austria	4,2%	5,2%	2,9%	3,9%
the Netherlands	2,4%	3,0%	2,3%	2,8%
France	2,8%	3,3%	2,2%	2,7%
Ireland	0,9%	1,2%	1,4%	1,7%

Table 2 - Total government debt to be held by domestic banks in Scenarios A, B, C and D to analysed countries.

Results under Scenario A capture the possible direct impacts of ending PEPP reinvestments, which are the ECB`s first line of defence against fragmentation. It evidences that the direct impact of not reinvesting securities under both the APP and PEPP is, per se, limited: the maximum value is for Spain, where the additional debt to be held by the domestic bank would be 1,6% of its assets. Even though the impact on financial fragility is limited, there is some heterogeneity among the analysed countries, and the most affected countries would be Spain, Italy, Belgium and Portugal.

Scenario B captures the case of an aggressive QT and implies a more pronounced and also more asymmetrical increase in the financial fragility of the analysed countries. In scenario B the countries with a higher share of additional debt that would need to be held by the domestic bank

are Spain (3,0%), Italy (2,8%), Portugal (2,6%) and Greece (2,3%). From Scenario A to Scenario B, the gap in terms of our financial fragility indexes of these four most affected countries relative to Germany increases: while under scenario A such a gap was of 0,8%, 0,7%, 0,3% and 0,3% to Spain, Italy, Portugal and Greece, respectively, these values increase to 1,3%, 1,2%, 1,0% and 0,6% under scenario B. Belgium might also be more impacted by the direct impacts of a more intense QT than other core countries, a result that was boosted by the high projected deficits and relatively smaller domestic bank sector.

Scenarios C and D examine the impacts of a QT that comes together with an asymmetrical role played by investor groups. Both scenarios rely on previous sections' empirical evidence that foreign investors play an asymmetrical role in the Eurozone that is stronger in cases of distresses combined with a more passive and market-based ECB`s approach to government securities.

Scenario C evidence the possible impacts of a moderate pace of QT that is matched by a partial reallocation of foreign investors' portfolios from countries perceived as riskier to safer. The scenario evidence that even in the case of a moderate QT, if such a shift or external shock triggers financial investors to play an asymmetrical role in the Eurozone in line with past trends, the impacts in terms of financial fragility will be substantial to most of the peripheral Eurozone. The most fragile countries are, once again, Spain (4,7%), Italy (4,4%), Portugal (3,9%), and Greece (2,6%), and the scenario further evidences a significant fragmentation in the region.

Scenario D represents the most adverse scenario in terms of fragmentation, with an aggressive QT matched by foreign investors' reallocations of government securities. Once again, the most fragile countries are Spain (5,9%), Italy (5,5%), Portugal (5,3%) and Greece (3,7%). Under this scenario, the negative impacts of QT on core countries are partially offset by foreign inflows into these government securities markets, while they are amplified by outflows from peripheral countries. Even though an aggressive QT is likely to negatively affect financial stability across the region, these foreign flows might allow the burden of monetary policy adjustments to shift to the periphery.

Table 2 illustrates total bank debt as a share of assets, which serves as a proxy to assess vulnerability to a doom loop between domestic banks and governments. In all analysed scenarios, Italy, Spain, Greece, and Portugal exhibit the highest total bank debt as a share of assets, further confirming the higher fragility of these economies.

In summary, our results indicate that Southern Europe would be the most affected by the combination of QT and potential foreign investors' portfolio reallocations. Both financial fragility indicators consistently show Italy and Spain as the most fragile countries across all scenarios. These findings align with the ECB's concerns about preventing shocks in these two economies, as they have been the primary beneficiaries of reinvestment flexibility under the PEPP[15].

The results from our framework must be interpreted with its limitations in mind. The cases of Greece, Ireland, and Germany warrant additional comments to help contextualize our findings.

Given the severity and persistence of the debt crisis in Greece, the share of foreign investor holdings and total securities relative to total debt remained low (3% and 12%, respectively). Thus, foreign outflows have a relatively small impact, but this reflects the financial fragility of the economy. Furthermore, our cross-correlation analysis from the previous section showed that Greece is the only country where domestic banks' net purchases are significantly and negatively correlated with government bond yields. This suggests that the domestic banking sector does not stabilize the economy – nor does any investment group. Therefore, our approach might underestimate Greece's financial fragility.

Ireland's surprisingly low financial fragility indicators are driven by the large government surplus projected for the coming years (10.7 billion euros in 2025) and the small size of government debt relative to domestic bank assets (total public debt represented just 14% of domestic bank assets in 2024). Ireland relies heavily on portfolio and direct gross inflows, with government securities comprising a small portion of these total inflows. Moreover, Ireland's strong financial ties with the UK and the US (Lane, 2015) distinguish it from other Eurozone peripheral countries. Thus, Ireland's financial fragility appears to be more influenced by private finance and factors outside the Eurozone, which are not covered in our framework.

The safe-haven status of the German government's securities might provide a higher degree of accommodation to Germany relative to the other core countries than reflected in our findings under both of these scenarios. Our approach treats all the core countries homogeneously under scenarios C and D since they were identified in the same cluster, which might also underestimate the financial fragility of other core countries relative to Germany.

[15] From June 2022 to March 2024, PEPP flexibility has allowed to a cumulative purchase of 9,9 EUR billion and 5,3 EUR billion of Italian and Spanish public securities, while a sale of 19,3 EUR billion of German public securities.

Empirical evidence from our analysis across various scenarios suggests that a ECB shift towards a more aggressive QT – by non-reinvesting securities, or by selling them – would have a harsher impact on most Eurozone peripheral countries. Such negative impact would be amplified if the ECB eventually adopts a faster balance sheet reduction, or if it is accompanied by a reemergence of asymmetrical foreign flows in the government securities market.

7 Conclusion

This article argued that the interaction between sovereign bondholder groups and the EMU institutional arrangement shapes Eurozone regional asymmetries. Specifically, our findings suggest that foreign investors play a potentially destabilising role in sovereign debt markets during periods of distress, disproportionately affecting peripheral Eurozone countries. Conversely, domestic banks have consistently acted as a more uniform stabilising force across the region. The uneven influence of foreign investors can be mitigated by the ECB's support for these states' liabilities or exacerbated by uncertainty surrounding such support. While the EMU policy constraints can be alleviated in the core Eurozone by the foreign investors' stabilising role, their effects may be amplified in the periphery. Depending on the ECB's approach to government debt, foreign flows in sovereign debt markets could become a mechanism for shifting the burden of adjustment from the core to the peripheral Eurozone.

In view of the post-pandemic institutional shift towards reinforcing market discipline, we proposed a framework to assess the potential consequences of central bank outflows combined with diverse private investor groups' behaviour. Our analysis contributed to shedding light on the likely asymmetrical impacts of the QT progression, which nowadays remains in its early stages and is gradually being intensified. According to the financial fragility indexes built in the scenarios under our framework, Southern European countries would be hardest hit by the QT evolvement. These countries could be even worse off, and asymmetries would be further exacerbated in the case of a faster QT pace or if it were accompanied by a reemergence of foreign investor asymmetries. Albeit the actual emergence of such an uneven role to be played by foreign investors is highly unpredictable, the shift towards reinforcing market discipline makes the environment open and favourable for such a role to perform.

By preventing public debt from attaining a supposed "too safe" status, the Eurozone's contradictory approach to government debt operates as a mechanism that reinforces regional

imbalances. It places government debt precariously on the edge of a knife, perpetuating hierarchical perceptions of debt safety among sovereign bondholders while risking financial instability. Addressing this delicate balance requires substantial institutional reform, which depends on resolving geopolitical disputes within the Eurozone. Key steps include defining a permanent and explicit role for the ECB in supporting government securities and establishing enduring risk-sharing measures, such as a broader role for regional safe assets.

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Appendix A

The framework and scenarios developed to assess financial fragility to domestic central banks and foreign investors' outflows are defined in more detail in this appendix. This framework is based on Alsalsp and Tsuda (2014), incorporating outflows by the Eurosystem and refining it to allow for asymmetrical investors group behavior.

The Gross Financing Needs for each country is defined as follows:

$$GFN_{i,t} = D_{i,t} + M_{i,t} = FD_{i,t} + DBD_{i,t} + DNBD_{i,t} + FM_{i,t} + DBM_{i,t} + DNBM_{i,t} + EuroM_{i,t}$$

Where, at time t and country i, $GFN_{i,t}$ = Gross Financing Needs; $D_{i,t}$= overall fiscal deficit; $M_{i,t}$=maturing debt; $FD_{i,t}$ = fiscal deficit financed by foreign private; $DBD_{i,t}$ = Fiscal deficit financed by domestic banks; $DNBD_{i,t}$ = Fiscal deficit financed by domestic non-banks; $FM_{i,t}$ = Maturing debt held by foreign private; $DBM_{i,t}$ = Maturing debt held by domestic banks; $DNBM_{i,t}$ = Maturing debt held by domestic non-banks; $EuroM_{i,t}$ = Maturing debt held by the Eurosystem.

We will assume that the domestic central banks - in line with the Eurosystem framework – and foreign official sector and do not finance the deficit. As we do not have access to data for the maturity per investor group, we are going to suppose that each investor`s contribution to finance short term debt over the next year will be proportional to their share in total debt:

$$FM_{i,t} = M_{i,t}\frac{F_{i,t}}{TD_{i,t}}\ ;\ \ DBM_{i,t} = M_{i,t}\frac{DB_{i,t}}{TP_{i,t}};\qquad DNBM_{i,t+1} = M_{i,t+1}\frac{DNB_{i,t}}{TP_{i,t}}$$

Where, at time t and country i, $F_{i,t}$ = total debt held by foreigners; $DB_{i,t}$= total debt held by domestic banks; $DNB_{i,t}$= total debt held by domestic non-banks; $TD_{i,t}$ = total government securities.

In the case of the official holdings by the Eurosystem, we do not have data on the amount of debt that is going to mature over the next year, but we have the Weighted Average Maturity (WAM) of each country and its evolution over time. So, we are going to assume that the yearly redemptions are homogeneous and determined inversely to the WAM, where $PS_{i,t}$ are the accumulated net purchases of government securities by the PEPP and the APP:

$$EuroM_{i,t+1} = \left[\frac{1}{2WAM_{i,t}-1}\right]PS_{i,t}\ = \left[\frac{1}{2WAM_{i,t}^{PEPP}-1}\right]PS_{i,t}^{PEPP}\ +\ \left[\frac{1}{2WAM_{i,t}^{APP}-1}\right]PS_{i,t}^{APP}$$

Additionally, each private investor group will finance the deficit in the following way. Foreign investors will be able to finance the deficit in the same share of their participation in total debt held by private investors, but they can also stop financing the deficit. Therefore, a is a binary

variable indicating if foreign investors finance ($a_i = 0$) or not ($a_i = 1$) their share in the debt. Domestic banks and non-banks will finance their share in the deficit and, if $a_i = 1$, a share of the deficit that is not financed by foreign investors. The deficit will be financed by each investor group as it follows:

$$FD_{i,t+1} = (1 - a_i)(D_{i,t+1}\frac{F_{i,t}}{TP_{i,t}})$$

$$DBD_{i,t+1} = (D_{i,t+1}\frac{DB_{i,t}}{TP_{i,t}}) + a_i(D_{i,t+1}\frac{F_{i,t}}{TP_{i,t}})[1 - (\varphi_i + \frac{DNB_{i,t}}{TD_{i,t}})]$$

$$DNBD_{i,t+1} = (D_{i,t+1}\frac{DNB_{i,t}}{TP_{i,t}}) + a_i(D_{i,t+1}\frac{F_{i,t}}{TP_{i,t}})[(\varphi_i + \frac{DNB_{i,t}}{TD_{i,t}})]$$

Therefore, Eurosystem outflows, foreign investors outflows and total additional debt to be held by the domestic banks will be determined by the following equations:

$$EuroOutflow_{i,t+1} = (1 - \omega)EuroM_{i,t+1} + \lambda(PS_{i,t} - EuroM_{i,t+1})$$

$$\text{Foutflow}_{i,\,t+1} = (1 - \beta_i)FM_{i,t+1} + \gamma_i[FS_{i,t} - (1 - \beta_i)FM_{i,t+1}]$$

$$\Delta\text{DebtDB}_{i,t+1} = (D_{i,t+1}\frac{DB_{i,t}}{TP_{i,t}}) + [(\text{FPoutflow}_{i,t+1} + \text{EuroOutflow}_{i,t+1} + a_i(D_{i,t+1} * \frac{F_{i,t}}{TP_{i,t}})]$$

$$[1 - (\varphi_i + \frac{DNB_{i,t}}{TD_{i,t}})]$$

The four scenarios here analysed, scenarios A, B, C, and D, are based on different values for the different parameters $\beta, \gamma, a, \omega, \lambda, \varphi$. Such parameters comprises different shares of reinvestments and sales of government securities by the foreign investors (β and γ, respectively) and the Eurosystem (ω and λ, respectively), to the role played by foreign investors in financing ($a = 0$) or not ($a = 1$) the deficit, and also the share of outflows that would be absorbed by the domestic non-banking system over the share of government securities held by this sector (φ).

While all these parameters are constant across the analysed countries in scenarios A and B, the parameters β, γ, a, φ were allowed to vary in scenarios C and D across the three clusters of countries that were identified in our empirical analysis (Figure 8), their values being based on the historical trends of each cluster as described in section 5. Therefore, under scenarios C and D the foreign outflows and the additional debt to be held by domestic banks have both three different equations, one for each of the three clusters. Cluster 1 comprises Greece and Portugal, Cluster 2, Spain, Ireland and Italy, and Cluster 3 the remaining countries.

The equations adopted in each analysed scenario are detailed in the Table 1. Equations on the total government debt to be held by domestic banks in each of the scenarios are illustrated in Table 2. Empirical data on outflows and additional debt to be held by domestic banks in each country are illustrated in Table 3, 4, 5 and 6.

Scenario	Parameters	Eurosystem outflows	Foreign Outflows
A	$\omega = \lambda = a = 0$ $\beta = 1$ $\gamma = \varphi = 0$	$\boldsymbol{EuroOutflow_{i,t+1}}$ $= EuroM_{i,t+1}$	$\mathbf{Foutflow_{i,t+1}} = 0$
B	$\omega = a = 0$ $\lambda = 0{,}1$ $\beta = 1$ $\gamma = \varphi = 0$	$\boldsymbol{EuroOutflow_{i,t+1}} =$ $EuroM_{i,t+1} + 0{,}1(PS_{i,t} - EuroM_{i,t+1})$	$\mathbf{Foutflow_{i,t+1}} = 0$
C	$\omega = \lambda = 0$ $a_1 = a_2 = 1$ $a_3 = 0$ $\beta_1 = \beta_2 = 0$ $\beta_3 = 1$ $\gamma_1 = 0{,}235$ $\gamma_2 = 0{,}057$ $\gamma_3 = -0{,}079$ $\varphi_1 = \varphi_3 = 0$ $\varphi_2 = 0{,}076$	$\boldsymbol{EuroOutflow_{i,t+1}}$ $= EuroM_{i,t+1}$	$\mathbf{Foutflow^1_{i,t+1}}$ $= FM_{i,t+1}$ $+ 0{,}235(FS_{i,t} - FM_{i,t+1})$ $\mathbf{Foutflow^2_{i,t+1}}$ $= FM_{i,t+1}$ $+ 0{,}057(FS_{i,t} - FM_{i,t+1})$ $\mathbf{Foutflow^3_{i,t+1}}$ $= -0{,}079FS_{i,t}$
D	$\omega = 0$ $\lambda = 0{,}1$ $a_1 = a_2 = 1$ $a_3 = 0$ $\beta_1 = \beta_2 = 0$ $\beta_3 = 1$ $\gamma_1 = 0{,}235$ $\gamma_2 = 0{,}057$ $\gamma_3 = -0{,}079$ $\varphi_1 = \varphi_3 = 0$ $\varphi_2 = 0{,}076$	$\boldsymbol{EuroOutflow_{i,t+1}} =$ $EuroM_{i,t+1} + 0{,}1(PS_{i,t} - EuroM_{i,t+1})$	$\mathbf{Foutflow^1_{i,t+1}}$ $= FM_{i,t+1}$ $+ 0{,}235(FS_{i,t} - FM_{i,t+1})$ $\mathbf{Foutflow^2_{i,t+1}}$ $= FM_{i,t+1}$ $+ 0{,}057(FS_{i,t} - FM_{i,t+1})$ $\mathbf{Foutflow^3_{i,t+1}}$ $= -0{,}079FS_{i,t}$

Table 3 – Scenarios, parameters and outflows in the government debt market

Scenario	Aditional debt to be held by the domestic bank
A	$\Delta\mathbf{DebtDB}_{i,t+1} = D_{i,t+1}\frac{DB_{i,t}}{TP_{i,t}} + EuroM_{i,t+1}(1 - \frac{DNB_{i,t}}{TD_{i,t}})$
B	$\Delta\mathbf{DebtDB}_{i,t+1} = D_{i,t+1}\frac{DB_{i,t}}{TP_{i,t}} + [(EuroM_{i,t+1} + 0{,}1(PS_{i,t} - EuroM_{i,t+1})](1 - \frac{DNB_{i,t}}{TD_{i,t}})$
C	$\Delta\mathbf{DebtDB}^{\mathbf{1}}_{i,t+1} = D_{i,t+1}\frac{DB_{i,t}}{TP_{i,t}} + [EuroM_{i,t+1} + FM_{i,t+1} + 0{,}235(FS_{i,t} - FM_{i,t+1}) + D_{i,t+1} * \frac{F_{i,t}}{TP_{i,t}}](1 - \frac{DNB_{i,t}}{TD_{i,t}})]$ $\Delta\mathbf{DebtDB}^{\mathbf{2}}_{i,t+1} = D_{i,t+1}\frac{DB_{i,t}}{TP_{i,t}} + [EuroM_{i,t+1} + FM_{i,t+1} + 0{,}057(FS_{i,t} - FM_{i,t+1}) + D_{i,t+1} * \frac{F_{i,t}}{TP_{i,t}}](1 - \frac{DNB_{i,t}}{TD_{i,t}} - 0{,}076)]$ $\Delta\mathbf{DebtDB}^{\mathbf{3}}_{i,t+1} = D_{i,t+1}\frac{DB_{i,t}}{TP_{i,t}} + [EuroM_{i,t+1} - 0{,}079FS_{i,t})(1 - \frac{DNB_{i,t}}{TD_{i,t}})]$
D	$\Delta\mathbf{DebtDB}^{\mathbf{1}}_{i,t+1} = D_{i,t+1}\frac{DB_{i,t}}{TP_{i,t}} + [EuroM_{i,t+1} + 0{,}1(PS_{i,t} - EuroM_{i,t+1}) + FM_{i,t+1} + 0{,}235(FS_{i,t} - FM_{i,t+1}) + D_{i,t+1} * \frac{F_{i,t}}{TP_{i,t}}](1 - \frac{DNB_{i,t}}{TD_{i,t}})]$ $\Delta\mathbf{DebtDB}^{\mathbf{2}}_{i,t+1} = D_{i,t+1}\frac{DB_{i,t}}{TP_{i,t}} + [EuroM_{i,t+1} + 0{,}1(PS_{i,t} - EuroM_{i,t+1}) + FM_{i,t+1} + 0{,}057\big(FS_{i,t} - FM_{i,t+1}\big) + D_{i,t+1} * \frac{F_{i,t}}{TP_{i,t}}](1 - \frac{DNB_{i,t}}{TD_{i,t}} - 0{,}076)]$ $\Delta\mathbf{DebtDB}^{\mathbf{3}}_{i,t+1} = D_{i,t+1}\frac{DB_{i,t}}{TP_{i,t}} + [EuroM_{i,t+1} + 0{,}1(PS_{i,t} - EuroM_{i,t+1}) - 0{,}079FS_{i,t})(1 - \frac{DNB_{i,t}}{TD_{i,t}})]$

Table 4 – Additional government debt to be held by domestic banks in each scenario.

Scenario A (EUR Billion)			
Country	**Foreign Outflows**	**Eurozone Outflows**	**Additional debt to be held by domestic bank**
Austria	0	8,54	9,67
Belgium	0	12,65	15,61
Germany	0	82,04	89,85
Spain	0	36,21	48,37
Finland	0	5,04	7,94
France	0	66,85	69,75
Greece	0	2,53	3,80
Ireland	0	4,43	2,50
Italy	0	52,65	62,89
the Netherlands	0	14,41	16,92
Portugal	0	6,23	5,08

Table 5 – Outflows in the government debt market to each country in Scenario A.

Scenario B (EUR Billion)			
Country	**Foreign Outflows**	**Eurozone Outflows**	**Additional debt to be held by domestic bank**
Austria	0	19,05	19,86
Belgium	0	26,13	27,07
Germany	0	173,95	171,92
Spain	0	81,55	88,17
Finland	0	11,45	14,09
France	0	140,65	129,16
Greece	0	6,21	7,39
Ireland	0	10,72	7,86
Italy	0	116,90	110,80
the Netherlands	0	33,28	32,00
Portugal	0	14,06	11,27

Table 6 – Outflows in the government debt market to each country in Scenario B.

Scenario C (EUR Billion)			
Country	**Foreign Outflows**	**Eurozone Outflows**	**Additional debt to be held by domestic bank**
Austria	-13,57536	8,54	-3,49
Belgium	-20,266976	12,65	-1,62
Germany	-35,711713	82,04	57,96
Spain	88,58357305	36,21	138,28
Finland	-4,663686	5,04	3,46
France	-80,441276	66,85	5,00
Greece	4,278520625	2,53	8,38
Ireland	11,3416977	4,43	10,95
Italy	154,6015247	52,65	176,53
the Netherlands	-5,558835	14,41	12,47
Portugal	14,73632293	6,23	16,88

Table 7 – Outflows in the government debt market to each country in Scenario C.

Scenario D (EUR Billion)			
Country	**Foreign Outflows**	**Eurozone Outflows**	**Additional debt to be held by domestic bank**
Austria	-13,57536	19,05	6,70
Belgium	-20,266976	26,13	9,84
Germany	-35,711713	173,95	140,04
Spain	88,58357305	81,55	174,64
Finland	-4,663686	11,45	9,61
France	-80,441276	140,65	64,41
Greece	4,278520625	6,21	11,97
Ireland	11,3416977	10,72	15,82
Italy	154,6015247	116,90	219,56
the Netherlands	-5,558835	33,28	27,56
Portugal	14,73632293	14,06	23,07

Table 8 – Outflows in the government debt market to each country in Scenario D.