Who Benefits from Capital Market Integration in a Monetary Union?

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I study how capital market integration redistributes risk and welfare in a monetary union hit by asymmetric shocks. Using microdata on household portfolios and macrodata on cross-border holdings, I document large disparities in financial participation within countries and persistent asymmetries in portfolio diversification between them. To assess the distributional consequences of limited integration, I develop a two-country monetary-union model with heterogeneity in participation and country-specific portfolio structures. Integration operates through two channels: a diversification channel that insures Savers by stabilizing financial income, and a reallocation channel that shifts capital toward higher returns, lowering real wages and amplifying consumption losses for Non-Savers where negative shocks occur. These mechanisms overturn the representative-agent prediction that deeper integration unambiguously enhances risk sharing. Calibrated to 2010 euro area data, the model shows that integration stabilizes aggregates but redistributes welfare unevenly across and within countries. Allowing for endogenous participation amplifies domestic asymmetries, weakens cross-country spillovers, and concentrates exposure to shocks among financially constrained households.

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1 Introduction

Financial integration fosters the holding of foreign assets, allowing households to insure their consumption against domestic shocks. By smoothing income, it mitigates downturns when domestic activity weakens. This stabilizing mechanism lies at the core of Mundell [1961]'s theory of optimal currency areas. When exchange rates cannot adjust, member states can absorb asymmetric shocks only through fiscal transfers, labor mobility, or financial integration. Yet, in the euro area, the largest monetary union in existence, these three mechanisms remain underdeveloped: fiscal transfers are limited, labor mobility is modest, and capital markets are still fragmented. The union therefore remains exposed to asymmetric shocks, such as the sovereign debt crisis. The *Capital Markets Union (CMU)* initiative was launched to partially address these vulnerabilities by deepening financial integration and strengthening private risk sharing across member states.[1] The continued fragmentation of capital markets calls for a reassessment of a central question: who ultimately benefits from financial integration?

This paper revisits that question by embedding household heterogeneity into the theory of capital market integration. It introduces two dimensions of integration: heterogeneity in financial participation within countries and portfolio diversification between them. Their interaction determines how financial integration shapes macroeconomic stabilization and welfare in a monetary union. Standard representative-agent models capture cross-country risk sharing but ignore within-country inequality. They predict that deeper integration always stabilizes the union. I show that this prediction fails once financial participation is incomplete and portfolios are asymmetric.

Combining new empirical evidence with a two-country model of a monetary union featuring heterogeneous households and asymmetric portfolios, I show that financial integration stabilizes the union in the aggregate but redistributes welfare unevenly across countries and wealth groups. Within each country, households differ in their ability to smooth consumption. Savers hold diversified portfolios and can adjust their assets in response to shocks. Non-Savers rely mainly on labor income and remain exposed to local labor market fluctuations. Across countries, asymmetric portfolio structures and persistent home bias create unequal exposure to shocks and heterogeneity in their transmission.

Two channels drive these outcomes. The *diversification channel* operates through the steady-state composition of portfolios and stabilizes income and consumption, but only for financially active households. The *reallocation channel* arises from portfolio adjust-

[1] The *Five Presidents' Report* (2015) and the *New Action Plan for a Capital Markets Union* (2020) define the CMU as a pillar of Europe's resilience strategy, alongside fiscal and banking union. Yet they emphasize that fragmentation in supervision, taxation, and insolvency continues to hinder cross-border financial flows.

ments after shocks and amplifies asymmetries by directing capital toward regions with higher returns. Together, these channels explain why integration can stabilize the union in the aggregate while increasing inequality both within and across member states.

This paper contributes in three ways. First, it documents the unequal structure of capital market integration in the euro area. Using microdata on financial participation and macrodata on cross-border portfolios, I show large disparities both across and within countries. Second, it develops a two-country model of a monetary union with heterogeneous agents that links these patterns to the diversification and reallocation channels. Third, it quantifies how these channels affect stabilization and welfare. Once participation and portfolio heterogeneity are accounted for, the conventional Mundellian result no longer holds: integration reduces aggregate volatility but redistributes welfare unevenly across households and countries.

Before the sovereign debt crisis, two distinct groups had already emerged within the euro area: financially stronger and externally balanced economies, referred to as the *Core* (for example, Germany, France, and the Netherlands), and more indebted, capital-importing economies, referred to as the *Periphery* (for example, Italy, Spain, and Greece). The sovereign debt crisis acted as a turning point, magnifying the structural divide between the Core and the Periphery.

Two stylized facts illustrate this divergence. First, cross-country wealth inequality has increased since the creation of the single currency, despite rising financial integration. The widening gap is driven by the lower tail of the distribution in the Periphery. Second, capital stocks have also diverged, reflecting these structural asymmetries. Since 2010, the Periphery has decoupled from its pre-crisis trend, while the Core has remained stable or slightly expanded.

These patterns point to two distinct dimensions of integration. Using data from the Household Finance and Consumption Survey (HFCS), I show that financial participation is much lower in the Periphery, where more than two-thirds of households hold no assets beyond deposits. Complementary evidence from the IMF's Coordinated Portfolio Investment Survey (CPIS) indicates that portfolios remain asymmetric and highly home-biased. Periphery investors have limited diversification and only partial insurance against domestic shocks, whereas Core portfolios remain largely insulated from foreign risk. The shift of Periphery investors from domestic to Core assets has reduced home bias but reinforced cross-country differences in ownership and exposure. Such persistent imbalances determine how capital market integration redistributes wealth and risk across the euro area. Unequal access to risk-sharing mechanisms, both at the household and aggregate levels, ultimately constrains the extent to which integration can smooth

asymmetric shocks.[2]

To analyze these asymmetries, I first develop a two-country New Keynesian model with heterogeneous agents in a monetary union, where each country features two household types: Savers and Non-Savers, reflecting empirical participation patterns (TANK). Savers hold capital and invest through a domestic mutual fund that allocates portfolios between domestic and foreign assets, subject to home bias and adjustment costs.[3]

The model takes the observed capital market structure as given and studies how these patterns shape macroeconomic adjustment and inequality after asymmetric shocks. Financial integration is characterized by two structural parameters corresponding to the two channels: a home bias parameter governing steady-state diversification and a portfolio adjustment cost controlling the speed of reallocation. Together, they determine how capital moves across countries and over time. This dual structure captures both the level and dynamics of integration and quantifies their joint effects on stabilization and inequality.

Importantly, even in a symmetric benchmark with no ex-ante heterogeneity, these mechanisms generate asymmetric responses. Diversification provides insurance by stabilizing Savers' income, while reallocation amplifies downturns in the affected country by withdrawing capital and depressing wages. The result is higher inequality, especially for Non-Savers who lack financial buffers. Over time, these opposing forces imply that diversification lowers volatility for Savers, while reallocation increases it for Non-Savers.

Calibrating the model to euro area data for 2010, a pre-sovereign crisis benchmark year, I show that the strong home bias in the Core and the smaller relative size of equity markets in the Periphery limit cross-border risk sharing. Integration therefore narrows inequality in the Core but widens it in the Periphery, mirroring post-crisis patterns in the data. Counterfactuals comparing equity autarky and representative-agent settings show that both participation and portfolio heterogeneity are crucial to capture the true transmission of shocks.

Building on this benchmark, I extend the analysis to a fully Heterogeneous-Agent New Keynesian (HANK) framework with endogenous participation and wealth heterogeneity. The HANK structure allows the share of liquidity-constrained households to evolve endogenously after shocks and shows how incomplete markets alter the transmission of asymmetric disturbances. As in the TANK model, the HANK is calibrated to euro area data and embeds realistic differences in participation and portfolio composi-

[2]Consistent with Lane and Milesi-Ferretti [2018], Vermeulen [2018], Fagereng et al. [2020], and Bach et al. [2020].

[3]This intermediary bridges the two-agent (TANK) and heterogeneous-agent (HANK) structures and reflects that most household portfolios are held indirectly through financial institutions.

tion, linking model mechanisms to observed heterogeneity.

The results confirm the qualitative insights of the two-agent model but add quantitative depth. Heterogeneity amplifies domestic downturns in the Periphery, as weaker financial positions magnify contractions in capital and consumption. It also dampens cross-country spillovers through stronger wealth and price responses in the Core. These effects show that accounting for heterogeneity is essential not only to match the observed wealth distribution but also to understand how integration redistributes exposure, welfare, and adjustment capacity across the union.

Quantitatively, the model shows that capital market integration stabilizes the euro area in the aggregate but redistributes volatility across households and countries. Relative to equity autarky, the variance of total consumption declines by about 1.8%, confirming that integration enhances overall stabilization. At the country level, volatility also falls, by roughly 5.5% in the Core and 3.5% in the Periphery, reflecting stronger cross-country risk sharing. However, this aggregate improvement conceals contrasting patterns within countries. In the Core, the gap between Savers and Non-Savers narrows: Saver volatility rises by about 21% while Non-Saver volatility falls by 37%, reducing inequality in volatility. In the Periphery, the opposite occurs: Saver volatility declines by 18% whereas Non-Saver volatility increases by 16%, widening the gap between groups. Hence, integration smooths fluctuations across countries but amplifies heterogeneity within them, as financial exposure determines how households absorb shocks. Five years after the shock, relative to equity autarky, capital market integration increases within-country inequality in the Periphery by about 18 basis points and reduces it in the Core by about 6 basis points. At the same time, between-country inequality falls by roughly 6 basis points. Integration therefore narrows disparities across countries while deepening inequality in the Periphery, where financially constrained households bear a larger share of the adjustment.

Overall, I show that financial integration stabilizes the union in the aggregate but redistributes its gains unevenly. Completing Europe's Capital Markets Union therefore requires more than removing financial barriers. Complementary mechanisms such as fiscal transfers and labor mobility are needed to offset the uneven distribution of risks across households and countries. Without them, the stabilizing benefits of integration remain concentrated among asset holders, while liquidity-constrained households continue to bear the costs of adjustment.

Literature review. This paper bridges two major strands of research: heterogeneous-agent macroeconomics and international risk-sharing through capital market integration.

The first strand of the literature highlights how household heterogeneity shapes ag-

gregate dynamics and policy transmission. Models with incomplete markets and idiosyncratic income risk show that differences in wealth and portfolio composition affect consumption, saving, and welfare responses to shocks. The Heterogeneous-Agent New Keynesian (HANK) framework of Kaplan et al. [2018] has been central to this progress. Building on this foundation, studies such as de Ferra et al. [2020], Auclert et al. [2021], Oskolkov [2023], Guo et al. [2023], and Acharya and Challe [2025] examine how heterogeneity in asset holdings shapes macroeconomic adjustment and policy effectiveness in open economies. Closer to my work, Bayer et al. [2024] develop a two-country HANK model of a monetary union. They show that monetary-union shocks are redistributed horizontally across countries, through trade and cross-border bond holdings, but not vertically across the wealth distribution within countries. Yet, both their framework and the broader literature abstract from cross-border capital investment: households can borrow or lend abroad through bonds but cannot invest in foreign productive assets. This paper extends this framework by introducing cross-border portfolio heterogeneity, allowing households to invest directly in foreign equity. This additional investment margin changes the nature of redistribution: capital market integration now transmits shocks both across countries and across the wealth distribution within each economy.

A second strand of research focuses on how financial integration fosters international risk-sharing. Foundational contributions by van Wincoop [1999], Obstfeld and Rogoff [2001], Heathcote and Perri [2013], and Coeurdacier and Rey [2013] formalize how cross-border asset holdings allow consumption to be smoothed relative to domestic output. Within monetary unions, Corsetti et al. [2008], Auray and Eyquem [2014], Farhi and Werning [2017], Senay and Sutherland [2019], and Cimadomo et al. [2020] show that portfolio diversification can partly substitute for missing fiscal transfers in absorbing asymmetric shocks. More recent studies—Blanchard et al. [2017], Almgren et al. [2022], Martín Fuentes et al. [2023], and Ferrari and Rogantini Picco [2023]—highlight persistent Core–Periphery asymmetries in the euro area, where incomplete financial integration limits private risk-sharing. Yet, this literature remains grounded in representative-agent frameworks that assume uniform market participation and therefore abstract from within-country heterogeneity. This paper introduces household heterogeneity into the analysis of international risk-sharing. When participation in capital markets is unequal, integration continues to stabilize the union in aggregate but shifts risk and welfare unevenly across households and countries, challenging the representative-agent intuition of Mundell [1961].

A complementary strand of research examines capital flows and the global financial cycle, showing that financial integration can amplify rather than mitigate cross-country

imbalances. Lane [2012] and Rey [2015] document the procyclicality of global capital flows. Broner et al. [2014], Caballero et al. [2017], and Maggiori [2017] show that investors in safe-asset countries absorb shocks through portfolio reallocations, reinforcing asymmetries between creditor and debtor economies. Recent evidence by Davis and van Wincoop [2024] and Beck et al. [2024] highlights that these dynamics are especially strong in the euro area, where flows toward the Core have deepened intra-union divergence. My framework incorporates portfolio rebalancing with heterogeneity in wealth and financial participation, linking aggregate capital flows to the distribution of assets and inequality within countries.

Taken together, this paper provides the first unified framework that embeds household heterogeneity into models of international risk-sharing. It demonstrates that capital market integration, traditionally viewed as a stabilizing force, can at once mitigate aggregate volatility and amplify inequality, both within and across member states.

2 Empirical Evidence on Heterogeneous Effects of Capital Market Integration

This section documents heterogeneity in the effects of capital market integration across euro area countries. I begin by identifying two groups of euro area countries, defined as the Core and the Periphery, emerging from a clustering of structural characteristics observed in 2010. To analyze how integration has shaped wealth, income, and portfolio dynamics between 2010 and 2021, I adopt a dual empirical approach. At the household level, I use data from the Household Finance and Consumption Survey (HFCS) conducted by the European Central Bank, which provides detailed information on wealth, income, and asset composition. Since this dataset does not contain information on the geographical allocation of households' portfolios, I complement it with aggregate country-level data on cross-border equity and investment fund holdings from the Coordinated Portfolio Investment Survey (CPIS) of the International Monetary Fund. Combining these two data sources enables me to capture both within-country and between-country heterogeneity in exposure to capital market integration.

Two new stylized facts emerge. First, wealth distributions in the Core and the Periphery have diverged significantly between 2010 and 2021, driven primarily by increasing inequality at the lower end of the distribution. Second, capital stocks in the Core and the Periphery have also drifted apart from their pre-crisis trajectories, reflecting a sustained shortfall in capital accumulation in the Periphery relative to the Core. To interpret these

patterns, I distinguish two dimensions of integration. Within countries, poorer households are substantially less financialized, particularly in the Periphery. Between countries, portfolio diversification across euro area members remains limited: home bias is large and persistent, especially in the Core. Together, these findings highlight that inequality in exposure to capital market integration arises both within and between countries, underscoring the importance of accounting for these heterogeneous effects when analyzing the consequences of integration.

2.1 Core and Periphery: Classification Based on Pre-Crisis Imbalances

To capture the structural asymmetries that predated the euro area sovereign debt crisis, I identify two groups of countries, defined as the Core and the Periphery, emerging from a clustering of macroeconomic imbalances in 2010. The clustering relies on three key indicators: GDP per capita (Eurostat), Net International Investment Position (NIIP, Eurostat), and the current account balance as a share of GDP (ECB and Eurostat). These variables jointly summarize countries' relative income levels, external indebtedness, and financing needs on the eve of the crisis. I employ a two-step clustering approach. First, I apply Principal Component Analysis (PCA) to reduce dimensionality and capture the main sources of cross-country variation. Second, I perform k-means clustering (with two clusters and 50 random starting points for robustness) on the first principal components to partition countries into two groups. The first cluster, labeled as the **Core**, includes Austria, Belgium, Finland, France, Germany, Luxembourg, and the Netherlands. The second cluster, labeled as the **Periphery**, includes Cyprus, Estonia, Greece, Ireland, Italy, Latvia, Lithuania, Malta, Portugal, Slovakia, Slovenia, and Spain.

Figure 1 demonstrates that Core countries are characterized by stronger external positions: higher current account balances, less negative (or positive) NIIPs, and higher GDP per capita. By contrast, Periphery countries exhibit persistent external deficits, large negative net positions vis-à-vis the rest of the world, and lower income levels. These patterns reflected expectations of real convergence toward Core countries, as Periphery members were receiving more investment inflows than their domestic savings could finance.

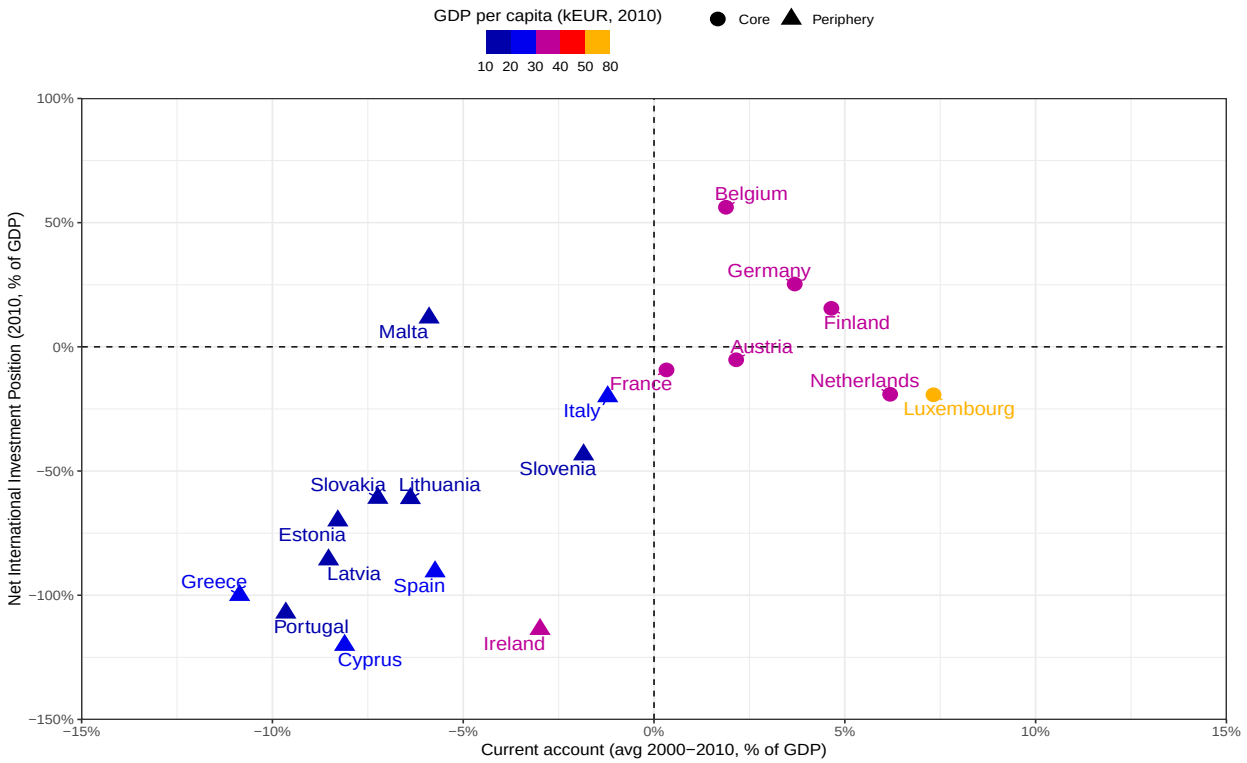

Figure 1: Clustering of Euro Area Countries in 2010

The figure plots euro area countries by their average current account balance (2000–2010, % of GDP, ECB & Eurostat) and their net international investment position (NIIP, 2010, % of GDP, Eurostat). Marker color reflects GDP per capita (in thousand EUR, 2010, Eurostat). Core countries (circles) and Periphery countries (triangles) are obtained from a PCA–*k*-means clustering based on these indicators. Periphery countries exhibit lower GDP per capita and persistent external deficits (negative current account and NIIP), while Core countries display higher income levels and more balanced external positions, reflecting pre-sovereign crisis imbalances and expectations of convergence within the monetary union.

Appendix A.1 provides complementary evidence and robustness checks. Using 2007 as a pre-crisis benchmark yields consistent cross-country patterns, confirming that the Core–Periphery division reflects pre-existing structural imbalances rather than crisis-driven adjustments. The classification remains stable across alternative specifications and aligns closely with Core–Periphery groupings commonly used in the literature[4].

This Core-Periphery classification provides a natural framework to study how capital market integration has generated heterogeneous outcomes within the euro area. In the next subsection, I document how these structural differences translated into divergent wealth and capital accumulation dynamics over the 2010-2021 period.

[4]See, for example, Jaumotte and Sodsriwiboon [2010], Eggertsson et al. [2014], Alesina et al. [2017], Mazzocchi and Tamborini [2019], Cimadomo et al. [2020], Ferrari and Rogantini Picco [2023], Martín Fuentes et al. [2023], Kaufmann et al. [2023], and Gatti et al. [2024].

2.2 Two New Stylized Facts: Divergent Wealth and Capital Stocks

To assess heterogeneity in capital market integration both within and between countries, I combine household-level data from the ECB's HFCS with aggregate cross-country data from the IMF's CPIS.

2.2.1 Data

At the micro level, the HFCS provides household-level information on income, wealth, private pensions, and consumption across four waves (2010, 2014, 2017, 2021). I use these data to characterize wealth heterogeneity, financial participation, and portfolio diversification within each country. Because the HFCS lacks information on the geographic allocation of financial assets, I complement it with bilateral investment positions from the CPIS, which records cross-border holdings of equities and investment fund shares between countries. The focus is on the period 2010–2021 to align with HFCS survey waves.

I also use data from the European System of Central Banks (ESCB) on domestic holdings of listed shares and investment fund units, following Beck et al. [2024]. All positions are converted into end-of-year U.S. dollars to ensure comparability. For countries with missing domestic data before 2012, I linearly retropolate values for 2010-2011 using country-specific trends. I then apply the correction proposed by Beck et al. [2024] to reallocate positions intermediated through Luxembourg, Ireland, and the Netherlands, using the Global Allocation database[5]. This adjustment introduces new bilateral links and significantly alters the distribution of holdings (Figure 29). Finally, I aggregate countries dynamically by group according to their euro area accession year: Estonia joins the Periphery from 2011, Latvia from 2014, and Lithuania from 2015.

[5]The correction proposed by Beck et al. [2024] addresses the misallocation of investment fund shares issued through onshore–offshore financial centers (OOFCs) such as Luxembourg, Ireland, and the Netherlands. Using the European Central Bank's *Securities Holdings Statistics* (SHS) combined with fund-level data from the Global Allocation Database and commercial sources, the procedure reallocates investment fund shares to their ultimate country of exposure. It does so by mapping each security to its ultimate parent entity and by distinguishing between holdings by euro area residents and those by the rest of the world. This correction mitigates the bias from financial intermediation through OOFCs, yielding a more accurate measure of bilateral equity exposures within the euro area.

2.2.2 Diverging Wealth Distributions

Figure 2 plots the log change in total gross wealth[6] between 2010 and 2021 across percentiles of the wealth distribution. In the Core, the entire distribution shifts upward, suggesting broad-based wealth gains and a tiny reduction of inequality. By contrast, in the Periphery, the top deciles experience moderate wealth gains while the bottom deciles lose significantly, leading to a widening of internal inequality. These dynamics mirror the divergent recovery trajectories following the sovereign debt crisis: between 2010 and 2017, the lower end of the distribution in the Periphery declined sharply, with only partial rebound by 2021.

The Theil decomposition[7] (Figure 42) shows that nearly all euro area wealth inequality originates within countries: the within-country component accounts for 97.4% of total inequality in 2010 and 97.1% in 2021. This indicates that disparities largely stem from heterogeneity within rather than between countries. Hence, understanding the impact of capital market integration requires accounting for household-level differences in financial exposure.

[6]Results are unchanged when using net wealth instead of gross wealth. As shown in Figure 41, the correlation between gross and net wealth by year and group is nearly one, indicating that the observed dynamics primarily reflect differences in asset accumulation rather than variations in household indebtedness.

[7]The Theil index measures the deviation of an observed income (or wealth) distribution from perfect equality. Higher values indicate greater inequality. Its main advantage is exact decomposability, allowing total inequality to be split into a within-group component (inequality within countries) and a between-group component (inequality across countries).

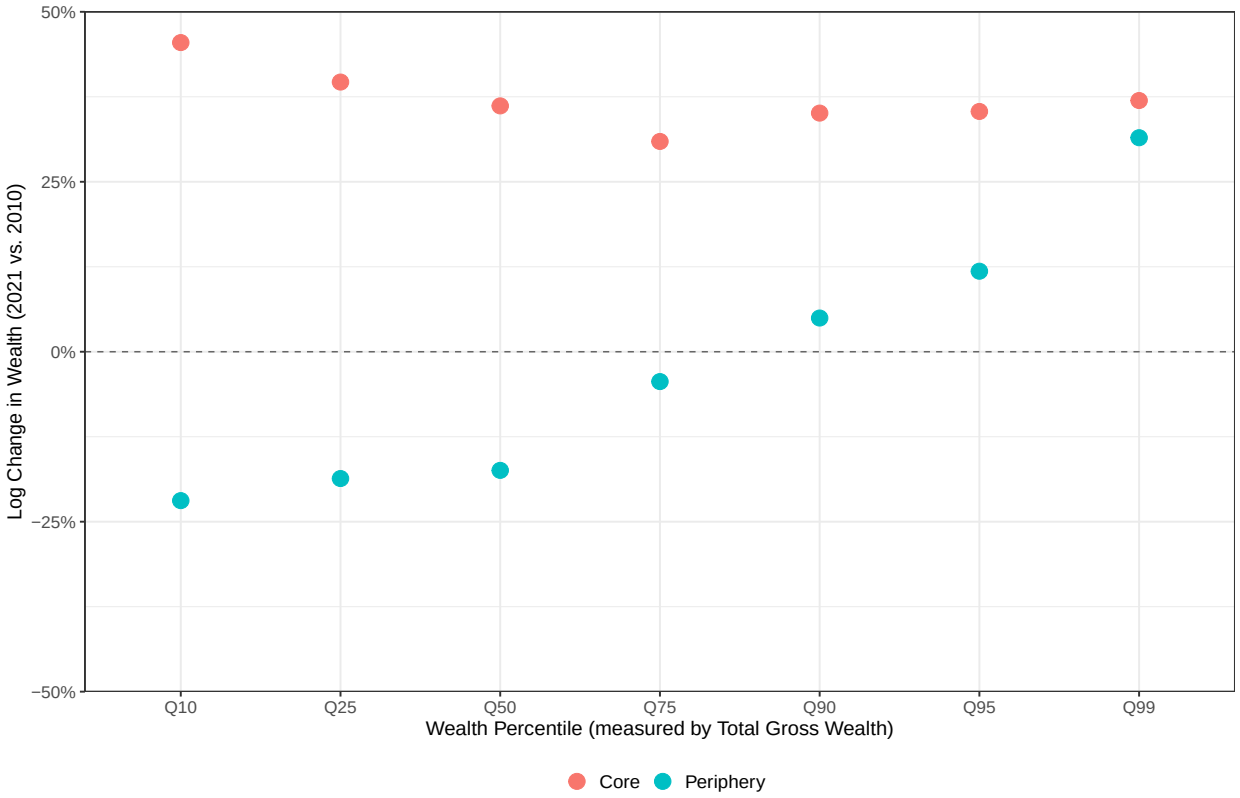

Figure 2: Change in Wealth Across the Wealth Distribution (2021 vs. 2010)

The figure plots the log change in total gross wealth between 2010 and 2021 for households grouped by wealth percentile within each group of countries—the Core (red) and the Periphery (blue). In the Core, wealth grew almost uniformly across the distribution, slightly narrowing inequality. In the Periphery, wealth declined at the bottom but rose at the top, indicating a widening of within-group wealth inequality and a divergence from the Core.

Appendix A.2.1 extends the analysis to financial wealth and income, showing that the widening Core–Periphery gap is driven primarily by lower-wealth households. Additional details on the distribution of wealth are reported in Appendix A.2.2, and the relationship between income and wealth is further documented in Appendix A.2.3.

2.2.3 Diverging Capital Stocks

Capital stock data[8] (Eurostat) reveal a similar divergence at the macro level. Figure 3 plots the evolution of total net fixed assets (in current prices) relative to pre-crisis trends estimated over 2000–2007. Before the crisis, both groups exhibited broadly parallel trends,

[8]Capital stock data come from Eurostat's dataset *Capital stocks by industry (NACE Rev.2) and detailed asset type*. The series measure net total fixed assets at current replacement costs, expressed in millions of euros and aggregated across all NACE activities (ESA 2010 definition). Figure 50 reports the same graph using gross total fixed assets.

with the Periphery growing slightly faster.[9] After 2010, however, the Core's capital stock recovered and outperformed its trend, while the Periphery's stagnated below it. By 2021, the Periphery's deviation from its pre-crisis trend reached 50 percentage points relative to the Core.

These patterns highlight a structural divergence in capital accumulation: the Core not only recovered but exceeded its pre-crisis trajectory, while the Periphery remained below. The asymmetry mirrors the wealth divergence documented above, suggesting that macro-level investment and micro-level wealth inequality are closely linked.

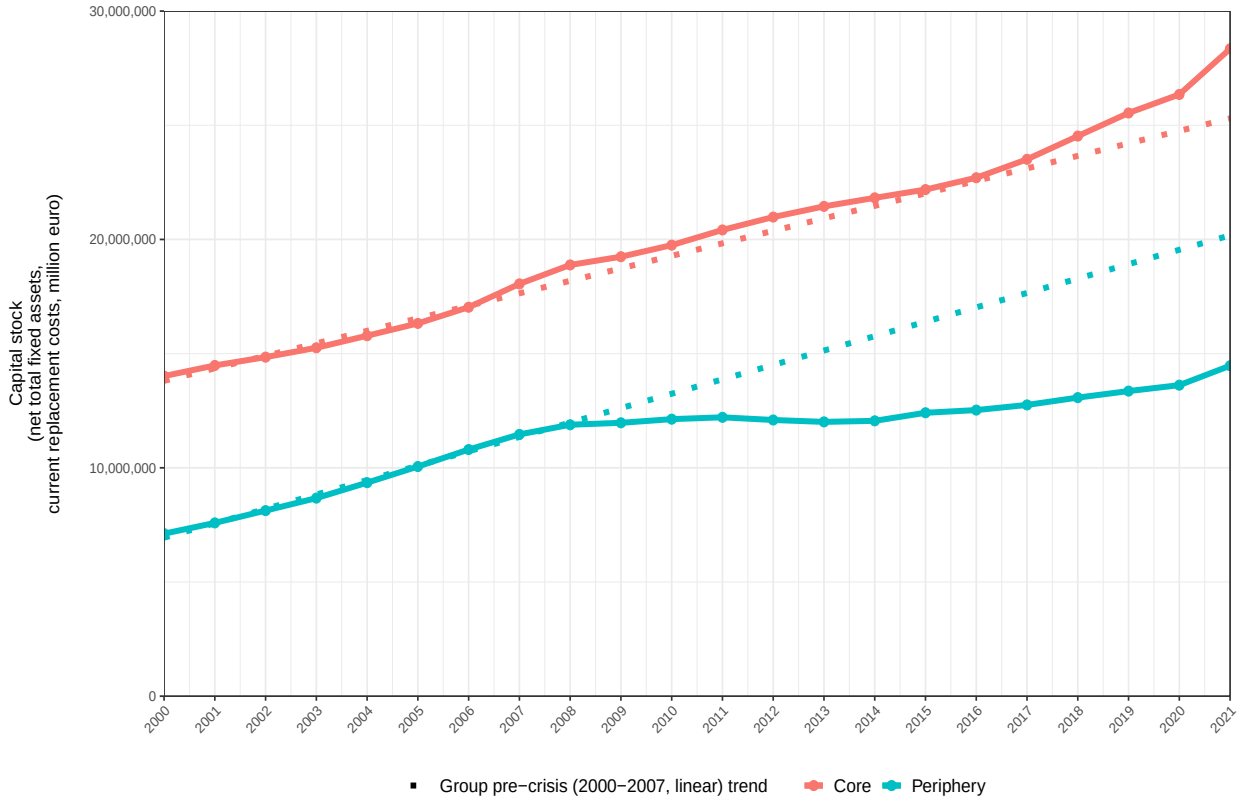

Figure 3: Capital Stock and Pre-Crisis Trends in the Core and Periphery (2000–2021)
The figure plots total net fixed capital stock (million euros, current replacement costs) for the Core (red) and the Periphery (blue). Dashed lines represent linear pre-crisis trends (2000–2007). Before the crisis, both groups followed similar upward trajectories, but after 2008 capital accumulation slowed markedly in the Periphery while remaining on trend in the Core, reflecting the persistent investment gap that emerged in the post-crisis period.

[9]The estimated pre-crisis slope for the Core is 547,271, while the interaction term ($Year \times Group_{Periphery}$) adds 83,112 (approximately 15% higher). These coefficients are obtained from an OLS regression of capital stock on year and its interaction with the group dummy over 2000–2007:

$$\text{Capital}_{it} = \alpha + \beta_1 \text{Year}_t + \beta_2 \text{Group}_{\text{Periphery},i} + \beta_3 (\text{Year}_t \times \text{Group}_{\text{Periphery},i}) + \varepsilon_{it}.$$

The interaction coefficient (β_3) measures the difference in pre-trend slopes; here $\beta_3/\beta_1 \approx 0.15$, with $p \approx 0.08$, indicating weak evidence that the Periphery's capital was growing faster before 2007.

Appendix A.2.4 presents robustness checks using gross capital measures, sectoral decompositions, and country-level deviations, showing that the divergence in capital accumulation is broad-based and not driven by any single country.

2.3 Two Dimensions of Integration

Having established divergence in both wealth and capital, I now examine the mechanisms driving these patterns through two complementary dimensions of integration: within and between countries. Within countries, poorer households are less financialized, particularly in the Periphery. Between countries, portfolio diversification remains limited, particularly among Core countries, whose portfolios exhibit a strong home bias. These two dimensions jointly explain the unequal transmission of shocks across the monetary union.

2.3.1 Within-Country: Financial Participation

Figure 4 illustrates the extensive and intensive margins of financial participation using HFCS data for 2010. The curve shows the share of households holding financial assets (extensive margin), while the bars show the share of financial assets in total wealth (intensive margin). Deposits are excluded, as they offer no cross-asset diversification and are insulated from international market conditions.

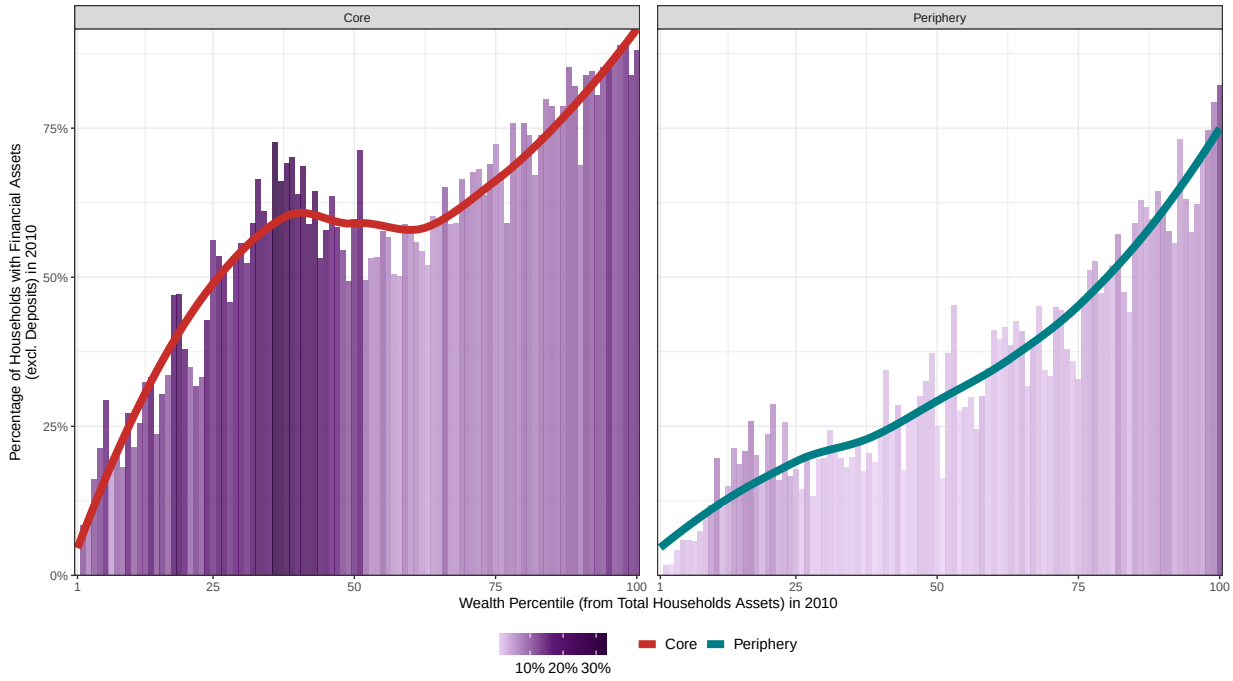

Figure 4: Financial Participation Along the Wealth Distribution (2010)

The figure shows the share of households holding financial assets (curve, extensive margin) and the share of financial assets in total wealth (bars, intensive margin) across wealth percentiles, using HFCS data for 2010. Participation and financialization increase steeply with wealth. The Core displays deeper participation and higher financial shares throughout the distribution, while portfolios in the Periphery remain dominated by real assets.

Participation in financial markets rises steeply with wealth. In 2010, 43% of households in the Core and 67% in the Periphery held no financial assets other than deposits. The share of financial assets in total wealth also increases with wealth, reaching 13.6% in the Core and 3.8% in the Periphery. By 2021, participation improved slightly but remained highly unequal (Figure 60). Appendix A.3.1 replicates this figure for all survey waves. Overall, financialization is systematically deeper in the Core, where middle-wealth households tend to accumulate financial assets before purchasing housing, whereas portfolios in the Periphery remain dominated by real assets.

Appendix A.3.2 provides further detail on portfolio composition, confirming that real assets dominate at the bottom of the distribution, while voluntary pension funds and equities account for a growing share at the top, especially in the Core. Appendix A.3.3 provides additional elements regarding foreign shares ownership through a binary question.

Sections 1–2 of the Online Appendix provide additional extensive-margin measures and further evidence of limited household diversification.

2.3.2 Between-Country: Diversification

A first proxy for household portfolio diversification is the aggregate investment portfolio, which captures both direct and indirect holdings through mutual funds and managed accounts. Using CPIS data, augmented with domestic holdings and adjusted for offshore-onshore centers, I compute the equity home bias following Coeurdacier and Rey [2013]. The home bias equals one minus the share of foreign equities in country i's portfolio relative to the share of foreign equities in the euro area market portfolio. The measure accounts for country size by comparing each country's foreign equity share to the euro area market portfolio, thereby controlling for the relative weight of domestic equities in the total market.[10]

Figure 5 shows that diversification remains limited, particularly in the Core. In 2010, home bias stood at 86.96% in the Core and 84.68% in the Periphery. By 2021, the Core's bias was unchanged while the Periphery's fell to 75.69%. Hence, the Periphery became somewhat more diversified, but exposure remains asymmetric: the Periphery is more exposed to the Core than vice versa. This asymmetry constrains risk sharing and may amplify distributional consequences of asymmetric shocks within the monetary union.

Additional results on portfolio composition, performance, and cross-country correlations (covering asset holdings, Sharpe ratio, returns, and consumption/GDP comovement) are reported in Sections 3–6 of the Online Appendix.

[10] Formally, from Coeurdacier and Rey [2013], $EHB_i = 1 - \dfrac{\text{Share of Foreign Equities in Country } i \text{ Equity Holdings}}{\text{Share of Foreign Equities in the Euro Area Market Portfolio}}$. A value of zero indicates full diversification consistent with the International CAPM; a value of one implies complete home bias.

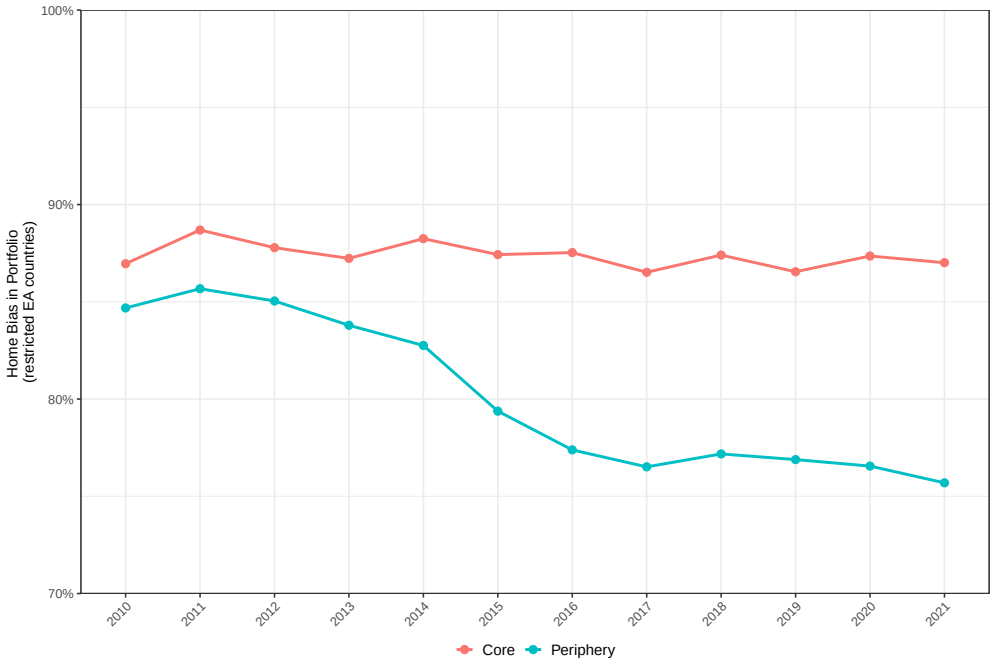

Figure 5: Home Bias in Portfolio Holdings (2010–2021)

The figure shows the average share of domestic assets in households' financial portfolios for Core (red) and Periphery (blue) euro area countries, restricted to euro area assets only. Home bias remains persistently high in the Core but declines steadily in the Periphery, indicating a gradual increase in cross-border diversification and asymmetric exposure across regions.

Overall, the evidence reveals substantial heterogeneity in diversification both within and between countries. Within countries, limited financial participation restricts poorer households' exposure to capital markets. Between countries, persistent home bias and asymmetric cross-border investment patterns constrain the scope for risk sharing across the monetary union. Core countries remain heavily invested in domestic and intra-Core assets, while Periphery countries have gradually diversified toward the Core but remain far less integrated overall.

These empirical findings point to a fundamental asymmetry in how capital market integration operates across the euro area. To interpret these patterns and assess their quantitative importance, the next section develops a unified framework combining two complementary approaches: a Two-Agent New Keynesian (TANK) model enables to isolate the main mechanisms and quantify the role of capital market integration under controlled conditions, while a Heterogeneous-Agent New Keynesian (HANK) model extends the analysis to a richer environment with endogenous distributional dynamics.

3 Two-Agent New Keynesian (TANK) Model

3.1 Overview of the Model

The model features two countries, the Core (C) and the Periphery (P), forming a monetary union calibrated to represent the corresponding euro area blocs. Each country produces a domestic good consumed both locally and abroad, with imperfect substitutability and country-specific import shares. Prices are flexible, while wages are sticky, ensuring zero profits each period so that the gains from diversification are not driven by countercyclical markups. A single central bank sets the nominal interest rate based on union-wide inflation. There is no migration between countries.

Each country $i \in \{C, P\}$ is populated by two household types $h \in \{N, S\}$: a share λ^i of Non-Savers (N) and $(1 - \lambda^i)$ of Savers (S). Setting $\lambda^i = 0$ collapses the model to a representative-agent (RA) framework. Non-Savers consume solely out of labor income and do not participate in asset markets, while Savers hold financial assets through country-specific, risk-neutral mutual funds. These funds pool domestic savings and allocate them between domestic and foreign capital according to relative returns. This structure departs from standard incomplete-markets frameworks, which typically restrict households to domestic (and occasionally foreign) bonds. Allowing funds to invest across member countries is crucial to capture the mechanisms of capital market integration and cross-border portfolio reallocation.

The model features two distinct channels of international transmission. The first is the *diversification channel*, which captures average exposure to shocks and depends on the steady-state domestic portfolio share ζ^i. The second is the *reallocation channel*, which captures the ability to adjust portfolios in response to shocks and depends on the adjustment cost of deviating from the steady-state portfolio, denoted κ^i.

In this model, portfolio allocations are indeterminate to a first-order approximation around the steady state. I therefore set the domestic share exogenously, although it could be rationalized through a zero-net portfolio condition. This parameter is interpreted as capturing structural sources of home bias, such as preferences for domestic assets, background risks, or portfolio frictions.[11]

[11] Several mechanisms can rationalize home bias: (i) preferences and risk attitudes (CRRA vs. habit formation, recursive preferences; Merton [1969]; Campbell and Cochrane [1999]; Epstein and Zin [1989]; Coeurdacier and Rey [2013]); (ii) background risks from non-tradable income or housing (Heaton and Lucas [1997]; Heaton and Lucas [2000]; Baxter and Jermann [1997]; Curcuru et al. [2010]; Guiso et al. [2018]); (iii) market frictions such as participation costs, transaction costs, taxes, or borrowing constraints (Constantinides [1986]; Vissing-Jørgensen [2002]; Martin and Rey [2004]; Du and Schreger [2022]); and (iv) institutional features such as pension restrictions, employer stock holdings, or informational asymmetries (Curcuru et al. [2010]; Sialm et al. [2015]; Lambert et al. [2024]).

In the dynamic setting, shocks alter relative returns across assets. Mutual funds then adjust their portfolio composition endogenously, subject to costs of deviating from initial portfolio shares. These adjustment costs can be interpreted as transaction or management fees typically incurred when rebalancing portfolios. This framework captures both the static and dynamic dimensions of portfolio allocation, allowing the model to quantify how capital market integration shapes macroeconomic adjustment and distributional outcomes across countries.

3.2 Risk-Neutral Mutual Fund

In each country i, a risk-neutral mutual fund intermediates all savings of domestic Savers. It collects the returns on its portfolio of interest-bearing assets and issues equity claims that households purchase. The fund allocates its portfolio between two assets: domestic capital, which produces the domestic good, and foreign capital, which produces the foreign good. Allowing mutual funds to invest across borders generates endogenous capital flows and net foreign asset positions, mechanisms that would otherwise be absent in a monetary union with a single common debt instrument.

The total equity value of the fund in country i, denoted E_t^i, equals the sum of its domestic and foreign capital holdings, $K_{i,t}^i$ and $K_{i,t}^j$:

$$E_t^i = K_{i,t}^i + \mathcal{S}_t K_{i,t}^j, \tag{1}$$

where $\mathcal{S}_t$ denotes the relative price of country j's consumption basket in terms of country i's:

$$\mathcal{S}_t \equiv \frac{CPI_t^j}{CPI_t^i}. \tag{2}$$

At each period, the fund chooses its portfolio allocation between the two assets based on their expected returns. The no-arbitrage (zero-profit) condition for the mutual fund in

country i is, under flexible prices:[12]

$$r_t^i E_{t-1}^i = (r_t^{k,i} + 1 - \delta^i) K_{i,t-1}^i + (r_t^{k,j} + 1 - \delta^j) \mathcal{S}_t K_{i,t-1}^j - \kappa^i \left(\frac{K_{i,t-1}^i}{E_{t-1}^i} - \zeta^i \right)^2 E_{t-1}^i, \quad (3)$$

where

$$\zeta^i \equiv \frac{\bar{K}_i^i}{\bar{E}^i} \quad (4)$$

denotes the steady-state domestic portfolio share, and κ^i captures portfolio adjustment costs associated with deviations from ζ^i.

The fund's first-order condition implies a no-arbitrage relationship between expected returns on domestic and foreign capital:

$$\mathbb{E}_t[r_{t+1}^{k,i} + 1 - \delta^i] = \mathbb{E}_t \left[(r_{t+1}^{k,j} + 1 - \delta^j) \frac{\mathcal{S}_{t+1}}{\mathcal{S}_t} \right] + \kappa^i \left(\frac{K_{i,t}^i}{E_t^i} - \zeta^i \right). \quad (5)$$

A higher κ^i implies greater rigidity in portfolio adjustment, reflecting higher transaction costs or financial frictions. This parameter is country-specific, capturing structural differences in market flexibility.

Finally, capital in country i is jointly owned by domestic and foreign mutual funds:

$$K_t^i = K_{i,t}^i + K_{j,t}^i, \quad (6)$$

with investment dynamics given by

$$I_{i,t}^{F,i} = K_{i,t}^i - (1 - \delta^i) K_{i,t-1}^i, \quad (7)$$

$$I_{j,t}^{F,i} = K_{j,t}^i - (1 - \delta^j) K_{j,t-1}^i. \quad (8)$$

Total investment in each country is thus the sum of domestic and foreign investments in its capital stock, linking portfolio decisions to aggregate capital accumulation.

[12] Under sticky prices, profits need not be zero, and the no-arbitrage condition can be written as:

$$r_t^i E_{t-1}^i = (r_t^{k,i} + 1 - \delta^i) K_{i,t-1}^i + (r_t^{k,j} + 1 - \delta^j) \mathcal{S}_t K_{i,t-1}^j + \frac{K_{i,t-1}^i}{K_{t-1}^i} \Omega_t^i + \frac{K_{i,t-1}^j}{K_{t-1}^j} \mathcal{S}_t \Omega_t^j - \frac{\kappa^{A,i}}{2} \left(K_{i,t-1}^i - \bar{K}_i^i \right)^2.$$

In this case, Ω_t^i denotes nominal profits in country i, and the last term represents portfolio adjustment costs relative to the steady-state allocation. Flexible prices imply $\Omega_t^i = 0$, leading to the simplified expression in the main text.

3.3 Households

3.3.1 Intratemporal Problem

In each country i, households consume a composite bundle of domestic and foreign goods:

$$C_t^i = \left[(1-\omega_i)^{\frac{1}{\phi}}(C_{i,t}^i)^{\frac{\phi-1}{\phi}} + \omega_i^{\frac{1}{\phi}}(C_{j,t}^i)^{\frac{\phi-1}{\phi}}\right]^{\frac{\phi}{\phi-1}}, \tag{9}$$

where $C_{i,t}^i$ and $C_{j,t}^i$ denote, respectively, domestic and imported goods consumed by households in country i. The parameter $\phi > 0$ is the elasticity of substitution between goods, and $0 \leq \omega_i < 1$ is the import share.

Under purchasing power parity (PPP), the composite price index simplifies to:

$$CPI_t^i = \left[(1-\omega_i)P_{i,t}^{1-\phi} + \omega_i P_{j,t}^{1-\phi}\right]^{\frac{1}{1-\phi}}, \tag{10}$$

where $P_{i,t}$ and $P_{j,t}$ are the prices of domestic and imported goods, respectively.

The intratemporal optimal allocation yields:

$$C_{i,t}^i = (1-\omega_i)\left(\frac{P_{i,t}}{CPI_t^i}\right)^{-\phi} C_t^i, \qquad C_{j,t}^i = \omega_i\left(\frac{P_{j,t}}{CPI_t^i}\right)^{-\phi} C_t^i. \tag{11}$$

Investment bundles are defined analogously, implying that the investment deflator equals the CPI.

Normalizing domestic prices by each country's CPI ($p_t^i \equiv P_{i,t}/CPI_t^i$), the CPI equations can be written as:

$$1 = (1-\omega_i)(p_t^i)^{1-\phi} + \omega_i(p_t^j \mathcal{S}_t)^{1-\phi}. \tag{12}$$

as $\mathcal{S}_t$ denotes the relative price of country j's consumption basket in terms of country i's.

3.3.2 Intertemporal Problem

Each household h in country i maximizes expected lifetime utility:

$$E_0 \sum_{t=0}^{\infty} \beta^t \left[\frac{(C_{h,t}^i)^{1-\sigma}}{1-\sigma} - \chi\frac{(L_t^{U,i})^{1+\eta}}{1+\eta}\right], \tag{13}$$

where $\beta \in (0,1)$ is the subjective discount factor, $\sigma > 0$ is the coefficient of relative risk aversion, $\eta > 0$ is the weight on labor disutility, and $\chi > 0$ is the inverse Frisch elasticity of labor supply. Labor supply $L_t^{U,i}$ is set by unions and is common to all households

within each country. It is therefore taken as exogenous from the household's perspective.

Savers. A share $(1-\lambda^i)$ of households are Savers. They choose consumption $C^i_{S,t}$ and invest in (i) equity claims issued by the domestic mutual fund, $E^i_{S,t}$, and (ii) nominal risk-free bonds, $B^i_{S,t}$, which are in zero net supply at the union level. Real bond holdings are $b^i_{S,t} = B^i_{S,t}/CPI^i_t$. Savers earn a real return r^i_t on equity and a nominal return r^U_{t-1} on bonds, set by the common central bank. Because both countries share a monetary union, bonds yield identical returns across countries[13].

The real budget constraint is:

$$C^i_{S,t} + E^i_{S,t} + b^i_{S,t} = w^i_t \Lambda L^{U,i}_t + r^i_t E^i_{S,t-1} + b^i_{S,t-1}\frac{r^U_{t-1}}{\pi^{CPI,i}_t} - \frac{\kappa^i_E}{2} p^i_t (E^i_{S,t} - \bar{E}^i_S)^2 - \frac{\kappa^i_D}{2} p^i_t (b^i_{S,t})^2, \tag{14}$$

where $\Lambda \geq 1$ captures the higher productivity of Savers relative to Non-Savers, and κ^i_E and κ^i_D represent portfolio adjustment costs à la Schmitt-Grohé and Uribe [2003]. The first-order conditions are:

$$(C^i_{S,t})^{-\sigma}\left(1 + \kappa^i_E p^i_t (E^i_{S,t} - \bar{E}^i_S)\right) = \beta E_t\left[(C^i_{S,t+1})^{-\sigma} r^i_{t+1}\right], \tag{15}$$

$$(C^i_{S,t})^{-\sigma}\left(1 + \kappa^i_D p^i_t b^i_{S,t}\right) = \beta E_t\left[(C^i_{S,t+1})^{-\sigma}\frac{r^U_t}{\pi^{CPI,i}_{t+1}}\right]. \tag{16}$$

Non-Savers. A share λ^i of households are Non-Savers. They consume their entire labor income each period:

$$C^{i,N}_t = w^i_t L^{U,i}_t. \tag{17}$$

As they have no access to financial markets, their consumption is determined by labor income alone.

3.4 Labor Supply and Wage Setting

In each country i, labor is supplied monopolistically by a continuum of unions indexed by $k \in (0,1)$, similar to Erceg et al. [2000]. A competitive labor aggregator combines union-

[13]Since the common central bank sets a single nominal policy rate, domestic and foreign bonds are perfectly substitutable within the monetary union. Consequently, it is not meaningful to track country-specific bond holdings—only aggregate bond positions at the union level matter. This modeling choice follows Bayer et al. [2024], who make the same assumption in their analysis of a monetary union, noting that both government bonds pay the same interest rate and can therefore be treated as identical assets.

specific inputs using a Dixit and Stiglitz [1977] technology with elasticity of substitution $\theta_W^i > 1$. The aggregate nominal wage index is then defined as:

$$W_t^i = \left(\int_0^1 [W_t^i(k)]^{1-\theta_W^i} \, dk \right)^{\frac{1}{1-\theta_W^i}}, \tag{18}$$

and the corresponding labor demand faced by each union is:

$$L_t^{U,i}(k) = \left(\frac{W_t^i(k)}{W_t^i} \right)^{-\theta_W^i} L_t^{U,i}. \tag{19}$$

Each union sets its nominal wage $W_t^i(k)$ subject to quadratic adjustment costs à la Rotemberg [1982]:

$$UC_t^i(k) = \frac{\kappa_W^i}{2} \left(\frac{W_t^i(k)}{W_{t-1}^i(k)} - \bar{\pi}^W \right)^2, \tag{20}$$

where κ_W^i governs wage rigidity and $\bar{\pi}^W$ denotes steady-state wage inflation.

In a symmetric equilibrium, all unions set the same wage $W_t^i(k) = W_t^i$ and supply the same labor input $L_t^{U,i}(k) = L_t^{U,i}$. Gross wage inflation in country i satisfies:

$$\pi_t^{W,i} = \frac{W_t^i}{W_{t-1}^i} = \frac{w_t^i}{w_{t-1}^i} \pi_t^{CPI,i}. \tag{21}$$

The union's optimal wage-setting condition yields a New Keynesian Wage Phillips Curve of the form:

$$\begin{aligned} \pi_t^{W,i}(\pi_t^{W,i} - \bar{\pi}^W) = \beta \, \mathbb{E}_t \left[(\pi_{t+1}^{W,i} - \bar{\pi}^W) \pi_{t+1}^{W,i} \right] \\ + \frac{\theta_W^i}{\kappa_W^i} \left[\chi (L_t^{U,i})^{1+\eta} - \frac{\theta_W^i - 1}{\theta_W^i} w_t^i L_t^{U,i} \left(\lambda^i (C_{H,t}^i)^{-\sigma} + (1-\lambda^i)(C_{S,t}^i)^{-\sigma} \Lambda \right) \right]. \end{aligned} \tag{22}$$

This condition links nominal wage inflation to expected future inflation and the deviation of the marginal rate of substitution between consumption and leisure from the real wage. It captures the degree of real wage rigidity in each country, reflecting both structural labor market frictions and the heterogeneity of household consumption responses.

3.5 Production

Each country $i \in \{C, P\}$ produces a differentiated good under perfect competition with flexible prices. This assumption eliminates countercyclical profits that would otherwise arise under price rigidities and allows the analysis to focus on risk-sharing and income heterogeneity rather than nominal distortions. Production follows a standard two-tier structure with monopolistically competitive intermediate firms and a representative final-good producer.

Final-good firms. Final output in country i is a Dixit–Stiglitz aggregate of a continuum of intermediate varieties:

$$Y_t^i = \left(\int_0^1 [Y_t^i(j)]^{\frac{\theta_P^i - 1}{\theta_P^i}} dj \right)^{\frac{\theta_P^i}{\theta_P^i - 1}}, \tag{23}$$

where $\theta_P^i > 1$ is the elasticity of substitution across intermediate goods. Profit maximization yields the standard demand function $Y_t^i(j) = (P_{i,t}(j)/P_{i,t})^{-\theta_P^i} Y_t^i$, and the associated price index

$$P_{i,t} = \left(\int_0^1 [P_{i,t}(j)]^{1-\theta_P^i} dj \right)^{\frac{1}{1-\theta_P^i}}. \tag{24}$$

Intermediate firms. Each firm j in country i produces according to a Cobb–Douglas technology:

$$Y_t^i(j) = Z_t^i [K_{t-1}^i(j)]^{\alpha} [L_t^i(j)]^{1-\alpha}, \tag{25}$$

where Z_t^i denotes total factor productivity (TFP), common across firms. Cost minimization implies the standard factor-price conditions:

$$w_t^i = (1-\alpha)\, \xi_t^i \frac{Y_t^i(j)}{L_t^i(j)}, \tag{26}$$

$$r_t^{k,i} = \alpha\, \xi_t^i \frac{Y_t^i(j)}{K_{t-1}^i(j)}, \tag{27}$$

where ξ_t^i is the real marginal cost. Substituting these conditions gives

$$\xi_t^i = \frac{1}{Z_t^i} \left(\frac{r_t^{k,i}}{\alpha} \right)^{\alpha} \left(\frac{w_t^i}{1-\alpha} \right)^{1-\alpha}. \tag{28}$$

Aggregating across firms yields the aggregate production function:

$$Y_t^i = Z_t^i (K_{t-1}^i)^{\alpha} (L_t^i)^{1-\alpha}, \tag{29}$$

$$\frac{K_{t-1}^i}{L_t^i} = \frac{\alpha}{1-\alpha} \frac{w_t^i}{r_t^{k,i}}. \tag{30}$$

Price setting and investment. Under flexible prices, firms set $P_{i,t}(j)$ as a constant markup over marginal cost:

$$P_{i,t} = \frac{\theta_P^i}{\theta_P^i - 1} (1 - \tau_t^i)\, CPI_t^i\, \xi_t^i. \tag{31}$$

Setting $\tau_t^i = 1/\theta_P^i$ removes steady-state distortions, implying $P_{i,t} = CPI_t^i \xi_t^i$ and zero profits in equilibrium. The domestic inflation rate is $\pi_t^i = P_{i,t}/P_{i,t-1}$, and capital evolves according to:

$$K_t^i = (1 - \delta^i) K_{t-1}^i + I_t^i, \tag{32}$$

$$I_t^i = I_{i,t}^{F,i} + I_{i,t}^{F,j}. \tag{33}$$

Investment is a CES bundle of domestic and imported goods, consistent with the structure of consumption.

Technology Shock. Each country i experiences an exogenous productivity process:

$$u_t^i = \rho^i u_{t-1}^i + \epsilon_t^i, \qquad \epsilon_t^i \sim \mathcal{N}(0, \sigma_{z,i}^2), \tag{34}$$

where $\rho^i \in (0,1)$ captures the persistence of technology shocks and $\sigma_{z,i}$ is the standard deviation of the innovation ϵ_t^i. A larger ρ^i implies more persistent business-cycle fluctuations, while a larger $\sigma_{z,i}$ raises their volatility.

TFP evolves as:

$$Z_t^i = Z_0^i e^{-u_t^i}. \tag{35}$$

The history of aggregate shocks up to period t in country i is denoted $z^{i,t}$.

3.6 Monetary Policy

Monetary policy is conducted at the union level by a single central bank that sets a common nominal interest rate, r_t^U, applying to both the Core and the Periphery. The policy

rate responds to union-wide inflation, measured as a weighted average of national inflation rates:

$$\pi_t^{HICP} = \left(\pi_t^{CPI,C}\right)^{\gamma}\left(\pi_t^{CPI,P}\right)^{1-\gamma}, \tag{36}$$

where γ captures the relative weight of the Core in the union's consumption basket, reflecting its economic size or relative nominal rigidity. The central bank follows a standard Taylor-type rule:

$$r_t^U = \bar{r} + \Psi\left(\pi_t^{HICP} - 1\right), \tag{37}$$

where $\bar{r}$ denotes the steady-state nominal rate and Ψ the policy response to inflation deviations. For simplicity, I abstract from monetary shocks, though they could be readily incorporated.

3.7 Market Clearing Conditions

In each country $i \in \{C, P\}$, aggregate variables are obtained by summing over Savers and Non-Savers. Aggregate consumption and labor supply are given by:

$$C_t^i = \lambda^i C_{N,t}^i + (1-\lambda^i) C_{S,t}^i, \tag{38}$$

$$L_t^i = \left[\lambda^i + (1-\lambda^i)\Lambda\right] L_t^{U,i}, \tag{39}$$

where $\Lambda \geq 1$ captures the productivity (and wage) premium of Savers.

Aggregate asset holdings reflect only Savers' portfolios:

$$E_t^i = (1-\lambda^i) E_{S,t}^i, \tag{40}$$

$$b_t^i = (1-\lambda^i) b_{S,t}^i. \tag{41}$$

The union-wide bond market clears as:

$$b_t^i + \mathcal{S}_t b_t^j = 0, \tag{42}$$

where $\mathcal{S}_t$ is the real exchange rate.

The final good produced in country i is allocated to domestic and foreign consumption, investment, and portfolio adjustment costs:

$$Y_t^i = C_{i,t}^i + I_{i,t}^i + C_{i,t}^j + I_{i,t}^j + \frac{\kappa^{E,i}}{2(1-\lambda^i)}(E_t^i - \bar{E}^i)^2 + \frac{\kappa^{D,i}}{2(1-\lambda^i)}(b_t^i)^2. \tag{43}$$

The trade balance equals the value of exports minus imports:

$$TB_t^i = (C_{i,t}^j + I_{i,t}^j)p_t^i - (C_{j,t}^i + I_{j,t}^i)p_t^j \mathcal{S}_t. \tag{44}$$

Linking real and financial accounts gives:

$$TB_t^i = b_t^i - b_{t-1}^i \frac{r_{t-1}^i}{\pi_t^{CPI,i}} + r_t^{k,i} K_{j,t-1}^i - r_t^{k,j} K_{i,t-1}^j \mathcal{S}_t + \mathcal{S}_t I_{j,t}^{F,i} - I_{i,t}^{F,j} + \frac{\kappa^i}{2}\left(\frac{K_{i,t-1}^i}{E_{t-1}^i} - \frac{\bar{K}_i^i}{\bar{E}^i}\right)^2 E_{t-1}^i. \tag{45}$$

Finally, the aggregate resource constraint in country i reads:

$$C_t^i + I_t^i + TB_t^i = p_t^i Y_t^i - \frac{\kappa^{E,i}}{2(1-\lambda^i)} p_t^i (E_t^i - \bar{E}^i)^2 - \frac{\kappa^{D,i}}{2(1-\lambda^i)} p_t^i (b_t^i)^2. \tag{46}$$

3.8 Equilibrium

Definition. A sequential competitive equilibrium is a collection of individual functions $\{C_{S,t}^i, C_{N,t}^i, E_{S,t}^i, b_{S,t}^i, L_t^{U,i}\}_{i\in\{C,P\},t\geq 0}$, aggregate quantities $\{C_t^i, L_t^i, K_t^i, E_t^i, Y_t^i, I_t^i, TB_t^i\}_{i\in\{C,P\},t\geq 0}$, portfolio positions $\{K_{i,t}^i, K_{i,t}^j\}_{i,j\in\{C,P\},t\geq 0}$, and price processes $\{w_t^i, r_t^{k,i}, r_t^i, P_{i,t}, CPI_t^i, \mathcal{S}_t, r_t^U\}_{i\in\{C,P\},t\geq 0}$, such that, for given initial asset positions and exogenous processes $\{Z_t^i\}_{i\in\{C,P\},t\geq 0}$, the following conditions hold for all $t \geq 0$:

1. **Mutual funds.** In each country $i \in \{C, P\}$, a risk-neutral mutual fund allocates its portfolio between domestic and foreign capital to maximize expected returns net of portfolio adjustment costs, subject to the zero-profit (3) and no-arbitrage (5) conditions.

2. **Households.** Savers in each country $i \in \{C, P\}$ maximize expected lifetime utility subject to the budget constraint (14), given the composite consumption bundle (9) and the associated consumer price index (10). Optimality conditions are given by the first-order conditions (15)–(16). Non-Savers consume their current disposable income according to (17).

3. **Wage setting.** Labor unions set nominal wages subject to Rotemberg adjustment costs (20), and wage inflation evolves according to the wage Phillips curve (22).

4. **Firms.** Firms in each country i hire labor and rent capital competitively to maximize profits, taking prices and productivity as given. Factor prices equal marginal products (26)–(27), and aggregate output satisfies the production function (25). Under flexible prices, firms earn zero profits and set prices as a constant markup over

marginal cost (31). Capital accumulates according to (32)–(33), and productivity follows the exogenous process (34)–(35).

5. **Monetary policy.** The common central bank sets the nominal interest rate according to a Taylor-type rule (37), responding to union-wide inflation defined as a weighted average of national CPI inflations (36).

6. **Market clearing.** In each country i, goods, labor, and financial markets clear. Capital equals the sum of domestic and foreign holdings (6), and the union-wide bond market clears (42). Aggregate consumption, labor supply, and asset holdings are given by (38), (39), (40), and (41). Goods-market equilibrium (43) is ensured by the resource constraint (46), while the trade balance (44) links the real and financial accounts (45).

The detailed structure of each block (mutual funds, households, labor, firms, monetary policy, and market clearing) is described in Sections 3.2–3.7.

3.9 Channels

Capital market integration in the model operates through two distinct channels of international transmission: *diversification* and *reallocation*. Both channels are mediated by the structure of the risk-neutral mutual fund in each country, which determines how savings are allocated across domestic and foreign capital.

The first channel, diversification, captures average exposure to shocks and depends on the steady-state domestic portfolio share, ζ^i. Formally, as defined in Equation (4):

$$\zeta^i \equiv \frac{\bar{K}_i^i}{\bar{E}^i},$$

which represents the ratio of domestic capital to total equity holdings in the steady state. In a benchmark economy without foreign capital holdings, households can only invest domestically, corresponding to full home bias ($\zeta^i = 1$) and no diversification. In contrast, a lower ζ^i implies greater cross-border diversification and therefore lower exposure to domestic shocks. In this framework, ζ^i is treated as an exogenous, calibrated target, reflecting structural determinants of home bias such as preferences, market frictions, or institutional constraints.[14]

[14] See footnote [11].

The second channel, reallocation, captures the dynamic adjustment of portfolios in response to shocks and depends on the adjustment cost parameter κ^i. This parameter determines how costly it is for investors to deviate from their steady-state portfolio composition. A higher κ^i implies greater rigidity, preventing reallocation and leading to fixed portfolio shares similar to models without international asset trade, whereas a lower κ^i reflects more flexible portfolios that can be rebalanced in response to changing relative returns.

The mutual fund's no-arbitrage condition, given by Equation (5), illustrates this mechanism::

$$\mathbb{E}_t[r^{k,i}_{t+1} + 1 - \delta^i] = \mathbb{E}_t\left[(r^{k,j}_{t+1} + 1 - \delta^j)\frac{\mathcal{S}_{t+1}}{\mathcal{S}_t}\right] + \kappa^i\left(\frac{K^i_{i,t}}{E^i_t} - \zeta^i\right),$$

showing that deviations from the steady-state domestic share ζ^i are penalized proportionally to κ^i. The larger the adjustment cost, the slower the portfolio response to shocks.

Together, these two channels — diversification and reallocation — characterize how financial integration shapes macroeconomic and distributional outcomes. The parameter ζ^i determines average exposure to country-specific shocks, while κ^i governs the dynamic flexibility of capital reallocation. Varying these two parameters allows the model to trace how different degrees of integration affect the transmission of shocks and the heterogeneity in their effects across and within countries.

4 Results - Two-Agent Model

First, I consider a symmetric two-country monetary union with no ex-ante heterogeneity. This setup isolates the mechanisms of financial integration in their simplest form, without additional amplification from structural differences between countries. I introduce an asymmetric negative technology shock affecting only one country. This shock, capturing a joint decline in output and asset values, mirrors the dynamics observed during the European sovereign debt crisis. The symmetric benchmark isolates how financial integration operates through two structural channels. The first is the diversification channel, determined by the steady-state composition of portfolios; the second is the reallocation channel, driven by dynamic portfolio adjustments. Together, these channels shape how shocks propagate across countries and households.

Through these channels, financial integration alters both capital and consumption dynamics. Following the shock, capital flows toward the unaffected country, reversing the sign of its capital adjustment relative to an equity-autarky benchmark and amplifying cross-country asymmetries. The diversification channel provides insurance that smooths

consumption for Savers, while the reallocation channel depresses real wages in the affected country, primarily harming Non-Savers who lack diversified portfolios. At the union level, integration leaves aggregate volatility broadly unchanged but instead redistributes adjustment across countries and households. In this symmetric setup, I can further disentangle two sources of inequality: within-country inequality, driven by differences in financial participation (captured by the share of Non-Savers), and between-country inequality, driven by differences in portfolio diversification (captured by the domestic portfolio parameter). This benchmark thus clarifies how these dimensions interact in response to asymmetric shocks.

Second, I calibrate the model to match the structural characteristics of the euro area in 2010. This calibration allows me to compare a realistic monetary union with empirically consistent inequality and portfolio structures to alternative frameworks. Specifically, I conduct two sets of experiments: (i) For a given level of inequality, I compare the calibrated economy, which features realistic capital market integration constrained by home bias and adjustment costs, with an equity-autarky benchmark characterized by full home bias and perfectly rigid portfolios. This comparison quantifies how much financial integration matters for macroeconomic adjustment. (ii) For a given level of capital market integration, I contrast the calibrated heterogeneous-agent economy, in which only a fraction of households participate in asset markets, with a representative-agent benchmark. This experiment evaluates how heterogeneity in financial participation shapes the aggregate and distributional effects of shocks.

4.1 Calibration

The calibration of parameters that remain constant across all cases is presented in the table below, while case-specific parameters are introduced at the beginning of each corresponding section. The overall calibration follows standard values commonly used in the literature.

Table 1: Calibration Parameters

Parameter	Value	Description	Source
β	0.99	Discount factor	Smets and Wouters [2003]
α	0.36	Capital share	Krueger et al. [2017]
σ	2.0	Relative risk aversion	CRRA
ϕ	2.0	Elasticity of substitution (home vs. foreign)	Pasch and Tervala [2024]
δ	0.025	Depreciation rate (quarterly)	Smets and Wouters [2003]
η	2.0	Inverse Frisch elasticity of labor supply	Chetty et al. [2011]
Ψ	1.5	Taylor rule coefficient on inflation	Darvas and Merler [2013]
κ_D	0.1	Debt adjustment cost	Schmitt-Grohé and Uribe [2003]
κ_E	0.1	Equity adjustment cost	Schmitt-Grohé and Uribe [2003]
ρ_z	0.95	TFP autocorrelation	den Haan [2010]
Λ	1.0	Saver wage premium	Normalization
θ_W	21.0	Wage markup elasticity	Bilbiie and Ragot [2021]
κ_W	2100	Wage adjustment cost	Bilbiie and Ragot [2021]
		Steady-State Normalization	
GDP^C	1.0	Gross nominal product in Core	Normalization
L^C	1/3	Hours worked in Core	Normalization

Additional technical details on the steady-state determination of portfolios are provided in Appendix C.1.

4.2 Understanding the Channels

In this section, I use my framework as a laboratory to illustrate the mechanisms through which capital market integration operates. I first analyze a symmetric monetary union, where countries are identical ex-ante and only one country experiences a negative technology shock. This setting isolates the transmission channels of diversification and reallocation in their pure form, abstracting from structural asymmetries. I then extend the analysis to an asymmetric environment, introducing heterogeneity in financial participation and portfolio composition to assess how these dimensions shape the distributional effects of integration.

4.2.1 Symmetric Case with Asymmetric Shock

To isolate the mechanisms through which capital market integration shapes the transmission of asymmetric shocks and inequality, I begin with a symmetric two-country benchmark. Both countries share identical structural parameters: a 30% import share and a 50% share of Savers. This setup abstracts from ex-ante heterogeneity and captures a realistic degree of trade and wealth heterogeneity within a monetary union.

An asymmetric technology shock is then applied to the Periphery, while the Core remains unaffected. The shock is modeled as an unanticipated, temporary 1% decline in productivity (MIT shock). This specification provides a natural experiment that mimics the dynamics of the euro area crisis, combining a recession and a decline in the return to capital in the affected economy, while preserving comparability across countries.

I consider three configurations that successively introduce diversification and reallocation of portfolios across countries:

1. **Equity autarky:** households can only invest in domestic capital, implying full home bias ($\zeta^C = \zeta^P = 1$) and infinitely costly reallocation ($\kappa^C = \kappa^P = 10{,}000$). This case corresponds to the standard closed-economy benchmark.

2. **Diversification only:** portfolios are equally split between domestic and foreign capital ($\zeta^C = \zeta^P = 0.5$), but reallocation remains prohibited through infinitely costly adjustment ($\kappa^C = \kappa^P = 10{,}000$). This case isolates the insurance role of diversification under fixed portfolio weights.

3. **Capital market integration:** both diversification and reallocation are active. Portfolios are initially diversified ($\zeta^C = \zeta^P = 0.5$), and adjustment costs are low ($\kappa^C = \kappa^P = 0.1$), allowing mutual funds to rebalance across countries in response to shocks. This value aligns with other portfolio adjustment parameters in the model and prevents near-unit-root behavior in portfolio dynamics.

Table 2: Simulation Scenarios under Symmetry

Case	ζ (domestic portfolio share)	κ (portfolio adjustment cost)
Equity autarky	1.0 (full home bias)	∞
Diversification only	0.5	∞
Capital market integration	0.5	0.1

Figure 6 plots the impulse responses of capital in the Core and the Periphery.

In the equity-autarky benchmark, capital falls in both economies following the shock, with a larger contraction in the Periphery, which is directly affected. The negative supply shock in the Periphery transmits to the Core as a fall in demand. Because households cannot diversify internationally, the adjustment occurs entirely within each country: investment falls, wages decline, and consumption contracts for all households.

Allowing for diversification without reallocation introduces valuation effects. Since the mutual fund keeps a fixed portfolio composition in value terms, relative price changes alone redistribute capital values across countries. The shock raises marginal costs and prices in the Periphery, reducing the real value of Periphery assets and increasing the relative value of Core assets. Even without active portfolio shifts, the value of Core capital rises mechanically, showing that diversification already affects capital through valuation channels.

When both diversification and reallocation are active, these asymmetries become stronger. Mutual funds respond to return differentials by redirecting investment toward the Core, where returns are higher. As a result, Periphery capital declines further, Core capital expands, and cross-country divergence in capital accumulation widens.

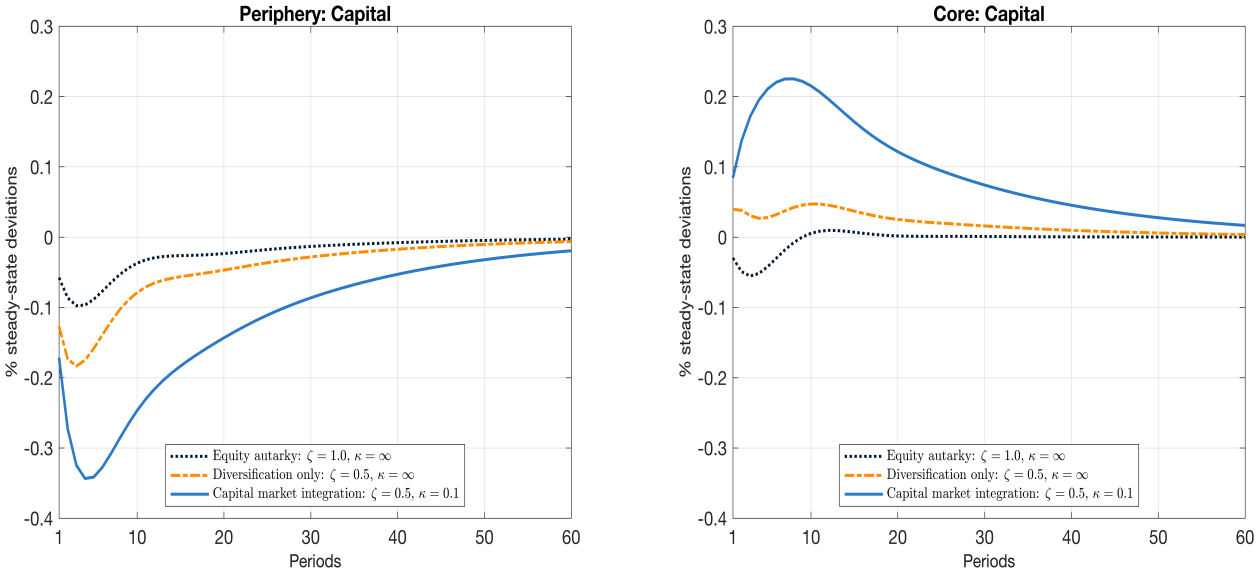

Figure 6: Impulse Response of Capital in the Core and the Periphery

The figure plots the response of capital to a 1% negative productivity shock in the Periphery under three integration regimes in a symmetric two-country setting with no ex-ante heterogeneity: equity autarky ($\zeta = 1, \kappa = \infty$), diversification only ($\zeta = 0.5, \kappa = \infty$), and capital market integration ($\zeta = 0.5, \kappa = 0.1$). As integration deepens, capital increasingly reallocates from the Periphery toward the Core, amplifying the decline in the shocked economy and supporting accumulation where returns are higher.

Figure 7 shows the consumption responses of Savers and Non-Savers in the Periphery.

In equity autarky, both groups experience a sharp decline in consumption, which is larger for Non-Savers who rely entirely on labor income.

Relative to autarky, a deeper decline in Periphery capital, whether driven by valuation effects under diversification or by the combined impact of diversification and reallocation, leads to a stronger contraction in Non-Saver consumption, as lower capital further reduces real wages.

For Savers, the adjustment reflects two opposing forces. The diversification channel provides insurance: by holding claims on Core capital, whose returns are less affected by the local shock, Savers partially hedge their income losses. The reallocation channel reinforces this effect by shifting investment toward the Core, where returns rise relative to the Periphery. At the same time, this mechanism reduces domestic capital and labor demand, putting additional downward pressure on wages. The result is a trade-off. Savers gain from higher financial income but lose through lower labor earnings. When both channels operate, Savers' consumption falls less than under autarky, reflecting gains from international diversification, while Non-Savers' consumption falls more, as lower wages dominate.

As a result, capital market integration amplifies inequality within the Periphery. The benefits accrue to asset-holding households, while liquidity-constrained households bear the costs of adjustment through the labor market.

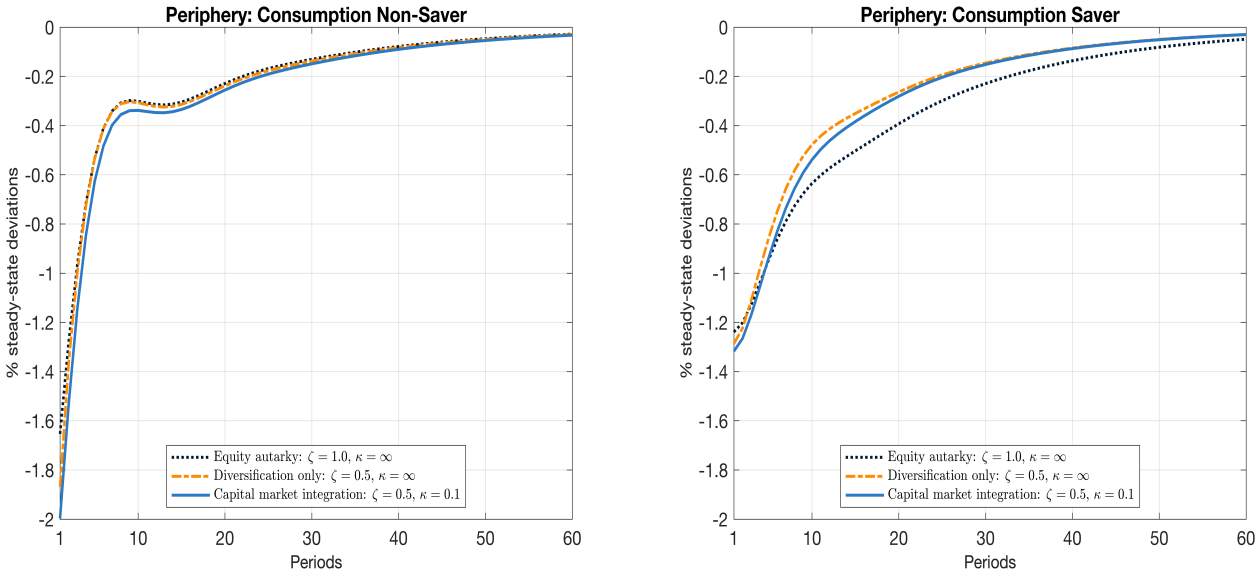

Figure 7: Impulse Response of Consumption for Non-Savers and Savers in the Periphery
The figure plots the consumption response in the Periphery to a 1% negative productivity shock under three integration regimes in a symmetric two-country setting with no ex-ante heterogeneity: equity autarky ($\zeta = 1, \kappa = \infty$), diversification only ($\zeta = 0.5, \kappa = \infty$), and capital market integration ($\zeta = 0.5, \kappa = 0.1$). Consumption declines most for Non-Savers, who remain exposed to labor-income losses, while Savers benefit from portfolio reallocation and partial insulation through higher returns.

Figure 8 shows the consumption responses of Savers and Non-Savers in the Core. Additional model variables are reported in Appendix C.2.

In equity autarky, consumption falls on impact for both groups, followed by a gradual recovery. The initial contraction reflects the negative demand shock transmitted from the Periphery, while the rebound results from trade substitution. As the negative productivity shock raises relative prices in the Periphery, Core goods become cheaper, boosting exports and supporting output. This pattern of an initial downturn followed by recovery arises even in a standard two-country monetary union without financial integration.

Relative to autarky, a deeper increase in Core capital, whether driven by valuation effects under diversification or by the combined impact of diversification and reallocation, leads to a stronger rise in Non-Saver consumption. Higher capital accumulation cushions the fall in real wages, producing a milder contraction and a faster recovery for households that rely solely on labor income.

For Savers in the Core, the adjustment again reflects two opposing forces. Under diversification alone, Savers hold claims on both domestic and foreign capital, leaving them partially exposed to the Periphery's downturn through lower returns on cross-border holdings. Valuation effects, arising from the relative appreciation of Core assets, further

reduce returns on domestic capital, causing financial income to fall despite a smaller decline in wages. As a result, Saver consumption drops more and recovers more slowly than under autarky.

When reallocation is allowed, mutual funds in both countries shift portfolios toward the Core. The resulting inflows raise Core capital and output but also lower the return on Core assets as total investment increases. This creates a trade-off: Savers lose from lower financial income but gain through higher labor earnings. When both channels are active, Saver consumption declines slightly more than under autarky, reflecting net losses from international diversification and reallocation.

Non-Savers, in contrast, are better off. Their only source of income, wages, falls less under integration, leading to a smaller consumption drop and a faster recovery.

As a result, capital market integration reduces inequality within the Core.

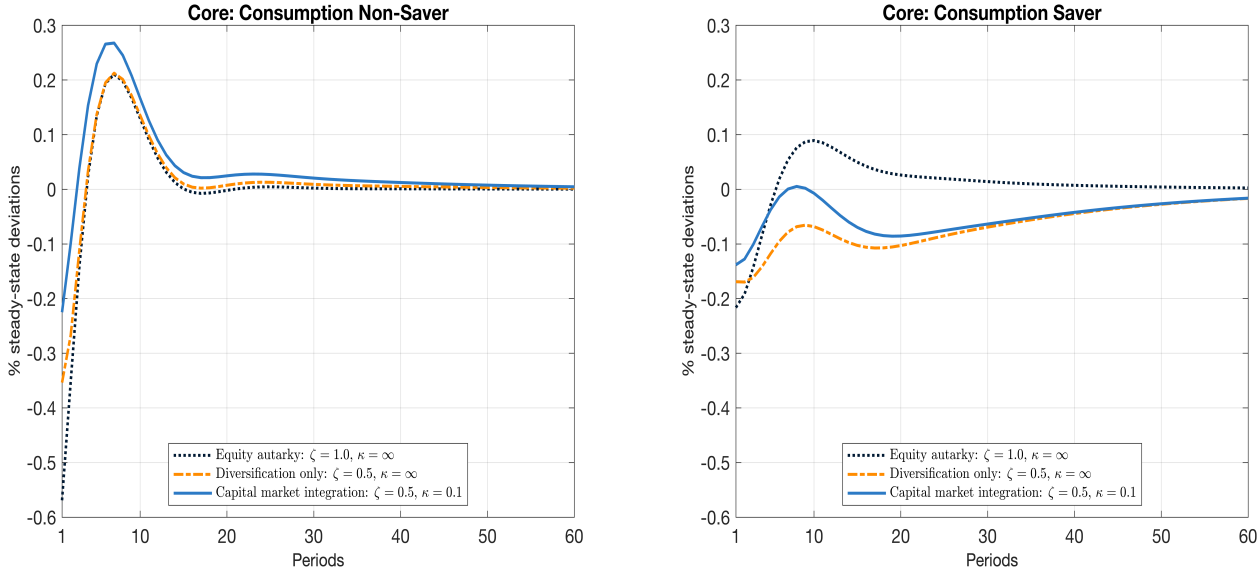

Figure 8: Impulse Response of Consumption for Non-Savers and Savers in the Core

The figure plots the consumption response in the Core to a 1% negative productivity shock in the Periphery under three integration regimes in a symmetric two-country setting with no ex-ante heterogeneity: equity autarky ($\zeta = 1, \kappa = \infty$), diversification only ($\zeta = 0.5, \kappa = \infty$), and capital market integration ($\zeta = 0.5, \kappa = 0.1$). As integration deepens, households in the Core, especially Non-Savers, benefit from capital inflows that support local production and wages, while Savers experience smaller gains as they bear part of the Periphery's downturn through financial income.

To summarize these dynamics, Figure 9 decomposes the cumulative response of consumption in the Core and Periphery into labor and financial income components. The figure shows that the composition of income adjustment differs sharply across countries. In the Periphery, both labor and financial income fall, with labor losses dominating. In-

tegration slightly mitigates the financial contraction but amplifies the wage decline. In contrast, the Core experiences opposite movements: labor income rises as capital inflows support local production, while financial income decreases due to lower returns on domestic assets. These opposing shifts illustrate the main trade-off created by capital market integration. The Periphery suffers from falling labor income, while the Core gains employment stability at the cost of reduced financial returns.

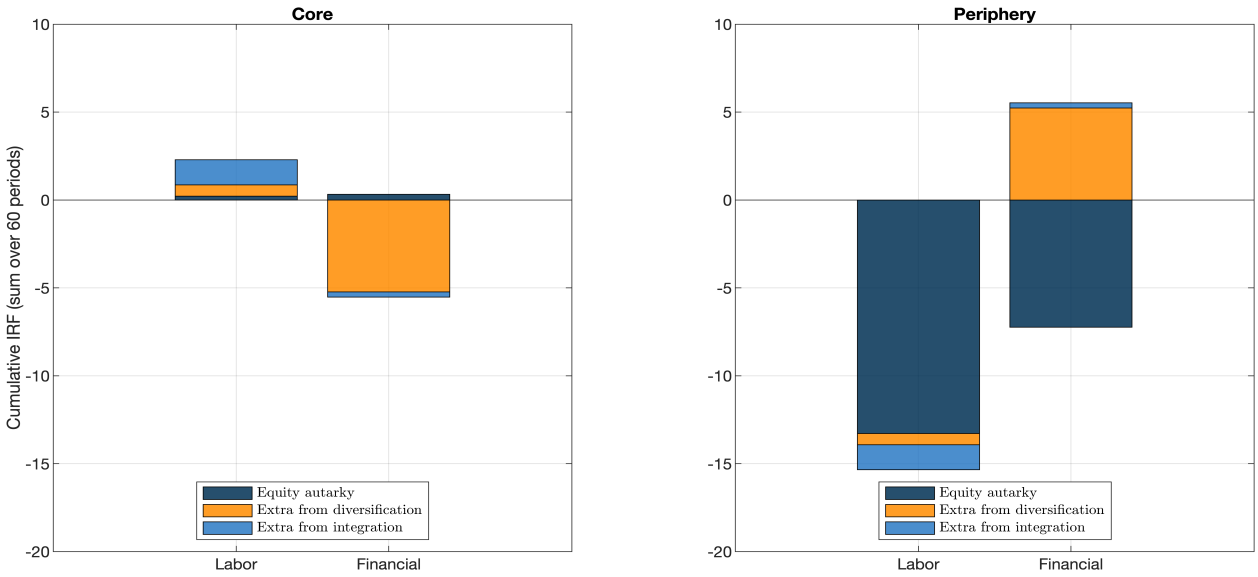

Figure 9: Cumulative Decomposition of Consumption Responses in the Core and Periphery
The bars show the cumulative impulse responses (sum over 60 periods) of labor and financial income under three regimes: equity autarky, diversification, and capital market integration. Integration amplifies the divergence between countries by increasing labor losses in the Periphery and reducing financial income in the Core.

Within-country inequality increases in the Periphery and declines in the Core relative to equity autarky. Across countries, the pattern reverses. Savers in the Periphery gain from diversification and portfolio reallocation, while Savers in the Core absorb a larger share of the external shock. Among Non-Savers, inequality widens as wage-driven consumption losses in the Periphery contrast with modest gains in the Core. These differences reflect the asymmetric labor-market effects of capital reallocation within the union.

Five years after the shock, capital market integration increases within-country inequality in the Periphery by about 3.5 basis points and reduces it by a similar amount in the Core. At the same time, between-country inequality falls by roughly 2 basis points. Integration therefore redistributes volatility across space, promoting convergence between

countries but widening disparities within them.[15]

The main mechanism operates through the spillover to Non-Savers. As domestic capital falls in the Periphery, real wages decline more sharply, while in the Core, capital inflows cushion wage losses relative to autarky. Capital market integration thus stabilizes aggregate volatility at the union level but redistributes the adjustment across households, deepening the gap between those with and without financial assets.

The variance of total consumption, measured as the sum of Core and Periphery consumption relative to steady state, remains nearly unchanged across regimes. Hence, integration does not lower overall volatility; it reallocates it between and within countries.

Compared with Bayer et al. [2024], who show that shocks in a monetary union are redistributed horizontally across countries, my results point to an additional vertical dimension. Capital market integration shifts adjustment not only between Core and Periphery but also between Savers and Non-Savers within each country.

Computing welfare changes as consumption-equivalent variations relative to equity autarky reveals similar patterns. Under both diversification and full capital market integration, welfare increases mainly for Savers in the Periphery and, to a lesser extent, for Non-Savers in the Core. It declines for Savers in the Core and slightly for Non-Savers in the Periphery. The welfare decomposition in Table 3 confirms that these signs and magnitudes are consistent with the transmission channels discussed above.[16]

[15]Changes in inequality are measured as deviations in Gini coefficients (in basis points) relative to the equity-autarky benchmark, computed five years after the shock. The Gini index is calculated for each country as $G_t = 10{,}000 \cdot \lambda(1-\lambda)\frac{|C_t^S - C_t^H|}{\lambda C_t^H + (1-\lambda) C_t^S}$, where C_t^S and C_t^H denote consumption of Savers and Non-Savers, respectively, and λ is the share of Non-Savers. Between-country inequality is analogously defined using aggregate Core and Periphery consumption.

[16]For each household type h, welfare is computed as the discounted sum of per-period utility, $U_h = \sum_{t=0}^{\infty} \beta^t \, u(c_{h,t}, \ell_{h,t})$, where $u(c, \ell) = \frac{c^{1-\sigma}}{1-\sigma} - \chi \frac{\ell^{1+\eta}}{1+\eta}$, with σ denoting the coefficient of relative risk aversion and η the inverse Frisch elasticity. Each experiment is simulated 100 times under identical stochastic shocks, and welfare measures are averaged across replications. The welfare gain of regime r relative to equity autarky (0) is expressed as a *consumption-equivalent variation* (CEV):

$$\lambda_h^r = \left(\frac{U_h^r}{U_h^0} \right)^{\frac{1}{1-\sigma}} - 1,$$

which represents the permanent percentage change in consumption that makes household h indifferent between regime r and autarky. Positive values of λ_h^r therefore indicate welfare improvements relative to the baseline.

Table 3: Welfare Decomposition Relative to Autarky (Discounted Utilities)

Household	ΔU^C	ΔU^{Total}	CEV (%)
Diversification only			
Core Saver	-0.411	-0.524	-0.332
Core Non-Saver	+0.084	-0.029	-0.015
Periphery Saver	+0.478	+0.584	+0.367
Periphery Non-Saver	-0.108	-0.001	-0.001
Capital market integration			
Core Saver	-0.300	-0.439	-0.278
Core Non-Saver	+0.263	+0.125	+0.064
Periphery Saver	+0.340	+0.459	+0.288
Periphery Non-Saver	-0.340	-0.221	-0.112

4.2.2 Symmetric Case with Uncorrelated Asymmetric Shocks

To assess the stabilization role of financial integration, I simulate uncorrelated technology shocks in the two countries. This setup removes any systematic advantage from being the directly affected country and isolates the insurance role of capital markets. Because the economies are structurally identical, the analysis focuses on the variance of consumption by household type relative to an equity-autarky benchmark with full home bias and infinitely costly portfolio adjustment.

Figure 10 shows the change in consumption variance relative to autarky, with levels reported in Appendix C.3. Capital market integration consistently reduces consumption volatility for Savers. The largest decline occurs under diversification, where exposure to foreign income provides insurance without the wage-side trade-offs that arise under reallocation.

Non-Savers, by contrast, face higher consumption volatility, especially when both channels operate. In this case, portfolio reallocation in response to idiosyncratic shocks amplifies wage fluctuations and destabilizes income for households that rely entirely on labor earnings. Even under diversification alone, valuation effects from asymmetric capital accumulation raise wage volatility and increase consumption variance for Non-Savers.

At the aggregate level, total consumption in each country appears more volatile. This arises because both countries are composed equally of Savers and Non-Savers, and the increase in variance for Non-Savers more than offsets the reduction for Savers.

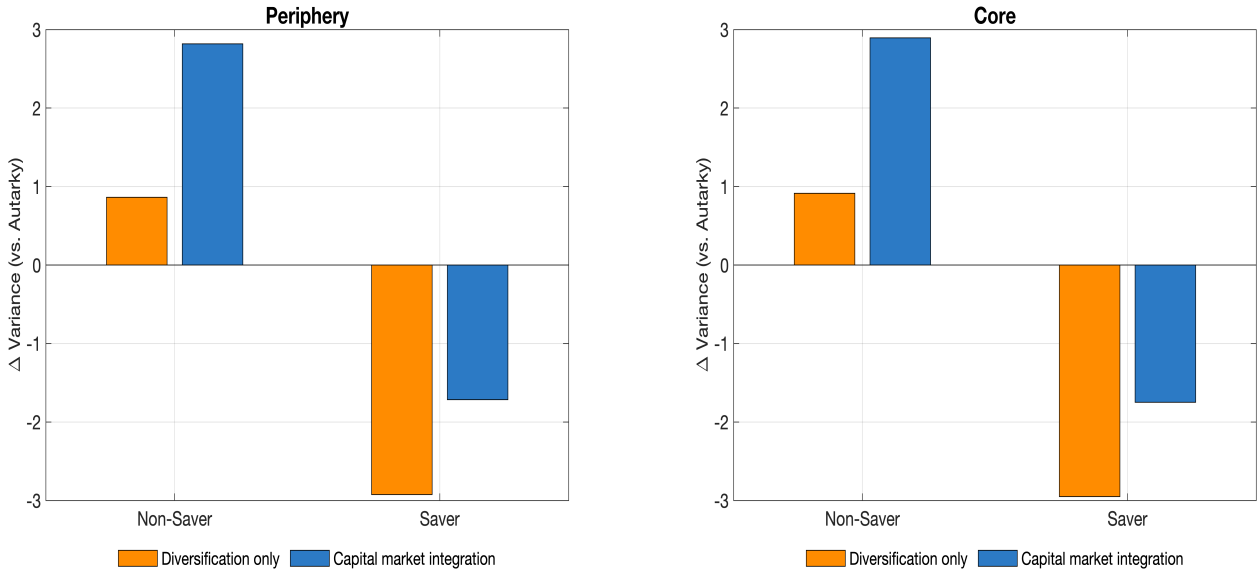

Figure 10: Variance of Consumption Deviations Relative to Equity Autarky

The figure plots the change in the variance of consumption by household type (Savers and Non-Savers) relative to the equity-autarky benchmark ($\zeta = 1$, $\kappa = \infty$). The experiment is conducted in a symmetric two-country setting with no ex-ante heterogeneity and uncorrelated 1% technology shocks in both countries, isolating the insurance role of financial integration. The two regimes displayed correspond to those shown in the impulse response figures: diversification only ($\zeta = 0.5$, $\kappa = \infty$), and capital market integration ($\zeta = 0.5$, $\kappa = 0.1$). capital market integration lowers consumption volatility for Savers, mainly through the diversification channel, but raises it for Non-Savers, as portfolio reallocation amplifies wage fluctuations and destabilizes labor income.

To better understand the mechanisms behind these results, Figure 11 decomposes consumption variance into labor and financial income components for both countries. In both the Core and the Periphery, most of the volatility originates from labor income. Financial integration reduces the variance of financial income through diversification, but this stabilizing effect is offset by higher volatility in labor income as portfolio reallocation amplifies wage fluctuations. Because Non-Savers depend entirely on wages, they experience greater overall volatility, while Savers benefit from smoother financial income streams. This decomposition confirms that the aggregate stabilization from integration stems from improved risk sharing among asset-holders, rather than from reduced macroeconomic shocks.

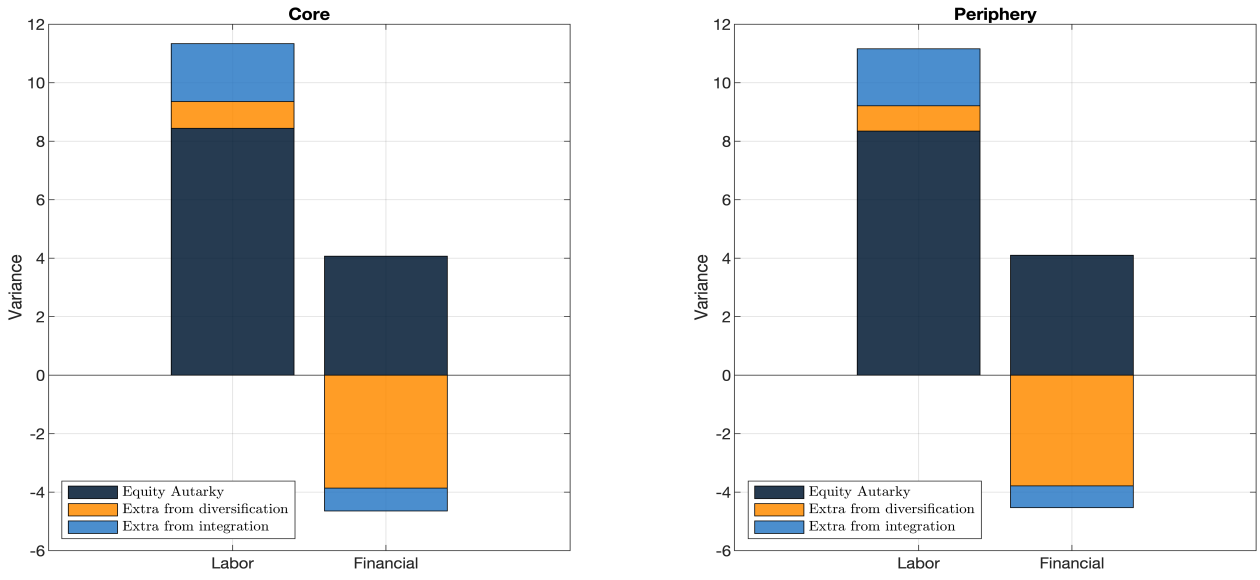

Figure 11: Variance Decomposition of Consumption by Income Source.
The figure decomposes total consumption variance in the Core and Periphery into labor and financial income components under three regimes: equity autarky ($\zeta = 1, \kappa = \infty$), diversification only ($\zeta = 0.5, \kappa = \infty$), and capital market integration ($\zeta = 0.5, \kappa = 0.1$). Integration reduces financial-income volatility but raises labor-income volatility, illustrating how the gains from diversification for Savers coexist with increased exposure for Non-Savers.

Overall, capital market integration has opposite effects across household types: it enhances risk sharing and stabilizes consumption for Savers, while amplifying income risk for Non-Savers. This asymmetry highlights that the potential aggregate gains from integration[17] mask important distributional trade-offs, underscoring the need to account for within-country heterogeneity when evaluating the welfare and policy implications of financial integration.

4.2.3 Asymmetric Case with Asymmetric Shock

To assess how structural heterogeneity shapes the distributional effects of capital market integration, I explore two dimensions: differences in the share of Non-Savers and differences in home bias across countries. The full results and figures are reported in Appendix C.4.

Varying the share of Non-Savers, which captures inequality in financial participation, shows that integration disproportionately benefits Savers while leaving Non-Savers

[17] Because both countries are composed equally of Savers and Non-Savers, the aggregate effect in this calibration is negative. Under a representative-agent setting, however, where the economy consists only of Savers, the aggregate outcome would mirror that of Savers and thus imply a reduction in aggregate consumption volatility.

largely unaffected. Because Savers alone hold financial assets, the aggregate gains from diversification become increasingly concentrated as their share declines. Non-Savers, relying solely on labor income, experience little direct change, as capital and wage dynamics remain broadly stable across configurations. Hence, the distributional effects of integration depend mainly on the overall prevalence of financial participation, rather than on its cross-country asymmetry.

Differences in home bias generate an additional layer of asymmetry through the portfolio structure. When the country hit by the shock is more diversified, its Savers benefit from foreign income that stabilizes domestic demand, moderating wage losses and cushioning Non-Saver consumption. Conversely, when the shocked country is more home-biased, the absence of foreign income insurance amplifies the contraction domestically and transmits it abroad through weaker demand, worsening outcomes for Non-Savers in both countries.

Together, these experiments highlight that heterogeneity in both financial participation and portfolio composition critically shapes the distributional consequences of capital market integration. The share of Non-Savers determines how aggregate gains are distributed across the population, while home bias governs how shocks are transmitted across borders through financial linkages.

4.3 Calibrated Case for 2010 with Asymmetric Shock

We now turn to the quantitative implications of the model when calibrated to match key features of the euro area. The calibration represents the euro area in 2010, the first year of observation and a pre-crisis benchmark that precedes the sovereign debt crisis, which was the main asymmetric shock of the period. It targets two main empirical asymmetries: differences in financial participation within countries and differences in portfolio composition between countries.

Within countries, the share of Non-Savers is lower in the Core (43%) than in the Periphery (67%), reflecting cross-country gaps in financial inclusion and market participation. Between countries, the Core displays a stronger home bias in equity holdings (97%) than the Periphery (89%). Import shares are computed as imports over total absorption, aggregated by bloc and normalized by GDP, implying higher trade openness in the Periphery (39%) than in the Core (33%). Portfolio adjustment costs are set to 0.1 in both regions. The inflation weight, based on Eurostat HICP data, assigns a higher policy weight to Core inflation (60%) than to Periphery inflation (40%).

The relative GDP ratio is calibrated to match the observed equity ratio between the

Periphery and the Core (0.23). Country-specific technology shocks are chosen to reproduce the deviations from pre-crisis capital trends (2000–2010) one year after the shock: a decline of 9.85% in Periphery capital and an increase of 0.46% in Core capital. Appendix D.2 reproduces the results of this section under an alternative calibration for the size of the technology shock, featuring a 1% decline in productivity in the Periphery only (MIT shock).

I conduct two experiments. First, I study capital market integration. For a given level of inequality, I compare the calibrated economy, which includes realistic integration constrained by home bias and portfolio adjustment costs, with an equity-autarky benchmark characterized by full home bias and rigid portfolios. This comparison measures how financial integration affects macroeconomic adjustment. Second, I study inequality. For a given level of capital market integration, I compare the calibrated heterogeneous-agent economy, in which only a fraction of households participate in asset markets, with a representative-agent benchmark. This experiment evaluates how differences in financial participation influence aggregate and distributional outcomes.

Together, the two experiments show how inequality and portfolio heterogeneity shape the transmission of shocks. Ignoring either factor gives an incomplete picture of how financial integration affects adjustment across households and countries.

Table 4: Calibration of Parameters for Core and Periphery (2010)

Parameter	Core	Periphery	Source
Domestic portfolio share	$\zeta^C = 0.97$	$\zeta^P = 0.89$	CPIS (IMF), corrected with Beck et al. [2024]
Share of Non-Savers	$\lambda^C = 0.43$	$\lambda^P = 0.67$	HFCS (ECB, 2010 wave)
Import share	$\omega^C = 0.33$	$\omega^P = 0.39$	Eurostat, national accounts (imports/GDP)
Portfolio adjustment cost	$\kappa^C = 0.10$	$\kappa^P = 0.10$	Calibrated to match other adjust. costs
Inflation weight in union	$\gamma = 0.60$	$1 - \gamma = 0.40$	ECB (HICP weights, 2010)
Size of TFP shock simulated	$\sigma_z^C = -0.042$	$\sigma_z^P = -0.291$	Q4 capital change from pre-crisis trend in 2011
GDP ratio $\frac{GDP^P}{GDP^C}$	$\psi = 0.23$		Equity ratios $\frac{E^P}{E^C}$ from CPIS (IMF)

Capital market integration. To quantify the macroeconomic and distributional implications of capital market integration, I compare the calibrated 2010 configuration with a counterfactual equity-autarky benchmark that preserves the same inequality structure. The autarky case corresponds to a standard macroeconomic environment in which households can invest only in domestic capital, implying full home bias and no cross-border reallocation.

Table 5: Simulation Scenarios: Equity Autarky vs. 2010 Calibration

	ζ		κ	
Case	Core	Periphery	Core	Periphery
Equity autarky	1.0	1.0	∞	∞
Calibrated (2010)	0.97	0.89	0.1	0.1

Figure 12 compares the impulse responses of capital and consumption for Savers and Non-Savers under both configurations. The dotted lines represent equity autarky, and the solid lines show the calibrated 2010 economy.

Relative to autarky, capital market integration increases cross-country divergence in investment and consumption. After a negative shock in both countries, which is larger in the Periphery, capital falls sharply in the Periphery (–182.3 percentage points in cumulative terms, obtained by summing deviations from the steady state over the transition) and rises in the Core (+43.8 percentage points). Savings are therefore reallocated toward the region with higher returns.

For Savers, the adjustment reflects the joint effects of diversification and reallocation. In the Periphery, Savers face a smaller drop in consumption (+134 percentage points relative to autarky) because Core asset holdings provide income insurance. In the Core, Savers experience a larger fall (–15.8 percentage points) due to their exposure to the Periphery downturn. Since the Periphery is more diversified than the Core, the gains of Periphery Savers outweigh the losses of Core Savers.

For Non-Savers, the transmission occurs through labor income. The stronger decline in Periphery capital lowers labor demand and real wages (–46.1 percentage points), reducing Non-Saver consumption. In the Core, higher capital inflows sustain labor demand and moderate the fall in real wages, leading to a small increase in Non-Saver consumption (+12.7 percentage points).

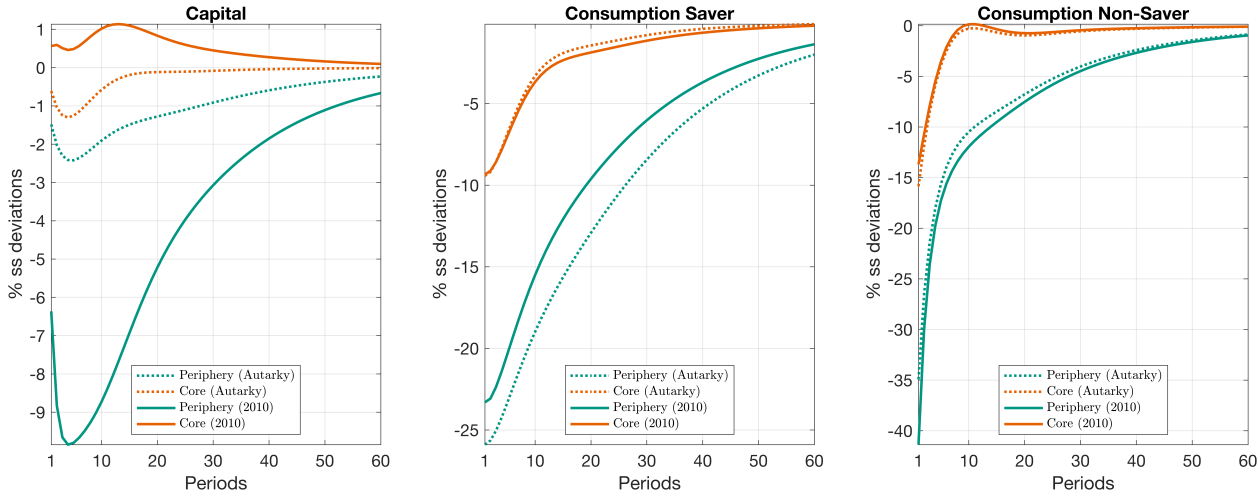

Figure 12: Impulse Responses of Capital and Consumption for Savers and Non-Savers in the Core and Periphery

The figure compares the impulse responses of capital and consumption under two configurations: the equity-autarky benchmark (dotted) and the calibrated 2010 euro area economy (solid). The calibration incorporates cross-country asymmetries in financial participation, portfolio home bias, and trade openness. Country-specific negative technology shocks are set to reproduce the observed deviations from pre-crisis capital trends one year after the shock: a 9.85% decline in the Periphery and 0.46% in the Core. The experiment quantifies the role of capital market integration in shaping macroeconomic adjustment, highlighting how aggregate dynamics differ once the true financial structure of the euro area is taken into account.

To understand how capital market integration reshapes the sources of income, Figure 13 decomposes cumulative consumption responses into labor and financial contributions. The bars represent the sum of impulse responses over 60 periods under both equity autarky and the calibrated 2010 economy. The results show that in the Periphery, the decline in labor income deepens substantially, while financial income rises through higher returns on Core assets. In the Core, the opposite occurs: labor income falls less and financial income declines, as households absorb part of the Periphery's losses. This decomposition highlights the main mechanism behind the distributional results discussed below: capital market integration shifts risk from labor to financial income and redistributes it across countries.

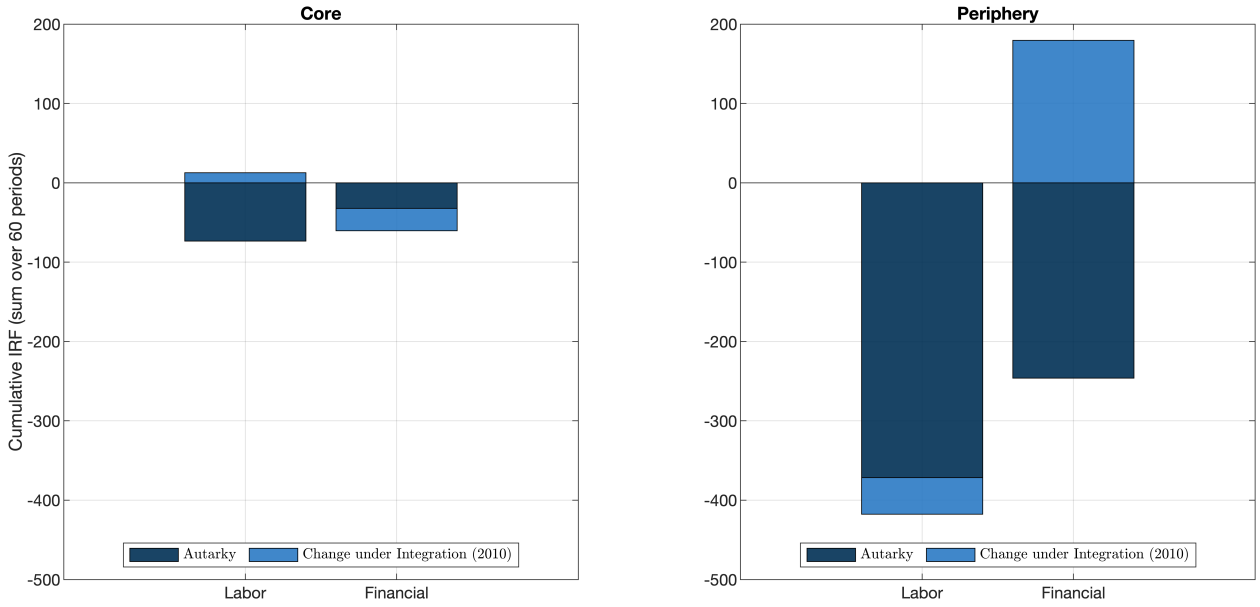

Figure 13: Cumulative Impulse Responses of Labor and Financial Income under Autarky and Integration

The figure shows the cumulative impulse responses (sum over 60 periods) of labor and financial income in the Core and Periphery under the equity-autarky benchmark (dark blue) and the calibrated 2010 euro-area economy (light blue). In the Periphery, capital market integration amplifies losses in labor income while raising financial income through cross-border asset holdings. In the Core, the opposite pattern holds. This shift in the sources of income explains the asymmetric welfare and inequality effects that follow.

These shifts in income composition have direct implications for volatility and welfare. Variance decompositions show that capital market integration stabilizes both national and union-wide consumption. Relative to equity autarky, the variance of aggregate consumption declines in the Periphery (–3.9%) and in the Core (–4.9%). At the union level, total variance falls by about –2.7%. These results support the traditional Mundellian view that cross-border asset holdings enhance macroeconomic stability by smoothing consumption across countries.

This stabilization, however, hides large differences across households. In the Periphery, consumption volatility decreases for Savers (–3.5%), who benefit from diversification through Core assets, but rises slightly for Non-Savers (+0.8%), whose income depends on domestic labor markets. In the Core, Savers face a small increase in volatility (+3.5%) due to exposure to Periphery assets, while Non-Savers experience a modest decline (–2.4%) as capital inflows support local labor demand. Capital market integration therefore smooths aggregate fluctuations at the union level but redistributes volatility across households and countries. Stabilization for some groups comes at the cost of greater exposure for others.

Five years after the shock, relative to equity autarky, capital market integration increases within-country inequality in the Periphery by about 102 basis points and reduces it in the Core by 16 basis points. At the same time, between-country inequality falls by roughly 20 basis points.

The welfare decomposition in Table 15 confirms these patterns. Capital market integration generates heterogeneous welfare effects across both countries and household types. Savers in the Periphery gain, as access to higher-return assets allows them to diversify away from local shocks. Core Non-Savers also benefit, since cross-country risk sharing stabilizes consumption and cushions domestic fluctuations. In contrast, Core Savers incur moderate welfare losses because returns on domestic assets fall after capital outflows. Periphery Non-Savers also lose, as weaker labor markets and limited access to financial income offset any gains from integration. Overall, these results show that the distributional effects of financial integration depend critically on portfolio structure and households' position in the income distribution.

Table 6: Welfare Decomposition Relative to Autarky (Discounted Utilities)

Household	ΔU^C	ΔU^{Total}	CEV (%)
Capital market integration			
Core Saver	-5.433	-5.126	-3.442
Core Non-Saver	+10.205	+10.512	+5.707
Periphery Saver	+14.490	+9.911	+2.640
Periphery Non-Saver	-5.207	-9.787	-0.632

Consistent with the empirical evidence presented earlier, the calibrated model predicts that integration reduces cross-country inequality among Savers but widens within-country inequality, as the welfare gap between Savers and Non-Savers expands in the Periphery and narrows in the Core.

Inequality. To isolate the role of household heterogeneity, I compare the calibrated 2010 economy with a counterfactual representative-agent benchmark, keeping the portfolio structure unchanged. The representative-agent case abstracts from financial participation heterogeneity by assuming universal market access ($\lambda^C = \lambda^P = 0$). This comparison identifies how the presence of liquidity-constrained households modifies the transmission of shocks through the capital allocation channel.

Table 7: Simulation Scenarios: Representative Agent vs. 2010 Calibration

Case	Core	Periphery
Representative agent	0.0	0.0
Calibrated (2010)	0.43	0.67

Figure 14 compares the impulse responses under the representative-agent and heterogeneous-household settings. Introducing household heterogeneity amplifies the asymmetry of macroeconomic adjustments across countries. In the Periphery, the decline in capital is significantly attenuated, by 39.9 percentage points over the period considered, reflecting weaker aggregate demand when a large share of households is liquidity-constrained and unable to smooth consumption. In the Core, by contrast, capital rises by about 18.3 percentage points relative to the representative-agent benchmark, as excess savings from unconstrained households are reallocated toward the higher-return region.

The same mechanism shapes the consumption responses. In the Periphery, liquidity constraints magnify the fall in aggregate demand: Non-Savers cut consumption sharply following the adverse technology shock, while Savers experience a sizeable drop in consumption (–39.4 percentage points relative to the representative-agent case) due to lower returns on domestic assets. In the Core, unconstrained households increase savings and capital flows toward the Periphery, dampening the local recession but transmitting part of the adjustment through asset returns. Savers in the Core thus face a larger decline in consumption (–20.7 percentage points), while Non-Savers benefit from improved labor market conditions and higher real wages. Together, these dynamics imply that heterogeneity widens inequality within the Periphery, where constrained households bear most of the adjustment, but narrows it modestly within the Core, where Non-Savers benefit from stronger labor income.

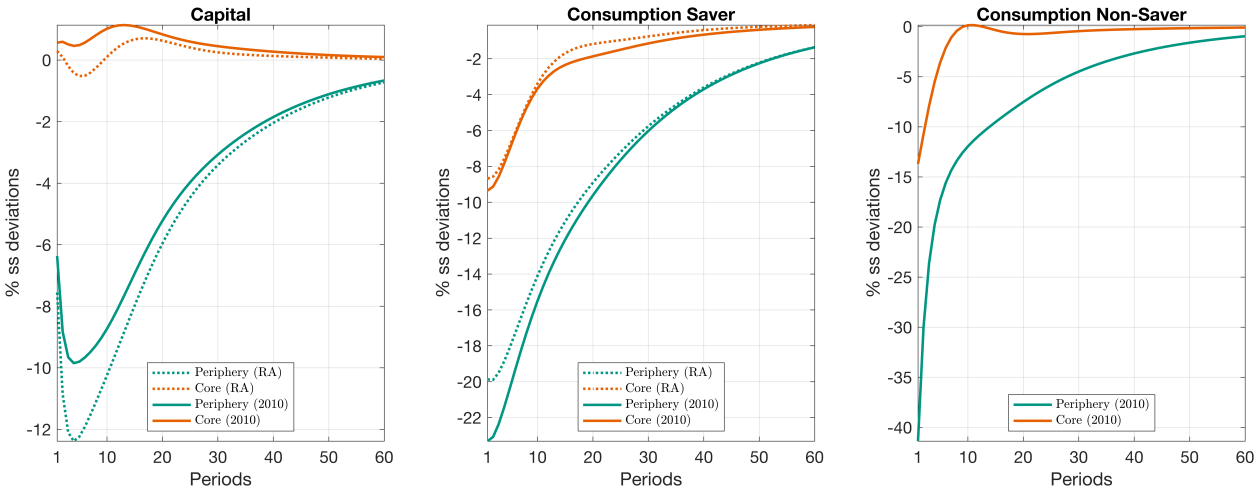

Figure 14: Impulse Responses of Capital and Consumption for Savers and Non-Savers in the Core and Periphery

The figure compares the impulse responses of capital and consumption under two configurations: a representative-agent benchmark (dotted) and the calibrated 2010 heterogeneous-agent economy (solid). Both simulations assume the same degree of capital market integration as in the 2010 calibration and are subject to the same country-specific negative technology shocks, calibrated to match the observed post-2010 deviations from capital pre-crisis trends. Holding financial integration constant, the comparison isolates the role of heterogeneity in financial participation: in the heterogeneous economy, limited asset-market participation amplifies the consumption responses and the aggregate asymmetry across countries.

Comparing the Representative-Agent (RA) benchmark with the Two-Agent (TANK) model reveals that aggregate stabilization masks important distributional effects. Under RA, the variance of aggregate consumption declines by about 3–4% relative to autarky, confirming that financial integration smooths consumption at the national and union-wide levels. However, this apparent stabilization largely reflects the average response of a single, unconstrained household.

Once heterogeneity in market participation is introduced, the picture changes substantially. In the TANK model, the variance of Saver consumption in the Periphery rises relative to the RA case (+4.3%), while Non-Savers experience even greater volatility due to their exclusive reliance on labor income (+2.7%). In the Core, Savers' consumption becomes slightly more volatile (+1.5%), whereas Non-Savers benefit from milder wage adjustments (–3.6%). These results show that the presence of liquidity-constrained households modifies the transmission of shocks even for unconstrained agents: when Non-Savers cut spending sharply, aggregate demand weakens, reducing Savers' income from domestic capital and amplifying their consumption response.

This implies that the RA benchmark overstates the stabilizing effects of integration by

ignoring these feedbacks between heterogeneous agents. Capital market integration does stabilize aggregate consumption, but it redistributes volatility across households, reducing fluctuations for some while amplifying them for others.

Five years after the shock, relative to the representative-agent benchmark, introducing household heterogeneity increases within-country inequality in the Periphery by about 159 basis points and in the Core by about 1 basis point. At the same time, between-country inequality rises by roughly 121 basis points. Heterogeneity therefore amplifies the overall dispersion of outcomes across the monetary union, widening gaps both within and between countries.

To understand how household heterogeneity alters the sources of income and the propagation of shocks, Figure 15 decomposes cumulative consumption responses into labor and financial income components under both the representative-agent and two-agent settings. The bars represent the sum of impulse responses over 60 periods. In the Periphery, introducing heterogeneity deepens the fall in labor income while increasing the contribution of financial income, reflecting the limited ability of constrained households to smooth consumption and the reallocation of savings toward the Core. In the Core, the pattern reverses: labor income stabilizes as capital inflows support employment, while financial income declines as domestic investors absorb losses from the Periphery. This shift in the composition of income risk explains the asymmetric distributional effects that follow, with larger income and consumption gaps in the Periphery and more muted responses in the Core.

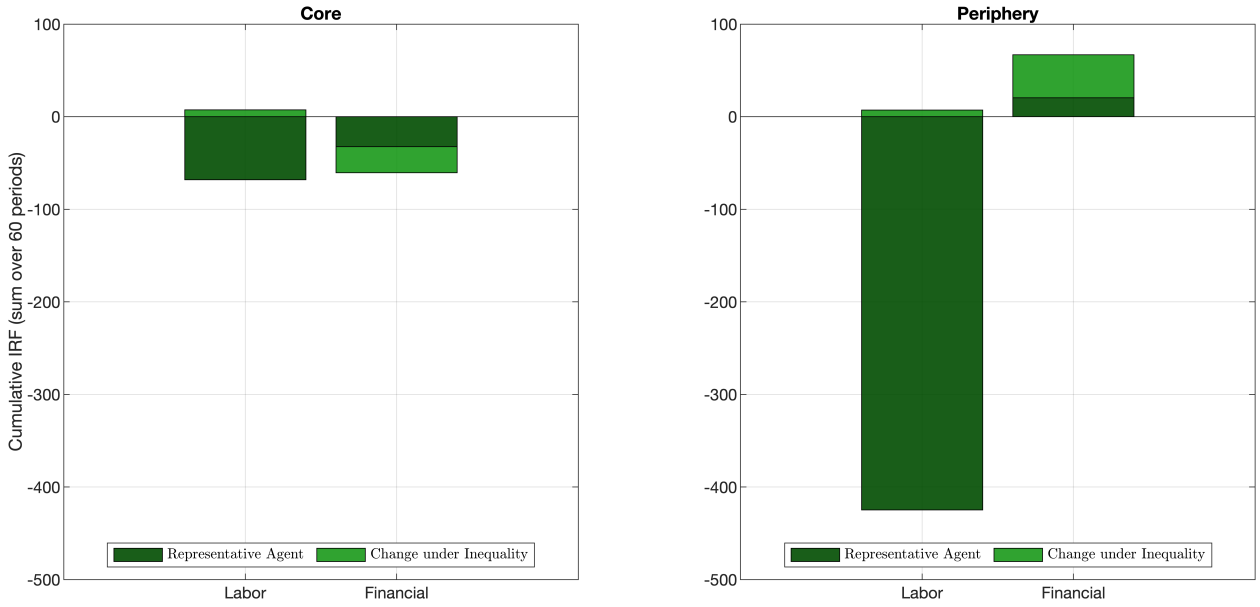

Figure 15: Cumulative Impulse Responses of Labor and Financial Income under Representative-Agent and Two-Agent Settings

The figure shows the cumulative impulse responses (sum over 60 periods) of labor and financial income in the Core and Periphery under the representative-agent benchmark (dark green) and the two-agent economy (light green). Introducing household heterogeneity amplifies losses in labor income in the Periphery while raising the contribution of financial income. In the Core, labor income stabilizes while financial income declines as domestic investors absorb part of the external shock. These patterns show how heterogeneity redistributes risk between labor and capital income, reinforcing within-country inequality in the Periphery and dampening it in the Core.

The welfare decomposition in Table 8 corroborates these findings. Capital market integration benefits liquidity-constrained households in the Core, whose welfare rises substantially due to stronger wage responses and smoother consumption paths. By contrast, Savers in the Core experience welfare losses as capital inflows compress domestic returns. In the Periphery, both Savers and Non-Savers are worse off: despite a slight consumption increase from short-lived income insurance, lower investment and weaker labor demand dominate in the long run. Overall, the results confirm that integration stabilizes aggregate consumption but redistributes welfare asymmetrically, favoring Non-Savers in the Core, while amplifying inequality across and within member states.

Table 8: Welfare Decomposition Relative to Autarky (Discounted Utilities)

Household	ΔU^C	ΔU^{Total}	CEV (%)
Inequality			
Core Saver	-6.837	-6.837	-22.781
Core Non-Saver	+6.614	+53.076	+45.822
Periphery Saver	+0.426	+0.426	-5.851
Periphery Non-Saver	+0.194	+95.230	-3.187

Overall, household heterogeneity amplifies both the cross-country and within-country asymmetries induced by capital reallocation. When Non-Savers lack buffers, demand contracts more sharply in the Periphery, deepening the local downturn and reinforcing capital accumulation in the Core. This magnifies divergences in consumption, wages, and welfare. Relative to the representative-agent benchmark, the heterogeneous framework provides a microfoundation for the asymmetric adjustment observed during euro area crises: financially constrained households propagate domestic shocks more strongly through limited consumption smoothing, while wealthier agents amplify cross-border spillovers through portfolio reallocation. Together, these mechanisms highlight that inequality and financial integration must be analyzed jointly to fully capture the macroeconomic and distributional consequences of asymmetric shocks within a monetary union.

As mentioned previously, Appendix D.2 reproduces the results of this section under an alternative and more standard calibration, featuring a 1% decline in productivity in the Periphery only.

To conclude, the calibrated model shows that capital market integration smooths aggregate fluctuations yet redistributes risk across countries and agents. Between countries, integration fosters convergence as cross-border portfolios absorb part of the shock. Within countries, however, inequality rises where financial participation is limited, especially in the Periphery. These results highlight that the gains from integration depend critically on who holds financial assets and how risks are shared across the union.

5 Heterogeneous-Agents New Keynesian (HANK) Model

The two-agent structure abstracts from wealth and income dispersion within each country. To assess whether this limitation affects macroeconomic adjustment, I extend the model to a fully heterogeneous-agent setting.

This extension introduces endogenous precautionary savings and a realistic wealth distribution that influence both domestic and cross-border dynamics. Unlike the previous model, it allows for endogenous participation, as the share of constrained households now adjusts in response to shocks.

The model builds on the Two-Agent New Keynesian (TANK) framework and introduces incomplete markets and household heterogeneity while keeping the aggregate structure unchanged. The Heterogeneous-Agent New Keynesian (HANK) version departs from the baseline in three main ways.

First, households face uninsurable idiosyncratic shocks to labor productivity. These shocks generate a nondegenerate stationary distribution of income and wealth.

Second, idiosyncratic risk generates precautionary saving motives and endogenous market participation. Agents self-insure against income fluctuations by accumulating buffer-stock savings under borrowing constraints. This mechanism governs the share of liquidity-constrained households at any point in time and produces a continuous distribution of marginal propensities to consume. As a result, the model captures how within-country inequality shapes aggregate adjustment. Differences in financial exposure amplify the effects of aggregate shocks and drive the redistributive impact of capital market integration.

Finally, each country features a risk-neutral mutual fund that intermediates aggregate savings across domestic and foreign capital and a union-wide bond. The fund issues a composite claim to households, preserving the international portfolio structure of the baseline model while incorporating wealth heterogeneity, diverse consumption responses, and heterogeneous marginal propensities to consume.

5.1 Aggregate and Idiosyncratic Risk

Aggregate productivity follows an AR(1) process as stated in (34) and (35). This is the sole aggregate source of uncertainty in the economy. In addition, each household is subject to an idiosyncratic, uninsurable productivity shock $y_t \in \mathcal{Y} = \{y_1, \ldots, y_n\}$, evolving according to a time-homogeneous Markov chain with transition probabilities $\pi_{yy'}$. Let S_y denotes the invariant distribution over Y, it satisfies:

$$S_y = \sum_{\tilde{y} \in \mathcal{Y}} \pi_{\tilde{y}y} S_{\tilde{y}}, \quad \text{for all } y \in \mathcal{Y}. \tag{47}$$

Idiosyncratic risk generates persistent heterogeneity in earnings and wealth across households even when aggregate conditions are constant.

5.2 Risk-Neutral Mutual Fund

In each country $i \in \{C, P\}$, a risk-neutral mutual fund intermediates household savings and issues a composite asset A_t^i to domestic Savers. This asset consolidates both equity and bond holdings, allowing households to invest in a single instrument that delivers the aggregate return on the fund's portfolio:

$$A_t^i = E_t^i + b_t^i. \tag{48}$$

where E_t^i represents the fund's i equity position and b_t^i its holdings of nominal union bonds.

The fund reallocates internally between equity and bonds to maximize expected returns. Its equity component aggregates domestic and foreign capital holdings:

$$E_t^i = K_{i,t}^i + \mathcal{S}_t K_{i,t}^j, \tag{49}$$

where $\mathcal{S}_t$ denotes the relative price of country j's consumption basket in terms of country i's, and thus represents the real exchange rate as defined in equation (2).

The gross real return on the composite asset equals the weighted average of equity and bond returns:

$$r_t^A A_{t-1}^i = r_t^i E_{t-1}^i + \frac{r_{t-1}^U}{\pi_t^{CPI,i}} b_{t-1}^i, \tag{50}$$

where r_t^i is the gross real return on equity, r_t^U the nominal union-wide interest rate, and $\pi_{CPI,t}^i$ domestic inflation. The second term converts nominal bond returns into real units.

Expected returns on equity and bonds are linked by the fund's no-arbitrage condition, which incorporates portfolio-adjustment costs:

$$\mathbb{E}_t[r_{t+1}^i] + \frac{\kappa_D}{1-\lambda^i} p_t^i b_t^i = \frac{r_t^U}{\pi_{t+1}^{CPI,i}} + \frac{\kappa_E}{1-\lambda^i} p_t^i (E_t^i - \bar{E}^i). \tag{51}$$

κ_E and κ_D measure the quadratic costs of adjusting respectively equity and bond positions, while $\lambda_i \in (0, 1)$ captures the share of constrained households (or equivalently, financial participation) in country i. The steady-state benchmark portfolio $\bar{E}_i$ denotes the long-run equity position around which deviations are penalized.

The internal allocation between domestic and foreign capital satisfies the same no-profit (3) and no-arbitrage (5) conditions as in the TANK model; the key difference is that households now interact with the fund through the single composite asset A_t^i.

5.3 Households

The intratemporal problem is the same as the one described in Section 3.3.1.

Each household $h \in [0,1]$ in country $i \in C, P$ faces an idiosyncratic productivity state $y_{h,t}$ and chooses consumption $c^i_{h,t}$ and asset holdings $a^i_{h,t}$ to maximize expected lifetime utility.

$$\max_{\{c^i_{h,t}, a^i_{h,t}\}_{t=0}^{\infty}} E_0 \sum_{t=0}^{\infty} \beta^t \left(\frac{(c^i_{h,t})^{1-\sigma}}{1-\sigma} - \chi \frac{(L^{U,i}_t)^{1+\eta}}{1+\eta} \right) \tag{52}$$

subject to the budget constraint

$$a^i_{h,t} + c^i_{h,t} = r^i_t a^i_{h,t-1} + w^i_t y_{h,t} L^{U,i}_t, \tag{53}$$

and the borrowing limit

$$a^i_{h,t} \geq -\bar{a}. \tag{54}$$

The borrowing limit $-\bar{a}$ ($\bar{a} \geq 0$) captures the degree of market incompleteness: a lower $\bar{a}$ tightens credit constraints and raises the share of liquidity-constrained households.

The first-order condition for optimal intertemporal choice gives the standard Euler equation for unconstrained households

$$(c^i_{h,t})^{-\sigma} = \beta E_t \left[r^i_{t+1} (c^i_{h,t+1})^{-\sigma} \right], \tag{55}$$

It equates the marginal utility cost of saving one unit of consumption today to its expected discounted benefit tomorrow.

Constrained households at the borrowing limit $a^i_{h,t} = -\bar{a}$ instead satisfy the inequality

$$(c^i_{h,t})^{-\sigma} \geq \beta E_t \left[r^i_{t+1} (c^i_{h,t+1})^{-\sigma} \right]. \tag{56}$$

Uninsurable idiosyncratic shocks $y_{h,t}$ generate precautionary saving motives, inducing a stationary wealth distribution even in the absence of aggregate uncertainty. Heterogeneity in $a^i_{h,t}$ and $y_{h,t}$ thus shapes the aggregate marginal propensity to consume and the transmission of shocks across households and countries.

5.4 Labor Supply and Union Wage Setting

Labor supply and wage setting follow the same structure as in the two-agent model, now aggregated over the continuum of heterogeneous households. Each country $i \in \{C, P\}$ features monopolistic unions indexed by $k \in (0,1)$, aggregated through a Dixit and

Stiglitz [1977] technology with elasticity $\theta_W^i > 1$.

As stated in the equation (20), unions set nominal wages subject to quadratic adjustment costs à la Rotemberg [1982].

In the heterogeneous-agent environment, unions internalize the distribution of marginal utilities across households and choose wages to maximize aggregate welfare. In a symmetric equilibrium ($W_t^i(k) = W_t^i$), the first-order condition yields a New Keynesian Wage Phillips Curve:

$$\pi_t^{W,i}(\pi_t^{W,i} - \bar{\pi}^W) = \beta E_t[\pi_{t+1}^{W,i}(\pi_{t+1}^{W,i} - \bar{\pi}^W)] + \frac{\theta_W^i}{\kappa_W^i}\left[\chi(L_t^{U,i})^{1+\eta} - \frac{\theta_W^i - 1}{\theta_W^i} w_t^i L_t^{U,i} \overline{MU}_t^i\right], \quad (57)$$

where $w_t^i = W_t^i / CPI_t^i$ denotes the real wage and

$$\overline{MU}_t^i = \int_h (c_{h,t}^i)^{-\sigma} \, d\mu^i(h) \quad (58)$$

is the average marginal utility of consumption across households in country i. When inequality or liquidity constraints are high, the wage-setting process becomes more sensitive to the consumption fluctuations of constrained households, amplifying the real wage response to shocks.

Production is specified as in Section 3.5, and monetary policy follows the rule described in Section 3.6.

5.5 Market Clearing Conditions

The aggregate equilibrium conditions in each country i mirror those in the TANK model, now integrated over the distribution of heterogeneous agents. Let $\mu^i(h)$ denote the stationary distribution of households h in country i over idiosyncratic states (that is, $\mu^i(h) \equiv \mu_t^i(a, y)$ when the state of each household is given by assets a and income y). Then:

- Aggregate consumption:
$$C_t^i = \int_h c_{h,t}^i \, d\mu^i(h), \quad (59)$$
- Aggregate assets:
$$A_t^i = \int_h a_{h,t}^i \, d\mu^i(h) = E_t^i + b_t^i. \quad (60)$$

Market clearing for capital follows equation (6), for union-wide bonds equation (42), and for goods equation (43). The trade balance condition (44) has the same structure as in

the two-agent model.

5.6 Equilibrium

Definition A sequential competitive equilibrium is a collection of individual policy functions $\{c^i_{h,t}, a^i_{h,t}\}_{h\in\mathcal{H}_i, i\in\{C,P\}, t\geq 0}$, aggregate quantities $\{C^i_t, L^i_t, K^i_t, A^i_t, Y^i_t, I^i_t, TB^i_t\}_{i\in\{C,P\}, t\geq 0}$, portfolio positions $\{K^i_{i,t}, K^j_{i,t}\}_{i,j\in\{C,P\}, t\geq 0}$, price processes $\{w^i_t, r^{k,i}_t, r^i_t, P_{i,t}, CPI^i_t, \mathcal{S}_t, r^U_t\}_{i\in\{C,P\}, t\geq 0}$, and distributions of households $\mu^i_t(a, y)$ over asset and income states, such that, for given initial distributions $\mu^i_0(a, y)$ and aggregate shocks $\{Z_t\}_{t\geq 0}$, the following conditions hold for all $t \geq 0$:

1. **Mutual funds.** In each country $i \in \{C, P\}$, a risk-neutral mutual fund in each country i intermediates all savings of domestic households through a composite asset A^i_t that combines equity and bond holdings. The fund reallocates internally between domestic and foreign capital to satisfy the zero-profit (3) and no-arbitrage (5) conditions. Aggregate asset demand by households equals the fund's supply (60).

2. **Households.** In each country $i \in \{C, P\}$, households facing idiosyncratic productivity shocks y_t following the Markov process in (47). Given prices, they choose consumption and next-period asset holdings to maximize expected lifetime utility subject to their budget constraint (53) and borrowing limit (54). Optimal policies satisfy the household Euler equation (55). The cross-sectional distribution $\mu^i_t(a, y)$ endogenously according to household decisions and the transition probabilities of y_t.

3. **Wage setting.** Labor unions set nominal wages subject to Rotemberg adjustment costs (20), taking into account the average marginal utility of consumption across households (58), and wage inflation evolves according to the wage Phillips curve (57).

4. **Firms.** Firms in each country i hire labor and rent capital competitively to maximize profits, taking prices and productivity as given. Factor prices equal marginal products (26)–(27), and aggregate output satisfies the production function (25). Under flexible prices, firms earn zero profits and set prices as a constant markup over marginal cost (31). Capital accumulates according to (32)–(33), and productivity follows the exogenous process (34)–(35).

5. **Monetary policy.** The common central bank sets the nominal interest rate according to a Taylor-type rule (37), responding to union-wide inflation defined as a weighted

average of national CPI inflations (36).

6. **Market clearing.** In each country $i \in \{C, P\}$, goods, labor, and financial markets clear. Capital equals the sum of domestic and foreign holdings, as in equation (6), and the union-wide bond market clears according to equation (42). Aggregate consumption, labor supply, and asset holdings are defined in equations (38), (39), (40), and (41). Goods-market equilibrium (43) is ensured by the resource constraint (46), while the trade balance (44) links the real and financial accounts (45). Finally, aggregate consumption and aggregate assets clear according to equations (59) and (60), respectively.

7. **Consistency.** The aggregate states (K_t^i, A_t^i, μ_t^i) summarize the distributional dynamics. All agents form rational expectations given the laws of motion for aggregate and idiosyncratic shocks $\{Z_t, y_t\}$ and their decisions are mutually consistent with equilibriul prices and allocations.

The transmission mechanisms operate through the same channels, diversification and reallocation, defined in Section 3.9.

6 Results - Heterogeneous-Agent Model

I extend the analysis to a fully Heterogeneous-Agent New Keynesian (HANK) model calibrated to the euro area in 2010. This version tests the mechanisms identified in the two-agent (TANK) model and quantifies their strength in an economy with realistic wealth and income heterogeneity.

Solving a heterogeneous-agent model with aggregate shocks is computationally demanding because the state space includes the entire household distribution, an infinite-dimensional object. Policy functions depend on both the aggregate state Z and the distribution itself, making a direct recursive solution infeasible. I address this using the hybrid projection–perturbation method of Reiter [2009], complemented by the simulation approach of Young [2010], which captures the interaction between micro heterogeneity and aggregate dynamics in a tractable way.

The procedure begins by discretizing the household state space and solving for the non-stochastic steady state with idiosyncratic shocks but no aggregate uncertainty. Once the steady state is obtained, I linearize the model around it and solve using a rational expectations algorithm. The linearization treats the full distribution as an additional aggregate state and approximates its dynamics with a finite set of moments that summarize

the relevant cross-sectional information. This setup captures how aggregate shocks affect the distribution of agents and how these distributional changes feed back into aggregate outcomes.

The model is solved in two steps.[18] First, the stationary equilibrium is computed using the endogenous grid method. Second, the transition dynamics around the steady state are characterized using the Reiter [2009] approach, which ensures consistency between micro heterogeneity and aggregate adjustment.

6.1 Calibration

The overall calibration follows standard values commonly used in the literature.

Table 9: Calibration Parameters

Parameter	Value	Description	Source
β	0.93	Discount factor	Smets and Wouters [2003]
α	0.36	Capital share	Krueger et al. [2017]
σ	2.0	Relative risk aversion	CRRA
ϕ	2.0	Elasticity of substitution (home vs. foreign)	Pasch and Tervala [2024]
δ	0.025	Depreciation rate (quarterly)	Smets and Wouters [2003]
η	2.0	Inverse Frisch elasticity of labor supply	Chetty et al. [2011]
Ψ	1.5	Taylor-rule coefficient on inflation	Darvas and Merler [2013]
κ_D	0.10	Debt adjustment cost	Schmitt-Grohé and Uribe [2003]
κ_E	0.10	Equity adjustment cost	Schmitt-Grohé and Uribe [2003]
ρ_Z	0.95	TFP autocorrelation	den Haan [2010]
ρ_y	0.96	Persistence of idiosyncratic productivity	Author's decision
σ_y	0.11	Std. dev. of idiosyncratic shock (annualized)	Author's decision
N_a	300	Number of asset grid points	Discretization for asset holdings
N_y	2.0	Number of income states	Rouwenhorst discretization
$\bar{a}$	0.0	Borrowing limits	Mass at constraint
θ_W	21	Wage markup elasticity	Bilbiie and Ragot [2021]
κ_W	2100	Rotemberg wage adjustment cost	Bilbiie and Ragot [2021]
		Steady-State Normalization	
r^U	1.065	Steady-state gross nominal rate	Asset clearing

[18] The stationary equilibrium is computed with the endogenous grid method (EGM) introduced by Carroll [2006], using interpolation over the joint asset–income space to obtain policy and distribution functions. The aggregate transition dynamics follow Reiter [2009], who combine linearization of the aggregate block with numerical solution of the heterogeneous-agent block.

In Appendix D.1, I reproduce the previous experiment conducted in 4.2.1 under a symmetric calibration with no ex-ante heterogeneity. I compare the responses to an asymmetric shock in one country across the TANK and HANK models and show that the results are qualitatively similar but differ quantitatively due to amplification from the endogenous wealth distribution and stronger wealth effects.

6.2 Calibrated Case for 2010 with Asymmetric Shock

Parameters are calibrated as explained in Section 4.3 to match key moments observed in 2010 for the Core and Periphery economies.

Table 10: Calibration of Parameters for Core and Periphery (2010)

Parameter	Core	Periphery	Source
Domestic portfolio share	$\zeta^C = 0.97$	$\zeta^P = 0.89$	CPIS (IMF), corrected with Beck et al. [2024]
Share of Non-Savers	$\lambda^C = 0.43$	$\lambda^P = 0.67$	HFCS (ECB, 2010 wave)
Import share	$\omega^C = 0.33$	$\omega^P = 0.39$	Eurostat, national accounts (imports/GDP)
Portfolio adjustment cost	$\kappa^C = 0.10$	$\kappa^P = 0.10$	Calibrated to match other adjust. costs
Inflation weight in union	$\gamma = 0.60$	$1 - \gamma = 0.40$	ECB (HICP weights, 2010)
Size of TFP shock simulated	$\sigma_z^C = 0.001$	$\sigma_z^P = -0.187$	**Q4 capital change from pre-crisis trend in 2011**
GDP ratio $\frac{GDP^P}{GDP^C}$	$\psi = 0.23$		Equity ratios $\frac{E^P}{E^C}$ from CPIS (IMF)

The only difference relative to the two-agent model lies in the calibration of the TFP shock. Because heterogeneous-agent models amplify aggregate responses, a smaller shock is required to match the observed Q4 decline from the pre-crisis trend in 2011. To reproduce the increase in Core capital observed in the data, the model must also assume that the negative shock in the Periphery coincides with a mild positive shock in the Core. This highlights the need to account for asymmetric shocks.

The rest of the calibration incorporates empirically grounded asymmetries in portfolio composition, financial participation, and trade openness, using data from CPIS, HFCS, and Eurostat. These differences introduce realistic cross-country heterogeneity in both financial structure and shock exposure, allowing the model to capture the distributional implications of capital market integration within the euro area. The ensuing comparison between the TANK and HANK versions highlights how market incompleteness and endogenous participation reshape the transmission of asymmetric shocks once structural asymmetries are disciplined by the data.

As in the two-agent model, Appendix D.2 reproduces the results of this section under an alternative calibration of the technology shock, featuring a 1% decline in productivity

in the Periphery only (MIT shock). In addition, Appendix D.3 compares the responses in the HANK and TANK models under the same shock structure as in Table 4, highlighting the differences that arise from household heterogeneity.

I reproduce the experiment described in Table 5, comparing an equity autarky with full home bias and infinite capital adjustment costs to a realistic degree of capital market integration calibrated to 2010. The key difference in this case is endogenous participation. The wealth distribution now evolves in response to the shock, whereas in the previous setup the shares of Savers and Non-Savers were fixed. This dynamic adjustment gives rise to *Switchers*: households that become liquidity-constrained and move from Saver to Non-Saver status after the shock. Endogenous participation introduces a new propagation margin: the reclassification of households between constrained and unconstrained states ('switchers').

Figure 16 sheds light on the microeconomic propagation mechanisms that distinguish the heterogeneous-agent model from its two-agent counterpart. Following the asymmetric productivity shock, the share of liquidity-constrained households increases sharply in both countries, with a larger and more persistent response in the Periphery. This reflects the tightening of borrowing constraints and the fall in labor income that push marginal households into constraint status. The dynamics of this reclassification constitute a new propagation margin: rather than all agents responding symmetrically to aggregate prices, the distribution itself shifts, altering the aggregate consumption response.

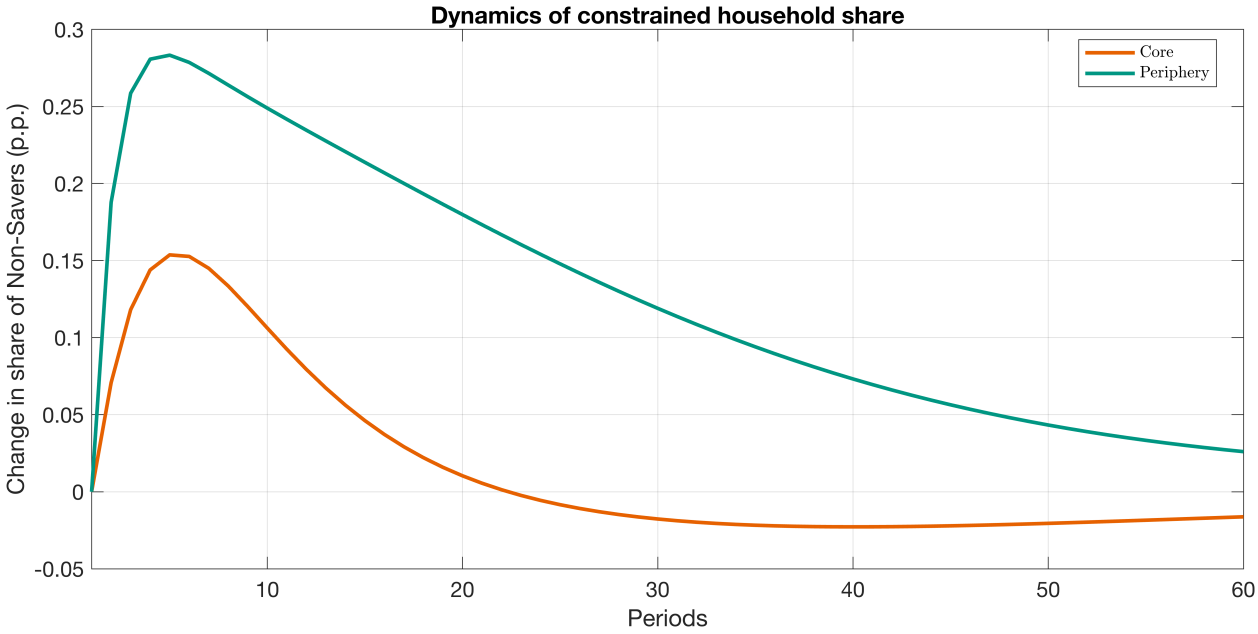

Figure 16: Dynamics of the Constrained Household Share

The figure reports the change in the share of liquidity-constrained households (Non-Savers) following a negative productivity shock in the Periphery. The share rises on impact in both countries, reflecting the tightening of borrowing constraints and the fall in labor income, and gradually returns to its steady state. The response is more pronounced in the Periphery (peaking at about 0.28 percentage points) than in the Core (around 0.15 percentage points), consistent with the stronger decline in aggregate demand and limited financial buffers. These dynamics capture the endogenous reclassification of households between constrained and unconstrained states, a mechanism that is absent in the two-agent framework.

Therefore, Figure 17 compares the impulse responses of capital and consumption for Savers and Non-Savers under equity autarky (dotted lines) and the calibrated 2010 economy (solid lines).

Relative to autarky, capital market integration increases cross-country divergence in capital and consumption. Following a negative productivity shock in the Periphery, dapital in the Periphery declines by about 218 percent (cumulative deviation), compared with 153 percent under autarky. In contrast, Core capital rises by 8.2 percentage points, instead of falling by 14.1 under autarky. Savings are therefore reallocated toward the region with higher returns, amplifying the contrast between countries.

For Savers, the adjustment reflects the combined effects of diversification and reallocation. In the Periphery, Savers face a smaller decline in consumption (–192.8 versus –217.5), as Core asset holdings provide partial income insurance. In the Core, Savers experience a larger fall (–15.6 versus –9.2) due to their exposure to the Periphery downturn. Because the Periphery is more diversified, the consumption gains of Periphery Savers outweigh

the losses of Core Savers.

For Non-Savers, the transmission occurs through labor income. In the Periphery, the sharper fall in capital reduces labor demand and real wages, leading to a larger drop in consumption (–197.0 versus –187.7). In the Core, higher capital inflows sustain employment and real wages, so Non-Saver consumption declines less (–8.3 versus –12.4).

Compared to the TANK results, the qualitative patterns remain consistent but the magnitudes differ. The responses are smaller than in the two-agent model under a shock generating the same change in aggregate capital. However, this difference conceals the role of the reclassification channel. The decline in consumption among always Non-Savers is stronger than in the TANK, as heterogeneity in productivity amplifies the negative effects of the shock and primarily affects constrained households. At the same time, as more households hit their borrowing constraint and become Non-Savers, aggregate consumption within this group increases mechanically due to composition effects.

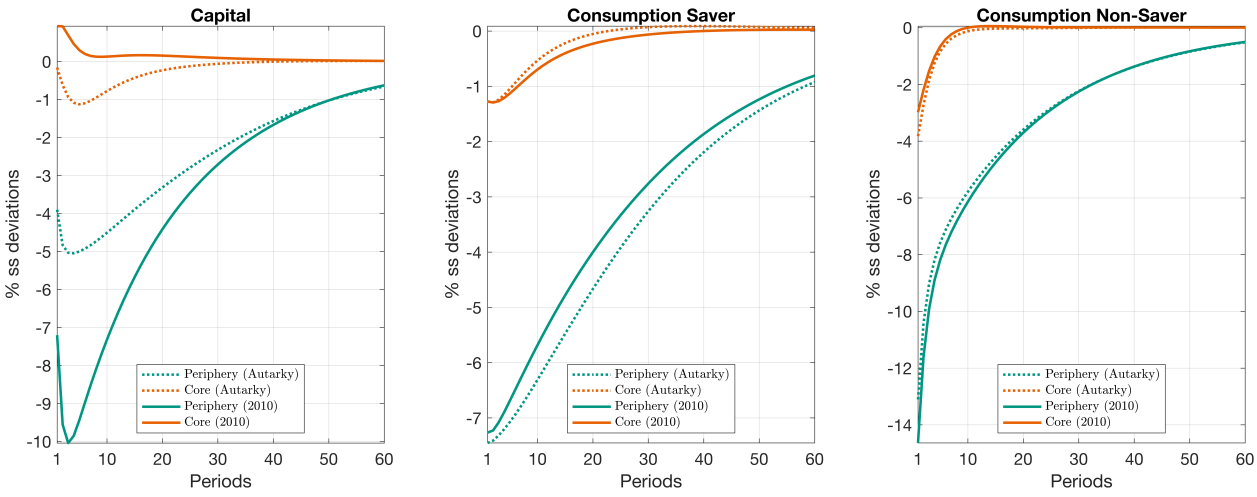

Figure 17: Impulse Responses of Capital and Consumption for Savers and Non-Savers in the Core and Periphery

The figure compares the impulse responses of capital and consumption under two configurations: the equity-autarky benchmark (dotted) and the calibrated 2010 euro area economy (solid). The calibration incorporates cross-country asymmetries in financial participation, portfolio home bias, and trade openness. Country-specific negative technology shocks are set to reproduce the observed deviations from pre-crisis capital trends one year after the shock: a 9.85% decline in the Periphery and a 0.46% rise in the Core. The experiment quantifies the role of capital market integration in shaping macroeconomic adjustment, highlighting how aggregate dynamics differ once the true financial structure of the euro area is taken into account.

Figure 18 summarizes these results by quantifying the contribution of each household group to the total change in aggregate consumption. The figure shows that most of the

adjustment in the Periphery comes from households that switch into constraint status after the shock, while the contributions of always-constrained and always-unconstrained households are negligible. In the Core, the overall adjustment is smaller but still largely driven by switchers. This confirms that the extensive margin, that is, changes in the share of constrained households, is the dominant propagation and amplification mechanism in the heterogeneous-agent model.

This mechanism is illustrated in Figures 112 and 113 in Appendix D.4, which decompose the consumption response of Non-Savers into three components: existing constrained households, newly constrained households (reclassification), and the composition effect arising from changes in the share of constrained agents. The figures show that the large aggregate movements in Non-Saver consumption are driven not by individual behavioral adjustments but by the growing share of households that become liquidity-constrained following the shock.

Overall, integration strengthens risk sharing between countries but redistributes its benefits unevenly across households. Savers in the Periphery gain from diversification, while Savers in the Core and Non-Savers in the Periphery bear a larger share of the adjustment.

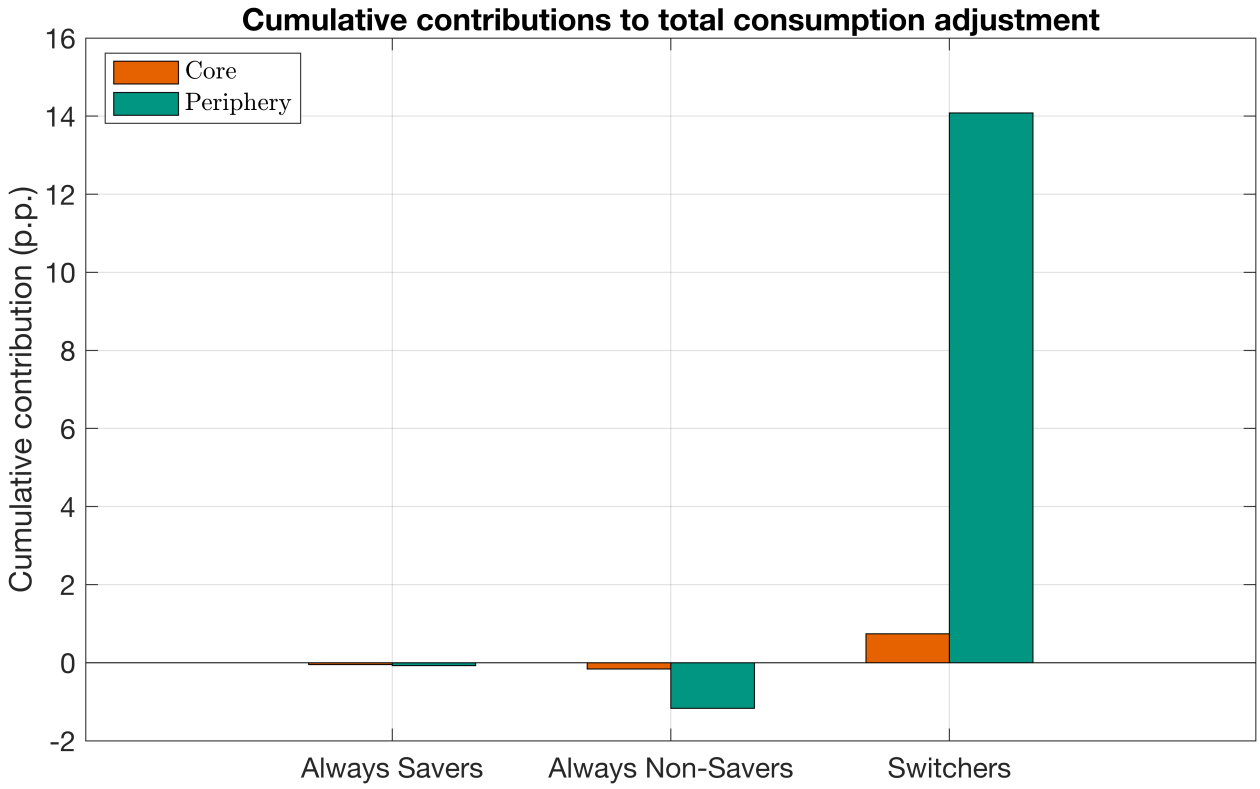

Figure 18: Cumulative Contributions to Total Consumption Adjustment

The figure decomposes the cumulative consumption adjustment into contributions from three groups of households: Always Savers, Always Non-Savers, and Switchers, defined as those who transition between constraint statuses following the shock. In the Periphery, Switchers account for nearly the entire decline in aggregate consumption (about 14 percentage points), whereas the contributions of the other groups remain limited. In the Core, the overall adjustment is smaller but still dominated by Switchers. This decomposition illustrates that the extensive margin (changes in the distribution of constraint status) constitutes the primary amplification channel of the heterogeneous-agent model.

Capital market integration reduces aggregate volatility but redistributes it unevenly across countries and households. Relative to equity autarky, the variance of total consumption falls slightly by about 1.8%, confirming that integration improves overall stabilization. At the country level, volatility declines by roughly 5.5% in the Core and 3.5% in the Periphery, consistent with enhanced cross-country risk sharing. Within countries, however, disparities in volatility increase. In the Core, the gap between Savers and Non-Savers widens as Saver volatility rises by about 21% while Non-Saver volatility falls by 37%. In the Periphery, volatility among Savers declines by 18%, whereas it rises by 16% for Non-Savers. These patterns indicate that integration smooths fluctuations between countries but amplifies heterogeneity within them, as financial exposure increasingly determines households' vulnerability to shocks.

Five years after the shock, relative to equity autarky, 'capital market integration increases within-country inequality in the Periphery by about 18 basis points and reduces it in the Core by about 6 basis points. At the same time, between-country inequality falls by roughly 6 basis points. Integration therefore narrows disparities across countries but widens them within the Periphery, where financially constrained households bear a larger share of the adjustment.

The welfare decomposition in Table 11 confirms these patterns. Capital market integration generates heterogeneous welfare effects across both countries and household types. Savers in the Periphery gain, as access to higher-return assets allows them to diversify away from local shocks. Core Non-Savers also benefit, since cross-country risk sharing stabilizes consumption and cushions domestic fluctuations. In contrast, Core Savers incur moderate welfare losses because returns on domestic assets fall after capital outflows. Periphery Non-Savers also lose, as weaker labor markets and limited access to financial income offset any gains from integration. Overall, welfare gains are concentrated among asset holders in the Periphery and among unconstrained households in the Core, while liquidity-constrained agents in both regions bear the costs of adjustment. These results show that the distributional effects of financial integration depend critically on portfolio structure and households' position in the income distribution.

Table 11: Welfare Decomposition Relative to Autarky (Discounted Utilities)

Household	ΔU^{C}	ΔU^{Total}	CEV (%)
Capital Market Integration			
Core Saver	-0.016	-0.571	-16.075
Core Non-Saver	+0.029	-0.526	+35.099
Periphery Saver	+0.074	-9.328	+9.354
Periphery Non-Saver	-0.081	-9.484	-7.999

The decomposition of cumulative consumption adjustments confirms that these *switchers*, households that transition between constrained and unconstrained states, account for most of the aggregate movement. In the Periphery, their contribution explains virtually all of the consumption decline, while the impact of households that remain permanently constrained or unconstrained is limited. In the Core, the mechanism operates in reverse: some households exit constraint status as higher capital inflows and wages ease liquidity pressures. Hence, the interaction between aggregate shocks and the endogenous distribution of constraint status amplifies adjustment in the Periphery and stabilizes it in the

Core. This extensive-margin mechanism is the main source of amplification and persistence in the heterogeneous-agent model and represents the key departure from the TANK framework, where the mass of constrained households is fixed by assumption.

These results highlight that the aggregate stabilization benefits of integration coexist with stronger within-country asymmetries once heterogeneity and endogenous participation are taken into account

7 Conclusion

The analysis shows that who benefits from capital market integration in the euro area depends critically on both where and who you are. Capital market integration operates through two channels, diversification and reallocation, that shape welfare and adjustment asymmetrically across households and countries. In the Periphery, integration stabilizes the consumption of wealthy Savers through diversification but exposes Non-Savers to deeper labor income losses as capital outflows depress domestic activity. In the Core, by contrast, capital inflows cushion wages and benefit liquidity-constrained households, while financially integrated Savers face lower returns through their exposure to the Periphery.

Taken together, these results imply that the main beneficiaries of capital market integration are asset-holding households in financially constrained regions and wage earners in capital-receiving economies, while liquidity-constrained households in debtor regions lose the most. At the aggregate level, integration stabilizes the monetary union but redistributes welfare both across and within countries, narrowing inequality in the Core while widening it in the Periphery. Integration therefore smooths fluctuations across countries but amplifies heterogeneity within them, as financial exposure increasingly determines households' vulnerability to shocks.

Importantly, once financial participation becomes endogenous, the reclassification of households between constrained and unconstrained states becomes a key amplification mechanism. These switchers account for most of the aggregate consumption adjustment, as changes in financial participation magnify downturns in debtor economies and help stabilize activity in creditor ones.

These findings also suggest that deep financial integration in a monetary union requires complementary adjustment mechanisms such as labor mobility, fiscal transfers, or broader financial participation to prevent the uneven distribution of gains and losses across regions. In their absence, the stabilizing benefits of integration risk being offset by rising internal imbalances.

Finally, a natural next step is to extend this framework beyond the euro area to explore the global dimension of capital market integration, focusing on linkages between the United States and the euro area. Both are large monetary unions but differ markedly in the depth and inclusiveness of their financial systems. The United States features deeper capital markets and broader household participation, while the euro area remains more segmented and financially heterogeneous. This contrast provides a natural setting to study how deeper participation and higher diversification reshape the distributional consequences of integration, how they influence the broader effects of globalization, and how cross-regional asymmetries transmit shocks internationally.

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A Empirics

A.1 Cluster

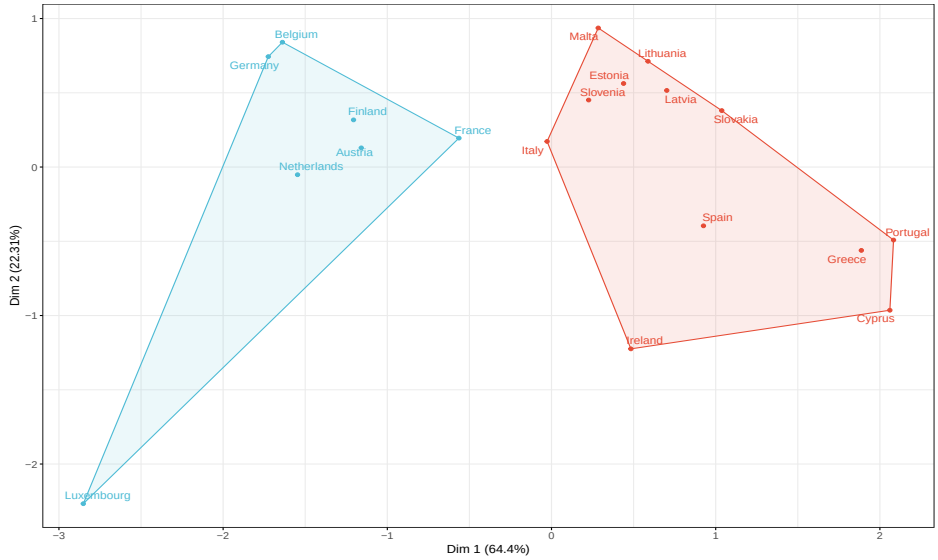


Figure 19: Clustering of Euro Area Countries in 2010. The figure shows the PCA–*k*-means classification of euro area countries into Core (red) and Periphery (blue) groups based on three indicators of pre-crisis imbalances: current account balance to GDP, net international investment position (NIIP, % of GDP), and GDP per capita. Dimension 1 mainly reflects external imbalances (CA/GDP: 38.7%; NIIP: 33.7%; GDP per capita: 27.6%), while Dimension 2 captures income differences (GDP per capita: 66.1%; NIIP: 31.2%; CA/GDP: 2.7%).

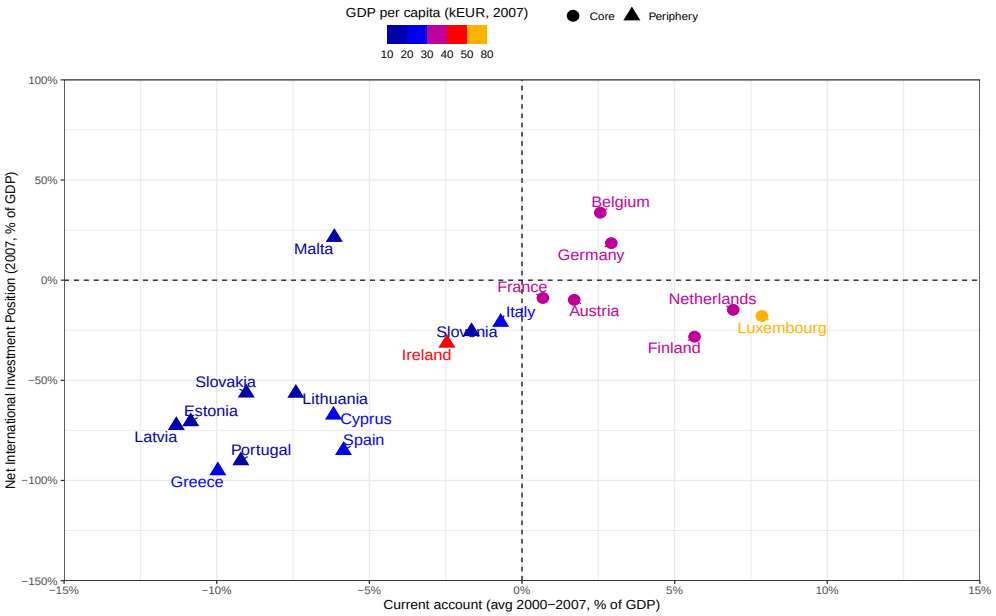


Figure 20: Clustering of Euro Area Countries in 2007. Euro area countries are plotted by their average current account balance (2000–2007, % of GDP) and net international investment position (NIIP, 2007, % of GDP). Marker color reflects GDP per capita (in thousand EUR, 2007). Core countries (circles) and Periphery countries (triangles) are derived from a PCA–*k*-means clustering based on these indicators.

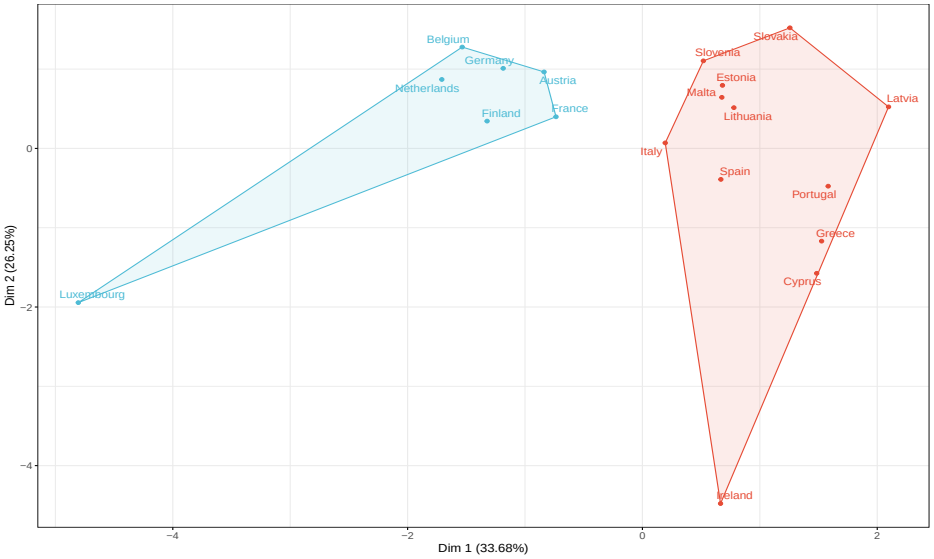


Figure 21: Robustness 1 - Clustering for 2010. The PCA–*k*-means classification is extended to include financial variables: market capitalization (% of GDP), equity return, portfolio domestic share, number of investment partners, and openness (% of GDP). The resulting Core–Periphery grouping remains identical to the baseline, confirming the stability of the classification. Main contributions to Dimension 1: GDP per capita (29.9%), market capitalization (26.9%), CA/GDP (17.9%), NIIP (15.9%); Dimension 2: domestic share (34.7%), equity return (24.2%), NIIP (14.5%), openness (13.7%).

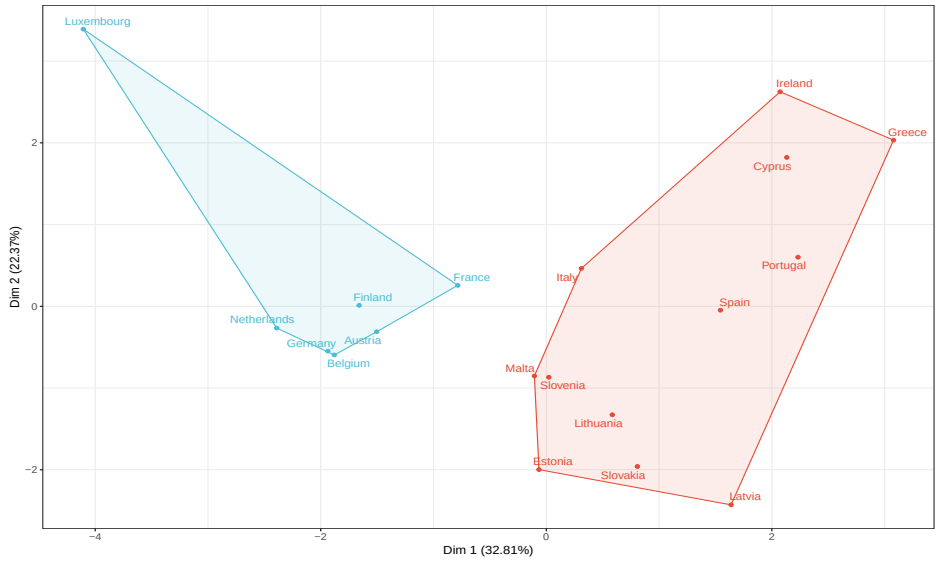


Figure 22: Robustness 2 - Clustering for 2010. Additional macro variables are included: unemployment rate, financial account (% of GDP), and real GDP growth (2009–2010). The Core–Periphery classification remains unchanged. Contributions to Dimension 1: NIIP (18.3%), CA/GDP (18.0%), FA/GDP (14.6%), GDP per capita (13.0%), market capitalization (12.4%), unemployment (10.7%). Contributions to Dimension 2: domestic share (24.2%), GDP per capita (19.1%), openness (13.1%), market capitalization (11.3%), FA/GDP (8.1%).

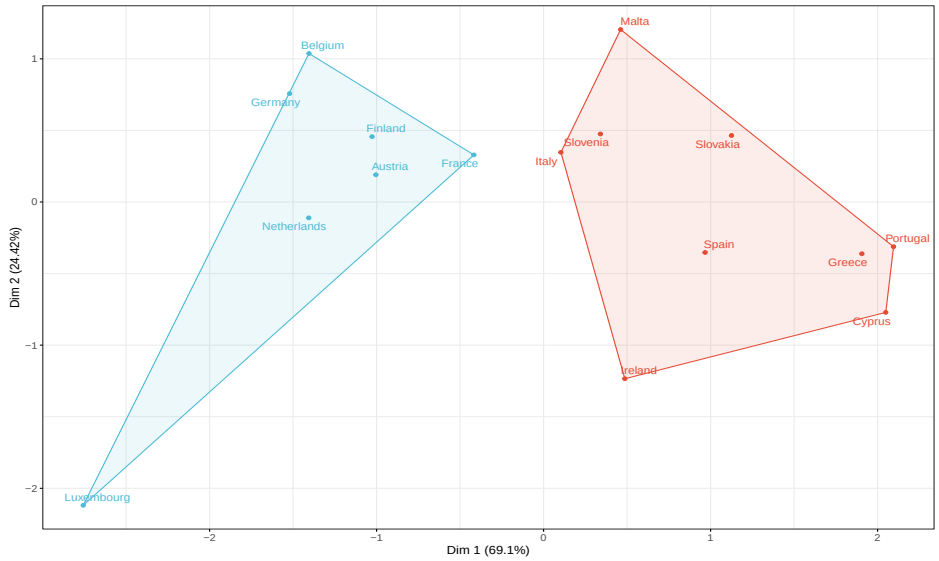


Figure 23: Clustering of Euro Area Countries in 2010 (restricted sample). The PCA–*k*-means clustering is restricted to euro area members as of 2010, excluding Estonia, Latvia, and Lithuania. Countries are classified into Core (red) and Periphery (blue) based on three indicators of pre-crisis imbalances: current account balance to GDP, net international investment position (NIIP, % of GDP), and GDP per capita. Dimension 1 mainly reflects external imbalances (CA/GDP: 42.9%, NIIP: 29.3%, GDP per capita: 27.8%), while Dimension 2 captures income differences (GDP per capita: 52.7%, NIIP: 47.3%, CA/GDP: 0.0%).

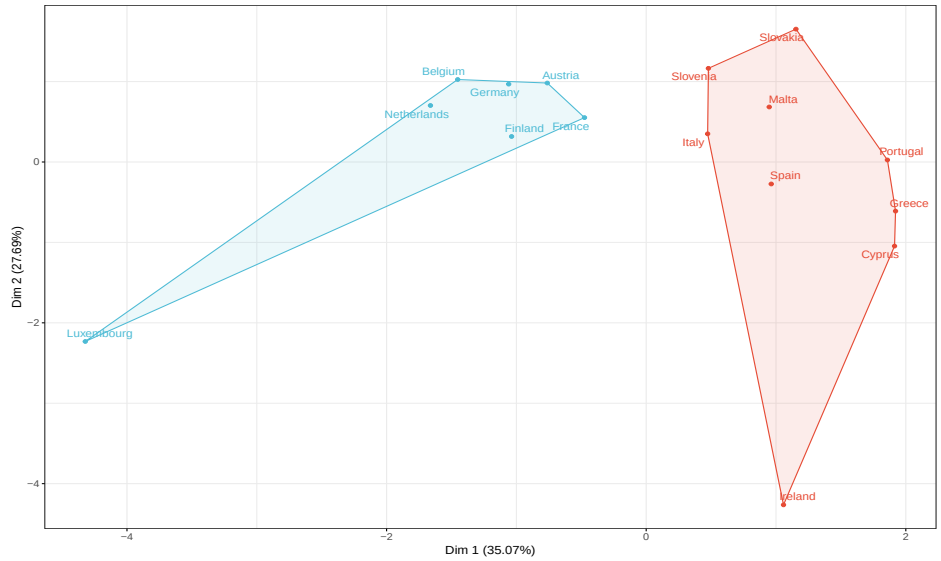


Figure 24: Robustness 1 - Clustering for 2010 (restricted sample). The PCA–*k*-means clustering is extended to include additional financial variables: market capitalization (% of GDP), equity return, portfolio domestic share, number of investment partners, and openness (% of GDP). Results remain consistent with the baseline classification. Main contributions to Dimension 1: CA/GDP (27.1%), GDP per capita (26.5%), market capitalization (22.7%), NIIP (15.7%), openness (3.2%). Main contributions to Dimension 2: portfolio domestic share (37.8%), equity return (26.3%), NIIP (12.6%), GDP per capita (9.6%), openness (8.8%).

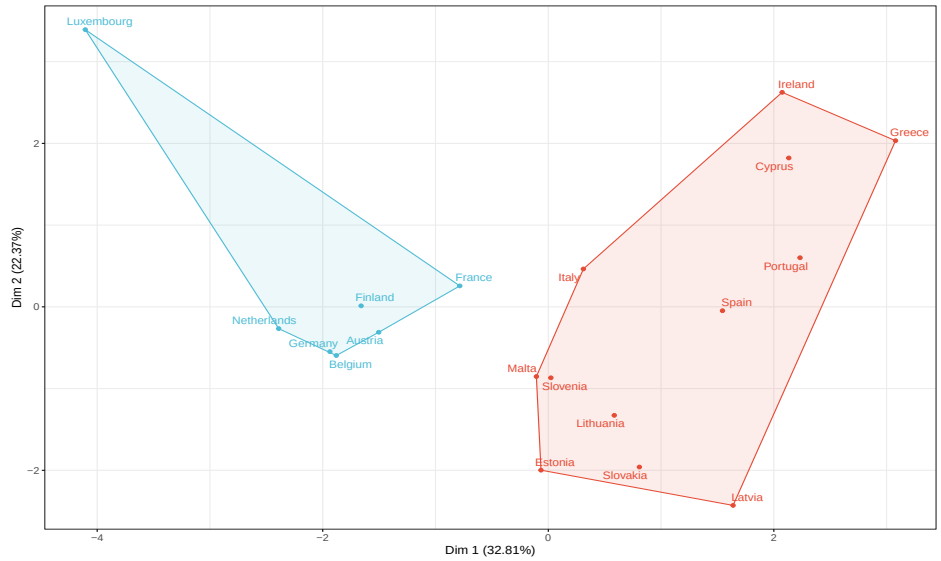


Figure 25: Robustness 2 - Clustering for 2010 (restricted sample). The classification includes additional macroeconomic variables: unemployment rate, financial account (% of GDP), and real GDP growth (2009–2010). The Core–Periphery structure remains unchanged. Main contributions to Dimension 1: NIIP (18.3%), CA/GDP (18.0%), FA/GDP (14.6%), GDP per capita (13.0%), market capitalization (12.4%), unemployment (10.7%). Main contributions to Dimension 2: domestic share (24.2%), GDP per capita (19.1%), openness (13.1%), market capitalization (11.3%), FA/GDP (8.1%).

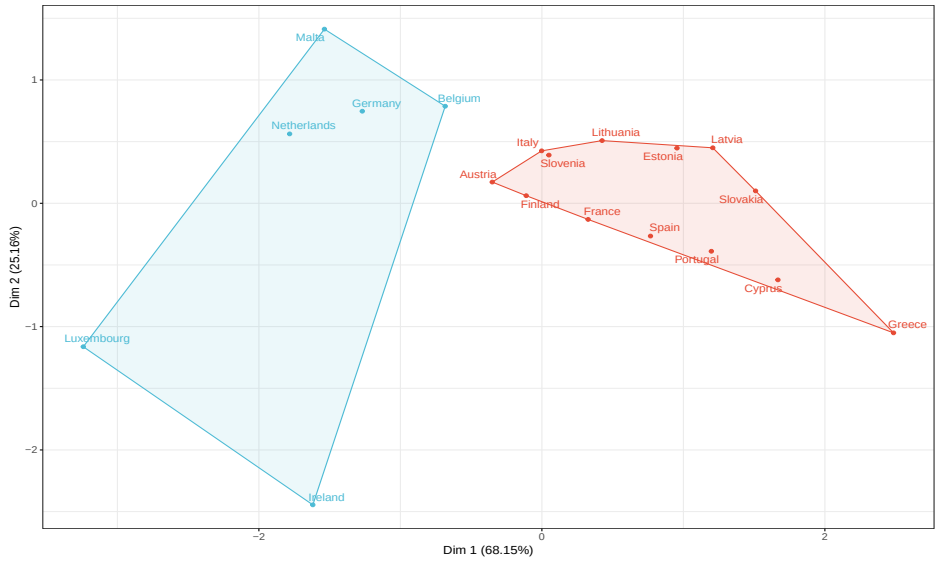


Figure 26: Clustering of Euro Area Countries in 2021. The PCA–*k*-means classification is replicated using 2021 data. France moves from the Core to the Periphery, indicating deeper heterogeneity since the crisis. Main contributions: Dimension 1 (CA/GDP: 43.1%, GDP per capita: 32.9%, NIIP: 23.9%) and Dimension 2 (NIIP: 64.6%, GDP per capita: 34.7%, CA/GDP: 0.7%).

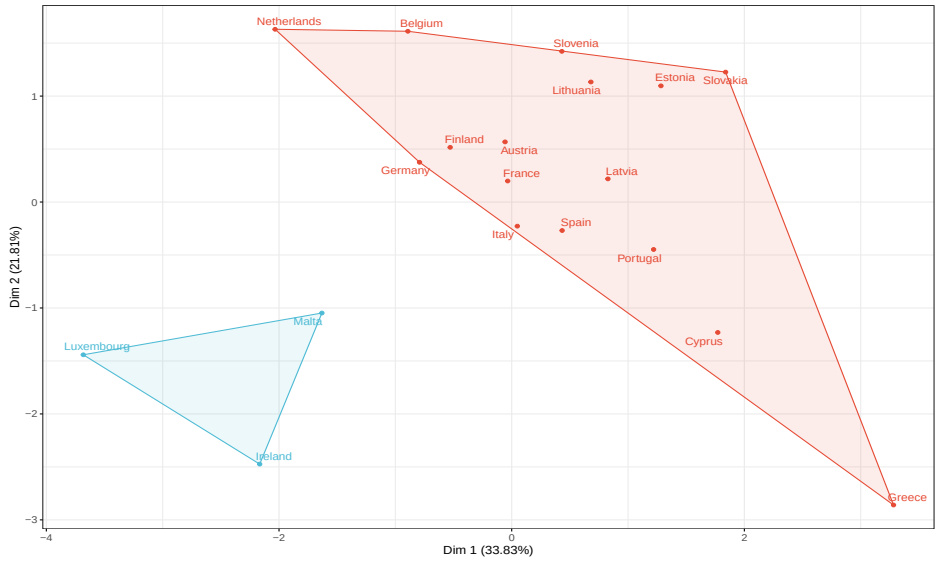


Figure 27: Robustness 1 - Clustering for 2021. The clustering includes additional financial indicators: market capitalization (% of GDP), equity return, portfolio domestic share, number of investment partners, and openness (% of GDP). The Core–Periphery classification remains broadly consistent. Main contributions to Dimension 1: CA/GDP (31.2%), GDP per capita (25.7%), NIIP (15.7%), portfolio domestic share (10.6%), market capitalization (9.1%). Main contributions to Dimension 2: openness (31.9%), equity return (28.3%), NIIP (16.0%), portfolio domestic share (10.7%), GDP per capita (5.4%).

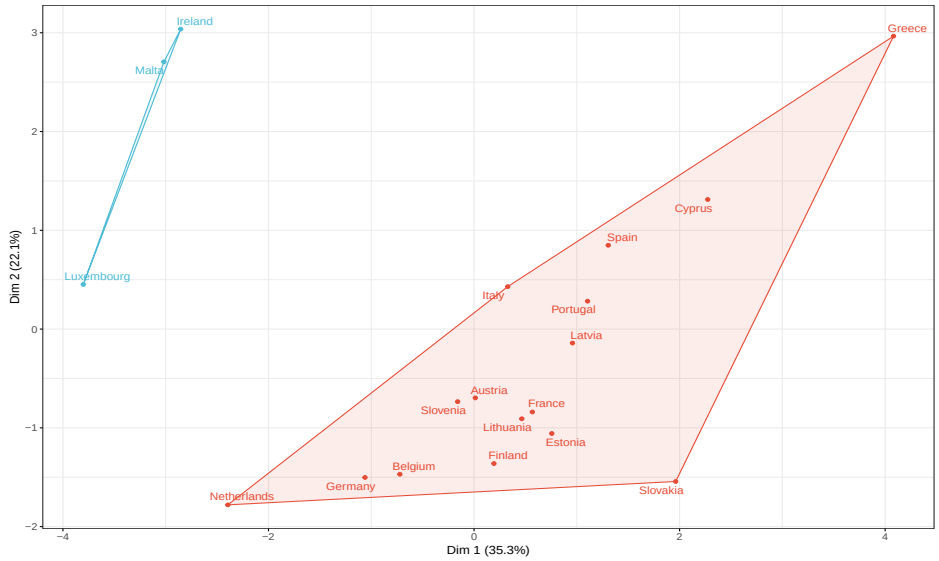


Figure 28: Robustness 2 - Clustering for 2021. The clustering further includes macroeconomic indicators: unemployment rate, financial account (% of GDP), real GDP growth, and portfolio structure variables. The Core–Periphery partition remains qualitatively stable. Main contributions to Dimension 1: CA/GDP (23.1%), FA/GDP (21.2%), GDP per capita (14.6%), NIIP (11.9%), unemployment (11.5%). Main contributions to Dimension 2: real GDP (28.0%), openness (16.0%), equity return (14.2%), number of investment partners (13.2%), NIIP (9.2%).

A.2 Two New Stylized Facts: Divergent Wealth and Capital Stocks

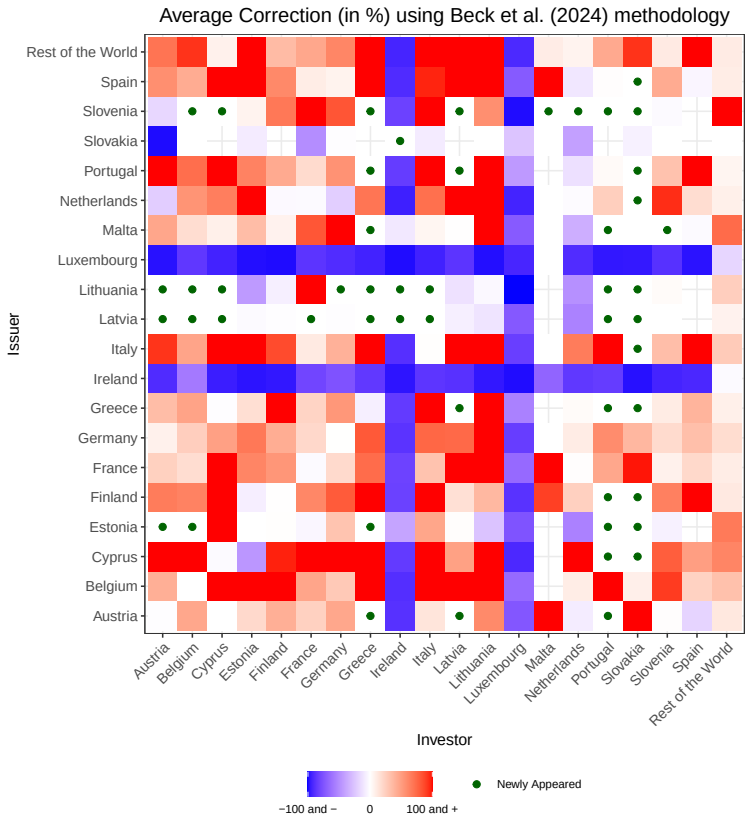


Figure 29: Average Correction (in %) Using the Beck et al. [2024] Methodology. The figure reports the average correction applied to bilateral investment positions (Issuer–Investor) between euro area countries and the Rest of the World, following the reallocation procedure of Beck et al. [2024]. Corrections are computed as the average percentage change between the original CPIS data and the adjusted dataset over 2014–2020. Red cells indicate downward corrections (reductions in reported holdings), blue cells indicate upward corrections (increases in holdings), and green dots mark pairs that newly appear in the corrected dataset. The adjustment reallocates portfolio positions routed through Luxembourg, Ireland, and the Netherlands to the Rest of the World, correcting for the fund-platform bias in euro area investment data.

A.2.1 Additional distributional evidence: financial wealth, income

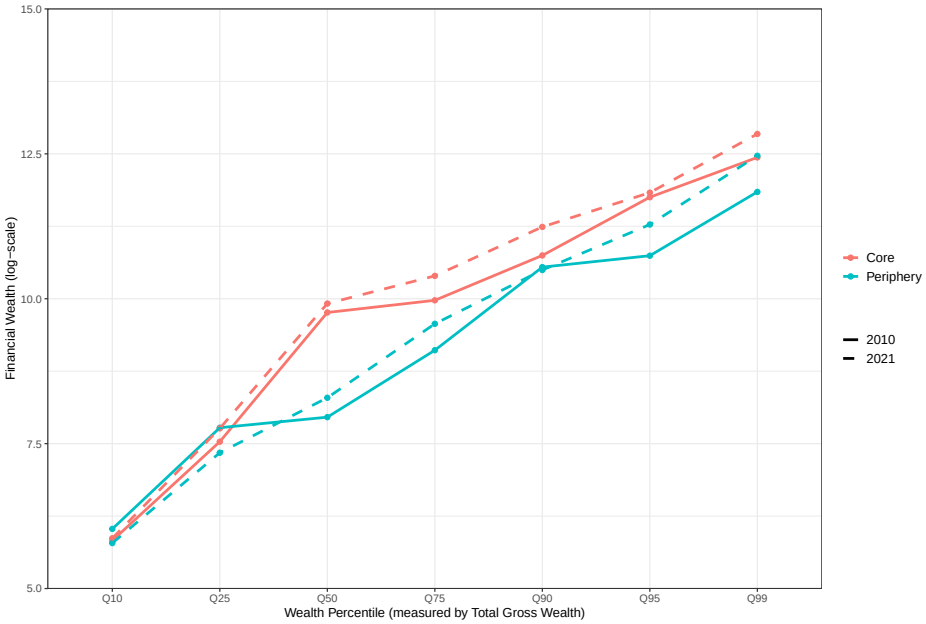


Figure 30: Change in Financial Wealth Across the Wealth Distribution (2021 vs. 2010). The figure plots the log deviation in financial wealth between 2021 and 2010 across percentiles of the wealth distribution for Core and Periphery households. Financial wealth includes bonds, equities, mutual funds, and private pensions, and excludes deposits.

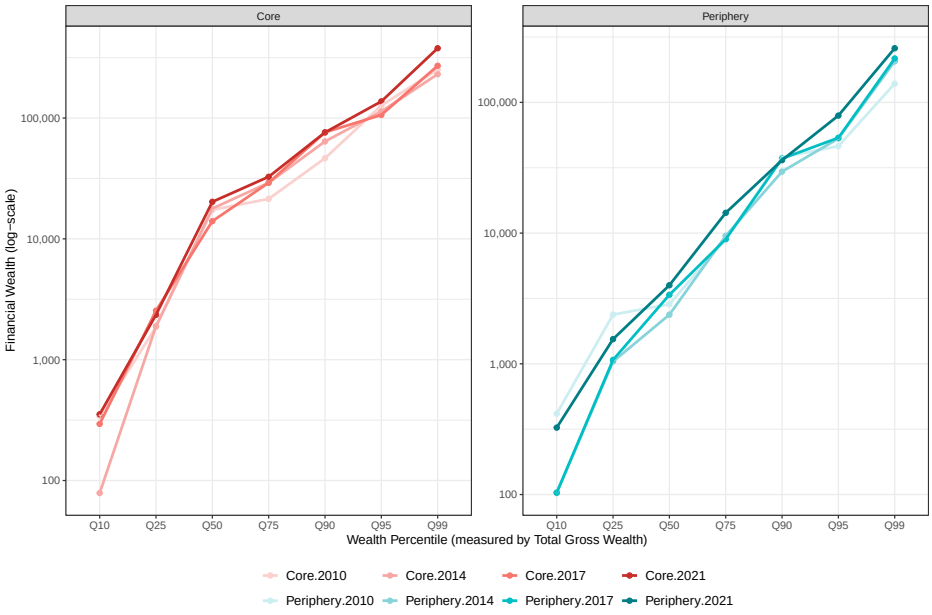


Figure 31: Financial Wealth Distribution (All Waves). The figure reports financial wealth (excluding deposits) by percentile for Core and Periphery households over the four HFCS waves (2010, 2014, 2017, and 2021).

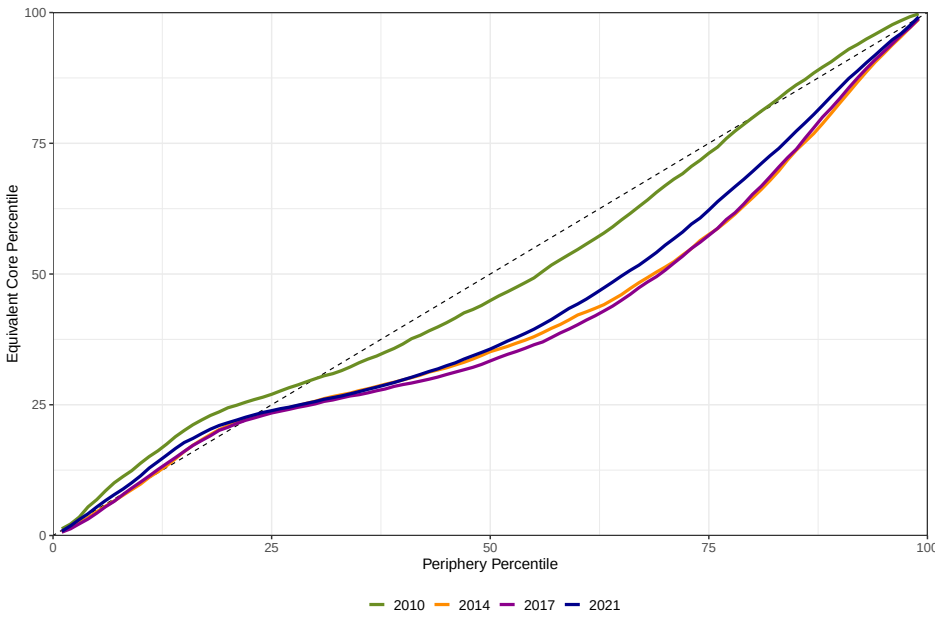


Figure 32: Equivalent Percentiles of Wealth Across Groups. This figure maps equivalent percentiles in the wealth distributions of the Core and Periphery.

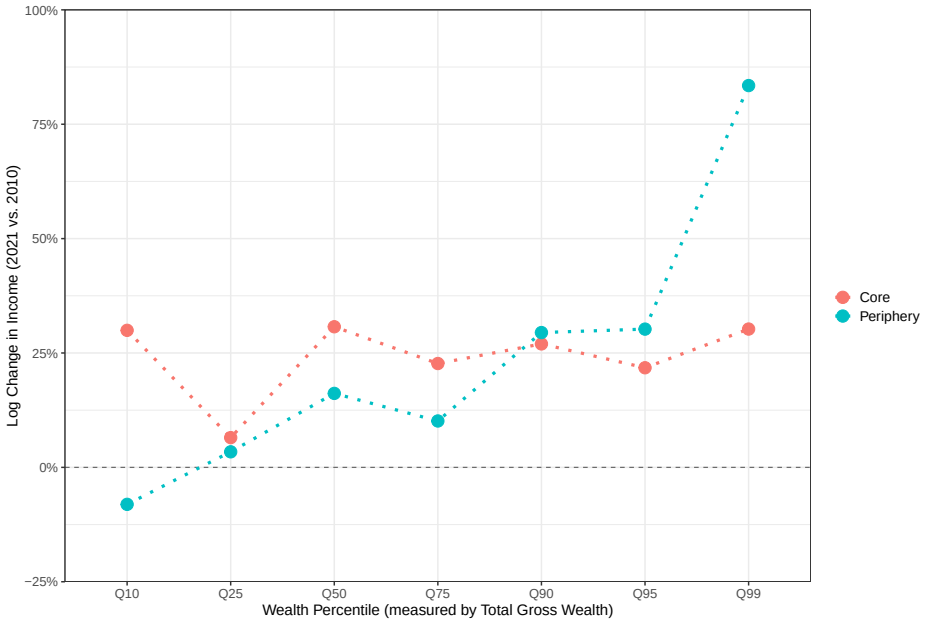


Figure 33: Change in Income Across the Wealth Distribution (2021 vs. 2010) The figure plots the log deviation in income between 2021 and 2010 across percentiles for Core and Periphery households.

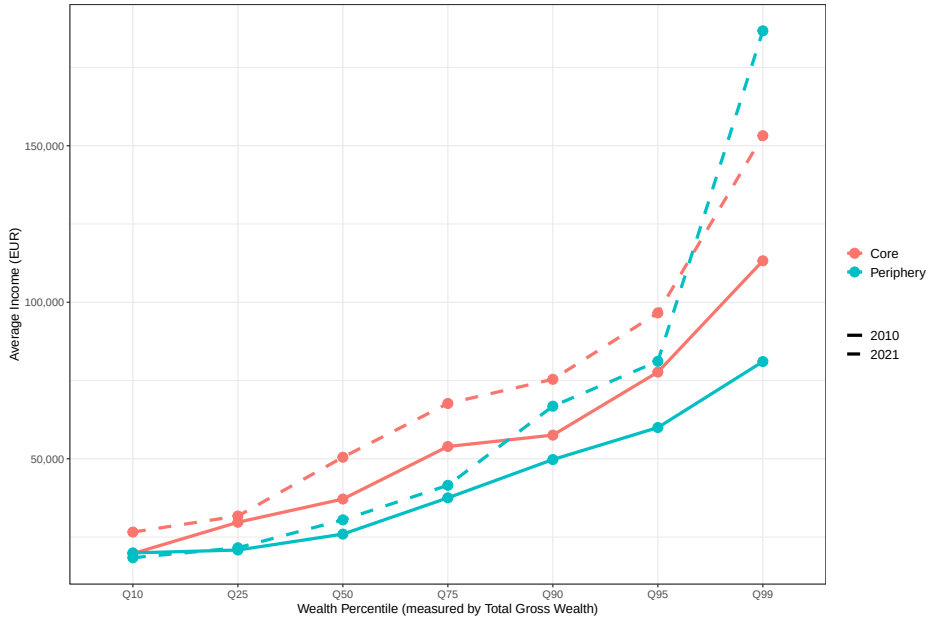


Figure 34: Income in Levels Across Wealth Distribution (2021 vs. 2010). The figure compares income in levels along the wealth distributions for Core and Periphery households in 2010 and 2021.

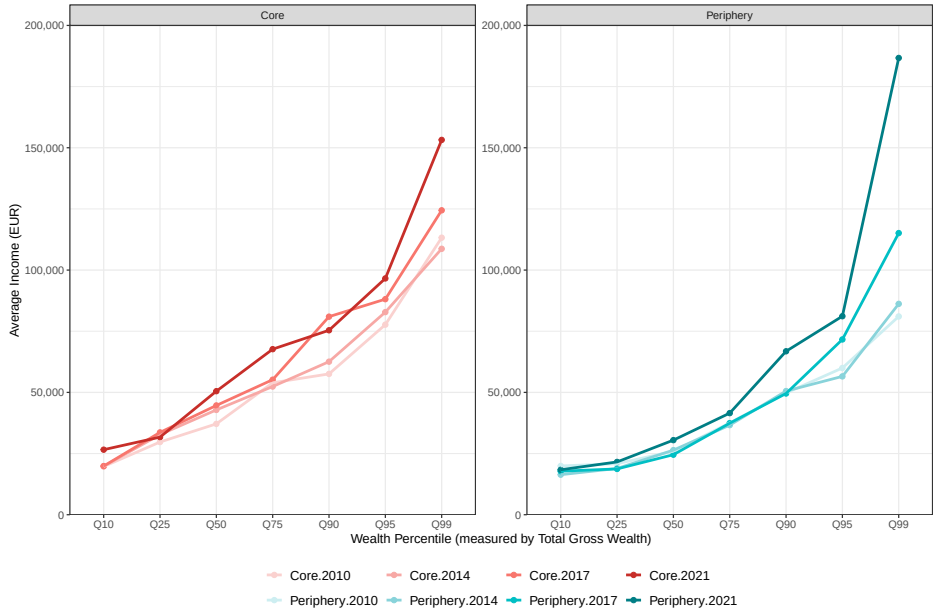


Figure 35: Income Across Wealth Distribution (All Waves) The figure reports household income by percentile for the Core and Periphery across the 2010, 2014, 2017, and 2021 HFCS waves.

A.2.2 Wealth Distributions

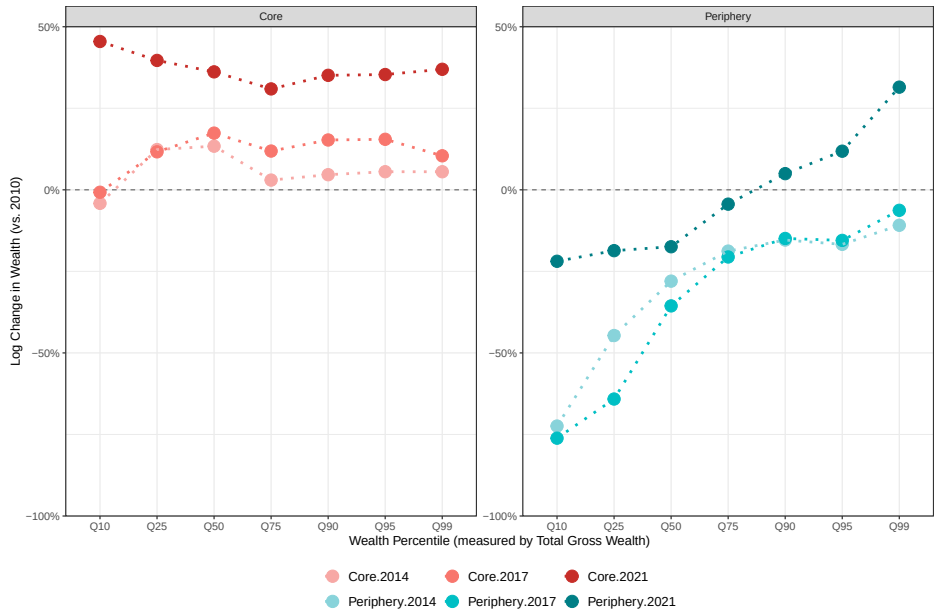


Figure 36: Evolution of Wealth Distributions (All Waves). The figure plots the log change in total gross wealth across percentiles relative to 2010 for each wave of the HFCS (2014, 2017, and 2021), comparing the Core and Periphery groups. The 2021 wave shows an upward shift in both distributions across all percentiles, likely reflecting post-COVID fiscal support.

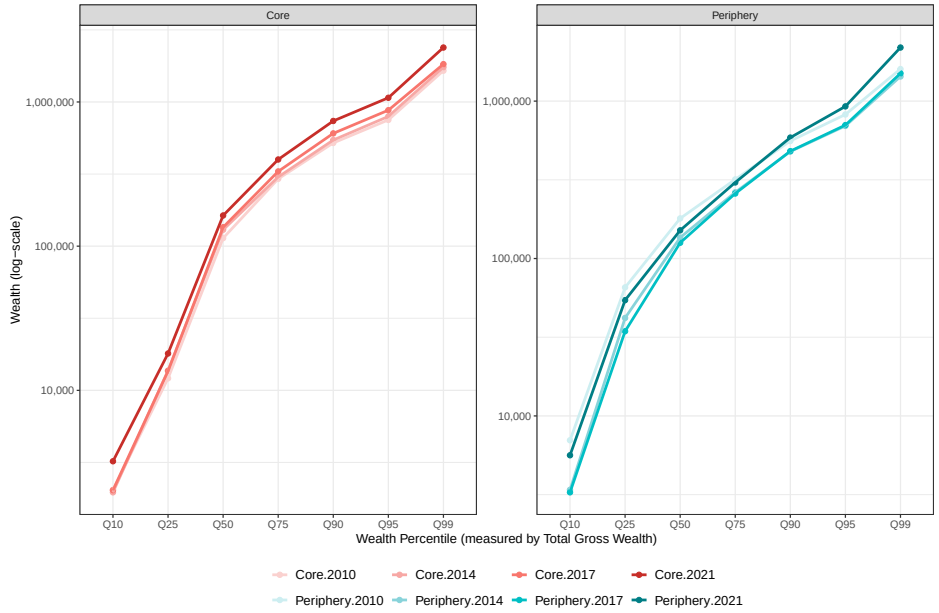


Figure 37: Wealth Distribution in Levels (All Waves). The figure presents the distribution of total gross wealth across percentiles for the Core and Periphery, shown in values (euros).

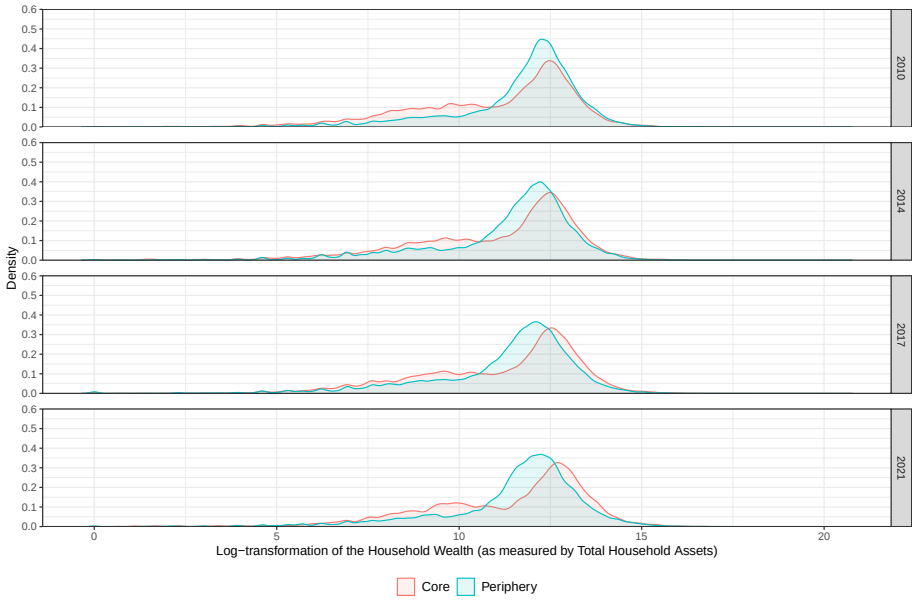


Figure 38: Wealth Distribution for Core and Periphery (All Waves). The figure compares the entire wealth distributions of Core and Periphery groups over all HFCS waves (2010–2021). The divergence between the two groups increases over time.

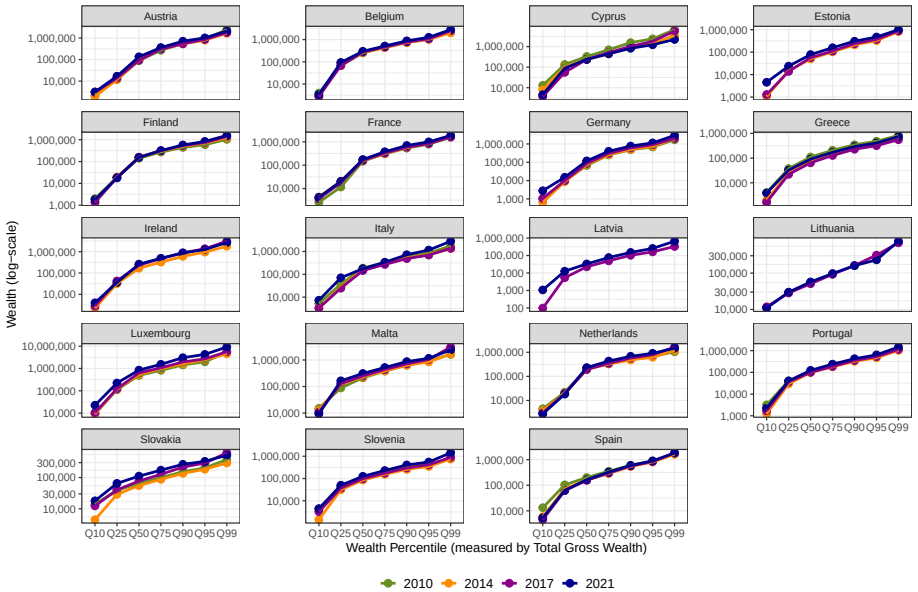


Figure 39: Wealth Distribution by Country and Quantile (All Waves). The figure plots the evolution of wealth across percentiles for each country between 2010 and 2021.

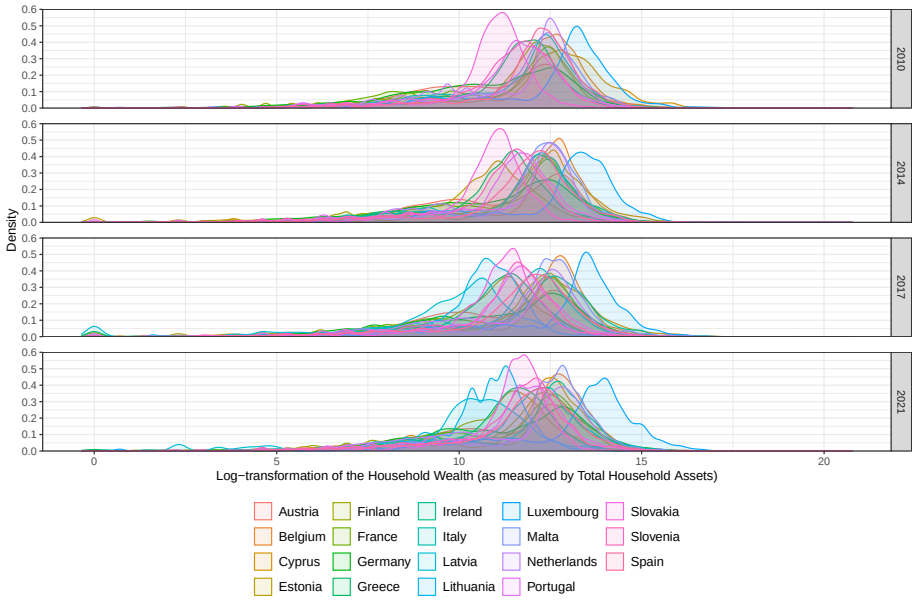


Figure 40: Wealth Distribution by Country (Full Sample). The figure shows the entire wealth distribution for each euro area country across all HFCS waves.

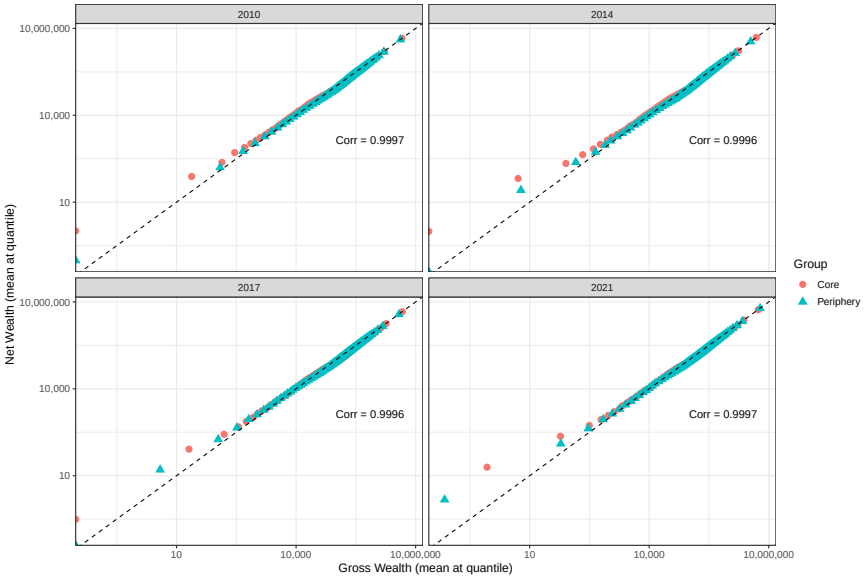


Figure 41: Correlation Between Net and Gross Wealth Across Waves. The figure reports the correlation between net and gross household wealth for each HFCS wave and group (Core and Periphery). The near-perfect correlation (close to one) indicates that the main patterns documented for gross wealth are not driven by household debt positions but by differences in asset accumulation.

A.2.3 Income/Wealth

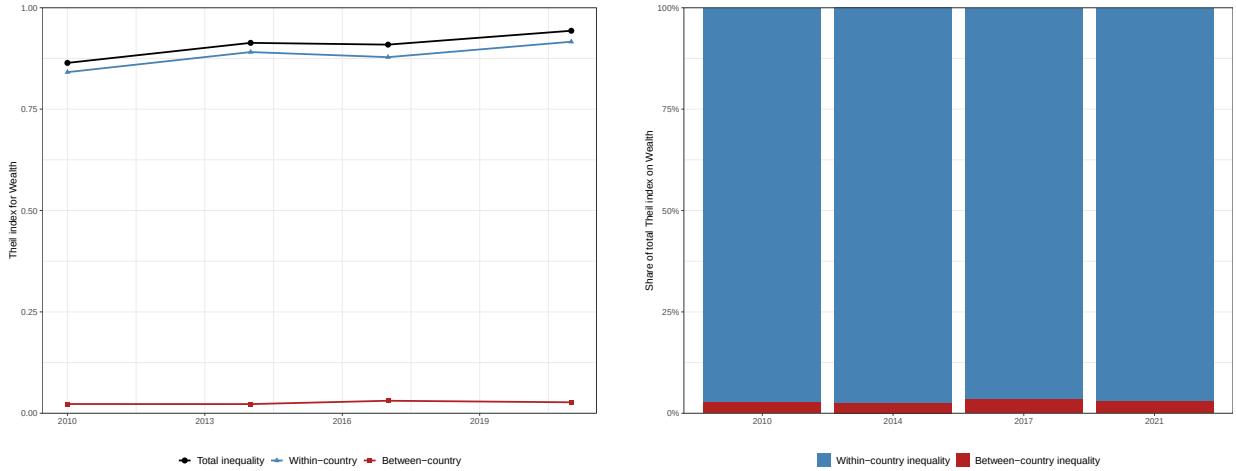


Figure 42: Wealth Inequality and Its Decomposition in the Euro Area (2010–2021). Panel (a) reports the Theil index of wealth inequality computed at the country level for each wave of the HFCS. Panel (b) decomposes total euro area wealth inequality into its *within-country* and *between-country* components.

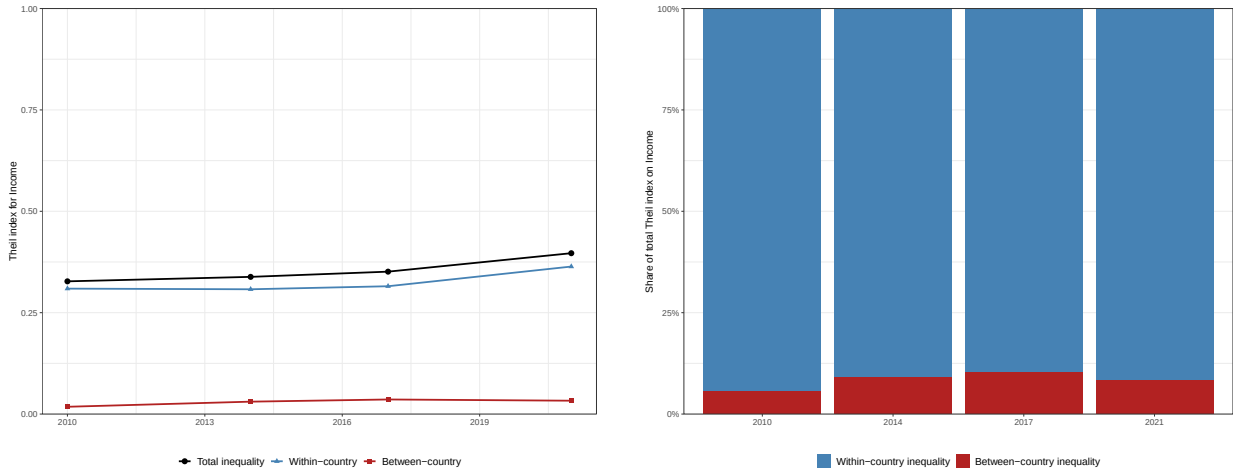


Figure 43: Income Inequality and Its Decomposition in the Euro Area (2010–2021). Panel (a) reports the Theil index of income inequality computed at the country level for each wave of the HFCS. Panel (b) decomposes total euro area income inequality into its *within-country* and *between-country* components.

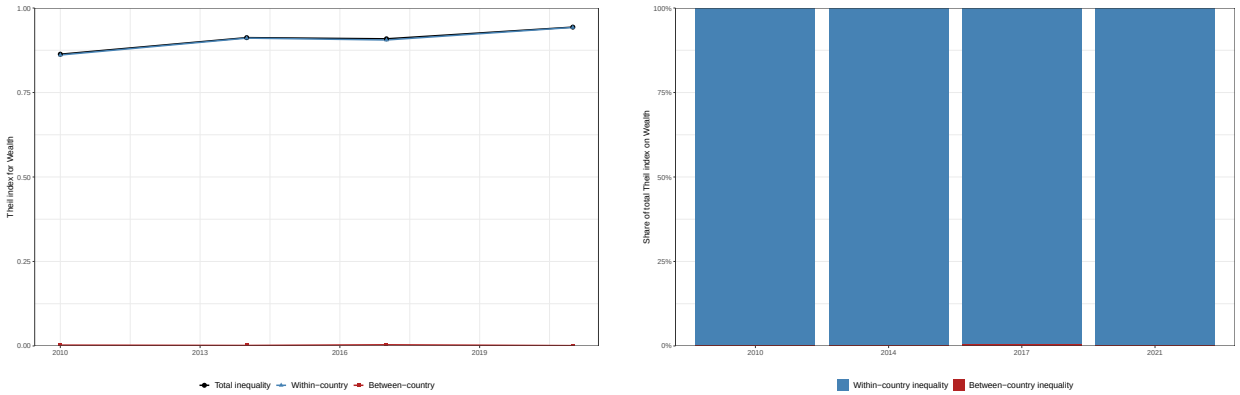


Figure 44: Wealth Inequality and Its Decomposition in the Euro Area (2010–2021). Panel (a) reports the Theil index of wealth inequality computed at the group level for each wave of the HFCS. Panel (b) decomposes total euro area wealth inequality into its *within-group* and *between-group* components.

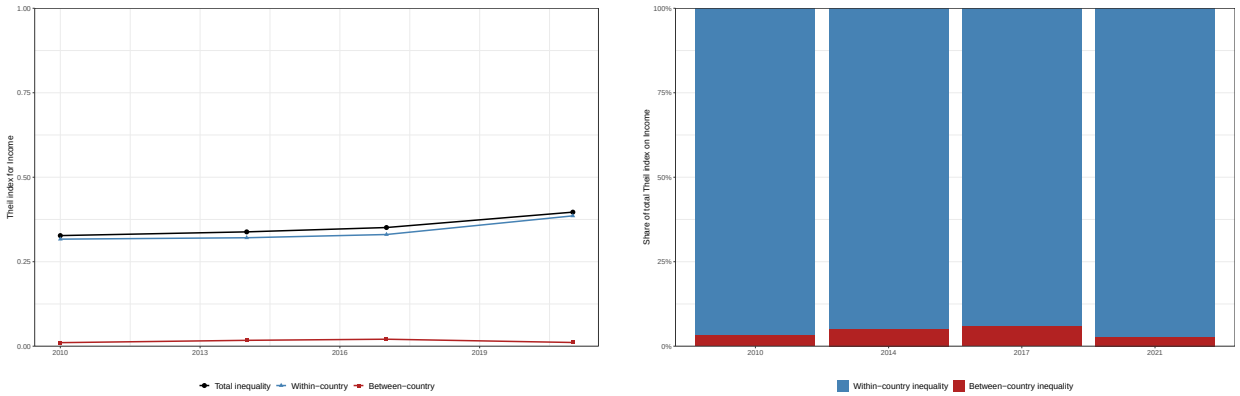


Figure 45: Income Inequality and Its Decomposition in the Euro Area (2010–2021). Panel (a) reports the Theil index of income inequality computed at the group level for each wave of the HFCS. Panel (b) decomposes total euro area income inequality into its *within-group* and *between-group* components.

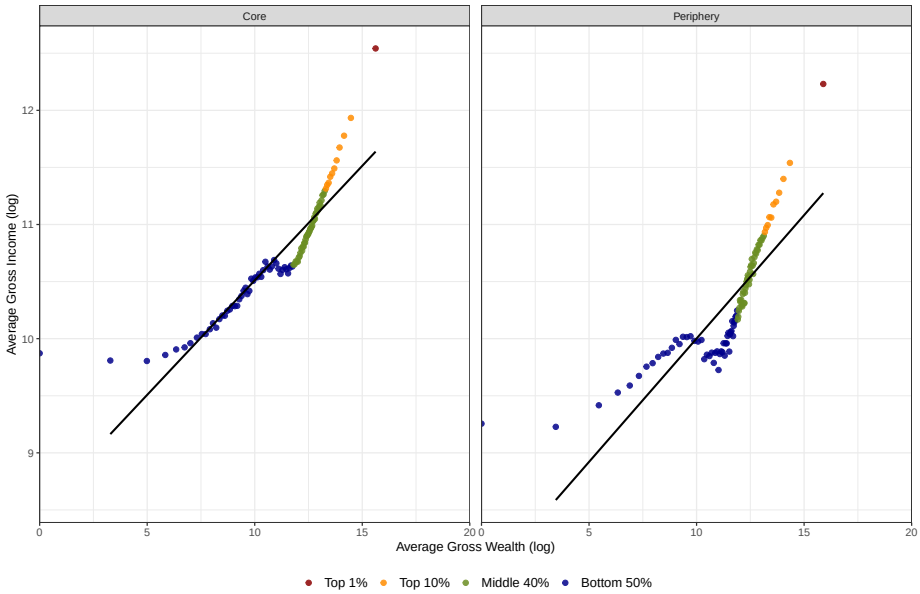


Figure 46: Wealth–Income Relationship in the Euro Area: Core vs. Periphery (All Years Combined). The figure plots the relationship between average wealth and income across percentiles for the Core and Periphery groups, pooling all HFCS waves (2010–2021). The positive slope reflects the strong association between income and wealth across the distribution, with higher wealth–income elasticity observed in the Core than in the Periphery.

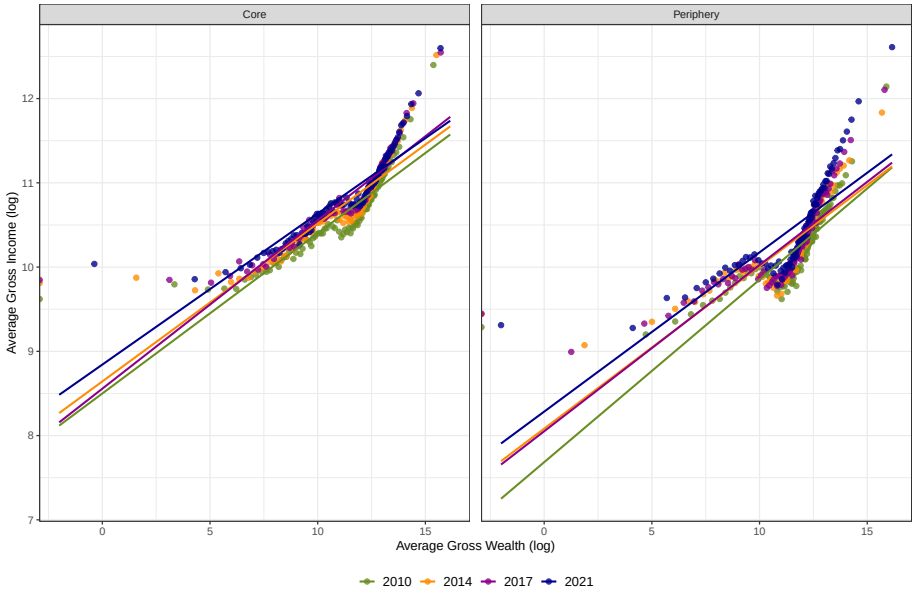


Figure 47: Wealth–Income Relationship by Survey Wave (Core vs. Periphery). The figure reports the wealth–income relationship separately for each HFCS wave (2010, 2014, 2017, and 2021). The Core exhibits a stable, upward-sloping relationship over time, while the Periphery shows a flattening after 2014, consistent with weaker post-crisis recovery among low- and middle-income households.

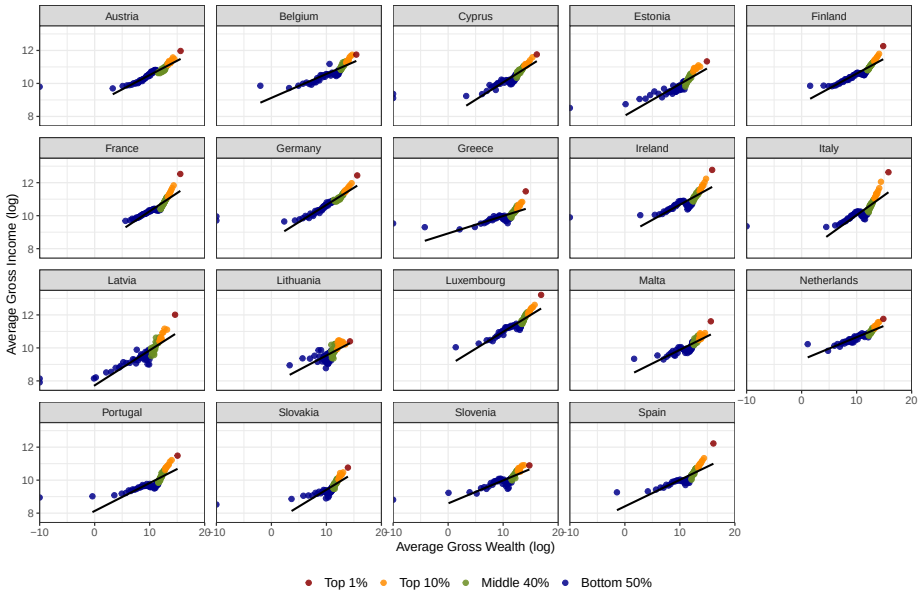


Figure 48: Wealth–Income Relationship by Country (All Years Combined). This figure displays the average relationship between wealth and income across countries, pooling all survey waves. Cross-country differences are substantial: Core countries cluster around higher wealth–income ratios, while Periphery countries display larger dispersion, especially in the middle of the distribution.

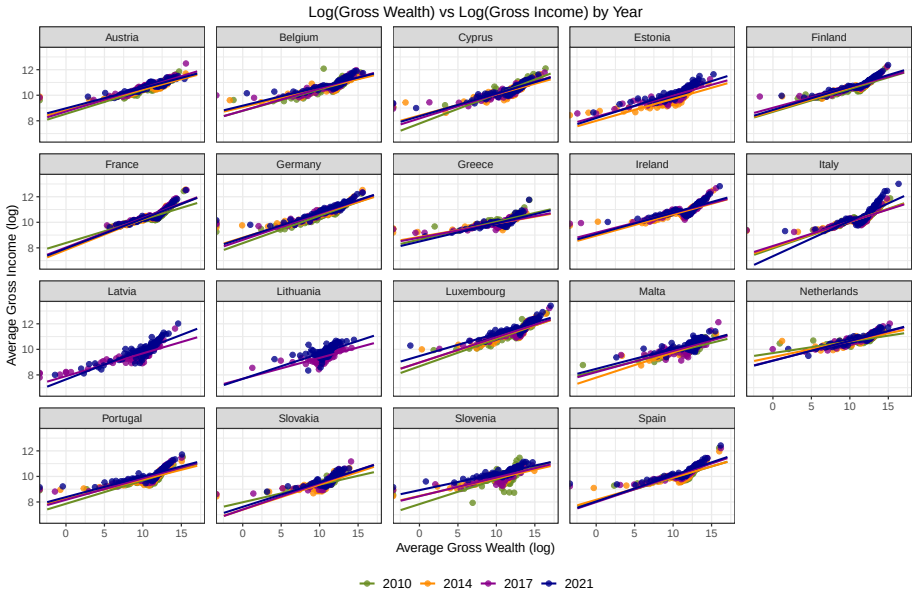


Figure 49: Wealth–Income Relationship by Country and Year. The figure illustrates the evolution of the wealth–income link across survey waves for each country. The slope of the relationship steepens in Core countries over time, whereas in several Periphery countries it flattens, reflecting persistently lower wealth accumulation for households with similar income levels.

A.2.4 Capital Stock

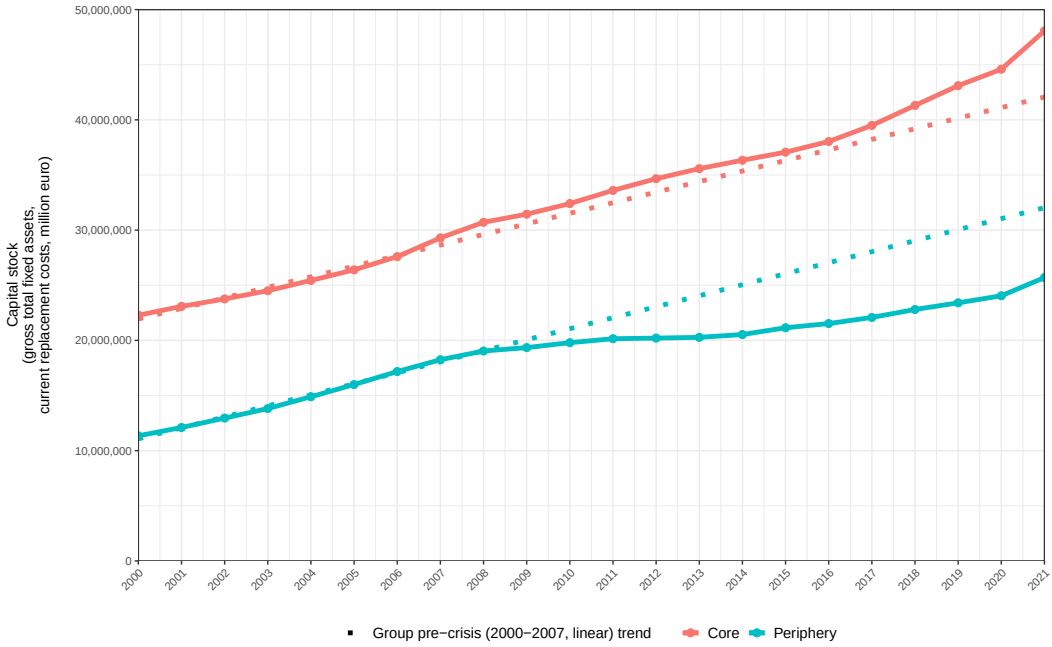


Figure 50: Gross Capital Stock and Pre-crisis Trends (2000–2021). The figure plots the evolution of the gross capital stock (total fixed assets at current replacement costs) for the Core and Periphery from 2000 to 2021. Dashed lines denote the pre-crisis linear trends (2000–2007).

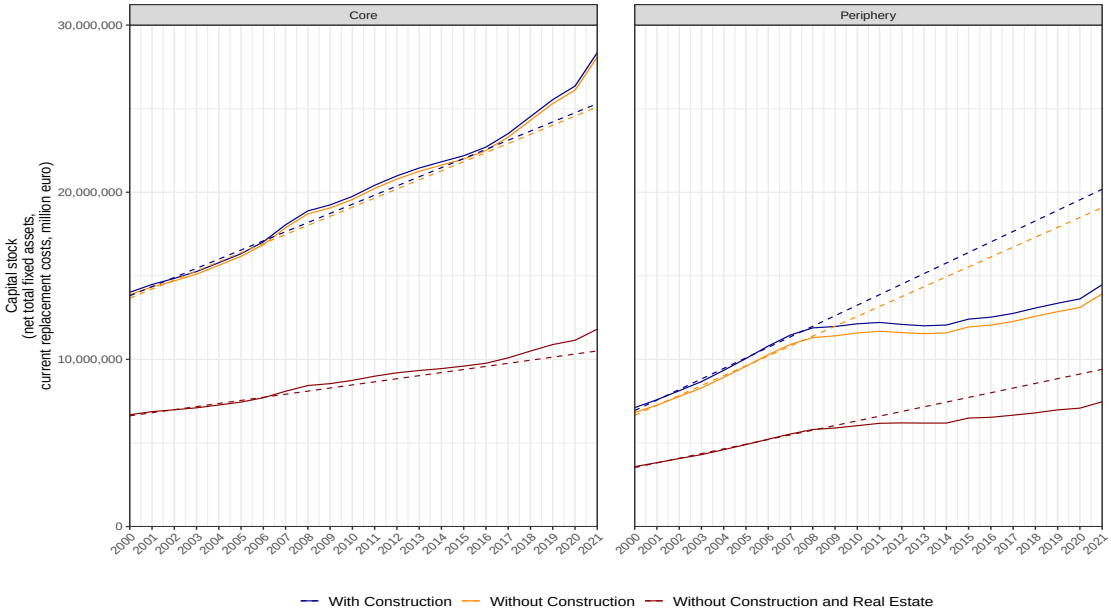


Figure 51: Net Capital Stock Excluding Construction and Real Estate (2000–2021). The figure displays the evolution of the net capital stock (current replacement costs) excluding the construction and real estate sectors.

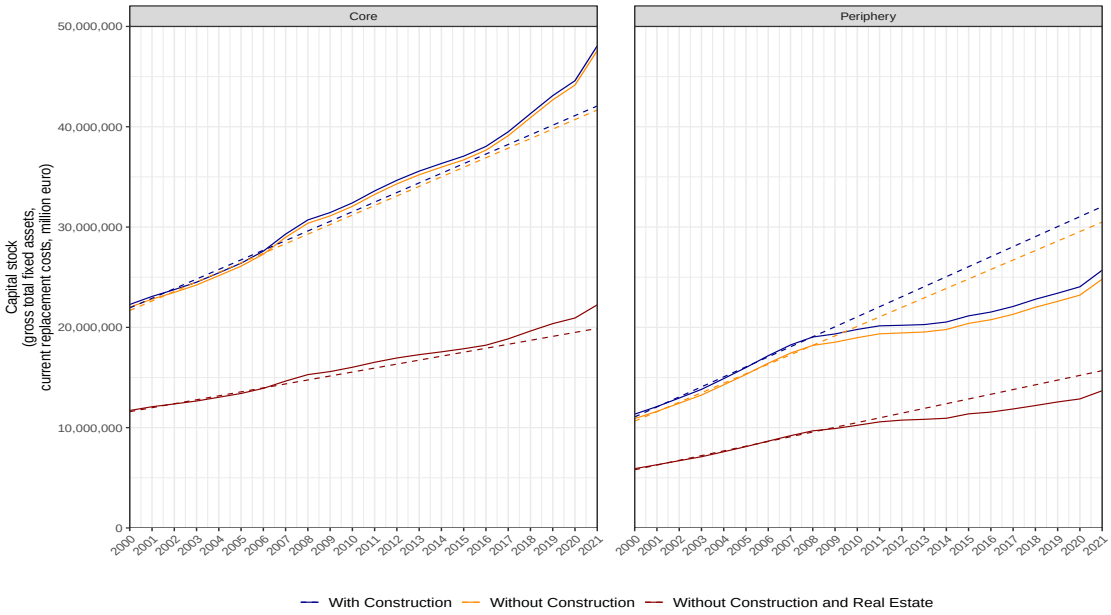


Figure 52: Gross Capital Stock Excluding Construction and Real Estate (2000–2021). The figure replicates the analysis using gross capital stock.

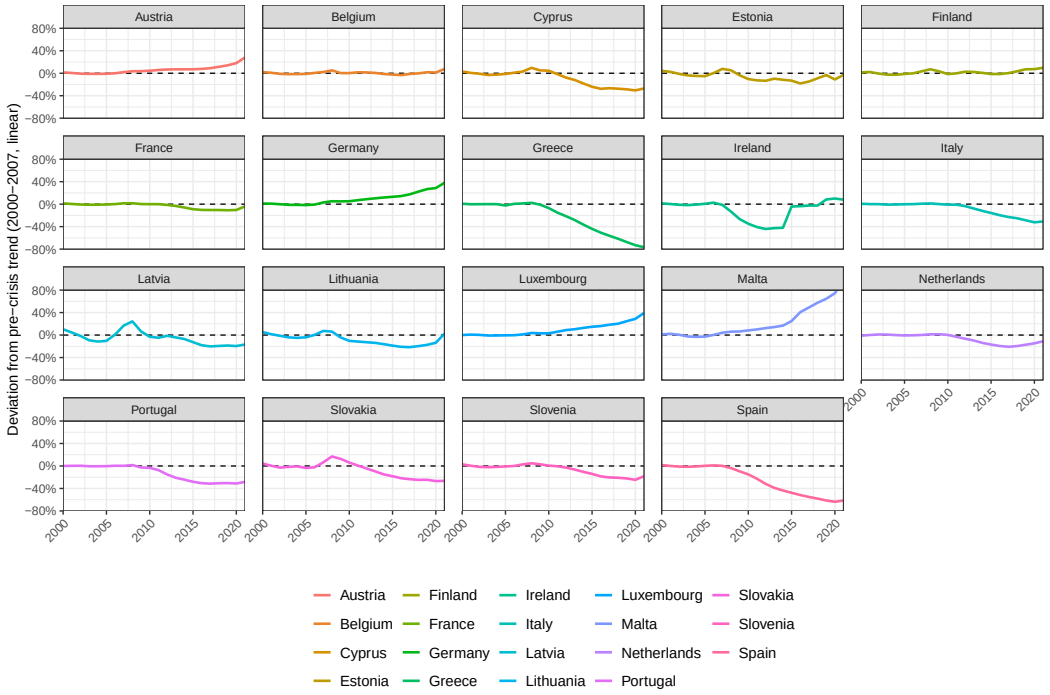


Figure 53: Deviation of National Capital Stocks from Pre-crisis Trends (2000–2021). The figure shows the deviation of each country's capital stock from its pre-crisis linear trend (2000–2007).

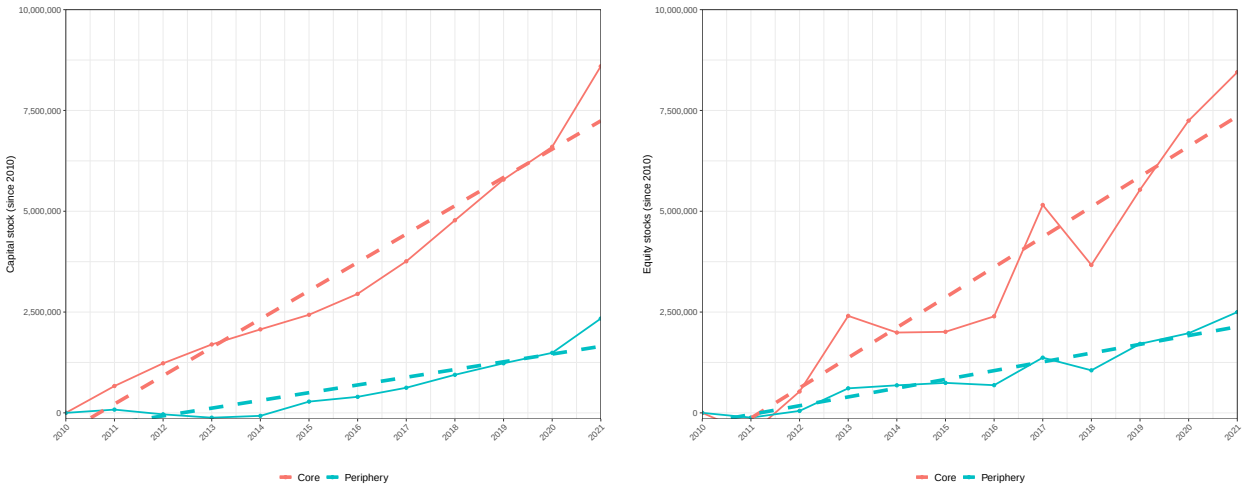


Figure 54: Capital Stock and Equity Stock Evolution (2010–2021). The figure compares the evolution of the capital stock (Eurostat) and equity stock (CPIS) for the Core and Periphery, normalized to zero in 2010.

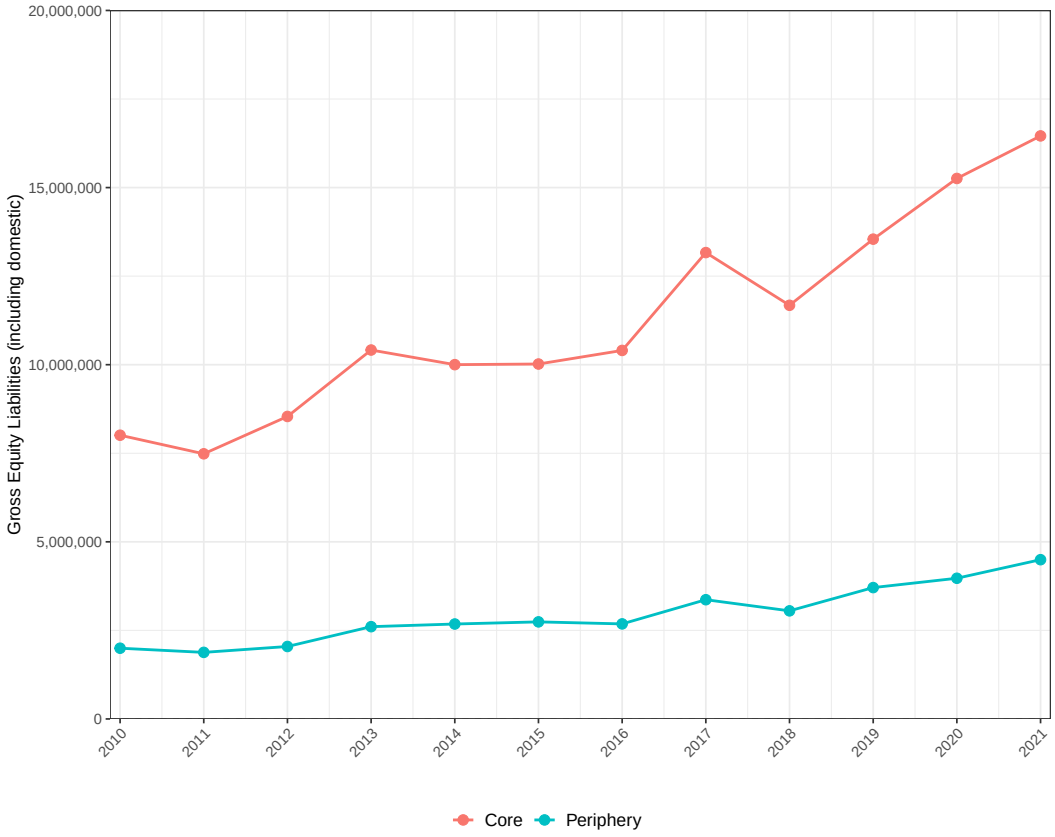


Figure 55: Gross Equity Liabilities by Group (2010–2021). The figure plots the value of gross equity liabilities as reported in the CPIS for for the Core and Periphery.

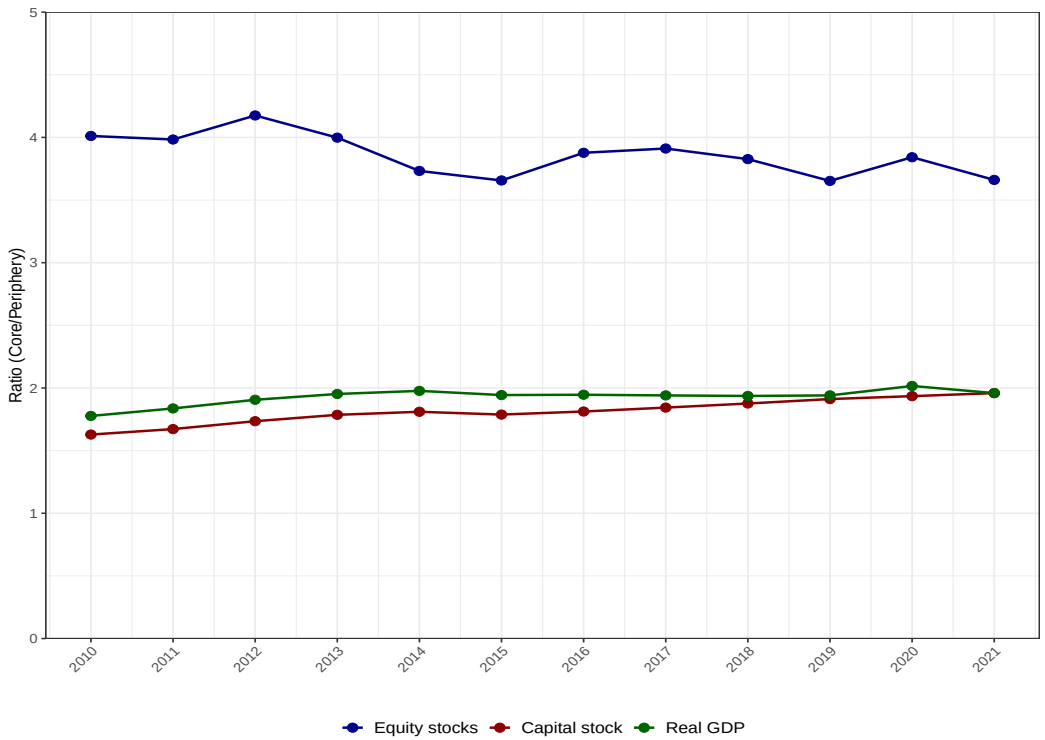


Figure 56: Ratios of Equity Stock, Capital Stock and Real GDP (2010–2021). The figure reports the ratio of equity stock, capital stock and real GDP for the Core and Periphery.

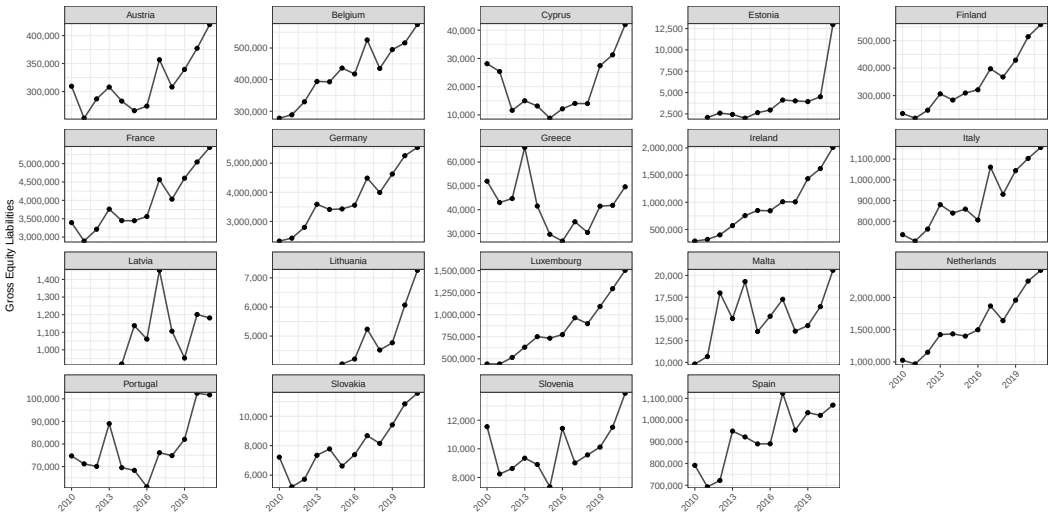


Figure 57: Gross Equity Liabilities by Country (2010–2021). The figure plots the value of gross equity liabilities as reported in the CPIS for euro area countries.

A.3 Two Dimensions of Integration

A.3.1 Financialization

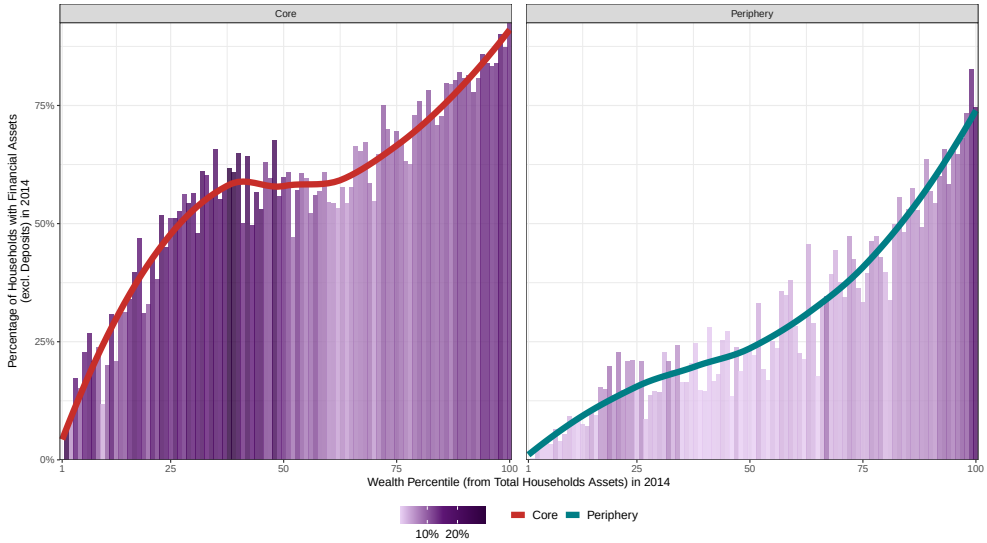


Figure 58: Financial Participation along the Wealth Distribution (2014). The figure plots, for each wealth percentile, the share of households holding financial assets (curve, extensive margin) and the share of financial assets in total household wealth (bars, intensive margin).

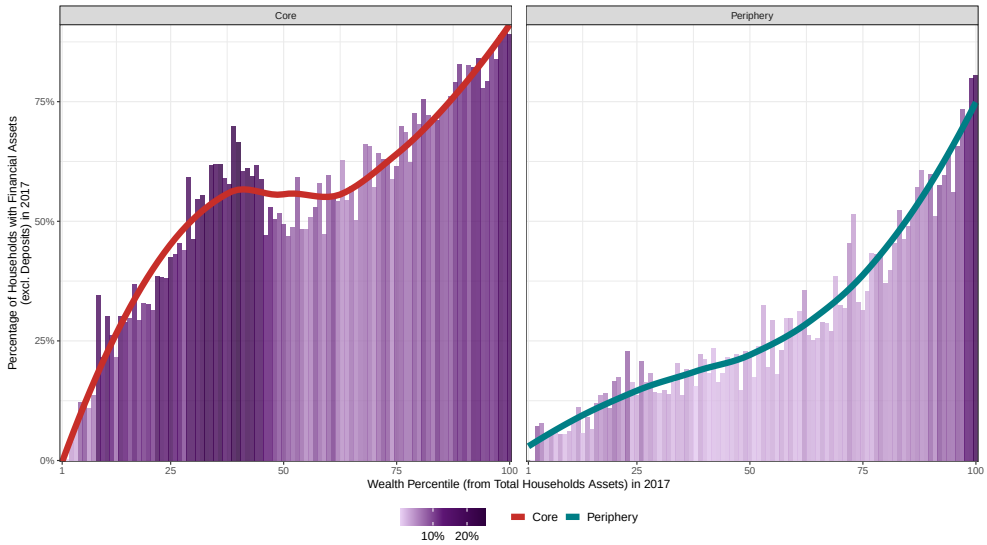


Figure 59: Financial Participation along the Wealth Distribution (2017). The figure shows the evolution of financialization relative to earlier waves.

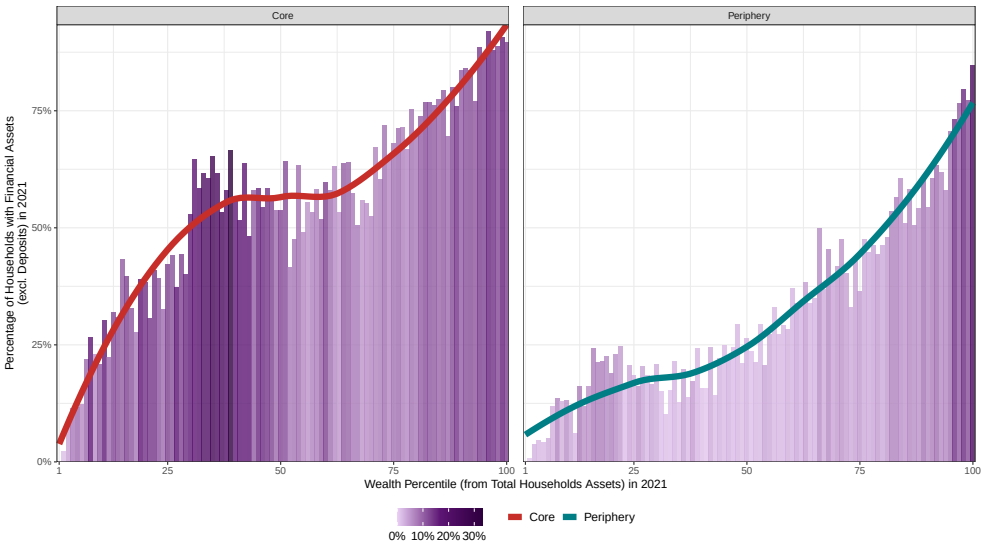


Figure 60: Financial Participation along the Wealth Distribution (2021). The figure reports financial participation and asset shares by wealth percentile, showing a slight increase in financialization since 2017 but a persistent gap between the Core and the Periphery.

A.3.2 Wealth Decomposition

Figure 61: Composition of Wealth along the Wealth Distribution (2010). The figure shows the composition of total household wealth by percentile of the wealth distribution for the Core (left) and the Periphery (right) in 2010. Each area represents the share of deposits (green), financial assets (orange), and real assets (blue) in total wealth.

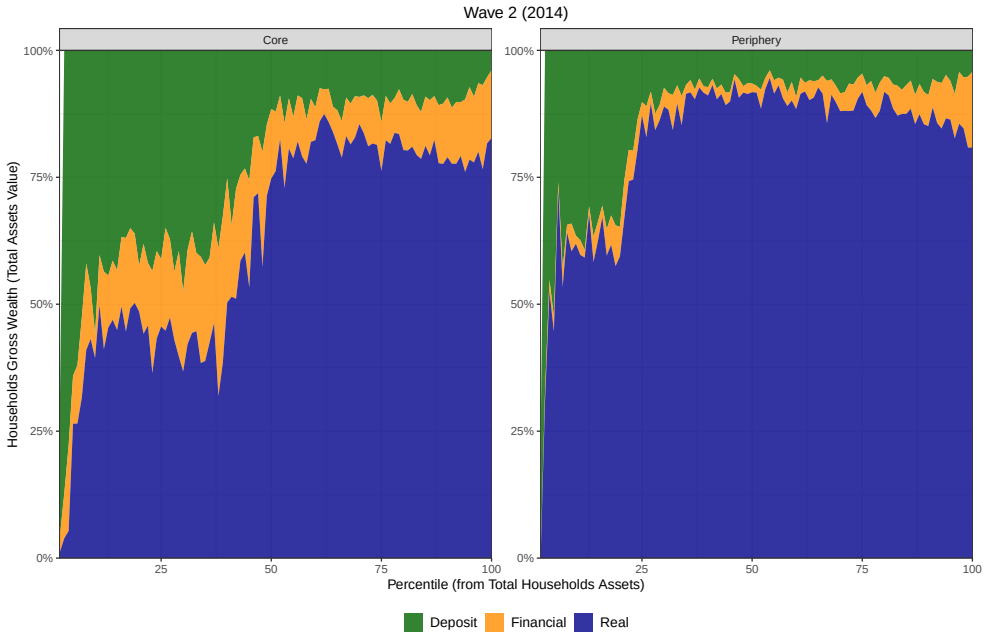


Figure 62: Composition of Wealth along the Wealth Distribution (2014). The figure shows the composition of total household wealth by percentile of the wealth distribution for the Core (left) and the Periphery (right) in 2014. Each area represents the share of deposits (green), financial assets (orange), and real assets (blue) in total wealth.

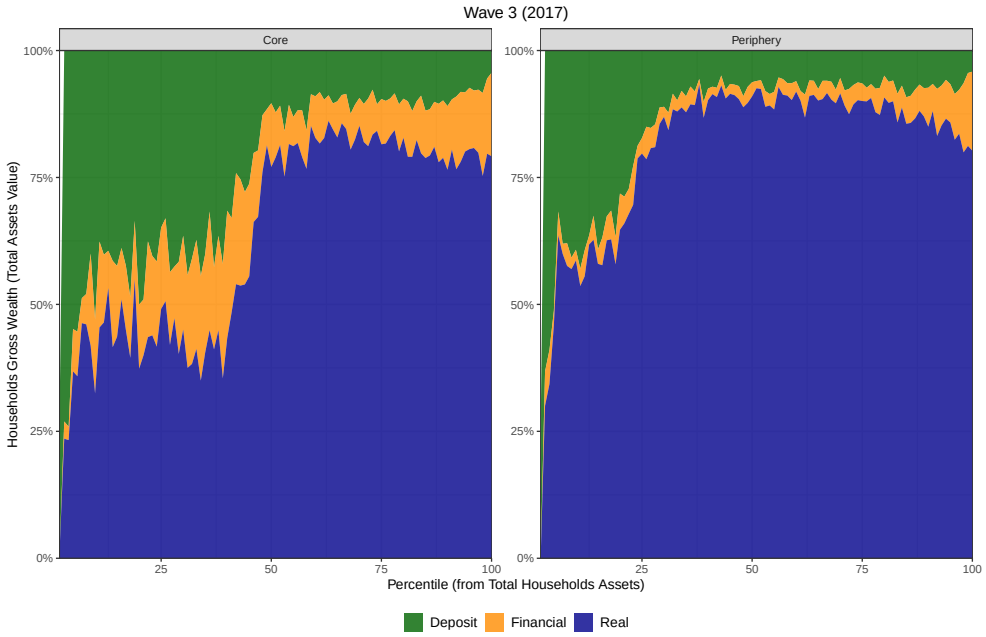


Figure 63: Composition of Wealth along the Wealth Distribution (2017). The figure shows the composition of total household wealth by percentile of the wealth distribution for the Core (left) and the Periphery (right) in 2017. Each area represents the share of deposits (green), financial assets (orange), and real assets (blue) in total wealth.

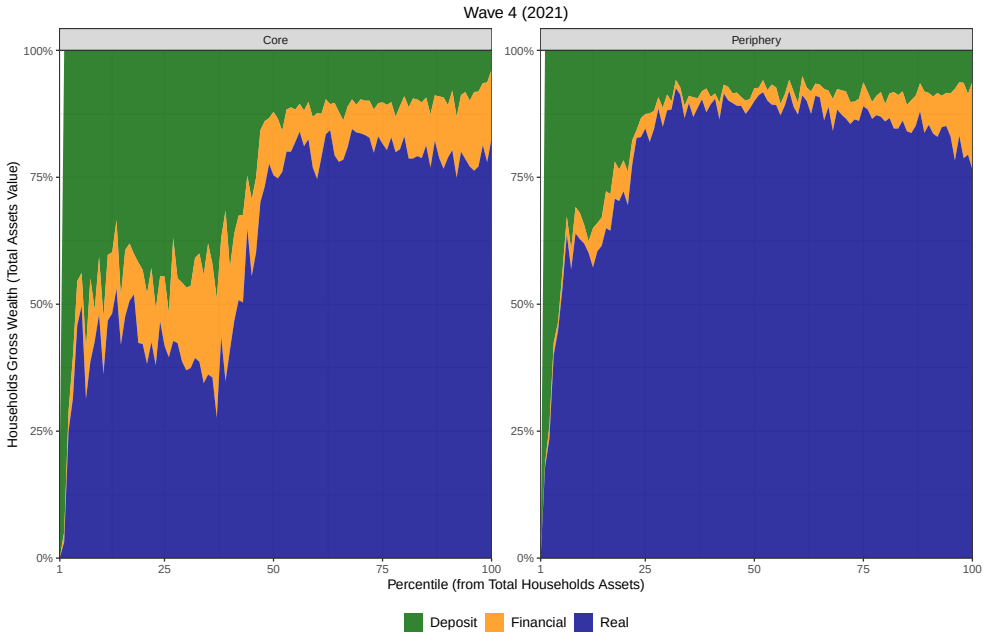


Figure 64: Composition of Wealth along the Wealth Distribution (2021). The figure shows the composition of total household wealth by percentile of the wealth distribution for the Core (left) and the Periphery (right) in 2021. Each area represents the share of deposits (green), financial assets (orange), and real assets (blue) in total wealth.

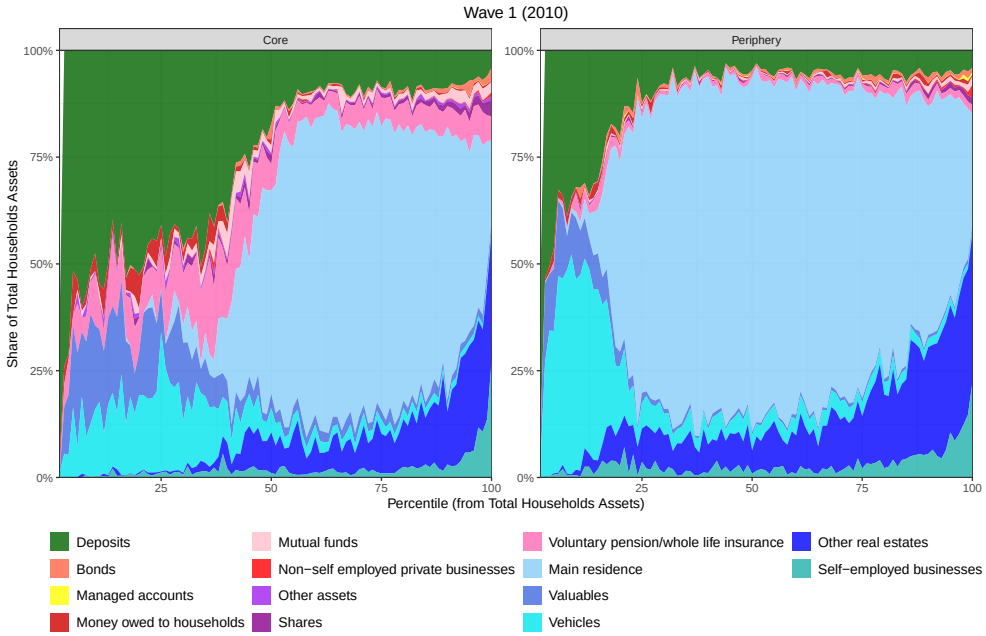


Figure 65: Detailed Composition of Wealth along the Wealth Distribution (2010). The figure displays the detailed breakdown of household wealth by percentile for the Core (left) and the Periphery (right) in 2010. Each color represents a distinct asset category: deposits, bonds, managed accounts, mutual funds, shares, voluntary pension and life insurance, money owed to households, self-employed and non-self-employed private businesses, valuables, main residences, other real estate, and vehicles.

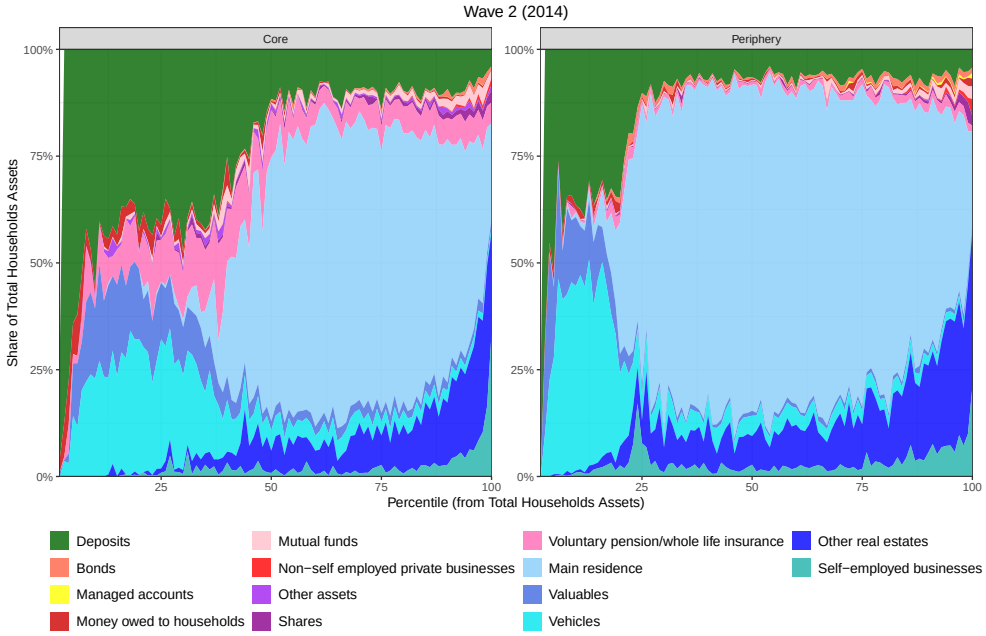


Figure 66: Detailed Composition of Wealth along the Wealth Distribution (2014). The figure displays the detailed breakdown of household wealth by percentile for the Core (left) and the Periphery (right) in 2014.

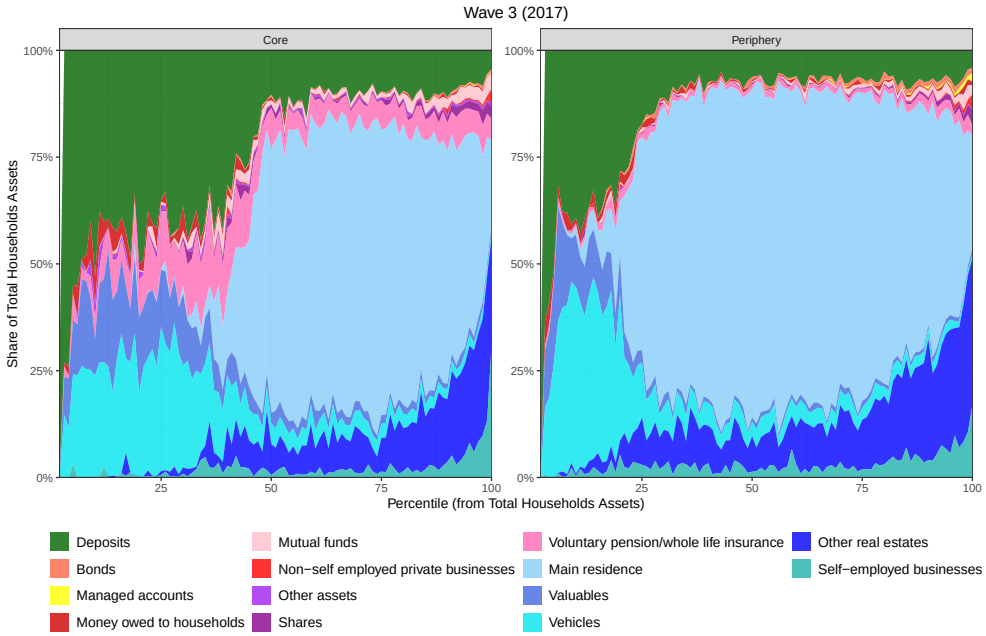


Figure 67: Detailed Composition of Wealth along the Wealth Distribution (2017). The figure displays the detailed breakdown of household wealth by percentile for the Core (left) and the Periphery (right) in 2017.

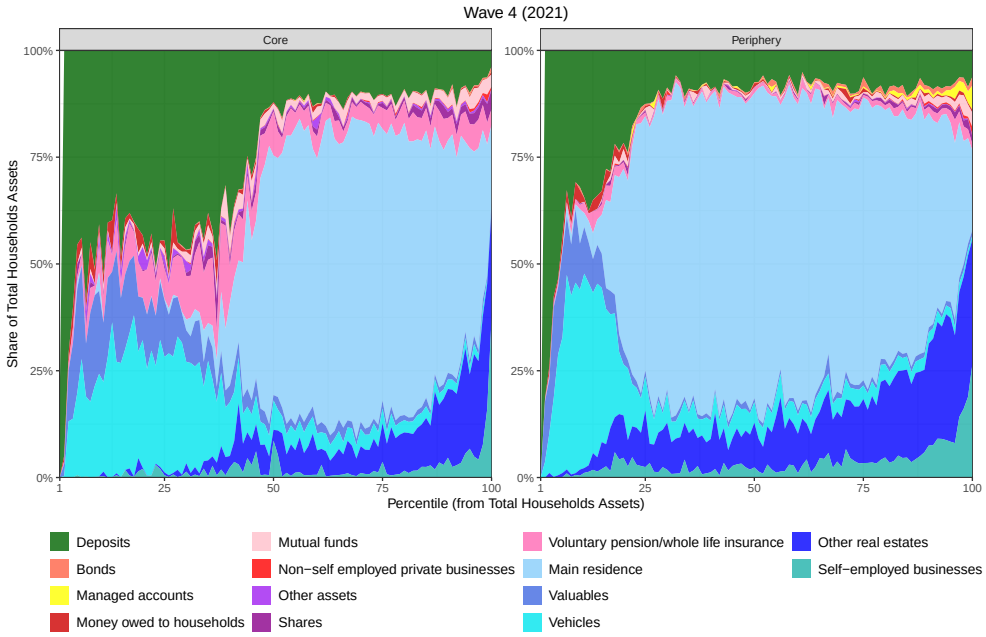


Figure 68: Detailed Composition of Wealth along the Wealth Distribution (2021). The figure displays the detailed breakdown of household wealth by percentile for the Core (left) and the Periphery (right) in 2021.

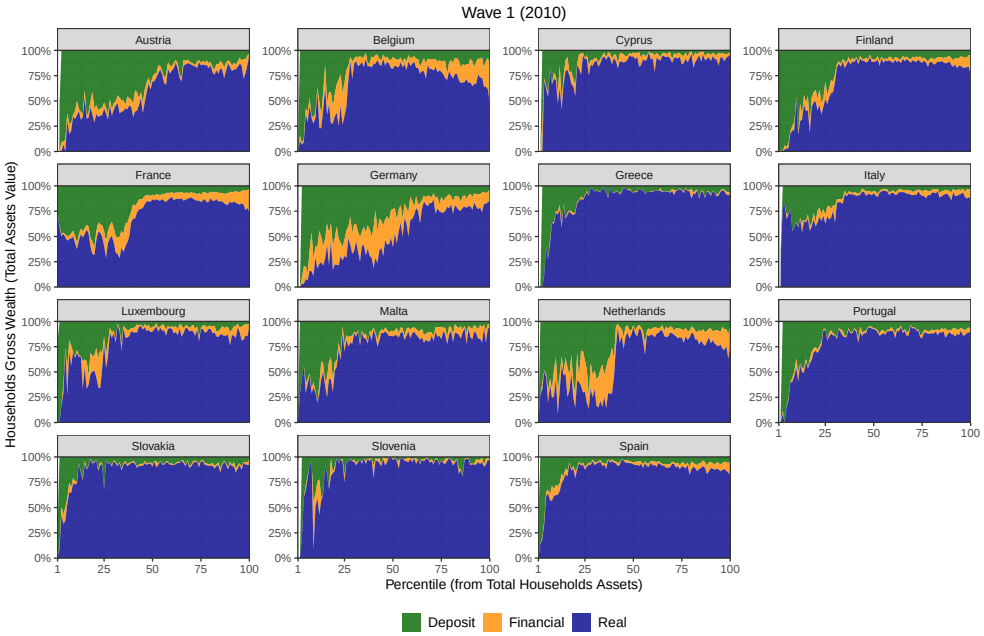


Figure 69: Composition of Wealth along the Wealth Distribution by Country (2010). The figure shows the composition of total household wealth by percentile of the wealth distribution for euro area countries in 2010. Each area represents the share of deposits (green), financial assets (orange), and real assets (blue) in total wealth.

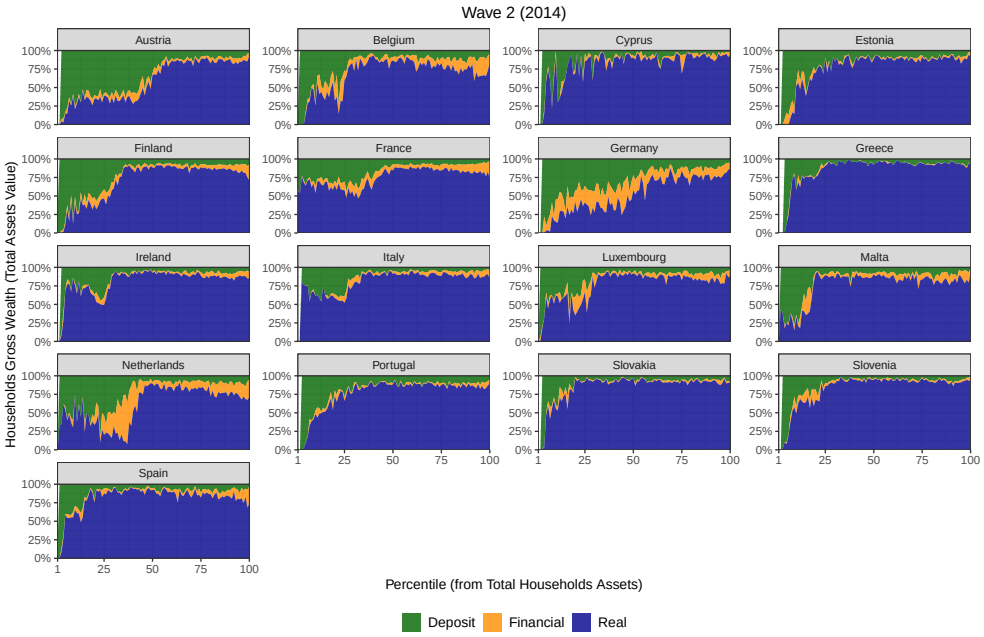


Figure 70: Composition of Wealth along the Wealth Distribution by Country (2014). The figure shows the composition of total household wealth by percentile of the wealth distribution for euro area countries in 2014. Each area represents the share of deposits (green), financial assets (orange), and real assets (blue) in total wealth.

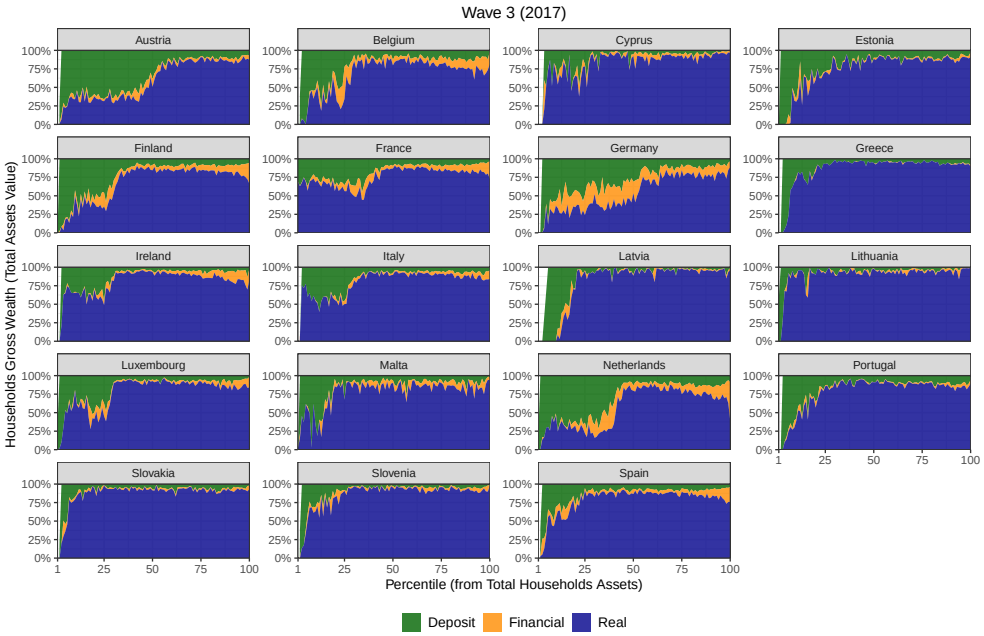


Figure 71: Composition of Wealth along the Wealth Distribution by Country (2017). The figure shows the composition of total household wealth by percentile of the wealth distribution for euro area countries in 2017. Each area represents the share of deposits (green), financial assets (orange), and real assets (blue) in total wealth.

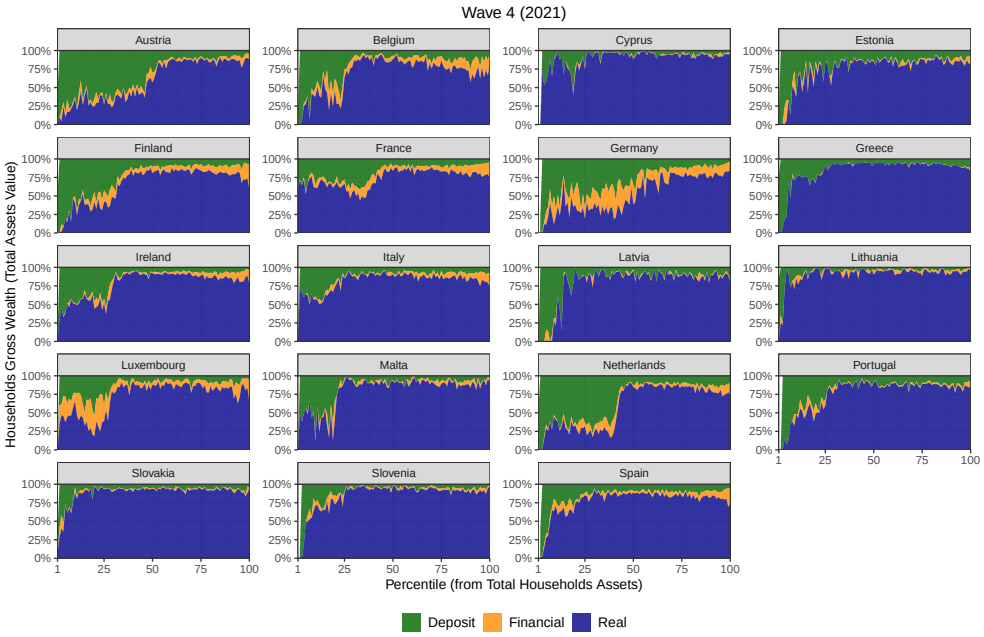


Figure 72: Composition of Wealth along the Wealth Distribution by Country (2021). The figure shows the composition of total household wealth by percentile of the wealth distribution for euro area countries in 2021. Each area represents the share of deposits (green), financial assets (orange), and real assets (blue) in total wealth.

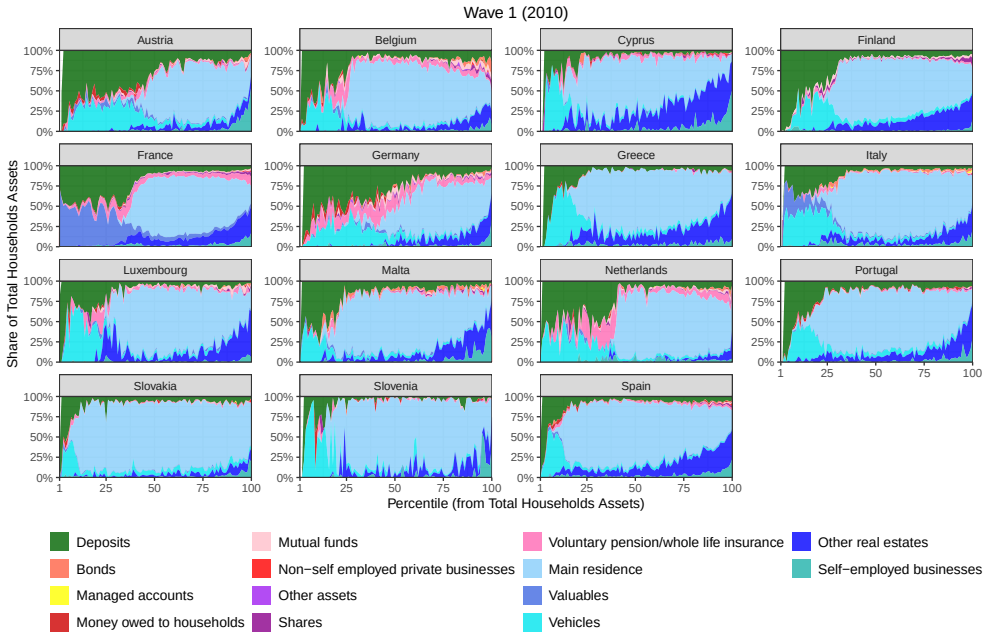


Figure 73: Detailed Composition of Wealth along the Wealth Distribution by Country (2010). The figure displays the detailed breakdown of household wealth by percentile for euro area countries in 2010. Each color represents a distinct asset category: deposits, bonds, managed accounts, mutual funds, shares, voluntary pension and life insurance, money owed to households, self-employed and non-self-employed private businesses, valuables, main residences, other real estate, and vehicles.

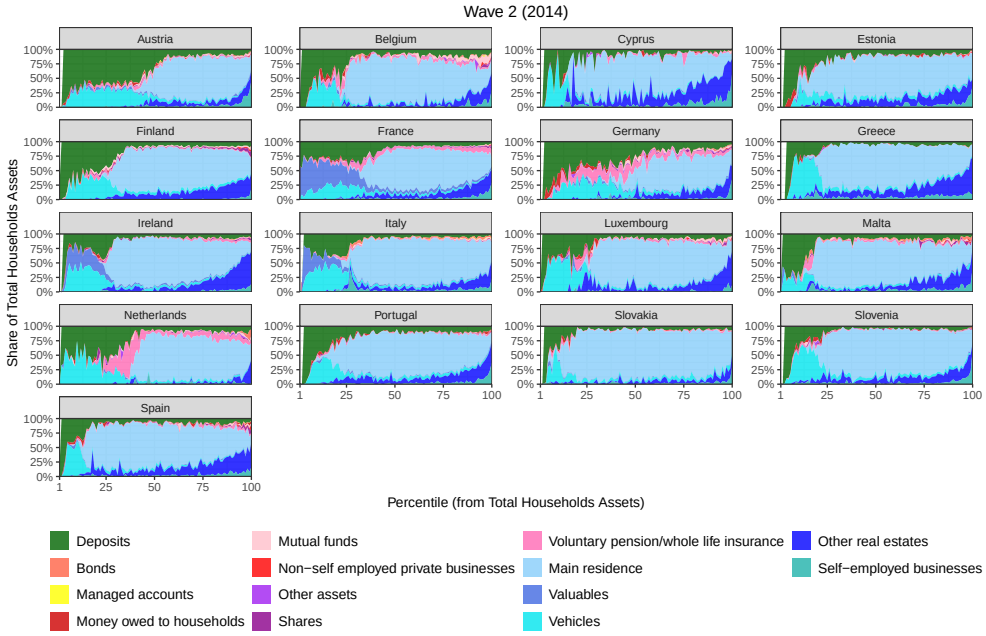


Figure 74: Detailed Composition of Wealth along the Wealth Distribution by Country (2014). The figure displays the detailed breakdown of household wealth by percentile for euro area countries in 2014.

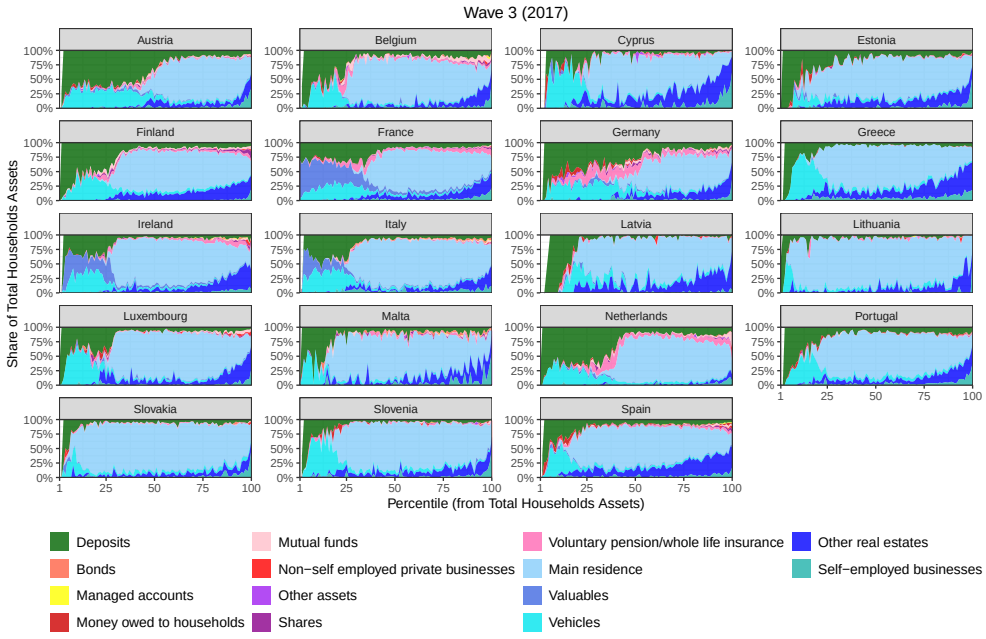


Figure 75: Detailed Composition of Wealth along the Wealth Distribution by Country (2017). The figure displays the detailed breakdown of household wealth by percentile for euro area countries in 2017.

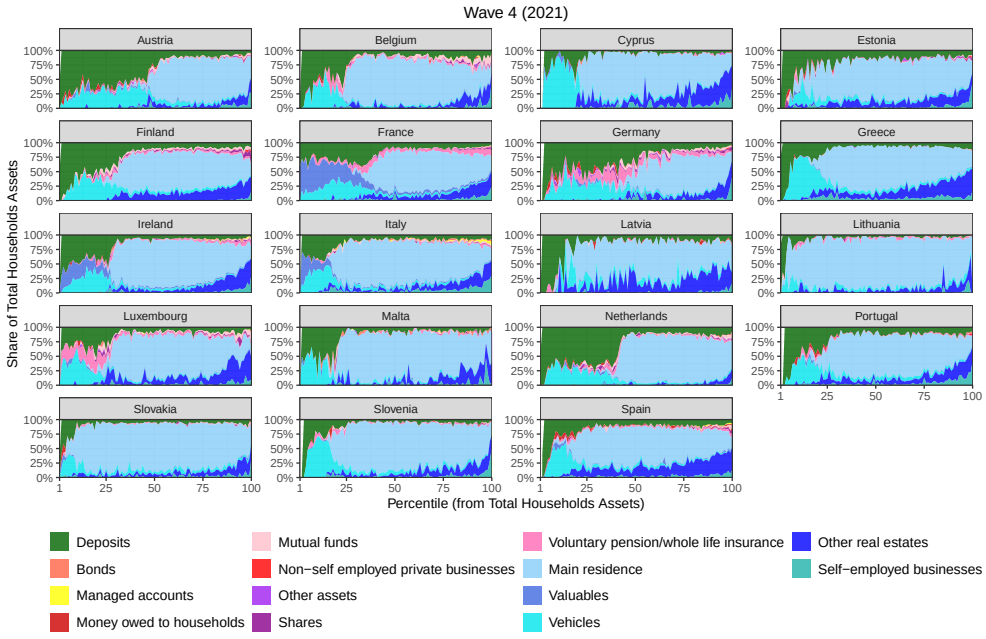


Figure 76: Detailed Composition of Wealth along the Wealth Distribution by Country (2021). The figure displays the detailed breakdown of household wealth by percentile for euro area countries in 2021.

A.3.3 Limited Evidence of Diversification at the Household Level

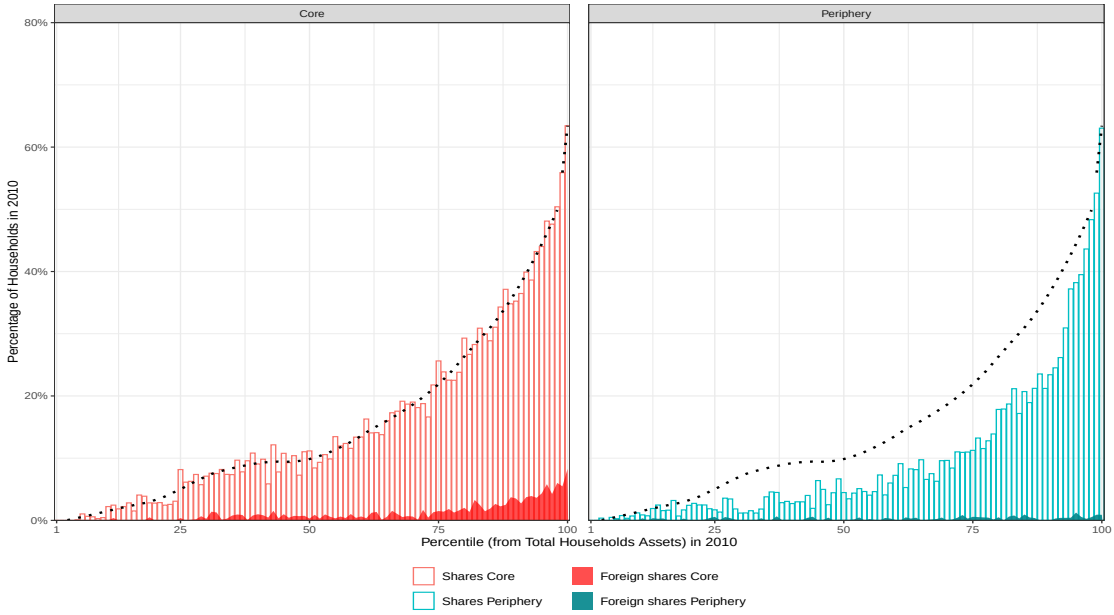
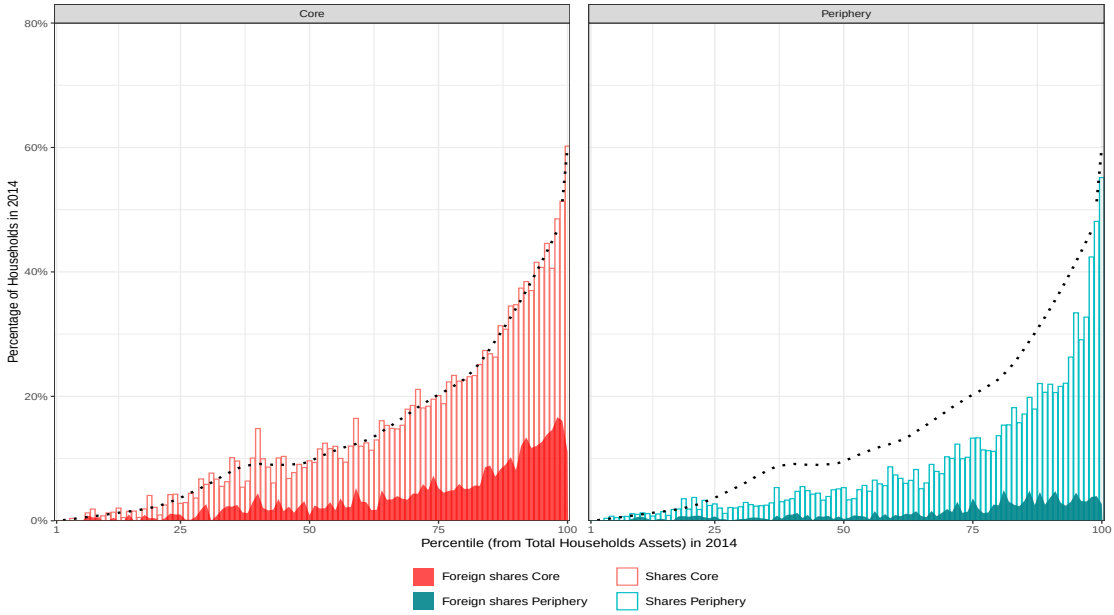


Figure 77: Share and Foreign Share Ownership Along the Wealth Distribution (2010). The figure displays the percentage of households holding shares (solid bars) and foreign shares (filled bars) by wealth percentile for the Core and the Periphery. The dotted line represents the Core distribution, allowing for a visual comparison of the shape and concentration of ownership between the two groups.



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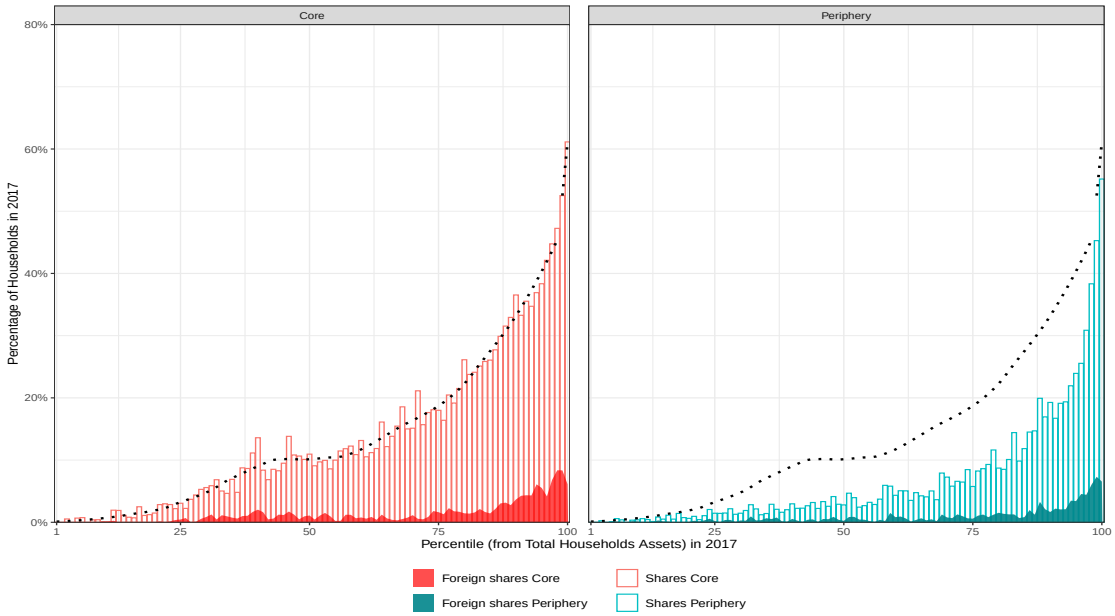

Figure 79: Share and Foreign Share Ownership Along the Wealth Distribution (2017). The figure displays the percentage of households holding shares (solid bars) and foreign shares (filled bars) by wealth percentile for the Core and the Periphery. The dotted line represents the Core distribution.

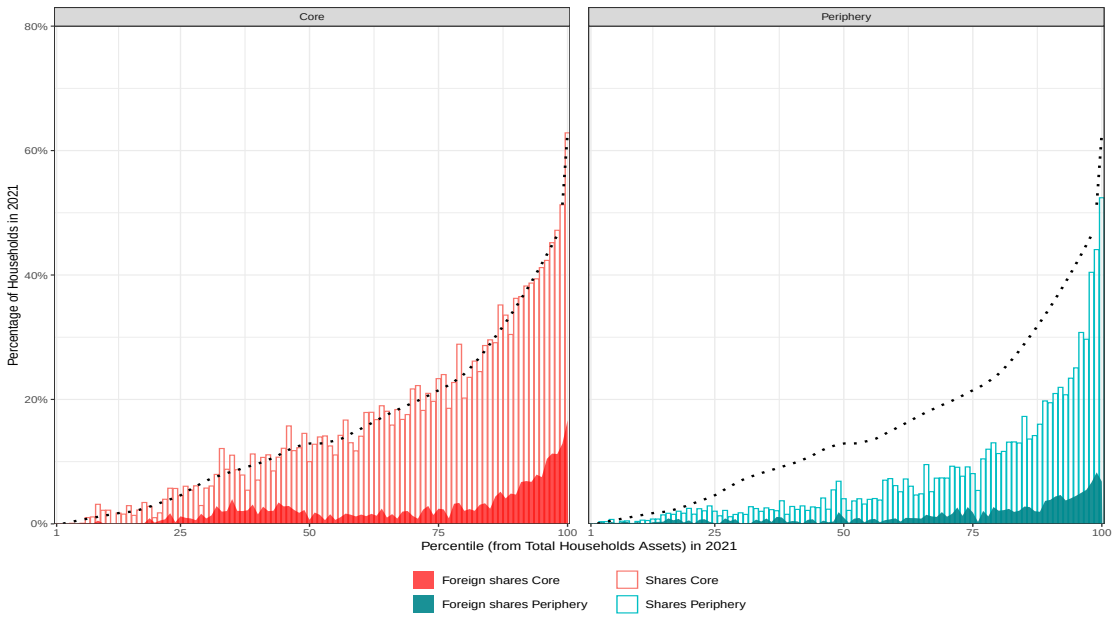

Figure 80: Share and Foreign Share Ownership Along the Wealth Distribution (2021). The figure displays the percentage of households holding shares (solid bars) and foreign shares (filled bars) by wealth percentile for the Core and the Periphery. The dotted line represents the Core distribution.

A.3.4 Home Bias

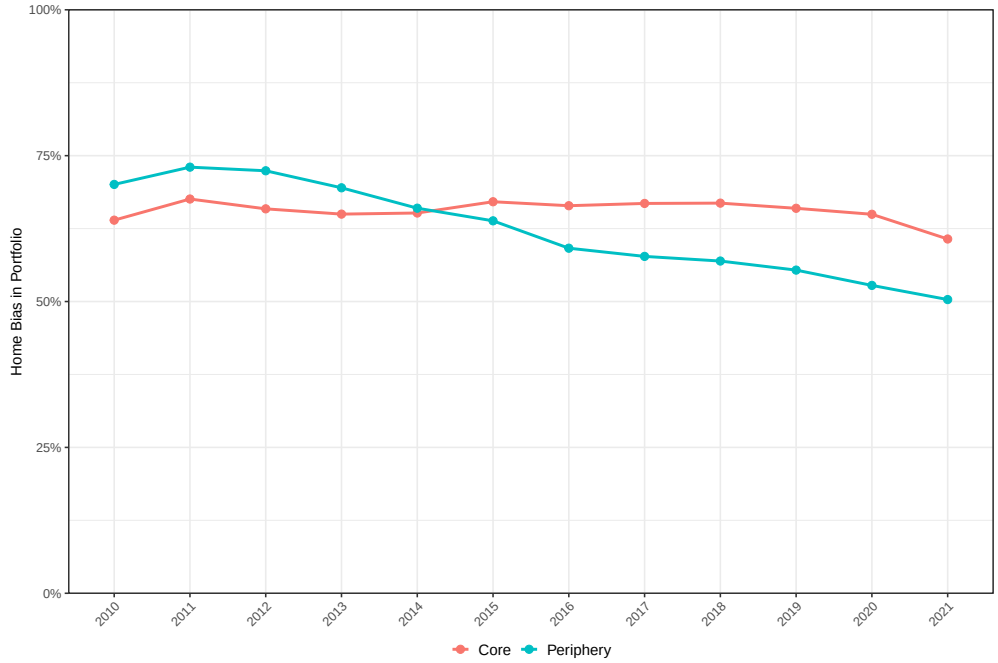

Figure 81: Home Bias in Portfolio Holdings, including the Rest of the World (2010–2021). The figure shows the home bias in equity portfolios for Core and Periphery euro area countries, including the Rest of the World.

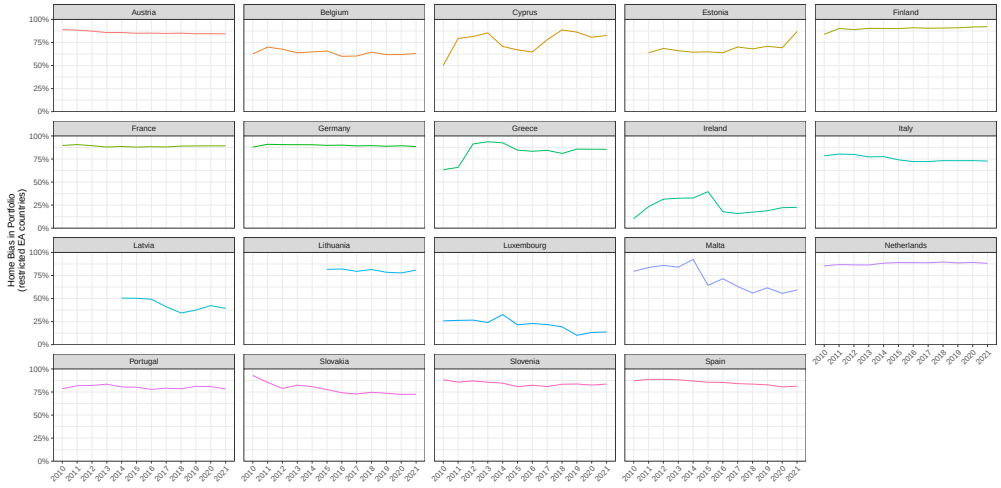

Figure 82: Home Bias in Portfolio Holdings by Country (2010–2021). The figure shows the home bias in equity portfolios across euro area countries, restricted to euro area countries.

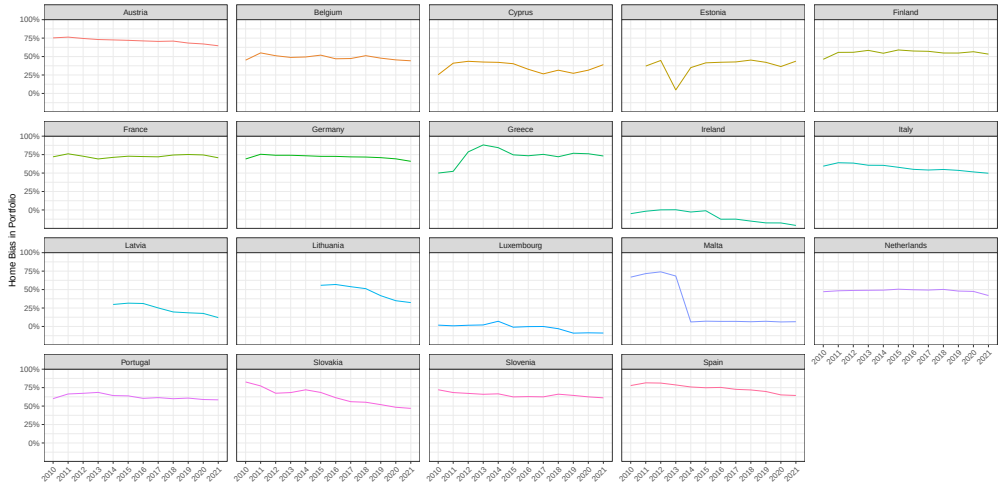

Figure 83: Home Bias in Portfolio Holdings by Country, including the Rest of the World (2010–2021). The figure shows the home bias in equity portfolios across euro area countries, including the Rest of the World.

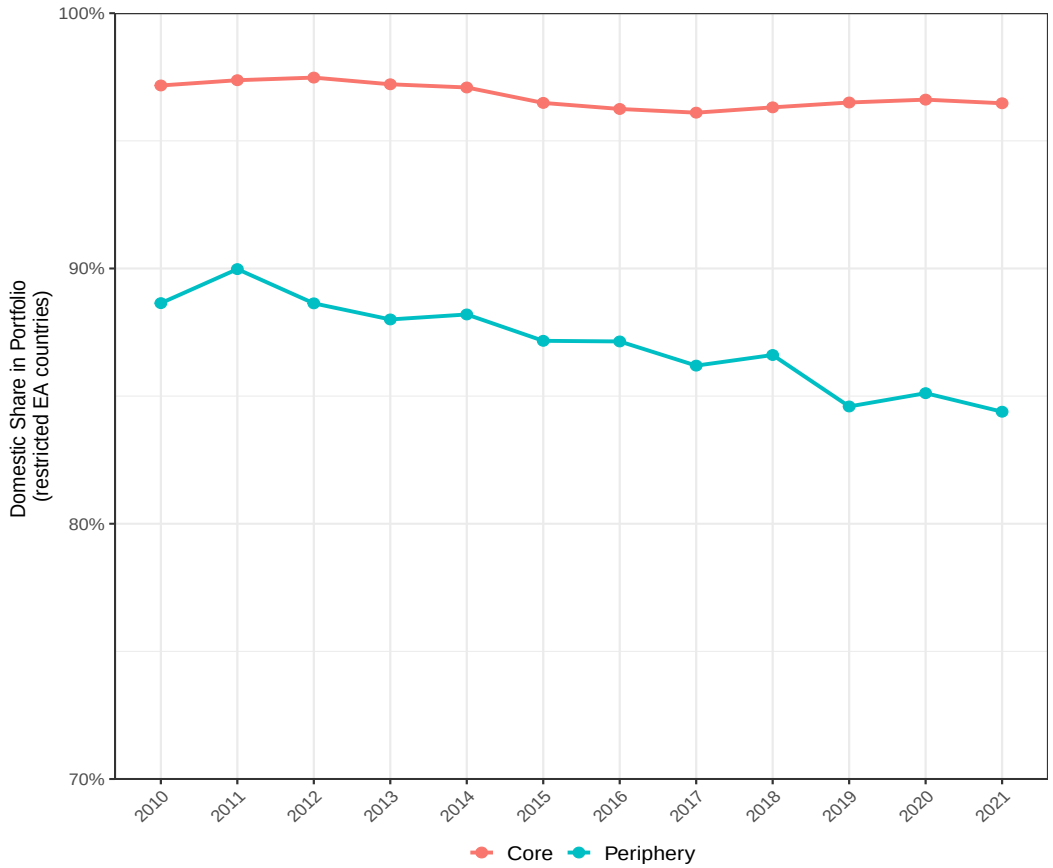

Figure 84: Domestic share in Portfolio (2010–2021). The figure shows the share of domestic assets in equity portfolios for Core and Periphery euro area countries, restricted to euro area countries.

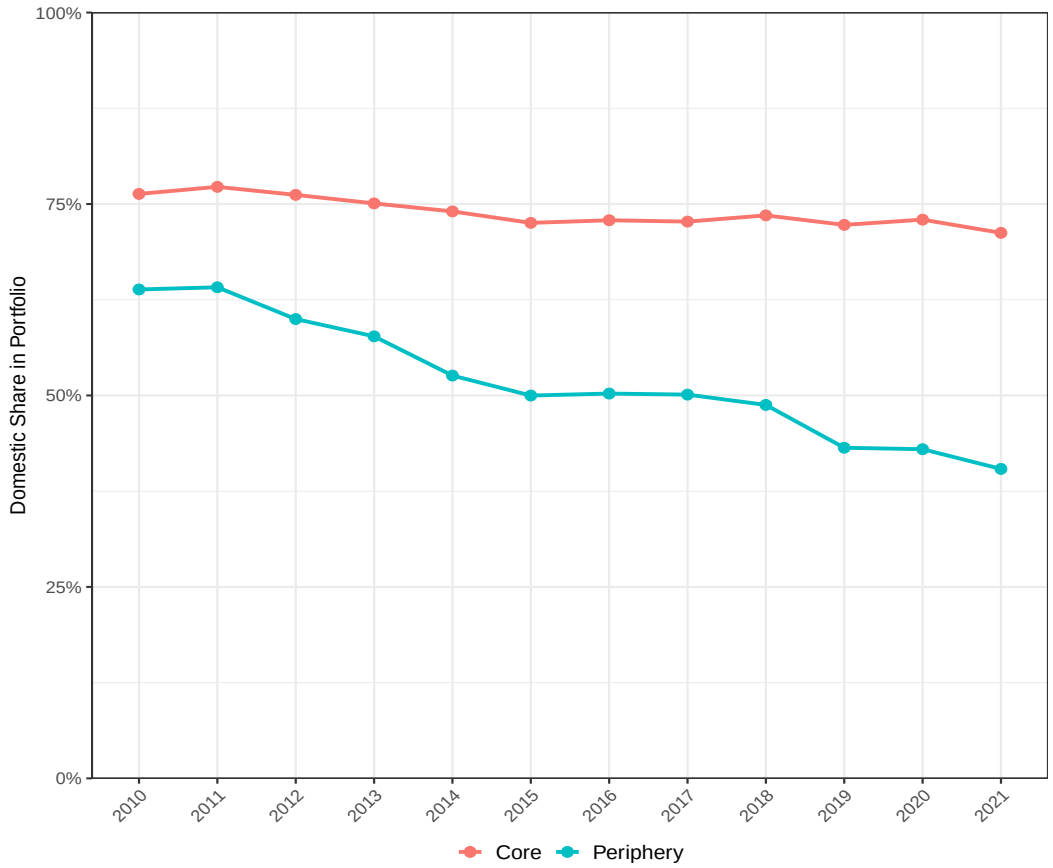

Figure 85: Domestic share in Portfolio, including the Rest of the World (2010–2021). The figure shows the share of domestic assets in equity portfolios for Core and Periphery euro area countries, including the Rest of the World.

Figure 86: Domestic share in Portfolio by Country (2010–2021). The figure shows the share of domestic assets in equity portfolios across euro area countries.

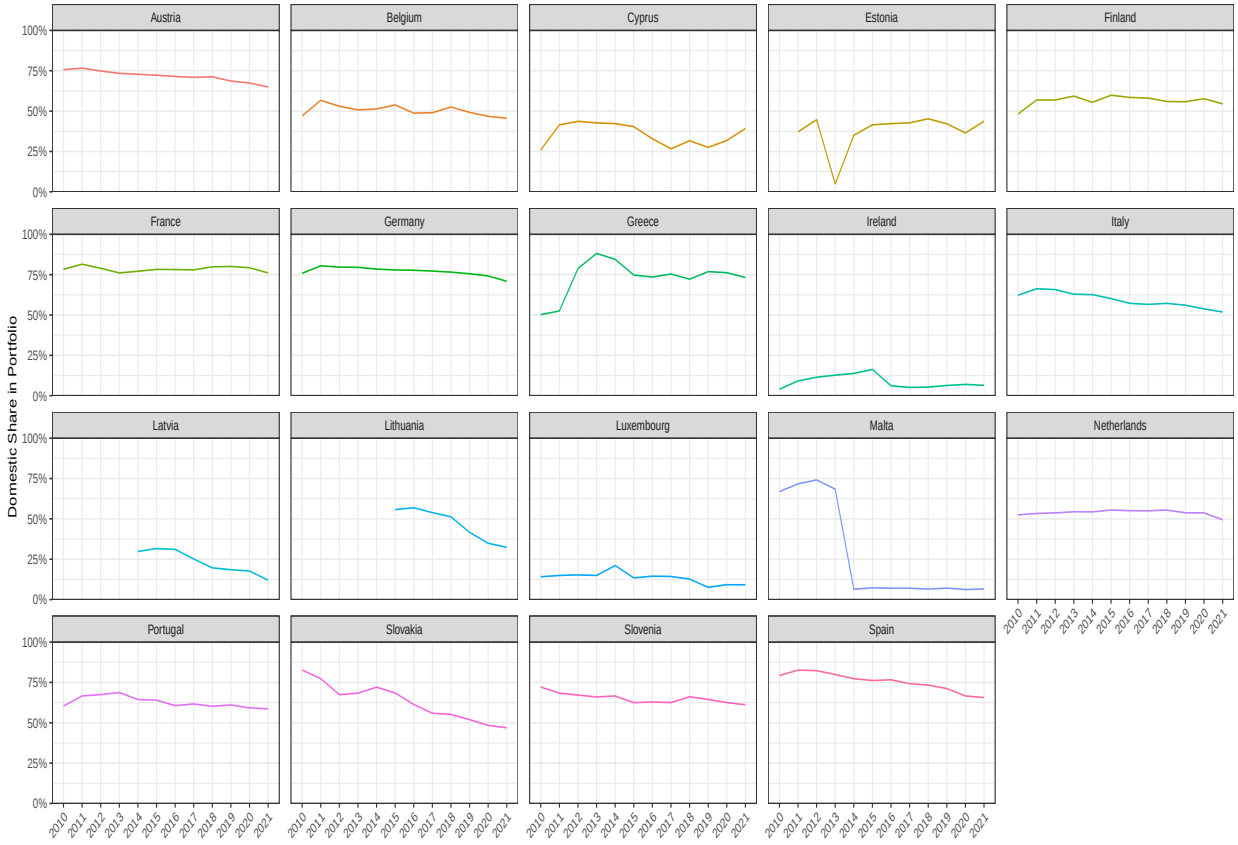

Figure 87: Domestic share in Portfolio by Country, including the Rest of the World (2010–2021). The figure shows the share of domestic assets in equity portfolios across euro area countries, including the Rest of the World.

B Two-Agent New Keynesian (TANK) Model

B.1 One-asset equivalent

In the baseline model, Saver households invest separately in two assets: equity claims issued by the domestic mutual fund, E_t^i, and one-period nominal union bonds, b_t^i. This section presents an equivalent formulation in which households instead hold a single composite asset issued by the mutual fund, denoted A_t^i, which internally reallocates between equity and bonds. This alternative representation is analytically equivalent to the baseline model but simplifies the household problem by consolidating all financial decisions into one aggregate asset.

B.1.1 Household

Households now purchase only the composite mutual fund claim A_t^i, instead of holding E_t^i and b_t^i separately. Their first-order condition for A_t^i becomes:

$$C_{S,t}^{i\ -\sigma}\left(1+p_t^i\left[\frac{E_t^i}{A_t^i}\frac{\kappa_E}{(1-\lambda^i)}(E_t^i-\bar{E}^i)+\frac{b_t^i}{A_t^i}\frac{\kappa_D}{(1-\lambda^i)}b_t^i\right]\right)=\beta\,\mathbb{E}_t\left[C_{S,t+1}^{i\ -\sigma}\,r_{t+1}^A\right],$$

where r_{t+1}^A denotes the gross real return on the aggregate fund. The term in parentheses captures the adjustment costs from changing equity and bond positions within the fund, weighted by their respective portfolio shares in A_t^i.

B.1.2 Risk-Neutral Mutual Fund

The mutual fund in each country i issues a composite claim A_t^i, whose value equals the sum of the fund's equity and bond holdings:

$$A_t^i = E_t^i + b_t^i.$$

Internally, the fund allocates its portfolio between equity and bonds according to optimal returns. The equity component E_t^i consists of both domestic and foreign capital holdings:

$$E_t^i = K_{i,t}^i + \mathcal{S}_t K_{i,t}^j,$$

where $\mathcal{S}_t$ is the relative price of the foreign good in terms of the domestic consumption basket.

The fund's realized return is the weighted average of returns on equity and bonds:

$$r_t^A A_{t-1}^i = r_t^i E_{t-1}^i + \frac{r_{t-1}^U}{\pi_t^{CPI,i}} b_{t-1}^i,$$

where r_t^i is the real return on equity, and $\frac{r_{t-1}^U}{\pi_t^{CPI,i}}$ is the real return on the nominal union bond.

The mutual fund's no-arbitrage condition links the expected return on equity to that on

bonds, taking into account portfolio adjustment costs:

$$\mathbb{E}_t(r^i_{t+1}) + \frac{\kappa_D}{(1-\lambda^i)} p^i_t b^i_t = \frac{r^U_t}{\pi^{CPI,i}_{t+1}} + \frac{\kappa_E}{(1-\lambda^i)} p^i_t (E^i_t - \bar{E}^i).$$

This condition states that expected returns must equalize across assets once adjustment costs are accounted for. A higher κ_D or κ_E increases the effective cost of reallocating wealth between bonds and equity, thereby reducing the responsiveness of portfolios to changes in relative returns.

The equity component of the fund obeys the same no-profit condition as in the baseline model:

$$r^i_t E^i_{t-1} = (r^{K,i}_t + 1 - \delta^i) K^i_{i,t-1} + (r^{K,j}_t + 1 - \delta^j) \mathcal{S}_t K^j_{i,t-1} - \frac{\kappa^i}{2} \left(\frac{K^i_{i,t-1}}{E^i_{t-1}} - \frac{\bar{K}^i_i}{\bar{E}^i} \right)^2 E^i_{t-1}.$$

The corresponding no-arbitrage condition between domestic and foreign capital holdings is:

$$\mathbb{E}_t(r^{K,i}_{t+1} + 1 - \delta^i) = \mathbb{E}_t \left[(r^{K,j}_{t+1} + 1 - \delta^j) \frac{\mathcal{S}_{t+1}}{\mathcal{S}_t} \right] + \kappa^i \left(\frac{K^i_{i,t}}{E^i_t} - \frac{\bar{K}^i_i}{\bar{E}^i} \right).$$

Thus, the internal portfolio of the mutual fund, composed of both equity and bonds, satisfies the same optimality and no-arbitrage conditions as in the baseline model. The only difference is that the household now interacts with the mutual fund through a single composite claim, while the fund reallocates internally across assets to ensure optimal portfolio returns.

This one-asset equivalent formulation provides a convenient way to represent the fund as the unique financial intermediary in the economy. It unifies the household's asset choice, while preserving the model's two key mechanisms: (i) portfolio composition across domestic and foreign capital (ζ^i), and (ii) portfolio reallocation dynamics governed by adjustment costs (κ^i). The simplification is particularly useful when extending the framework to heterogeneous-agent settings, where computational efficiency and aggregation are essential.

C Results - Two-Agent Model

C.1 Steady-state Portfolios Determination

In the steady state, portfolio allocations are determined by the domestic ownership shares of capital in each country. Let θ^i denote the share of country i's total capital that is domestically owned, such that:

$$K_i^i = \theta^i K^i, \qquad K_j^i = (1-\theta^i)K^i.$$

Total equity held by residents of country i is therefore given by:

$$E^i = K_i^i + SK_i^j = \theta^i K^i + (1-\theta^j)SK^j,$$

where S is the steady-state relative price (terms of trade) between the two countries.
The steady-state domestic portfolio share ζ^i, that is, the fraction of total equity owned domestically, is defined as:

$$\zeta^i \equiv \frac{\bar{K}_i^i}{\bar{E}^i} = \frac{\theta^i \bar{K}^i}{\theta^i \bar{K}^i + (1-\theta^j)S\bar{K}^j}.$$

This relationship links the observed steady-state portfolio composition to the underlying domestic ownership shares (θ^C, θ^P). Not all combinations of (θ^C, θ^P) yield interior solutions for ζ^C and ζ^P: some parameter pairs lead to corner solutions where portfolios are fully domestic or fully foreign.

Figure 88 illustrates this mapping under a symmetric calibration, showing how the steady-state domestic portfolio shares ζ^C and ζ^P vary with the domestic ownership parameters θ^C and θ^P. The yellow regions correspond to corner solutions, where full domestic ownership ($\zeta = 1$) prevails, while the darker regions represent interior cases with partial diversification.

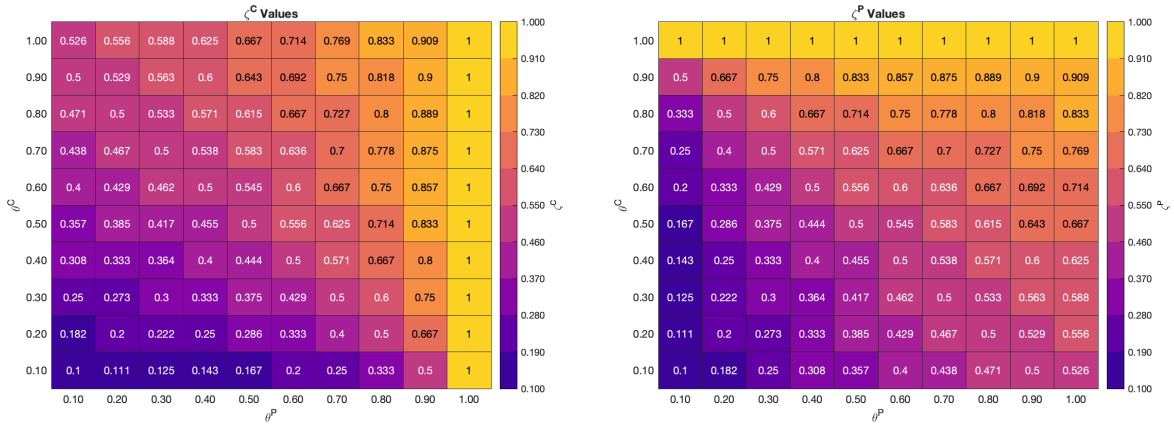

Figure 88: Steady-State Portfolio Shares ζ^C and ζ^P under Symmetric Calibration. The figures show the mapping between the domestic ownership shares (θ^C, θ^P) and the corresponding steady-state domestic portfolio shares (ζ^C, ζ^P).

To match the empirical values of ζ^C and ζ^P, I select the triplet $(\theta^C, \theta^P, \psi)$, where ψ denotes the ratio of the Periphery's to the Core's total GDP, calibrated in order to match the relative economic size and the ratio of total equity between the two blocs in 2010. Together, (θ^C, θ^P) determine the domestic ownership structure within each country, while ψ ensures that the relative scale of capital and equity holdings is consistent with observed macroeconomic aggregates. This approach guarantees internal consistency between the steady-state portfolio composition, the relative capital stocks, and the empirical Core–Periphery asymmetries in financial integration. Table 4 reports the calibrated parameter values for 2010.

Table 12: Calibration of Portfolio Determination Parameters (2010)

Parameter (Symbol and Description)	Value	Target
Domestic ownership share in the Core, θ^C	0.974	Domestic portfolio share in the Core, $\zeta^C = 0.972$
Domestic ownership share in the Periphery, θ^P	0.877	Domestic portfolio share in the Periphery, $\zeta^P = 0.886$
GDP ratio (Periphery/Core), ψ	0.231	Ratio of total equity holdings (Periphery/Core)

C.2 Symmetric Case with Asymmetric Shocks

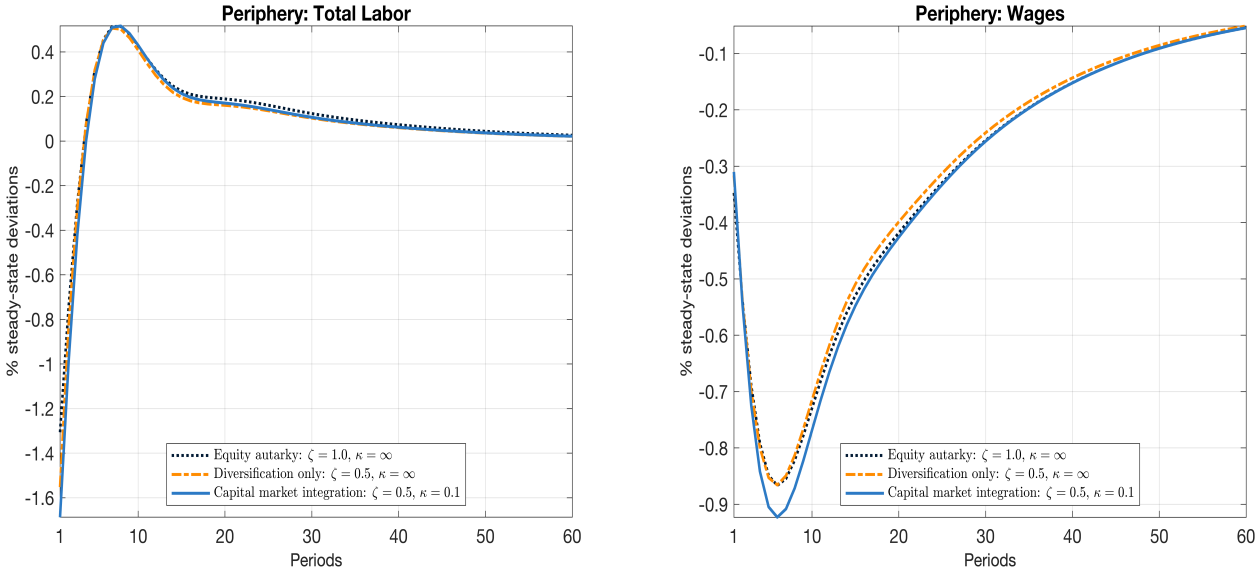

Figure 89: Impulse Response of Wages and Total Labor in the Periphery

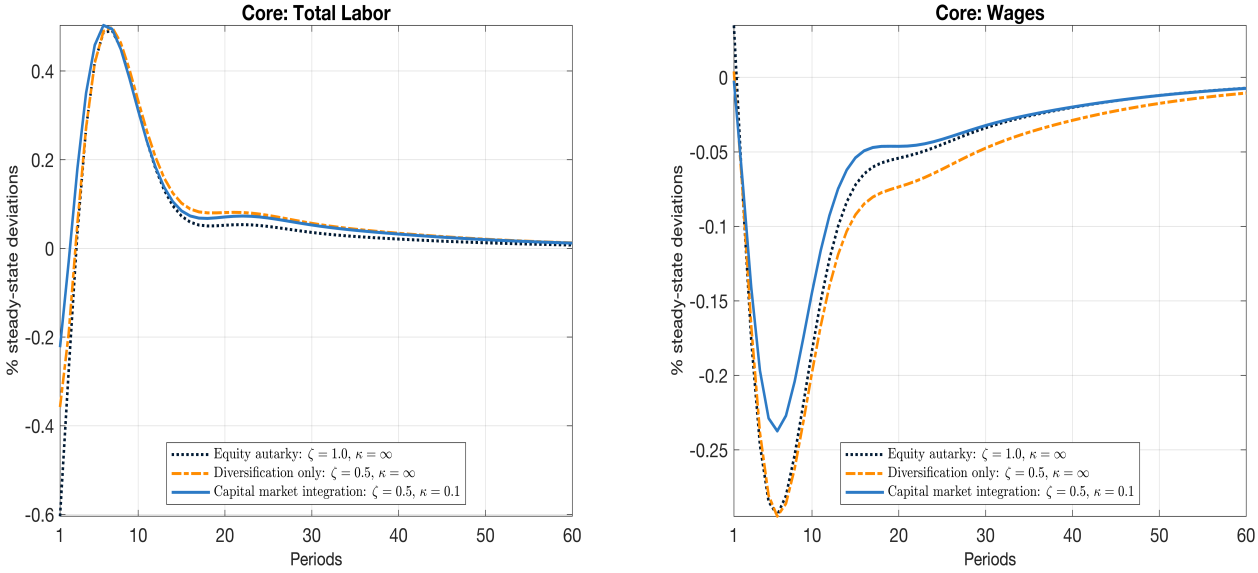

Figure 90: Impulse Response of Wages and Total Labor in the Core

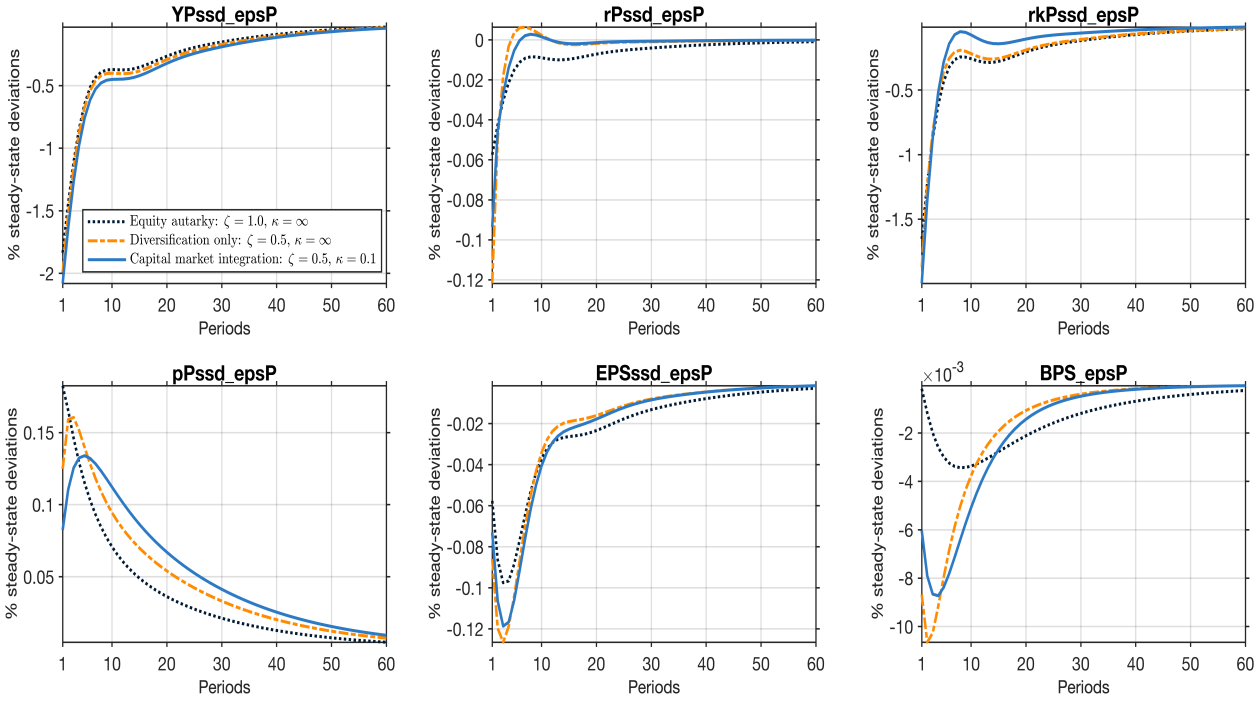

Figure 91: Impulse Response of Selected Variables in the Periphery

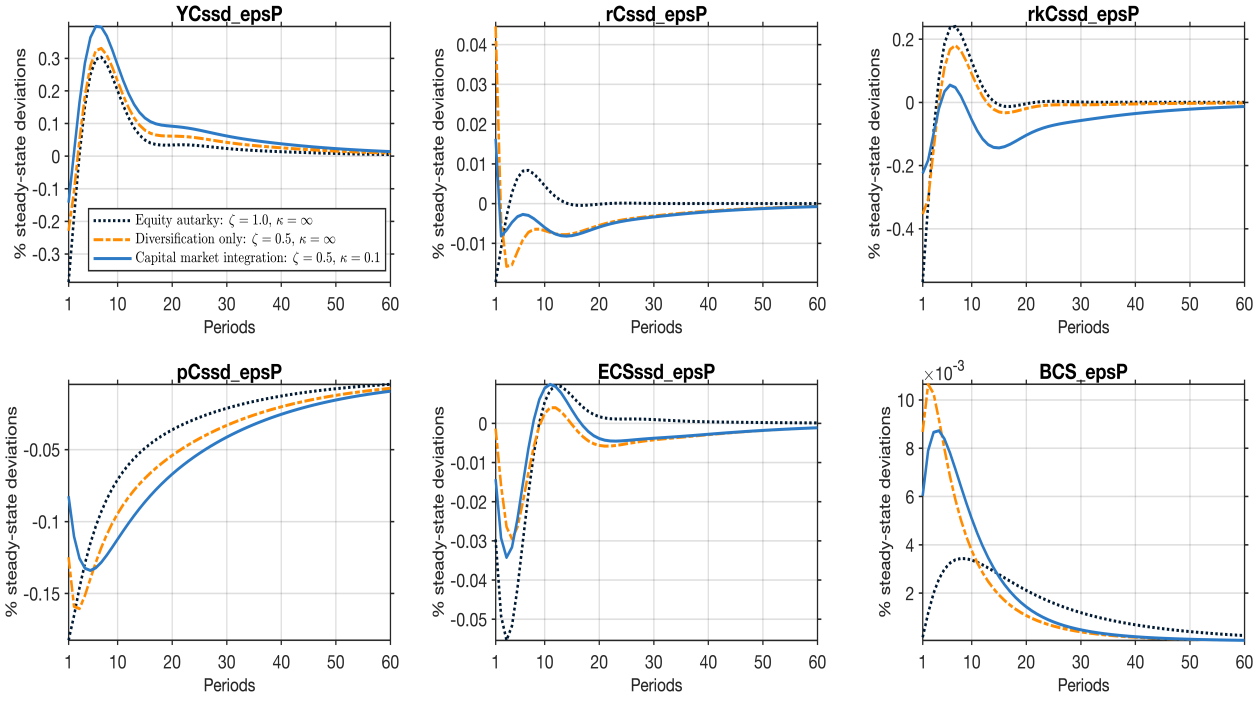

Figure 92: Impulse Response of Selected Variables in the Core

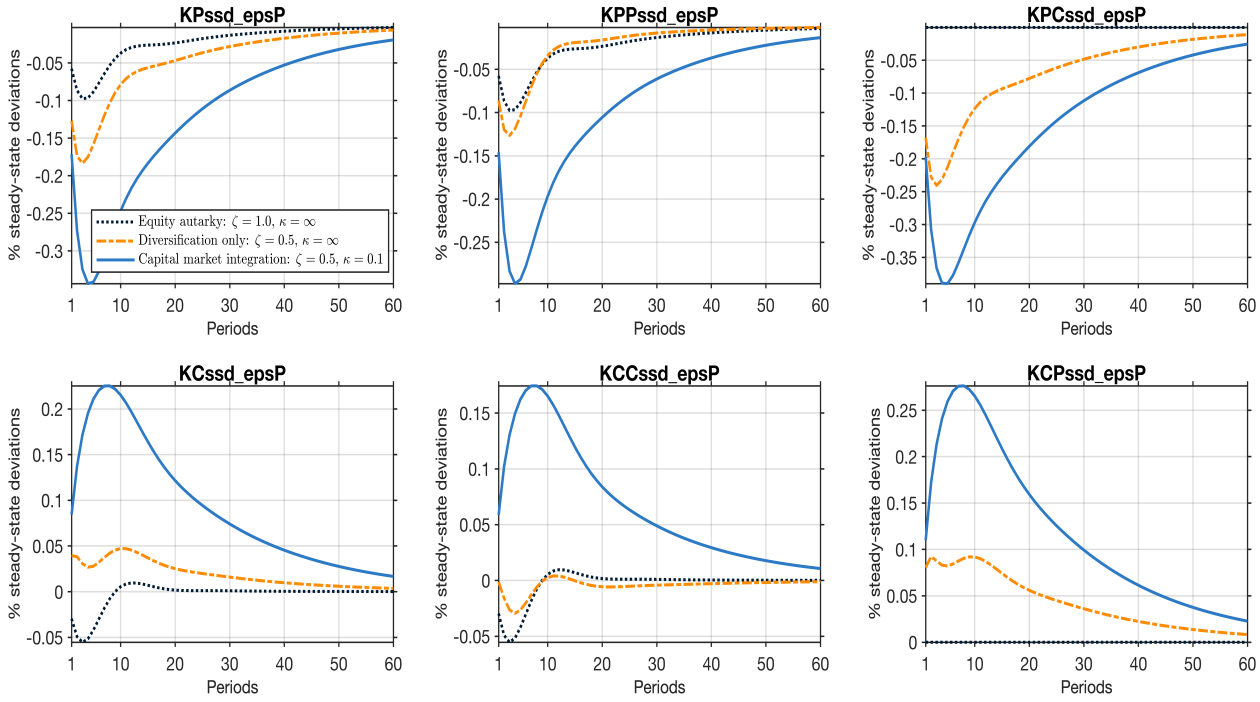

Figure 93: Impulse Response of Selected Variables for Capital

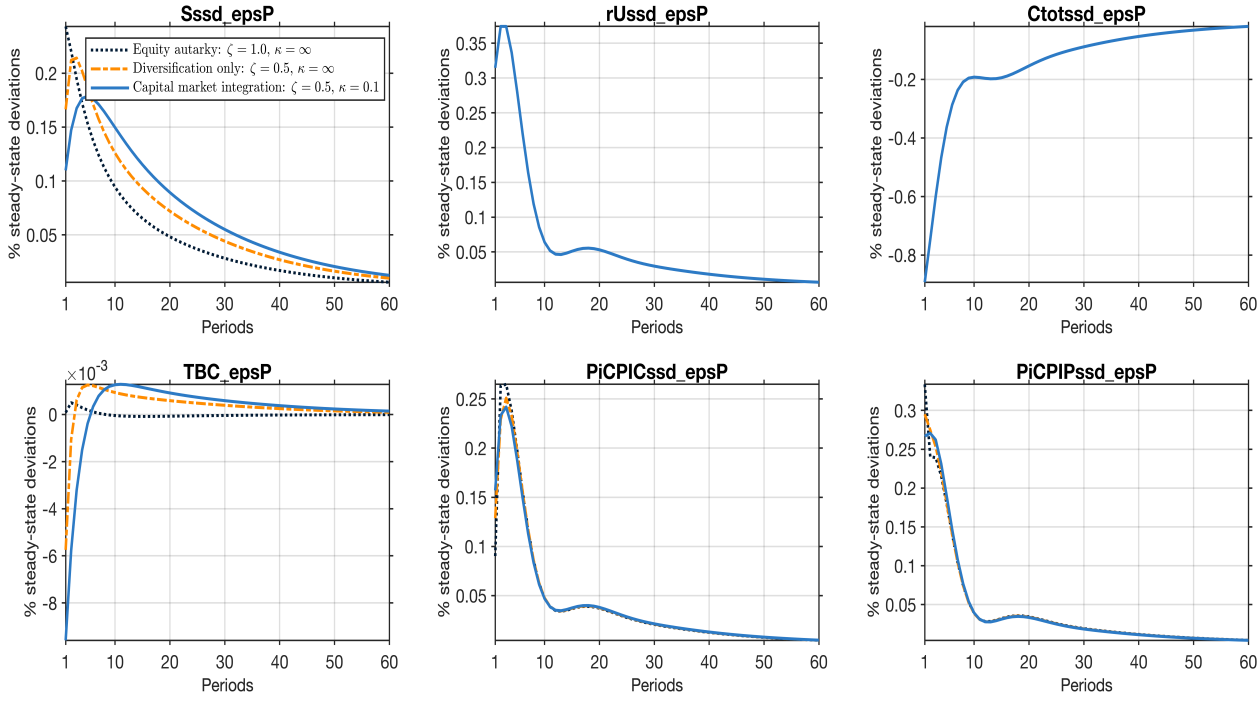

Figure 94: Impulse Response of Selected Variables for Prices

C.3 Variance under Symmetric Case with Uncorrelated Asymmetric Shocks

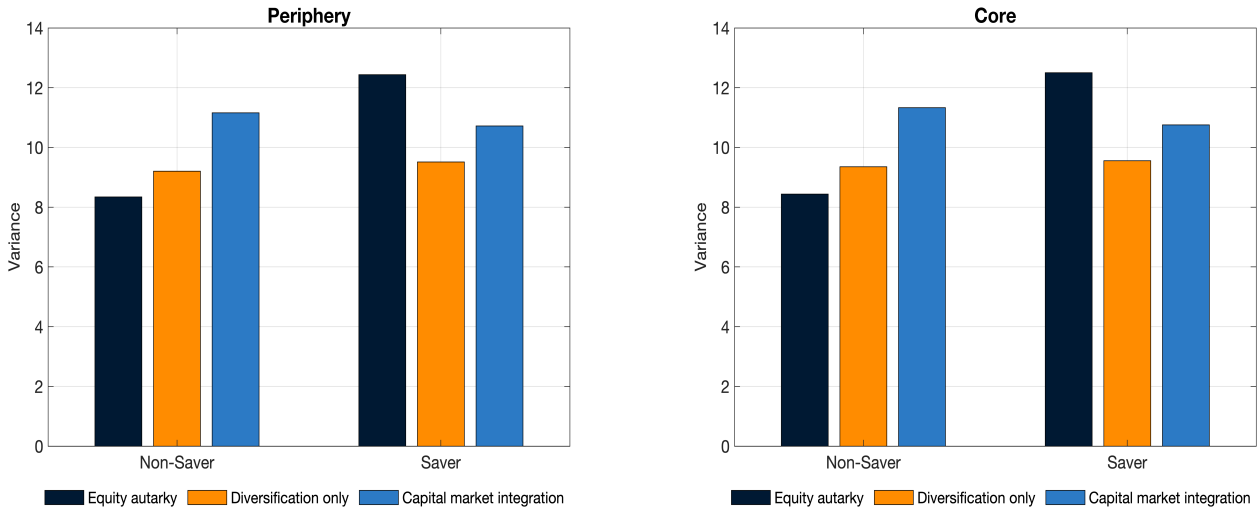

Figure 95: Variance of Consumption across regimes

C.4 Sensitivity to Heterogeneity in Financial Participation and Portfolio Composition

This appendix reports the full results underlying Section 4.2.3. The analysis explores two dimensions of heterogeneity that shape the distributional effects of capital market integration: (i) the share of Non-Savers, capturing differences in financial participation across countries; and (ii) the domestic portfolio share, capturing differences in home bias and diversification.

C.4.1 Varying the Share of Non-Savers

Figure 96 presents simulations under alternative configurations of the share of Non-Savers. The benchmark assumes a symmetric 50% share in both countries. Two asymmetric cases are considered: one where the Core has a higher share (60%) and another where the Periphery does (60%). Each panel reports cumulative consumption responses of Savers and Non-Savers, measured as the sum of deviations in impulse responses over 100 periods relative to the benchmark, decomposed into the effects of diversification only and of diversification with reallocation.

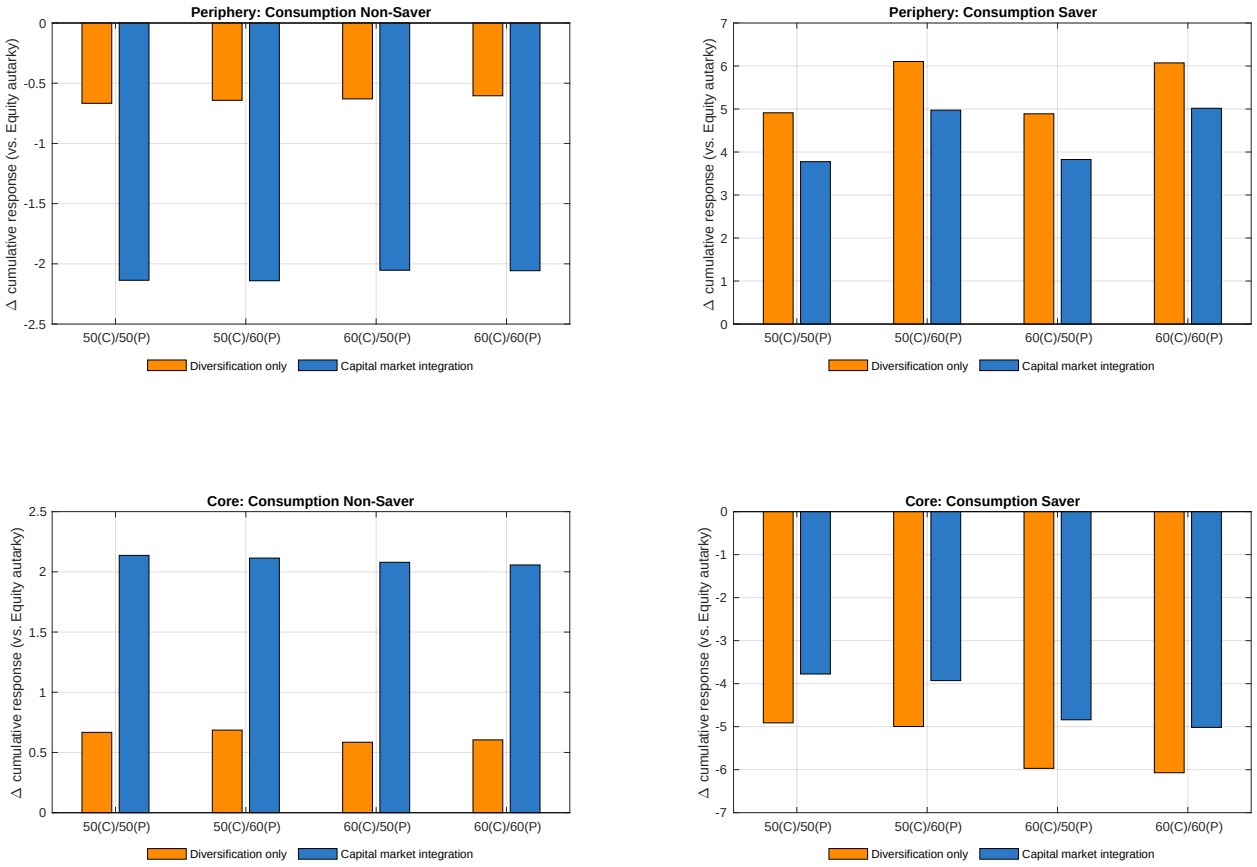

Figure 96: Sensitivity of Distributional Effects to the Share of Non-Saver Households (Deviations from Benchmark). Bars show cumulative effects of each channel, measured as the sum of differences in IRFs over 100 periods relative to the benchmark. The x-axis reports the share of Non-Savers (with the associated country in parentheses).

Results show that the benefits of integration accrue primarily to Savers and become more concentrated as the share of Non-Savers rises. Since only Savers hold financial assets, a smaller investor base implies that aggregate gains from diversification are distributed among fewer households. Non-Savers, who rely solely on labor income, experience little direct change, as wage and capital dynamics remain broadly stable across configurations. The overall distributional outcome depends mainly on the aggregate share of Non-Savers rather than its cross-country distribution.

C.4.2 Varying the Degree of Home Bias

Figure 97 reports simulations where countries differ in their domestic portfolio share. The benchmark assumes symmetric portfolios with 90% domestic equity. Two asymmetric cases are considered: one where the Core is more diversified (90%) and the Periphery

fully home-biased (100%), and the reverse.

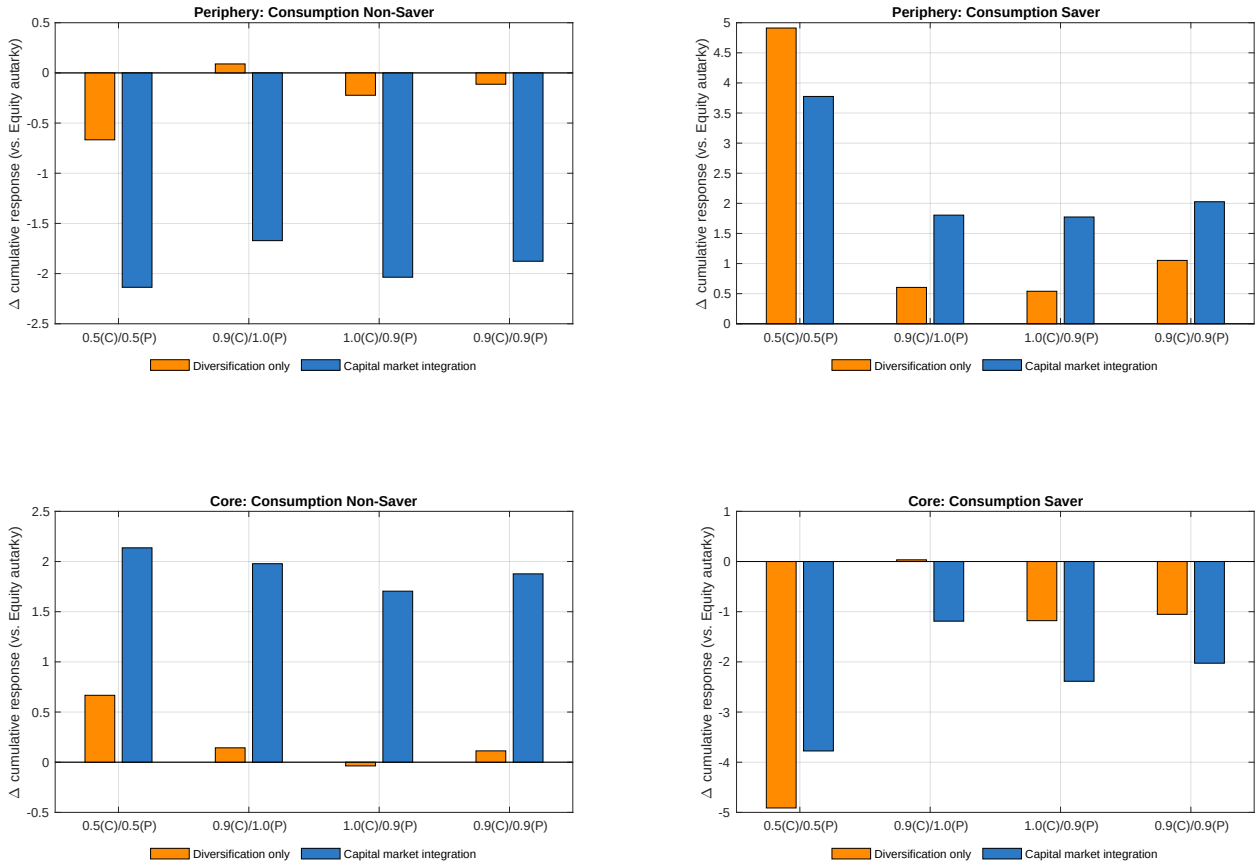

Figure 97: Sensitivity of Distributional Effects to Asymmetric Domestic Portfolio Shares (Deviations from Benchmark). Bars show cumulative effects of each channel, measured as the sum of differences in IRFs over 100 periods relative to the benchmark. The x-axis reports the degree of domestic portfolio share (with the associated country in parentheses).

When the country hit by the shock is more diversified, Savers benefit from foreign income that stabilizes domestic demand and supports wages, moderating consumption losses for both household types. When the shocked country is more home-biased, the absence of foreign income insurance magnifies domestic contractions and transmits the downturn abroad, worsening outcomes for Non-Savers in both regions.

These results demonstrate that asymmetric diversification amplifies cross-country spillovers and has important implications even for households without financial assets. The structure of portfolio holdings shapes how shocks are absorbed and transmitted through income and labor channels, influencing both within- and between-country inequality.

C.5 Calibrated case to 2010 with Standard Asymmetric Shock

In this section, I replicate the results from Section 4.3 under a temporary 1% decline in productivity in the Periphery only (an MIT shock), which is a more standard specification. The calibration remains unchanged, except that $\sigma_z^P = 0.01$ while $\sigma_z^C = 0.0$.

Figure 98 compares the impulse responses of capital and consumption for Savers and Non-Savers under both configurations. The dotted lines correspond to equity autarky, while the solid lines represent the calibrated 2010 economy. The results are qualitatively similar to those under a larger shock specification.

Relative to autarky, capital market integration amplifies the cross-country divergence in investment and consumption dynamics. Following a negative technology shock in the Periphery, capital falls more sharply there (–7.3 percentage points) and rises in the Core (+1.8 percentage points), as savings are reallocated toward the higher-return region.

For Savers, the effects reflect the interaction of diversification and reallocation. In the Periphery, Savers experience a smaller decline in consumption (+5.3 percentage points relative to autarky) owing to income insurance from Core asset holdings. Core Savers, by contrast, face a modestly larger decline (–0.6 percentage points) due to exposure to the Periphery downturn. Yet, because the Periphery is more diversified than the Core, the gains for Periphery Savers outweigh the losses for Core Savers.

For Non-Savers, the transmission operates through wages. The stronger contraction in Periphery capital depresses labor demand and real wages (–1.86 percentage points), reducing Non-Saver consumption. In the Core, higher capital inflows increase labor demand, moderating the wage decline and slightly raising Non-Saver consumption (+0.5 percentage points).

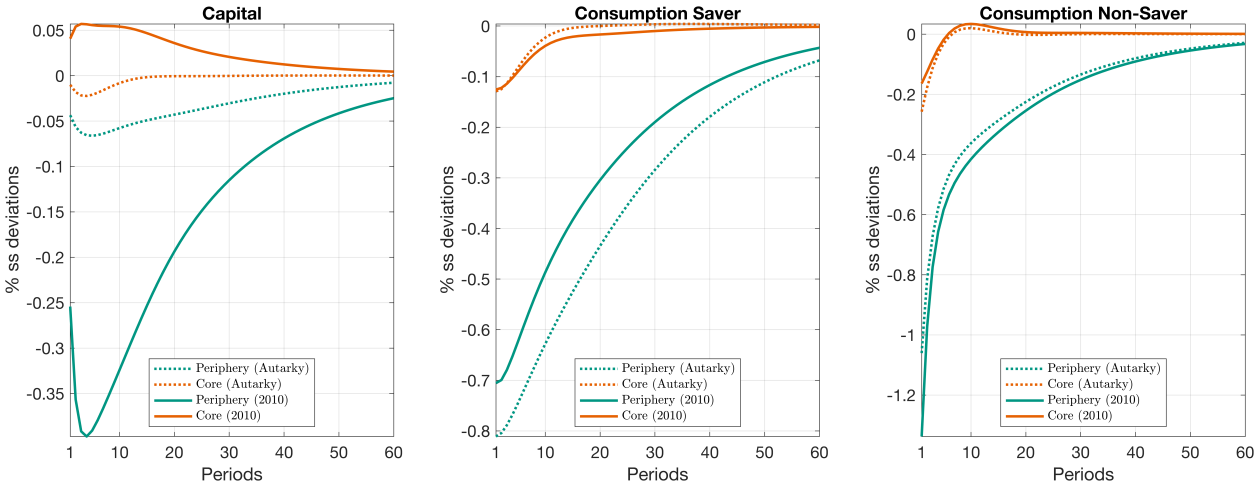

Figure 98: Impulse Responses of Capital and Consumption for Savers and Non-Savers in the Core and Periphery. Comparison between equity autarky (dotted) and calibrated 2010 (solid) configurations.

The welfare decomposition in Table 13 confirms these patterns: capital market integration improves welfare for Savers in the Periphery and for Non-Savers in the Core, while Non-Savers in the Periphery experience losses driven by labor market effects.

Table 13: Welfare Decomposition Relative to Autarky (Discounted Utilities)

Household	ΔU^C	ΔU^L	ΔU^{Total}	CEV (%)
Diversification only				
Core Saver	+0.046	+0.013	+0.059	+0.038
Core Non-Saver	+0.002	+0.013	+0.015	+0.001
Periphery Saver	-1.286	-0.188	-1.474	-0.214
Periphery Non-Saver	+0.048	-0.188	-0.139	+0.005
Capital market integration				
Core Saver	+0.006	-0.003	+0.004	+0.005
Core Non-Saver	+0.064	-0.003	+0.061	+0.041
Periphery Saver	+0.831	+0.045	+0.876	+0.139
Periphery Non-Saver	-1.526	+0.045	-1.480	-0.172

Interestingly, introducing realistic euro area asymmetries substantially attenuates the redistributive impact of integration. In the symmetric benchmark, integration benefits Savers in the Periphery and harms those in the Core, while Non-Savers gain in the Core and lose in the Periphery. Under the 2010 calibration, these effects are much weaker. The small relative size of the Periphery, the pronounced home bias of Core investors, and limited portfolio reallocation restrict risk-sharing. Consequently, Core returns and Periphery

wages fall less, and welfare gains and losses are smaller overall. Capital market integration remains stabilizing in aggregate but continues to generate unequal gains, favoring asset holders in the Periphery and wage earners in the Core, while leaving liquidity-constrained households most exposed.

Consistent with the empirical evidence in the paper, the calibrated model predicts that integration reduces cross-country inequality among Savers but widens within-country inequality, as the welfare gap between Savers and Non-Savers expands in the Periphery and narrows in the Core.

Inequality. Figure 99 compares the impulse responses of capital and consumption for Savers and Non-Savers under both configurations. The dotted lines correspond to the representative-agent benchmark, while the solid lines represent the calibrated 2010 economy. It provides similar qualitative results as under a larger estimation of the shock, though magnitudes differ due to the presence of household heterogeneity.

Relative to the representative-agent benchmark, introducing inequality amplifies the asymmetry of the response to shocks across countries and household types. In the Periphery, capital declines less sharply (+1.23 percentage points relative to the representative-agent case), reflecting weaker aggregate demand when a large share of households cannot smooth consumption. In contrast, capital rises more in the Core (+0.42 percentage points), as excess savings from unconstrained households are redirected toward the higher-return region. This reallocation of savings mitigates the output decline in the Core but exacerbates the downturn in the Periphery.

For Savers, the effects reflect the interaction between diversification and reallocation. In the Periphery, Savers' consumption falls slightly more (-0.6 percentage points relative to the representative-agent case) due to lower returns and depressed local demand. In the Core, Savers also face a larger decline (-0.52 percentage points) owing to their exposure to the Periphery's downturn. However, these effects are moderate compared to the large losses experienced by liquidity-constrained households.

For Non-Savers, the main transmission operates through wages. The contraction in Periphery capital depresses labor demand and real wages, leading to a substantial fall in Non-Saver consumption (-14.1 percentage points). In the Core, by contrast, stronger capital inflows support labor demand, slightly reducing the fall in Non-Saver consumption (-0.02 percentage points). Overall, inequality amplifies within-country heterogeneity, as liquidity-constrained households bear the brunt of the adjustment in the Periphery.

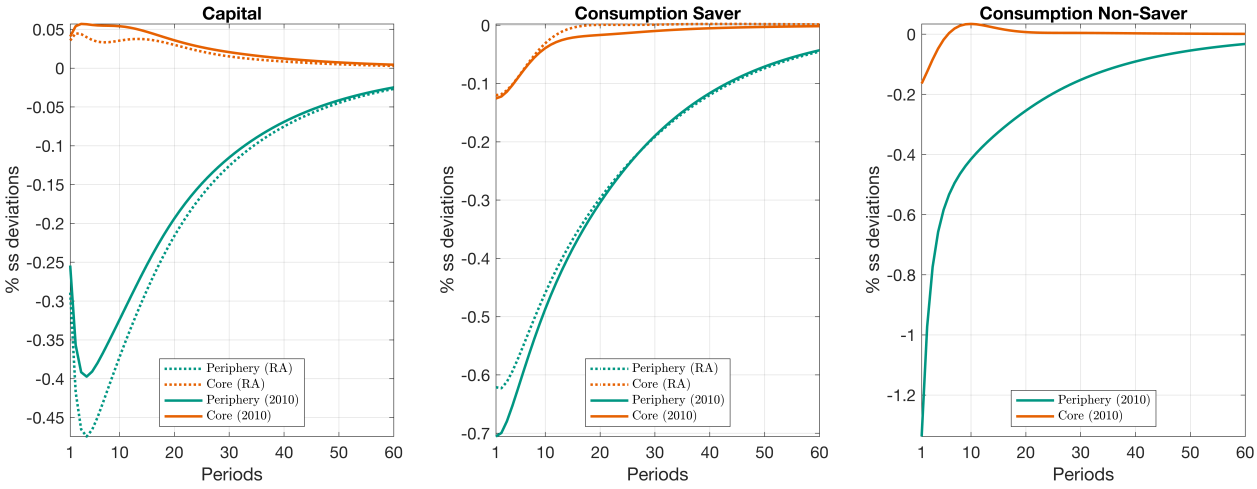

Figure 99: Impulse Responses of Capital and Consumption for Savers and Non-Savers in the Core and Periphery. Comparison between representative-agent (dotted) and calibrated 2010 (solid) configurations.

The welfare decomposition in Table 14 confirms these patterns. Introducing heterogeneity generates highly unequal welfare effects across countries and households. When only the Periphery is heterogeneous, welfare improves for Periphery Savers (+143.0) but falls sharply for Periphery Non-Savers (-1116.8), reflecting adverse labor market dynamics and limited access to capital income. When only the Core is heterogeneous, welfare gains are concentrated among Core Savers (+11.3), while Core Non-Savers face losses (-194.9) due to increased inequality in labor income. Under full inequality, the pattern of heterogeneous effects persists but is somewhat attenuated, as partial risk-sharing across countries moderates the extreme welfare losses among constrained households.

Table 14: Welfare Decomposition Relative to Representative Agent Baseline (Discounted Utilities)

Household	ΔU^C	ΔU^L	ΔU^{Total}
Periphery heterogeneity only			
Core Saver	+0.000	+0.001	+0.001
Core Non-Saver	-156.335	-36.812	-193.148
Periphery Saver	+163.978	-20.976	+143.002
Periphery Non-Saver	-886.777	-230.000	-1116.777
Core heterogeneity only			
Core Saver	+13.044	-1.780	+11.265
Core Non-Saver	-156.336	-38.593	-194.929
Periphery Saver	+0.005	-0.002	+0.004
Periphery Non-Saver	-887.006	-209.026	-1096.032
Inequality			
Core Saver	+13.010	-1.802	+11.208
Core Non-Saver	-156.260	-38.616	-194.875
Periphery Saver	+166.132	-20.760	+145.372
Periphery Non-Saver	-888.317	-229.784	-1118.102

Consistent with the macroeconomic adjustment described above, heterogeneity increases within-country inequality in the Periphery, as constrained households suffer disproportionately from the shock. In the Core, heterogeneity primarily redistributes income among households but leaves aggregate outcomes largely unaffected. Overall, inequality amplifies welfare dispersion within countries while slightly improving risk-sharing across them, underscoring the asymmetric role of household heterogeneity in shaping the transmission of shocks in the euro area.

D Results - Heterogeneous-Agent Model

D.1 Understanding the channels: TANK vs. HANK

This section compares the two-agent (TANK) and heterogeneous-agent (HANK) versions of the model under the symmetric benchmark described above. Both frameworks share identical aggregate calibration, portfolio shares, adjustment costs, and shock processes. They are evaluated under three integration regimes: equity autarky, diversification only, and capital market integration (Table 2).

The key difference lies in the treatment of household heterogeneity. In the TANK model, each country contains two representative types—a Saver and a Non-Saver—whose

behavior responds mechanically to aggregate variables. In the HANK model, households differ in wealth and productivity and face borrowing constraints that bind endogenously. This richer structure introduces endogenous participation and allows the share of constrained households to vary over time as the wealth distribution evolves. Capital market integration therefore affects both aggregate responses and the composition of households across the distribution.

Figures 100 and 101 show the response of capital in the Core and Periphery to a negative productivity shock in the Periphery. In both models, capital reallocation is the main adjustment channel: investment falls in the Periphery and rises in the Core. Under equity autarky, the absence of cross-border portfolio adjustment prevents reallocation. With diversification only, portfolio holdings are fixed, and the adjustment occurs through valuation effects. Under capital market integration, portfolios can rebalance across borders, and capital flows endogenously toward the Core.

While the qualitative pattern is similar, the magnitude and timing differ. In the TANK model, capital shifts rapidly across countries. In the HANK model, reallocation is slower and less complete. Borrowing constraints limit the ability of Periphery households to adjust savings and delay inflows into the Core. Financial integration is therefore incomplete in the short run, even though portfolios are diversified in steady state. Heterogeneity reduces the speed of capital reallocation and weakens cross-country stabilization.

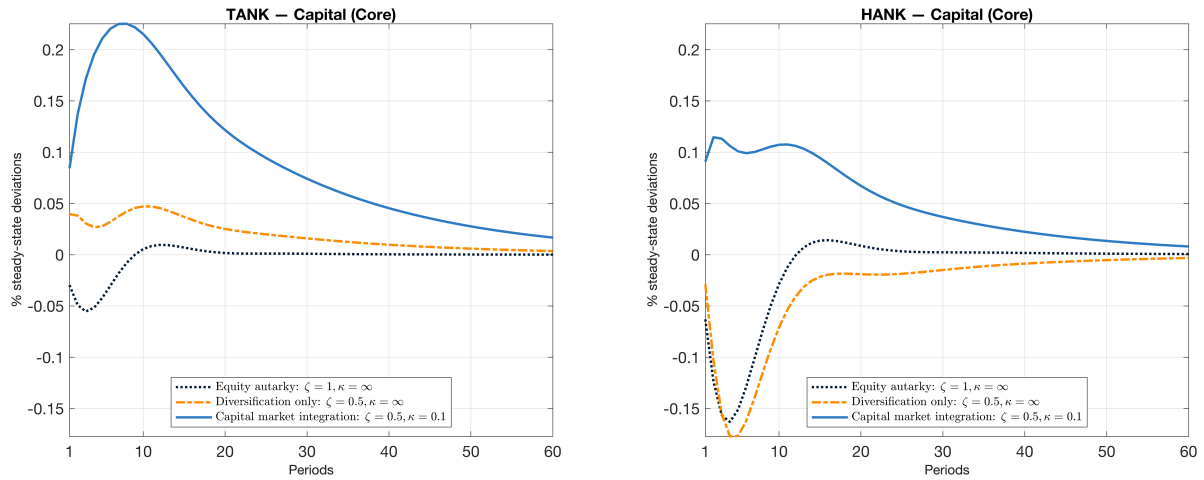

Figure 100: Capital in the Core

The figure plots the response of Core capital to a negative productivity shock in the Periphery under three integration regimes: equity autarky ($\zeta = 1$, $\kappa = \infty$), diversification only ($\zeta = 0.5$, $\kappa = \infty$), and capital market integration ($\zeta = 0.5$, $\kappa = 0.1$). Results are shown for the two-country TANK model (left) and its heterogeneous-agent HANK counterpart (right). In the TANK model, capital reallocation is immediate and symmetric across countries, whereas in the HANK model it is slower and less complete due to borrowing constraints.

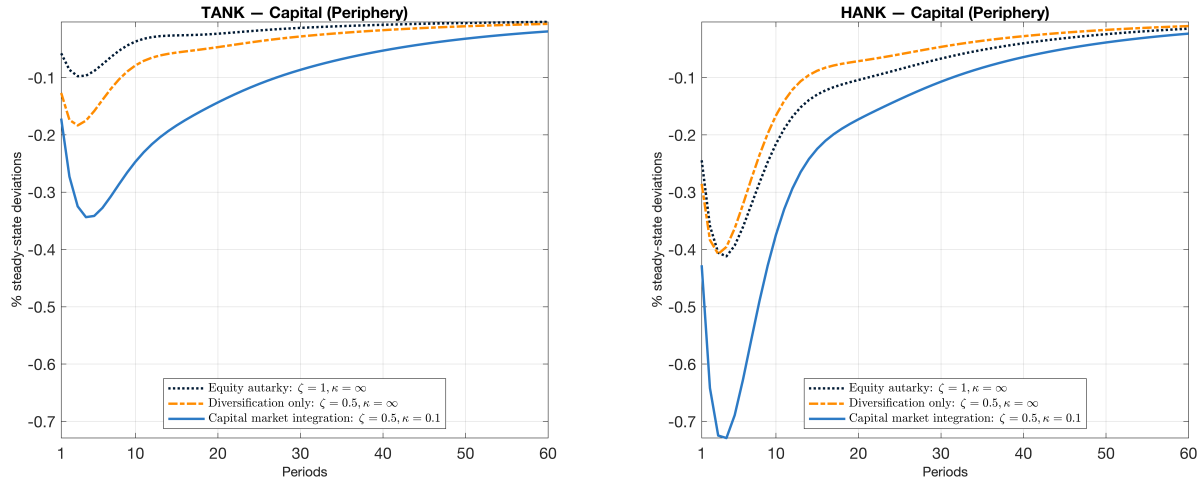

Figure 101: Capital in the Periphery

The figure plots the response of Periphery capital to a negative productivity shock in the Periphery under three integration regimes: equity autarky ($\zeta = 1$, $\kappa = \infty$), diversification only ($\zeta = 0.5$, $\kappa = \infty$), and capital market integration ($\zeta = 0.5$, $\kappa = 0.1$). Results are shown for the two-country TANK model (left) and its heterogeneous-agent HANK counterpart (right). In the TANK model, capital flows rapidly to the Core, generating a sharp domestic contraction. In the HANK model, borrowing constraints among households amplify the downturn and delay recovery, leading to a more persistent fall in capital despite identical steady-state diversification.

Figures 102 and 103 display Saver consumption in both regions. In both models, consumption follows capital income dynamics: it rises in the Core and falls in the Periphery. Under equity autarky, Savers are fully exposed to domestic shocks. Diversification introduces partial insurance, while reallocation transfers income toward the Periphery, stabilizing aggregate consumption.

However, the magnitude of these effects is smaller in the HANK model. Incomplete markets and heterogeneous balance sheets dampen Savers' responses. Wealthier households smooth more effectively, while others adjust portfolios gradually. Integration thus delivers weaker short-run insurance but more persistent redistribution. Heterogeneity turns capital market integration from an immediate stabilizer into a gradual redistributive process.

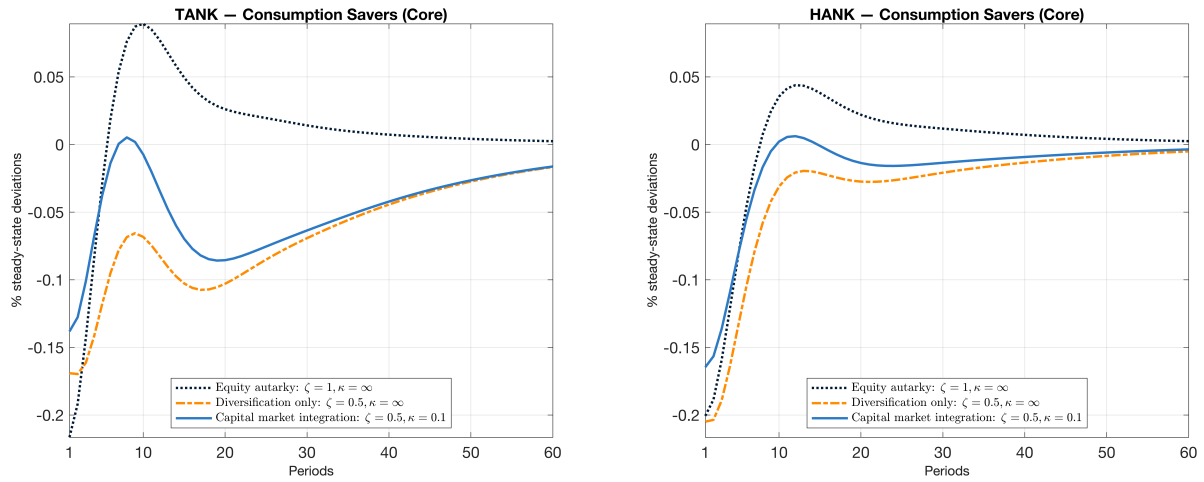

Figure 102: Consumption of Savers (Core)

The figure plots the response of Saver consumption in the Core to a negative productivity shock in the Periphery under three integration regimes: equity autarky ($\zeta = 1$, $\kappa = \infty$), diversification only ($\zeta = 0.5$, $\kappa = \infty$), and capital market integration ($\zeta = 0.5$, $\kappa = 0.1$). Results are shown for the two-country TANK model (left) and its heterogeneous-agent HANK counterpart (right). In both models, consumption rises with capital reallocation toward the Core. The TANK response is stronger and more immediate, while in the HANK model, heterogeneity dampens the initial effect and smooths adjustment.

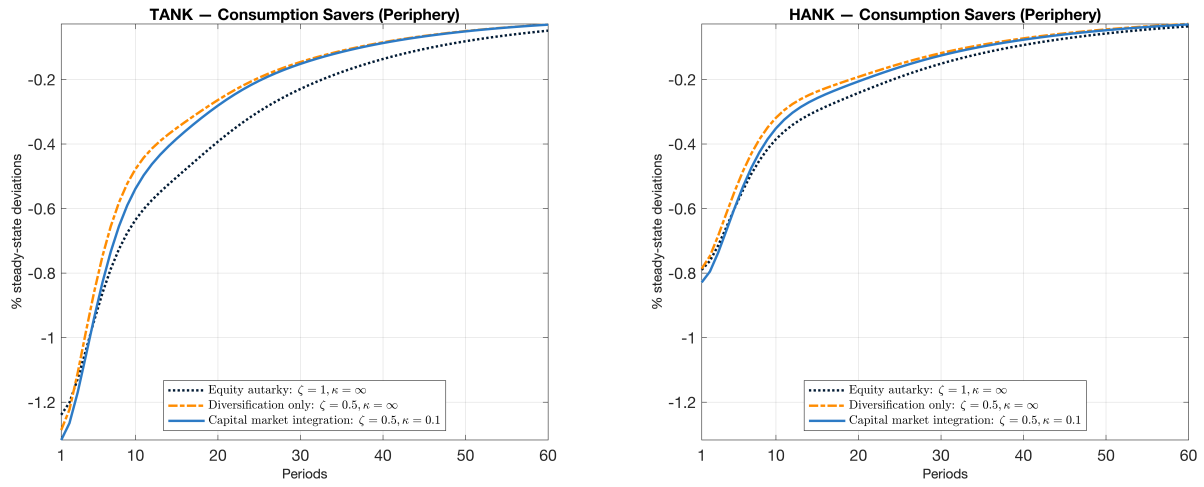

Figure 103: Consumption of Savers (Periphery)

The figure plots the response of Saver consumption in the Periphery to a negative productivity shock in the Periphery under three integration regimes: equity autarky ($\zeta = 1$, $\kappa = \infty$), diversification only ($\zeta = 0.5$, $\kappa = \infty$), and capital market integration ($\zeta = 0.5$, $\kappa = 0.1$). Results are shown for the two-country TANK model (left) and its heterogeneous-agent HANK counterpart (right). Without diversification, consumption falls sharply as domestic returns decline. Diversification and reallocation mitigate these losses in both frameworks, but the HANK response is smoother and more persistent due to wealth heterogeneity.

Figures 104 and 105 show Non-Saver consumption. Because Non-Savers do not hold assets, their consumption depends mainly on labor income. In both models, Periphery

Non-Savers experience a sharp contraction, while Core Non-Savers benefit from higher labor demand. In the TANK model, these effects are nearly symmetric across integration regimes. In the HANK model, endogenous changes in the share of constrained households amplify the downturn in the Periphery and dampen the upturn in the Core. More households become constrained in the Periphery, cutting consumption further, while fewer remain constrained in the Core. Integration therefore redistributes both across and within countries, stabilizing the union in the aggregate but widening inequality.

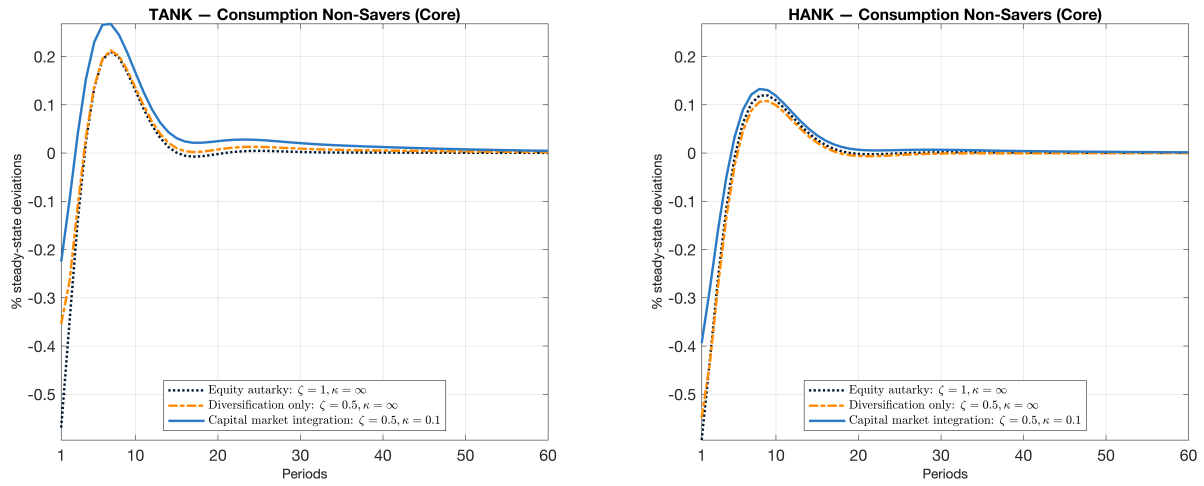

Figure 104: Consumption of Non-Savers (Core)

The figure plots the response of Non-Saver consumption in the Core to a negative productivity shock in the Periphery under three integration regimes: equity autarky ($\zeta = 1$, $\kappa = \infty$), diversification only ($\zeta = 0.5$, $\kappa = \infty$), and capital market integration ($\zeta = 0.5$, $\kappa = 0.1$). Results are shown for the two-country TANK model (left) and its heterogeneous-agent HANK counterpart (right). Consumption rises slightly as labor demand and capital inflows increase, with differences between the TANK and HANK responses driven by endogenous changes in the share of constrained households.

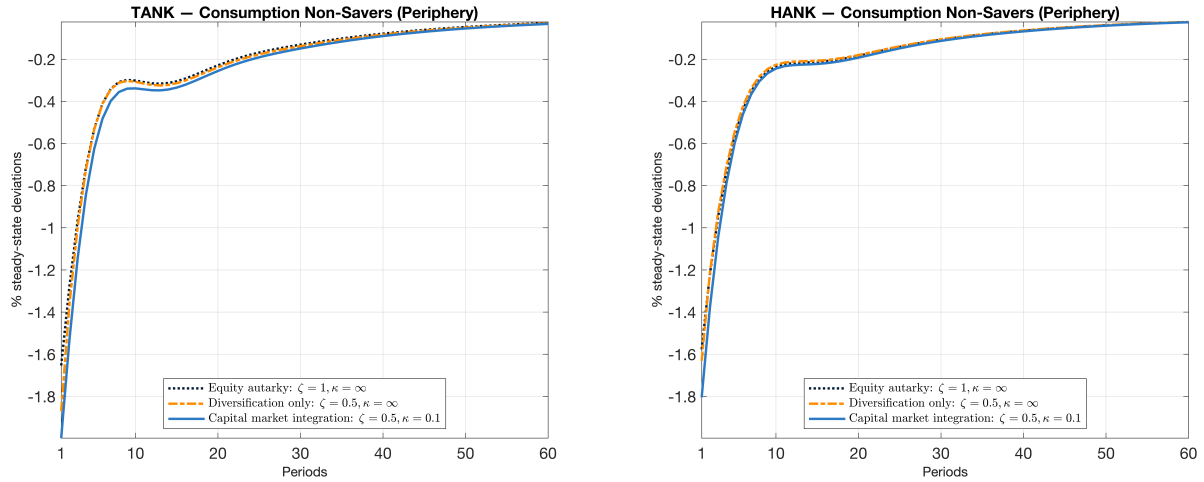

Figure 105: Consumption of Non-Savers (Periphery)

The figure plots the response of Non-Saver consumption in the Periphery to a negative productivity shock in the Periphery under three integration regimes: equity autarky ($\zeta = 1$, $\kappa = \infty$), diversification only ($\zeta = 0.5$, $\kappa = \infty$), and capital market integration ($\zeta = 0.5$, $\kappa = 0.1$). Results are shown for the two-country TANK model (left) and its heterogeneous-agent HANK counterpart (right). In both models, consumption declines as real wages fall, but in the HANK economy, tightening borrowing constraints further depress consumption, leading to stronger within-country redistribution.

Figures 106 and 107 decompose Non-Saver consumption into three parts: (i) within-household changes among the already constrained, (ii) reclassification of newly constrained households, and (iii) composition effects from shifts in the share of constrained agents.[19]

In the Periphery, the fall in aggregate consumption is driven mainly by newly constrained households. Borrowing constraints tighten, and the share of constrained agents rises, amplifying the downturn. In the Core, fewer households remain constrained, producing a temporary boost in the reclassification component. This shows that capital market integration affects not only average behavior but also the distribution of constraint status, reshaping who can smooth consumption.

Capital market integration reduces Core consumption volatility by about 47% but increases it by 5% in the Periphery. At the union level, volatility is unchanged. Among Savers, volatility declines by 30–35% in the Core and 6% in the Periphery. Among Non-Savers, it rises by 23% in the Periphery and falls by nearly half in the Core. Integration therefore stabilizes aggregates by concentrating volatility among constrained households. Aggregate stabilization is achieved through micro-level amplification.

[19] Following Altonji and Paxson [1988], aggregate consumption changes can be expressed as $\Delta \bar{C}t^{HtM} = St - 1^{HtM}\Delta C_t^{HtM} + C_{t-1}^{HtM}\Delta S_t^{HtM} + \mathrm{Cov}_t(\Delta S_t^{HtM}, \Delta C_t^{HtM})$. The first term captures within effects, the second reclassification, and the third composition changes.

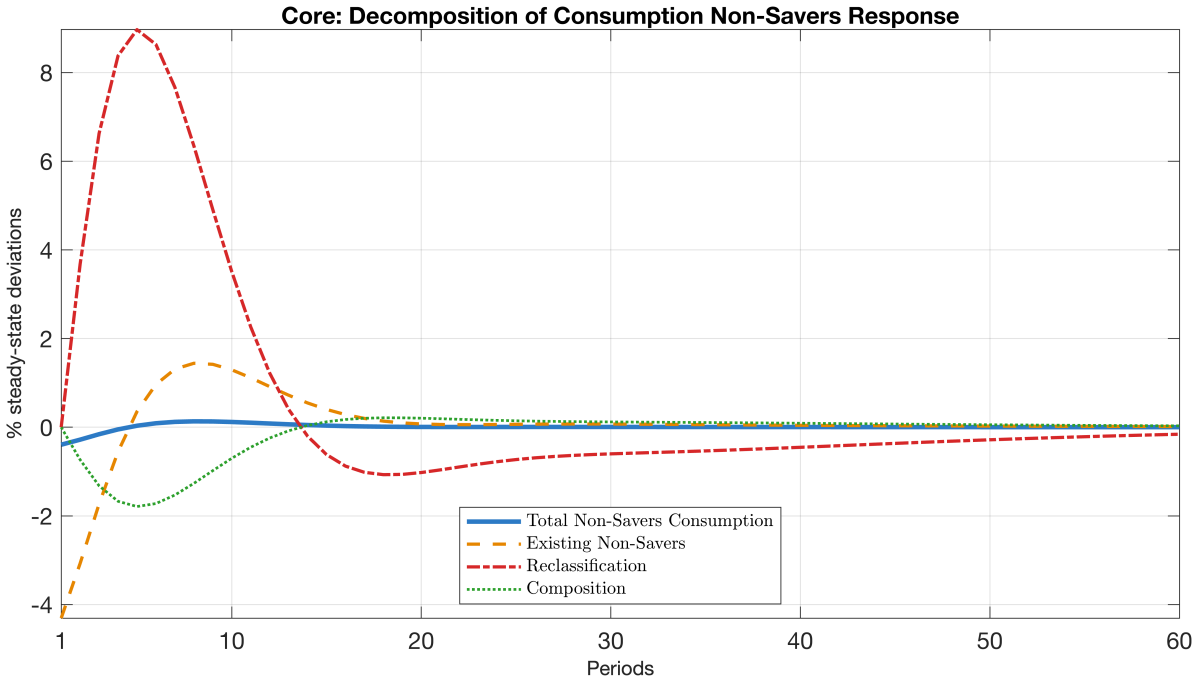

Figure 106: Decomposition of Non-Saver Consumption Response in the Core

The figure decomposes the response of Non-Saver consumption in the Core to a negative productivity shock in the Periphery. The total response (blue) combines three components: within-household adjustments among existing Non-Savers (orange), the reclassification of newly constrained households (red), and composition effects due to the changing share of constrained agents (green). The sharp fall in consumption among already constrained households is partly masked by composition effects: as more households become constrained, the group's average consumption mechanically rises, making the aggregate decline appear milder despite worsening individual outcomes.

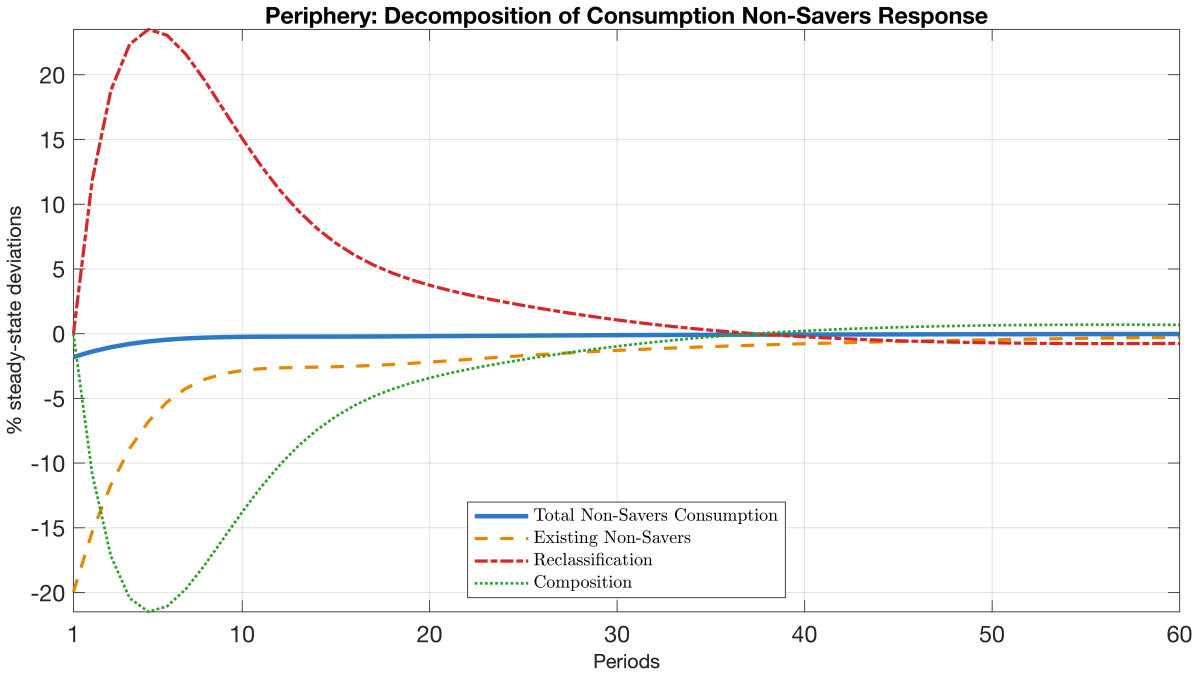

Figure 107: Decomposition of Non-Saver Consumption Response: Periphery

The figure decomposes the response of Non-Saver consumption in the Periphery to a domestic negative productivity shock. The total response (blue) reflects within-household adjustments of existing Non-Savers (orange), the reclassification of newly constrained households (red), and composition effects from the shifting population weights (green). In the Periphery, both the fall in consumption and the reclassification shock are much larger: tighter borrowing limits cause a sharp expansion in the share of constrained households, amplifying heterogeneity. As a result, the severe drop in consumption among constrained households is partly concealed by the composition effect, which mechanically raises average consumption within the expanded Non-Saver group.

D.2 Calibrated Case for 2010 with Standard Asymmetric Shock

In this section, I replicate the results from Section 6.2 under a temporary 1% decline in productivity in the Periphery only (a MIT shock), which is a more standard specification. The calibration remains unchanged, except that $\sigma_z^P = 0.01$ while $\sigma_z^C = 0.0$. Results for the same shock under the TANK are available in the Appendix .

In Figure 108, the results remain qualitatively similar to those in the baseline calibration. Capital increases in the Core under the realistic calibration, whereas it previously declined under autarky, and it falls more sharply in the Periphery. Consumption of Savers in the Periphery declines less, as they benefit from greater insurance through foreign financial income. Conversely, Savers in the Core experience a larger fall in consumption, as they bear part of the negative shock originating in the Periphery. As capital decreases

in the Periphery, real wages drop further, reducing Non-Savers' consumption, while the increase in Core capital mitigates the fall in real wages there.

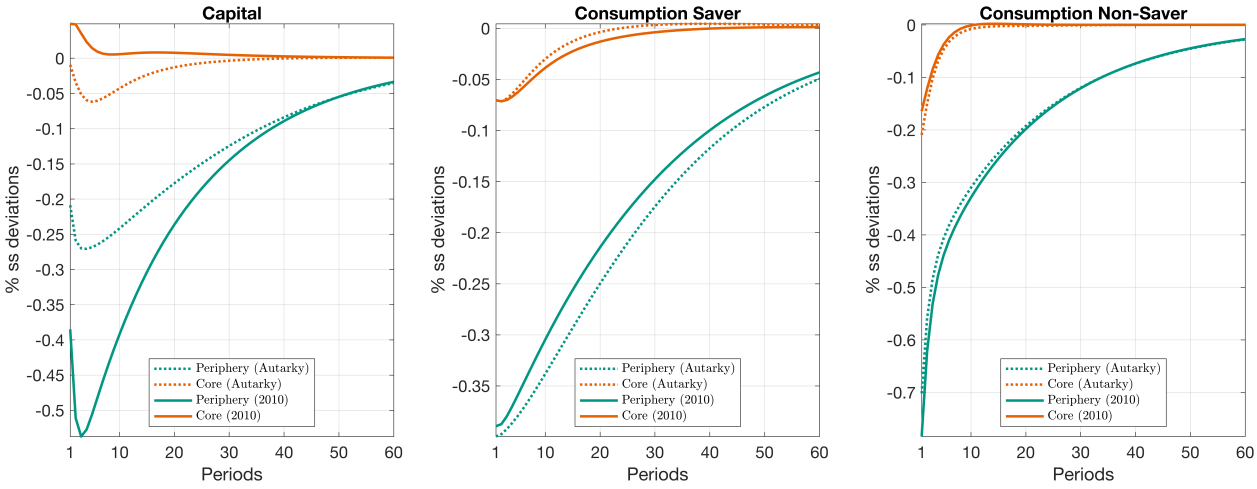

Figure 108: Impulse Responses of Capital and Consumption for Savers and Non-Savers in the Core and Periphery. Comparison between equity autarky (dotted) and calibrated 2010 (solid) configurations.

Diversification reduces aggregate consumption volatility while amplifying disparities within countries. At the union level, the variance of total consumption declines slightly by around 2%, and country-level volatility also falls by about 5% in the Core and 4% in the Periphery, indicating improved cross-country risk sharing. However, within-country heterogeneity in volatility rises markedly. In the Core, the gap in consumption volatility between household types widens by roughly 30%, with the variance of Non-Savers falling (from 0.087 to 0.055) and that of Savers increasing (from 0.034 to 0.041). In the Periphery, the divergence is even more pronounced: the variance among Savers decreases by about 18%, whereas that of Non-Savers increases by roughly 16%. Overall, diversification stabilizes macroeconomic fluctuations across regions but exacerbates microeconomic heterogeneity in exposure to shocks within countries.

Five years after the shock, relative to equity autarky, capital market integration slightly reduces inequality in the Core by about 0.3 basis points and increases it in the Periphery by roughly 0.9 basis points. At the same time, between-country inequality declines by about 0.3 basis points. Overall, integration promotes mild convergence across countries while marginally widening disparities within the Periphery.

The welfare decomposition in Table 13 confirms these patterns: capital market integra-

tion improves welfare for Savers in the Periphery and for Non-Savers in the Core, while Non-Savers in the Periphery experience losses driven by labor market effects and Savers in the Core bears a larger share of the negative shock in the Periphery.

Table 15: Welfare Decomposition Relative to Autarky (Discounted Utilities)

Household	ΔU^C	ΔU^L	ΔU^{Total}	CEV (%)
Capital market integration				
Core Saver	-2.522	+7.158	+4.636	-4.167
Core Non-Saver	+7.171	+3.656	+10.826	+10.045
Periphery Saver	+18.684	-1.178	+17.506	+47.642
Periphery Non-Saver	-33.313	-0.582	-33.895	-29.608

D.3 Calibrated Case for 2010 with Asymmetric Shock: HANK vs. TANK

Figure 109 compares the impulse responses of capital in the Periphery and the Core between the TANK and HANK models. Both frameworks generate qualitatively similar dynamics: following a negative productivity shock in the Periphery, capital contracts domestically and rises in the Core as savings reallocate toward higher returns. Introducing household heterogeneity, however, alters both the amplitude and persistence of these adjustments.

In the Periphery, the decline in capital is deeper and more persistent under HANK. The presence of liquidity-constrained households weakens aggregate saving capacity, while tighter financial conditions amplify the fall in investment. These mechanisms generate a stronger domestic amplification effect. At the same time, unequal asset holdings and portfolio adjustment costs slow down the reallocation of funds toward the Core, muting the external response relative to the TANK benchmark. Hence, heterogeneity simultaneously strengthens domestic amplification and dampens cross-border spillovers.

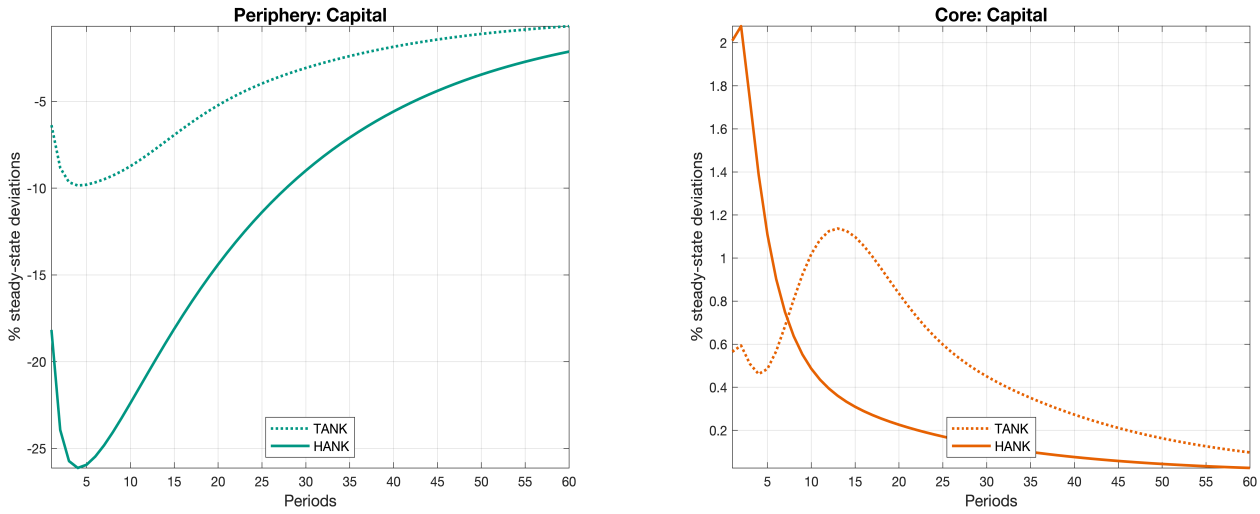

Figure 109: Impulse Response of Capital in the Core and the Periphery Across Models

In the Periphery, both models display a sharp contraction in consumption following the shock, but the adjustment is considerably stronger under HANK (Figure 110). Liquidity-constrained households suffer the largest losses, as falling wages and asset prices compress disposable income and limit their ability to smooth consumption. Savers, facing weaker returns, increase precautionary savings, which further reduces aggregate demand. The resulting interaction between constrained and unconstrained agents magnifies the decline in aggregate consumption and delays the recovery relative to the representative-agent case.

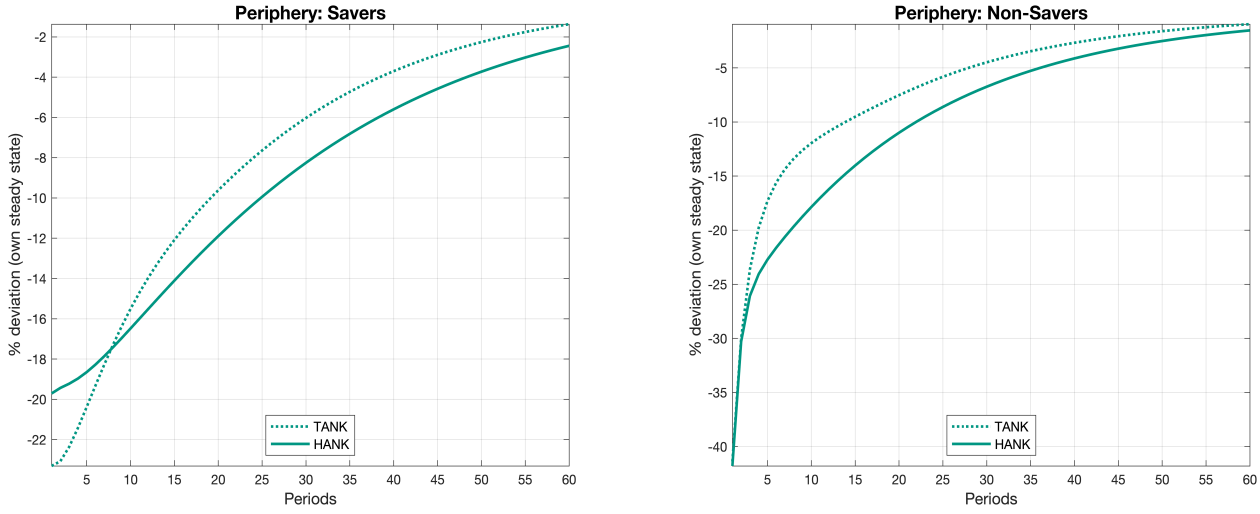

Figure 110: Impulse Response of Consumption in the Periphery Across Models

In the Core, the initial dynamics are again similar across frameworks, consumption

falls moderately as external demand weakens—but the HANK model exhibits a more persistent and dampened response (Figure 111). The key difference lies in the behavior of Savers. Under HANK, the consumption decline among Core Savers is smaller and less abrupt than in the TANK model. This muted reaction reflects two forces: a stronger wealth effect, as falling prices increase the real value of nominal assets, and a weaker transmission of foreign losses, since diversified portfolios cushion the decline in returns. Together, these mechanisms stabilize Savers' consumption and reduce the amplitude of the aggregate downturn.

The price channel further reinforces this dampening effect. The stronger wealth response under HANK lowers prices more sharply in the Core, cushioning real income losses and offsetting part of the external spillover that would otherwise amplify the contraction. At the same time, compositional effects across households introduce inertia: Non-Savers, facing lower wages and lacking access to assets, cannot smooth consumption, while Savers, despite being wealthier, reduce spending in response to lower returns. The coexistence of high- and low-marginal-propensity-to-consume households therefore flattens the aggregate consumption response, yielding a slower yet more stable adjustment than in the representative-agent economy.

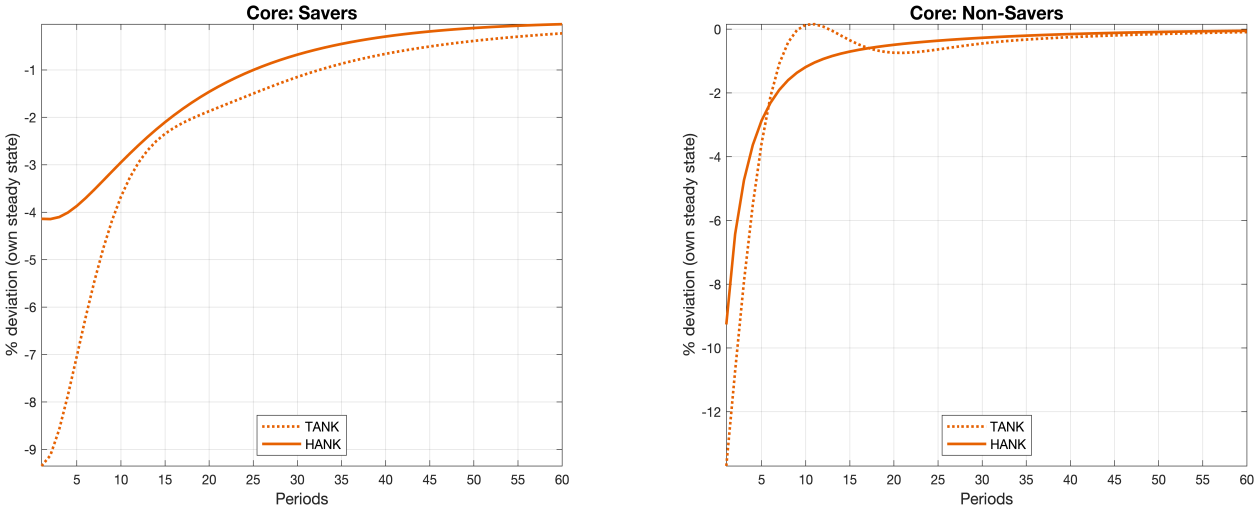

Figure 111: Impulse Response of Consumption in the Core Across Models

Overall, introducing heterogeneity does not alter the direction of adjustment but amplifies its magnitude. The same channels identified in the two-agent framework—diversification, reallocation, and labor-income effects—continue to operate, yet their strength depends critically on the distribution of financial wealth and the prevalence of liquidity constraints. In the Periphery, heterogeneity magnifies domestic amplification through balance-sheet

and demand effects, while in the Core it moderates the transmission of capital inflows through stronger wealth and price responses.

Crucially, the presence of Non-Savers shapes both the intensity and persistence of adjustment. Their inability to smooth consumption amplifies local downturns, while their aggregate weight dampens the short-run transmission of shocks across borders. Consequently, the HANK framework preserves the qualitative insights of the TANK model but reveals stronger and more persistent cross-country asymmetries driven by unequal household exposure and the dominant role of liquidity-constrained households in shock propagation.

D.4 Calibrated Case for 2010 with Asymmetric Shock: Decomposition

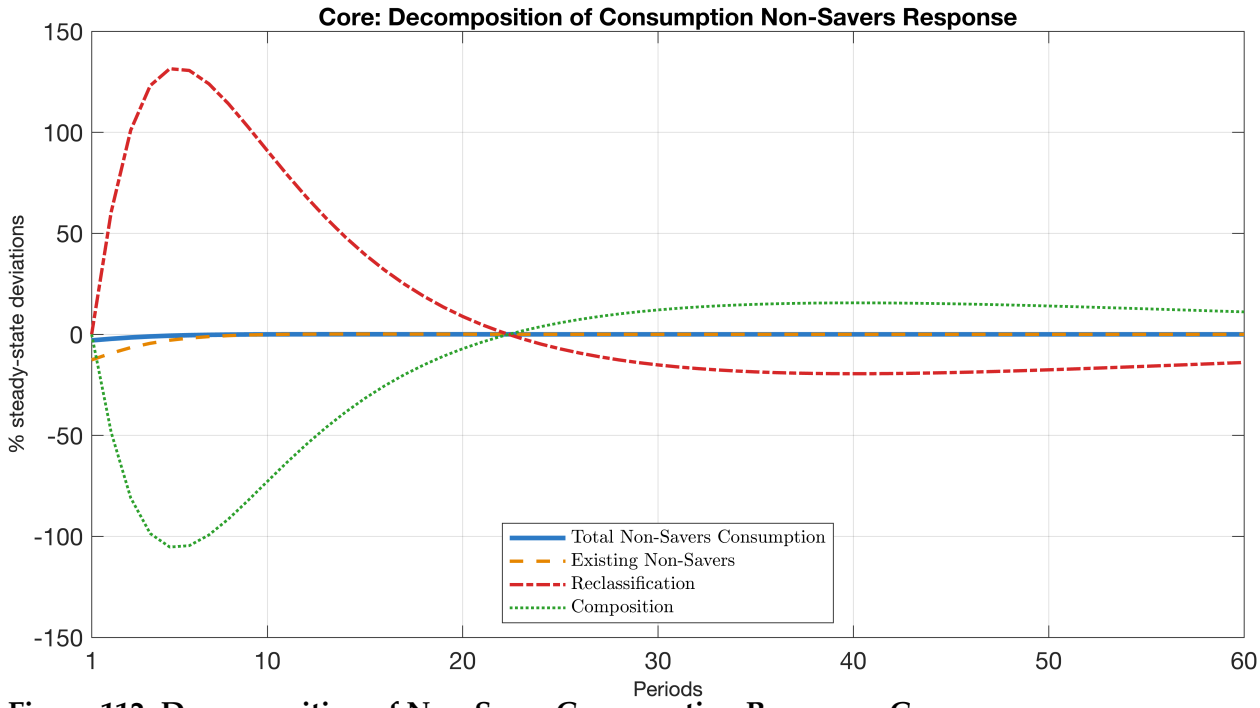

Figure 112: Decomposition of Non-Saver Consumption Response: Core
The figure decomposes the change in aggregate consumption among Non-Savers into contributions from existing Non-Savers, newly constrained households (reclassification), and composition effects. The reclassification component accounts for most of the adjustment in total Non-Saver consumption.

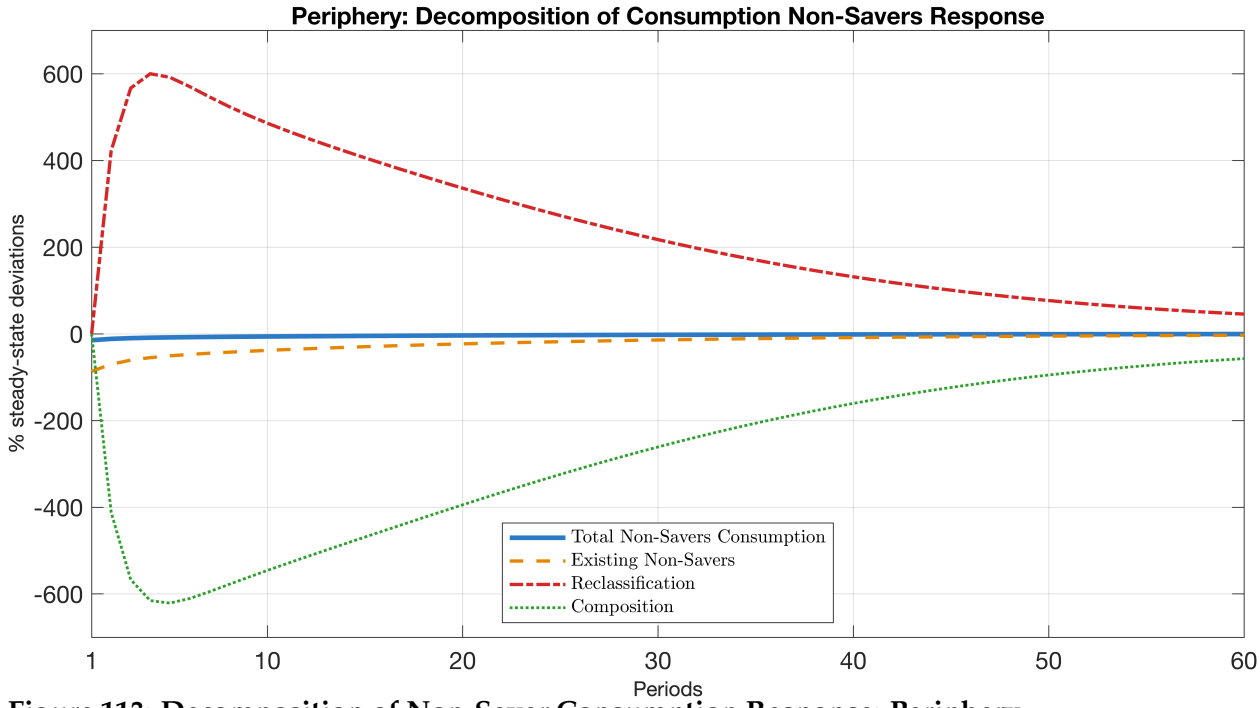

Figure 113: Decomposition of Non-Saver Consumption Response: Periphery
Similar decomposition for the Periphery. The large positive reclassification effect indicates that a growing share of households becomes liquidity constrained, offsetting part of the consumption decline among existing Non-Savers.