The Geography of Capital Allocation in the Euro Area

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Abstract

We reassess the pattern of Euro Area financial integration adjusting for the role of "onshore offshore financial centers" (OOFCs) within the Euro Area. While the Euro Area records large levels of international investment both within and outside of the currency union, much of these flows are intermediated via the OOFCs of Luxembourg, Ireland, and the Netherlands. These countries have dual roles as both hubs of investment fund intermediation and centers of securities issuance by foreign firms. We look through both roles and restate the pattern of Euro Area investment positions by linking fund sector investments to the underlying holders and securities issuance to the ultimate parent firms. Our new estimates of Euro Area investment allow us to document a number of stylized facts. First, the Euro Area's estimated gross external position is smaller than in official data. Second, the Euro Area is more biased towards euro-denominated assets and away from US dollar and other foreign currency assets than in official data. Third, the Euro Area is less financially integrated than it appears. Fourth, European financial integration occurs disproportionately through securities issued in OOFCs rather than via domestic capital markets. Fifth, there is a North-South bias in Euro Area financial integration whereby Northern European countries are relatively underweight securities issued by Southern European countries.

Keywords: Financial Integration, Offshore and Onshore Financial Centers, Capital Markets Union, Residency and Nationality, Home Currency Bias.

JEL Codes: F3, F4, G2, G3.

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1 Introduction

The creation of the Euro Area (EA) has been one of the most important economic developments of the post World War II economic architecture. The EA is at its core an attempt of countries to unite their monetary and financial systems. By moving to a common currency, integrating capital markets, and harmonizing regulation, the EA was expected to generate one of the largest capital markets in the world. Financial integration remains a key policy objective, with the Capital Markets Union initiative an ongoing priority for the European Commission.[1]

Policymakers and researchers have long lamented that assessing European financial integration is difficult because of heavily concentrated financial intermediation in Ireland, Luxembourg, and the Netherlands, which obscures the underlying capital allocation. We refer to these countries as "onshore offshore financial centers" (OOFCs) because they are onshore markets in the Euro Area and at the same time their financial activities have parallels to those of offshore financial centers. These OOFC countries have dual roles both as hubs of investment fund intermediation and as centers for securities issuance by foreign firms. The role of these financial centers has grown enormously over time (Kindleberger 1973, Eichengreen 1996, Cassis 2010). When investment funds domiciled in these countries hold securities on behalf of other Euro Area or global investors, these holdings are recorded in official statistics as belonging to these OOFCs rather than the underlying owners. Similarly, when firms issue bonds through subsidiaries based in these jurisdictions, official statistics record these bonds as the liabilities of the OOFC countries rather than the country of the ultimate parent company.

In this paper, we look through both of these OOFC roles and restate the pattern of Euro Area portfolio investment positions by unwinding fund sector investments—linking them to the ultimate underlying investors—and by associating securities issuance with the ultimate parent firms. We use our resulting estimates to reassess European financial integration: we document that Euro Area financial integration is qualitatively and quantitatively different from what can be ascertained using routinely available aggregate data.

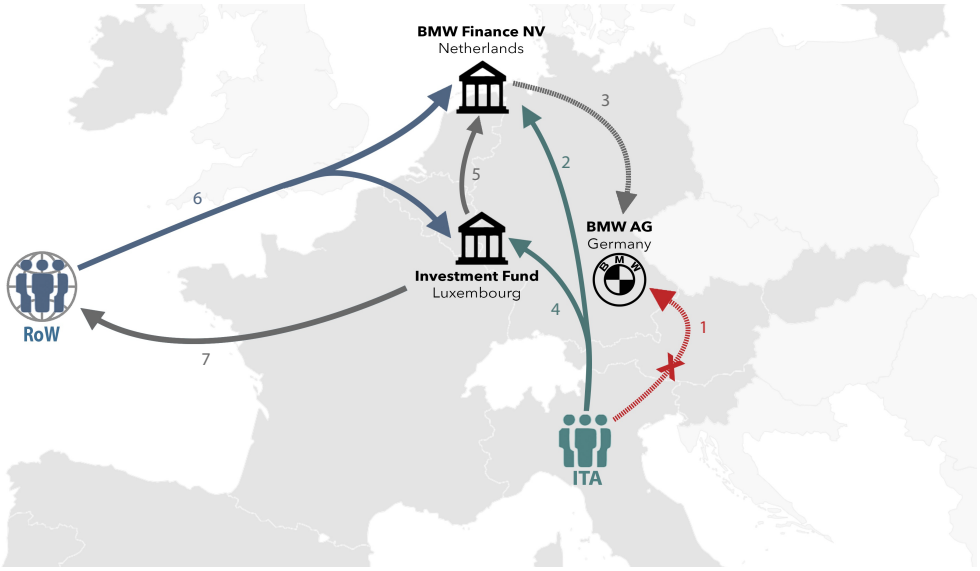
To understand the challenges of measuring European financial integration, consider as an example BMW AG, the German automaker. Figure 1 illustrates how BMW raises capital from foreign investors, including from the rest of the Euro Area—for example, Italian investors.[2] One might reasonably imagine that BMW would simply issue bonds in Germany that are then bought by the Italian investors (arrow labeled 1 in the figure), but in fact this is not what happens, as BMW not issue bonds from any corporate entity resident in Germany. In practice, BMW has established a financing subsidiary domiciled in the Netherlands, BMW Finance NV, through which it issues bonds

[1] There were several milestones on the road towards European financial integration, including the European Commission's Financial Services Action Plan for the harmonisation of the EU financial services markets starting in 1999, the Lamfalussy architecture to improve regulatory processes introduced in 2001, the launch of the banking union in 2012, and the two subsequent action plans for the Capital Markets Union in 2015 and 2020.

[2] No data from the European Central Bank was used in the production of Figure 1, which should be understood as an illustrative example only, constructed from public information.

which are then bought by foreign investors (arrow 2). The capital might then be lent on to the German parent (arrow 3). This is an example of the role of OOFCs as places of securities issuance: this occurs for a variety of reasons, including favorable regulatory and withholding tax regimes in these jurisdictions. International financial statistics are typically assembled on a *residency* basis, and therefore holdings in bonds issued by BMW Finance NV are considered portfolio assets issued in the Netherlands, and correspondingly portfolio liabilities of the Netherlands. For many practical applications, economists would rather measure these positions under a *nationality* view, which instead associates the positions with Germany by linking them to the ultimate corporate parent, BMW AG (Avdjiev, McCauley and Shin 2016).

Figure 1: **The dual roles of European OOFCs: an illustrative example**



Notes: This figure provides a schematic representation of the dual roles of European OOFCs, focusing on the example of BMW AG raising bond capital from Italian investors as well as investors outside the Euro Area (labeled Rest of the World, or RoW).

Further, in this example the Italian investors may not hold these bonds directly, but rather part of these positions are likely to be intermediated through investment funds domiciled in Luxembourg or Ireland. In the example given in the figure, a Luxembourg fund holds the securities on behalf of the Italian investors (arrows 4 and 5). This illustrates the second role of European OOFCs, as hubs of fund intermediation. Luxembourg and Ireland are not used just by Euro Area investors, but also by investors in the rest of the world (RoW). RoW investors might buy bonds issued by BMW Finance directly, or they might also go through investment funds in Luxembourg or Ireland (arrow 6). RoW investors also hold securities issued by firms and governments outside the Euro Area: in this case, the intermediation through Luxembourg and Ireland funds simply reflects a form of "round-tripping", or spurious foreign investment (arrow 7).

In all these cases, Euro Area international investment statistics record large levels of cross-border investment, as each of the arrows shown in the graph is recorded separately in disparate categories of portfolio investment and FDI, leading to double-counting and a murkier picture of

capital allocation. Our estimates allows us to consolidate all these various positions, leading us—for example—to consider arrows 2 through 5 as a single portfolio debt investment from Italy to Germany.

The issues discussed above are not unique to the EA and are common in other financial centers. However, in the EA they have grown to such proportions, probably due to these centers being onshore and to their role in the overall process of integration of the EA, as to make it nearly impossible to understand Euro Area portfolio investment: for example, 40% of all cross-border securities claims of Euro Area residents in official data are intermediated through investment funds domiciled in Luxembourg and Ireland, while 33% of all cross-border holdings of corporate bonds within the Euro Area are in securities issued in these OOFC jurisdictions.

This topic is of pressing academic and policy interest. Academic research has had to apportion these large positions, one way or another: we show that given the magnitudes and heterogeneity of the portfolios research, results ranging from home bias to currency composition and financial integration vary greatly as a result. In policy, the divergent credit risks among EA member countries, with highly rated countries in the North (e.g., France, Germany, Netherlands, Finland) and lower rated sovereigns in the South (e.g., Italy, Spain), have made understanding which countries and sectors will suffer losses in a possible future crisis of paramount importance. Sorting out these issues also has implications for public finance, as the decisions of firms and funds to locate in the OOFCs are connected to their tax regime—in terms of both corporate and, especially, withholding taxes. Finally, the analysis of the ultimate ownership of fund shares in Luxembourg and Ireland is important for long-standing debates on wealth inequality.

The starting point of our analysis is the European Central Bank's Securities Holdings Statistics (SHS), which covers the EA countries' securities investments. This dataset is the micro data behind the EA aggregate domestic and international portfolio investment statistics. It is collected on a residency basis at the security level, with the holder recorded at the country-sector level (for instance, SHS will record holdings of the French banking sector, but not of individual French banks). We combine this data with estimates on fund-level investment for funds domiciled in Luxembourg and Ireland from commercial sources to unwind fund investment by EA residents. We also combine the resulting data with a mapping algorithm that assigns each security not to its immediate issuer but to the ultimate parent entity and determines its nationality.

Reported holdings of fund shares in Luxembourg and Ireland by Euro Area resident investors only account for a fraction of the total fund shares issued by investment funds resident in these OOFCs. Throughout the paper, we refer to fund shares not reported to be held by Euro Area investors as being held by the rest-of-world ("RoW"), a residual category. In Section 4, we shed light on who these residual RoW investors are likely to be by combining information on the immediate counterpart owners of fund shares in Luxembourg and Ireland with the portfolio composition of the funds. The RoW category comprises both known holdings by RoW investors and unknown holdings. The unknown holdings are in part offshore wealth by Euro Area residents held through jurisdictions such as Switzerland (Zucman 2013), and in part non-Euro Area global investors.

Our restatement of the Euro Area's position uncovers a number of findings. First, the Euro Area as a whole is less financially integrated with the rest of the world than it appears. Its gross assets and liabilities are smaller than reported in official data. Quantitatively, this happens in large part because a fraction of fund holdings in Luxembourg and Ireland are reported to not be held by Euro Area residents. Using our fund unwind methodology, we document that the underlying portfolio of securities held by EA and RoW investors in these funds is highly heterogeneous. Funds held by EA investors are more likely to invest in securities issued by EA entities (exhibiting stronger home and EA bias) and, within bond investment, are more likely to hold euro-denominated bonds (a home currency bias), as compared to funds held by RoW investors. Overall, rather than the officially reported positions of 5 trillion euros in non-EA bonds and 4 trillion euros in non-EA equity, we estimate that the Euro Area owns around 2.8 trillion of non-EA bonds and 2 trillion of non-EA equity at the end of 2020. Similarly, the amount of bonds held by EA investors denominated in non-euro currencies falls from 3.8 to 1.6 trillion euros, implying roughly a halving of the non-euro share in the overall EA bond portfolio (from 23% to 12%). One goal of this research project is to develop and provide estimates of bilateral investment positions for the Euro Area that account for these issues.[3]

Second, Euro Area financial integration is lower than official data implies. Most obviously, this occurs because many claims of one EA member country on another represent only one step in a long chain of intermediation. Going back to the example in Figure 1, the direct route would have resulted in two euros in recorded gross positions within the EA for each euro of investment: one in portfolio assets booked by Italy and one in portfolio liabilities booked by Germany. The indirect route, in contrast, leads to six euros in recorded gross positions. More subtly, attempts to either consider the EA as a single block or to naïvely distribute the full Luxembourg and Ireland fund portfolio to the rest of the EA member states (either proportionally to reported fund shares holdings or by GDP weights) would still result in estimates of financial integration in the Euro Area that are too high. This occurs, despite the netting of fund shares, because the positions of Luxembourg and Ireland funds not held by EA investors are large and more diversified within the EA (on top of being more diversified in the rest of the world) than those held by each respective EA member state. For instance, there is home country bias within the EA even when investing indirectly via Luxembourg and Ireland. Additionally, remapping the securities by nationality rather than residency shrinks the cross-border positions held by all investors in the EA.

Third, we show that securities issued in OOFCs are more widely held by EA investors (bringing portfolios closer to an international CAPM benchmark) than those issued in national capital markets. Firms which raise capital through OOFCs therefore better approximate the policy goal of a Capital Markets Union in the EA, with their liabilities held widely by investors around the currency area. We show that this integration is not purely the result of selection, but rather that there is an allocative effect of moving issuance to the OOFCs. We demonstrate that *within* a given

[3]The paper is part of a research collaboration between the ECB and the Global Capital Allocation Project and we aim to make aggregate estimates publicly available.

firm's issuance (using firm fixed effects) the rest of the EA members are more likely to hold bonds issued in the OOFCs (in the same currency, i.e. euros) than those issued domestically in the country of nationality of the firm. Further, we document that this effect is heterogeneous and related to a North-South bias in EA investment patterns. We establish the North-South bias by showing that investors in the North are more likely to invest in each other (excluding the domestic effect) than in the South, and vice versa. We establish this effect in bonds, and show that it is particularly strong for sovereign bonds. For corporate issuers, one way to overcome home bias and North-South bias within the Euro Area is to issue in the OOFCs, as this allocative effect is quantitatively larger for countries in the South, like Italy, and smaller for countries in the North, like Germany.

Fourth, we provide an analysis of who the unaccounted-for investors in Ireland and Luxembourg funds are likely to be and examine how their portfolio holdings differ from known EA investor holdings. The identity of these investors is notoriously difficult to ascertain. The range of possibilities is wide, with papers in the literature assuming everything from all of these unrecorded investors being EA-based to none of them being resident in the EA. Using administrative data from the Central Bank of Ireland and the Commission de Surveillance du Secteur Financier (CSSF) for Luxembourg, we show that the United Kingdom plays an outsized role in investing and intermediating investment into funds based in the OOFCs. We discuss the implications of whether this investment recorded as being done by the United Kingdom is actually on behalf of United Kingdom investors or is done on behalf on non-residents.

For Ireland, for example, we show that both data on the immediate counterpart owners of the fund shares and the composition of the portfolio point to investors based in the United Kingdom accounting for the bulk of fund investment. In particular, the Irish investment fund sector has large holdings of UK assets and especially UK gilt bonds denominated in pounds. These assets are mostly indirectly held by British investors via fund shares.[4] For Luxembourg, the United Kingdom plays a similarly large role, while custodial accounts in Switzerland (potentially constituting hidden household wealth) can account for at most 800 billion euros of holdings in 2020. Further, the underlying portfolio is very different in composition from that known to be held by EA investors in Luxembourg funds. This supports the notion that there are additional EA holdings unaccounted for, but that these are not the bulk of the holdings.

Related Literature. Our paper makes progress on long standing issues in international macroeconomics and finance that have implications both within the field but also in the areas of public finance and corporate finance.

First, a voluminous literature has studied international financial centers, both onshore and offshore, and documented their growing role and how they complicate economic analysis, both generally and in the context of the Euro Area. An early landmark study is Kindleberger (1973) on

[4]In fact, liability-driven investment (LDI) vehicles of British pension funds are often domiciled in Ireland and to a lesser extend in Luxembourg and have a core investment strategy of buying (levered) gilt bonds. These positions, spuriously considered foreign positions, were central in the turmoil of gilt markets in September 2022 following the Truss government budget proposal.

the history and formation of these centers (see also Eichengreen 1996 and Cassis 2010). Hines and Rice (1994), Lane and Milesi-Ferretti (2001), and Zucman (2013) all stress the importance of these centers and analyze their impact on global capital flows.

Second, a literature has focused on the increased financial integration among Euro Area member countries following the creation of the monetary union. Lane and Milesi-Ferretti (2005) and Lane (2005) emphasized that the introduction of the euro was associated with an increase in cross-border bond and equity holdings within the Euro Area, a Euro Area bias. Coeurdacier and Martin (2009), Kalemli-Ozcan, Papaioannou and Peydró (2010), and Fornaro (2022) point to the elimination of exchange rate risk and the legal and administrative harmonization lowering transactions costs within the Euro Area as important drivers of financial integration. Hale and Obstfeld (2016) study how, with the introduction of the euro, the core EA countries levered up to gain exposure to the periphery. Floreani and Habib (2018) use gravity models to document asymmetric exposures to high-rated and low-rated economies in the EA and the importance of fund intermediation in Luxembourg and Ireland. Gopinath et al. (2015), Garcia-Santana et al. (2016), and Dias et al. (2016) investigate the negative impact of financial integration on misallocation of capital in southern Europe.

Third, there is a literature on advances in analyzing portfolio exposure at the security level by residency and nationality and by currency. Coppola, Maggiori, Neiman and Schreger (2021) provide a restatement of portfolio investment from residency to nationality for many countries, but only consider the Euro Area as a block precisely because of the issues taken on by this paper. We use a version of their remapping algorithm. Avdjiev et al. (2016) pointed out the growing discrepancies of residency data with respect to the true underlying capital allocation, Fonseca et al. (2022) and Aminadav and Papaioannou (2020) analyze global corporate control chains, Bertaut et al. (2019) provide a restatement by nationality for US investors, and Damgaard et al. (2019) focus on FDI and point out the growing role of Luxembourg and Ireland in intermediating FDI.[5] Maggiori, Neiman and Schreger (2020) establish home currency bias for ten developed countries and prove a causal relationship using within-firm variation in bonds issued in different currencies, but again consider the Euro Area as a single block of investors. We use estimates, based on their work, of security holdings by funds domiciled in Luxembourg and Ireland.

The establishment of the SHS database at the ECB was a major data collection effort for both policy and research. Boermans (2022) provides a survey of the research sparked by this dataset. Koijen, Koulischer, Nguyen and Yogo (2018), Bergant, Fidora and Schmitz (2020), Papoutsi, Piazzesi and Schneider (2021), and Holm-Hadulla and Leombroni (2022) investigate quantitative easing and monetary policy shocks. Boermans and Vermeulen (2016) document a preference of investors for euro denominated securities and Faia et al. (2022) point out heterogeneity in the currency composition of bond portfolios among different sectors like investment funds and insurance companies. Darmouni and Papoutsi (2022) explore the growth of non-financial corporate bond issuance in the

[5]There is a broader literature on firm usage of tax haven jurisdiction, including the firm activities in Luxembourg and Ireland: see Hines and Rice (1994), Desai et al. (2006), Huizinga et al. (2008), Hanlon et al. (2015), Fuertes and Serena (2016), Bilicka (2019), Guvenen et al. (2018), Pacheco (2022), and Altshuler et al. (2023).

Euro Area. Bergant et al. (2023) investigate capital flows to emerging markets. The literature has varied a lot in its attempt to treat investment fund shares. Most studies, especially those at the EA consolidated levels, include all funds. Some studies drop the Ireland and Luxembourg funds altogether or treat them separately. Carvalho and Schmitz (2021) unwind the fund share holdings by EA members by assuming that investors all own a representative portfolio of all fund holdings. Vivar et al. (2020) perform an unwind at the fund-security level and find the home bias within the mutual fund sector is lower for EA member countries once the unwound positions are included.[6]

Fourth, there is a literature on missing wealth in the fund shares issued by Luxembourg and Ireland. In an important paper, Zucman (2013) points out that many European securities, in particular, have no identifiable owner due to the role of Luxembourg and Ireland as mutual fund centers, and he attributes the missing wealth to hidden savings stashed by wealthy residents of the US and EA in tax havens such as Switzerland.[7] Ciccone et al. (2022) provides evidence that Luxembourg based funds are held by investors outside the EA, and that those funds distributed globally pursue more diversified investment strategies.

Fifth, our new estimates of European capital allocation contribute to a growing literature on understanding the drivers and implications of the patterns of bilateral capital allocations. This recent literature includes Koijen and Yogo (2019), Coppola (2022), Liu, Redding and Yogo (2022), Pellegrino et al. (2022), Jiang et al. (2022), and Morelli, Ottonello and Perez (2022).

2 Unwinding the Dual Roles of OOFCs

This section provides an overview of the usage of OOFC intermediation and financing structures by global investors and firms. It introduces the methodology that we use to unwind the dual roles of Euro Area OOFCs and provide a set of restated financial statistics that better reflect the true financial linkages connecting Euro Area countries to each other and to the rest of the world.

2.1 OOFC Exceptionalism and Impact on EA Aggregate Statistics

To provide an illustrative reference point, Panel A of Figure 2 focuses on the ratio of gross external assets plus liabilities to gross domestic product. This is a common measure of the scale of external finance in a country (see for instance Fornaro 2019). Financial globalization has caused this measure to increase fast over the last thirty years for most countries in the world. To illustrate the extent to which the EA has had an extraordinary growth, we scale the EA index by similar measures computed for other large developed countries.[8] The resulting index (red line) is displayed in Panel A of Figure 2. From 1990 to 2005, the Euro Area member countries' cross-border investment positions grew

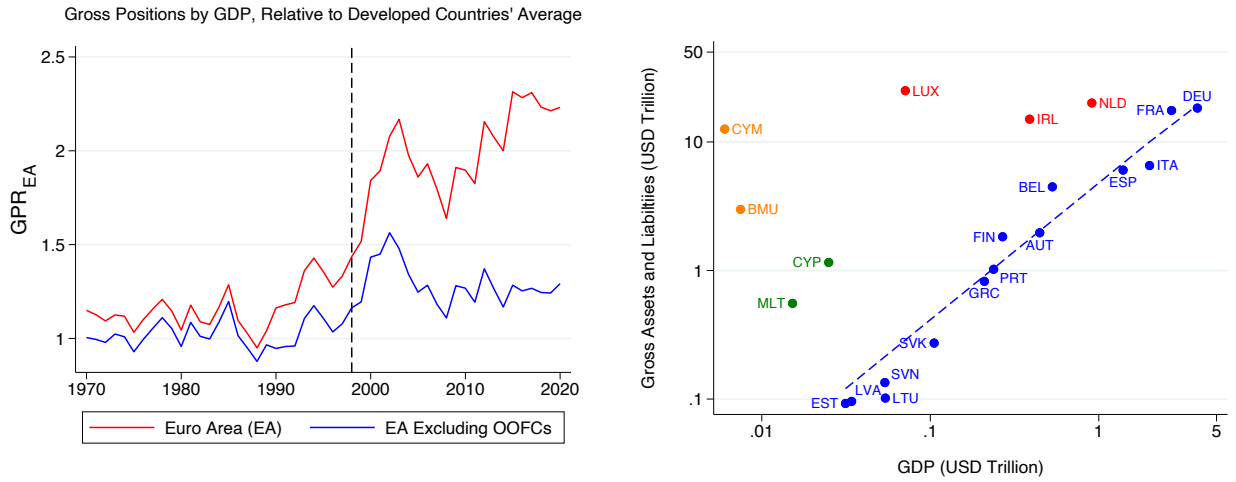
[6] Boermans et al. (2022) take an intermediate approach for equity funds and perform the unwind at the fund level but estimating the holdings based on funds reported style and benchmark.

[7] See also Alstadsæter et al. (2019), Johannesen et al. (2020), and Menkhoff and Miethe (2019).

[8] We define GP_{EA} to be ratio of the gross assets (A_j) and gross liabilities (L_j) of all Euro Area countries, relative to the sum of their GDPs. Figure 2 Panel (a) plots a time series for this gross positions index GP_{EA}

much faster than other developed countries—a structural break that would be consistent with a major shift in financial integration around the time of the introduction of the euro.[9] However, this pattern was largely driven by cross-border holdings into and out of three small Euro Area countries: Luxembourg, Ireland, and the Netherlands. Once those are excluded, even this rough but commonly used proxy points to a more complex story about the dynamics of cross-border investment in the Euro Area.

Figure 2: **Euro Area external positions and *onshore offshore financial centers***



(a) Excess growth of Euro Area gross positions (b) Onshore offshore financial centers

Notes: We define GP_{EA} to be ratio of the gross assets (A_j) and gross liabilities (L_j) of all Euro Area countries, relative to the sum of their GDPs. Panel A plots a time series for this gross positions index GP_{EA} scaled by the average value of GP_j for a set of other developed economies (*red line*) which includes the United States, Japan, the United Kingdom, Switzerland, Australia, New Zealand, South Korea, Norway, and Canada. The *blue line* shows the equivalent series when excluding Luxembourg, Ireland, and the Netherlands from the set of Euro Area members. Panel B plots gross assets and liabilities ($A_j + L_j$) against GDP in the cross-section of countries as of the year 2019, on a log-log scale. The *dashed blue line* shows the OLS best fit for the set of observations in blue. We use data from the IMF, together with data from Lane and Milesi-Ferretti (2007) for the early period.

Panel B of Figure 2 illustrates just how different the external positions of these OOFC countries are as compared to the rest of Euro Area members. While for most countries, there is an approximately stable relationship between a country's GDP and its external financial position, Luxembourg, Ireland, and the Netherlands stand out as countries with massive financial positions relative to the size of their real economy, along with the smaller Malta and Cyprus. They look quite similar to

scaled by the average value of GP_j for a set of other developed economies:

$$\text{GP}_j = \frac{A_j + L_j}{\text{GDP}_j}, \qquad \text{GP}_{\text{EA}} = \frac{\sum_{j \in \mathcal{J}_{\text{EA}}} (A_j + L_j)}{\sum_{j \in \mathcal{J}_{\text{EA}}} \text{GDP}_j}, \qquad \text{GPR}_{\text{EA}} = \frac{\text{GP}_{\text{EA}}}{\sum_{j \in \mathcal{J}_{\text{DM}}} \text{GP}_j \frac{\text{GDP}_j}{\sum_{j' \in \mathcal{J}_{\text{DM}}} \text{GDP}_{j'}}},$$

where $\mathcal{J}_{\text{EA}}$ is the set of all Euro Area countries and the set of countries $\mathcal{J}_{\text{DM}}$ includes the United States, Japan, the United Kingdom, Switzerland, Australia, New Zealand, South Korea, Norway, and Canada.

[9] Coeurdacier and Rey (2013) show that aggregate measures of equity home bias also decreased faster for Euro Area countries than other large developed countries around this period and mention this as a possible sign of financial integration within the Euro Area.

well-known offshore financial centers like the Cayman Islands and Bermuda, jurisdictions where capital is only passing through and not allocated to local economic activity. Given that the rise in aggregate measures of European integration is largely explained by the growth in financial activity in these OOFCs, this raises the question of how much one misses about European integration without accounting for the nature of this rise.

2.2 Estimating OOFC Activities in the Data

Throughout the paper, we rely on multiple data sources. The core data source is the Securities Holdings Statistics database (SHS) maintained by the European Central Bank. This dataset, collected since 2013 in recognition of the importance of tracking the ownership of financial assets for economic policy, is a security-level dataset measuring how much of every portfolio asset each sector-country in each euro area country owns.[10] To perform our analysis and look through the activities of the OOFCs, we link SHS to several commercial data sources. Estimates based on comprehensive fund portfolio holdings from Morningstar, constructed in Maggiori et al. (2020) and Coppola et al. (2021), let us observe each fund's complete holdings of securities worldwide: by linking these estimates to SHS, we can attribute the funds' positions to their underlying owners, as discussed further in Section 2.4. Additionally, we use a version of the algorithm built in Coppola et al. (2021)—which assembles the information coming from many commercial data sources—to link each of the securities issued by an entity in OOFCs (as well as all other countries in the world) to its ultimate parent entity and its nationality: this is described in Section 2.5.

To clarify how these multiple sources of data allow us to trace the dual roles of European OOFCs in capital allocation, consider again the example shown in Figure 1. Through the SHS data, we can observe the position of Euro Area investors (at the holder country by holder sector level) in individual securities, including fund shares, which in our example corresponds to arrows 1, 2, and 4: the holdings (or lack thereof) of Italian investors in BMW Finance NV securities, BMW AG securities, and individual Luxembourg fund shares are all contained in SHS. Conversely, the fund holdings estimates based on Morningstar data show us arrow 5: in this data, we can see the securities positions, including in BMW Finance NV bonds, of the individual OOFC investment fund which intermediates the Italian investors' capital. The securities aggregation algorithm, on the other hand, links the securities issued in OOFCs to their ultimate corporate parents, which corresponds to arrow 3 in the figure. Lastly, since we observe Euro Area investors' comprehensive holdings in each security plus the securities' values outstanding (obtained via the ECB's Centralized Securities Database, or CSDB), we can measure the size of the positions unaccounted for—corresponding to arrows 6 and 7—as a residual. We will revisit the question of who exactly holds these unaccounted-for positions, and whether they are actually RoW investors, in Section 4.

By bringing together and linking all the data sources, we gain a complete picture of all these aspects of cross-border financial intermediation through OOFCs, and hence we can more properly

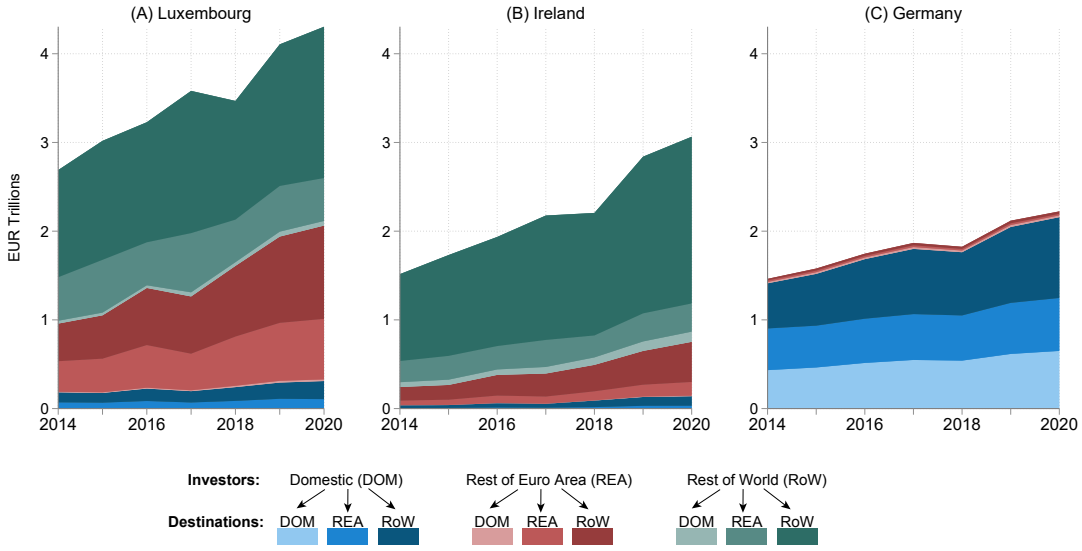
[10] Additional data on security characteristics (such as amounts outstanding) comes from the ECB's Centralized Securities Database (CSDB) as well as Factset.

understand the real extent of financial integration that has occurred in the Euro Area.

2.3 Growth and Heterogeneity in OOFC Financial Intermediation

We now turn to documenting the growth in the dual roles of European OOFCs and analyzing the heterogeneous ways in which different investors and firms intermediate financial activities through these jurisdictions. Starting with fund intermediation, the heterogeneity is apparent in Figure 3, which displays the aggregate pattern of reallocations via funds based in OOFCs, and also demonstrates our focus on these locations rather than other countries—with Germany shown as a comparative example. The topmost lines plot the total assets of the fund sectors in these three countries. The first takeaway is that the fund sectors in Luxembourg and Ireland are extremely large and rapidly growing, with assets reaching 4 trillion and 3 trillion euros, respectively, and exceeding those of the German fund sector.

Figure 3: **Heterogeneity in holdings through Luxembourg and Ireland funds: geography**



Notes: This figure uses our methodology to decompose the assets of investments funds domiciled in Luxembourg, Ireland, and Germany in SHS according to who the ultimate investors are and which countries' securities (by nationality) the investments are in. Blue areas correspond to domestic investors, red areas to investors in the rest of the Euro Area (REU), and green areas to unaccounted-for investors, potentially in the rest of the world (RoW). Light shades correspond to investment in domestic securities, medium shades to investment in REU securities, and dark shades to investment in RoW securities.

The shaded regions in Figure 3 capture the high-level results of our methodology, splitting the investment funds' assets according to who the ultimate owner is, and which countries' securities these portfolios are invested in.[11] The blue areas correspond to domestic ultimate owners—that

[11]For Luxembourg and Ireland, we aggregate unwound fund holdings by investment destination for fund positions of domestic and other EA investors. Under the assumption these are representative, we scale up these amounts by the match rate for the unwind in order to account for fund holdings that we do not unwind (see Section 2.4). We then calculate the unallocated, or rest of world, holdings as the residual of the total

is, owners based in the country's of the investment fund. The red areas correspond to ultimate owners in the rest of the Euro Area, and the green areas correspond to ultimate owners that do not report through the Euro Area's SHS administrative data (labeled RoW). Each of these blue, red, and green areas is then decomposed further into three shades, which correspond to the destination of the investments. The lightest shades are for investment into domestic securities (i.e., those whose country corresponds to the fund's domicile, on a residency basis), the medium shades are for investments into securities issued in the rest of the Euro Area, and the darkest shades are for securities issued outside of the Euro Area.

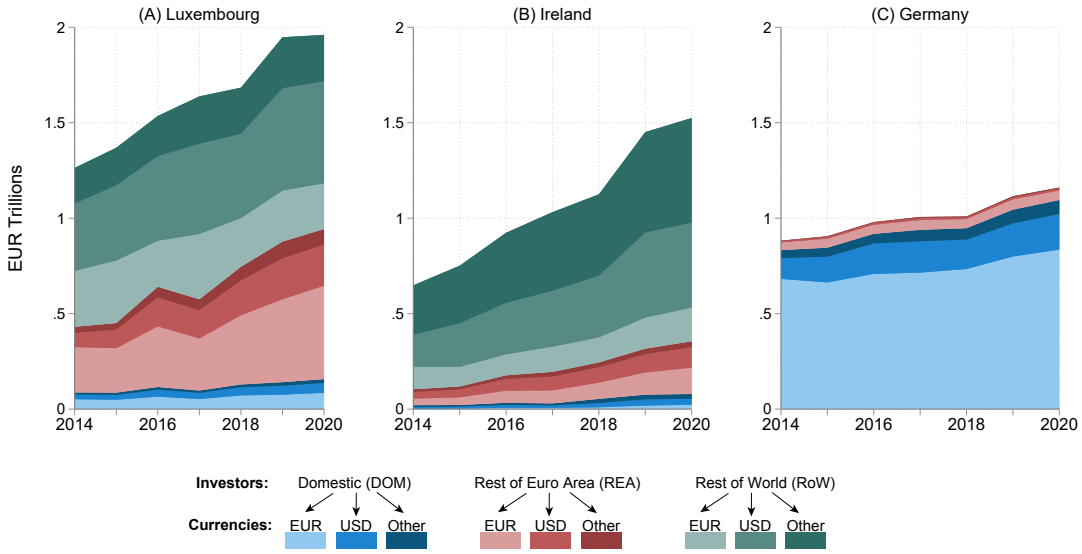
This graph allows us to look at how different investors sort into buying different assets when investing through funds domiciled in these three countries. It is immediately clear that it is virtually only German investors who hold assets through German funds. However, for Luxembourg and Ireland the pattern is starkly different: holdings by domestic investors are minuscule, and only around half of the positions are accounted for by reported positions of investors in the Euro Area. For Ireland, the situation is even more skewed, with Irish and other Euro Area reported positions accounting for less than a third of the holdings of Irish funds. Instead, we see that a huge portion of the positions are unaccounted for in SHS, indicating that they are potentially held by investors outside of the Euro Area. Moreover, the portfolios held by different investors through Luxembourg and Ireland funds are highly heterogeneous, with particularly large differences between EA and RoW investors. RoW investors are much more tilted towards non-EA assets than EA investors when investing through these funds.

We observe a similar pattern when looking at the currency composition of these investments. Figure 4 repeats the same decomposition exercise, but now instead of looking at the destination of these investments, we focus on their currency composition. Since currency of denomination is only clearly defined as a security attribute for fixed income securities, the figure now includes only the bonds held by these funds. Hence the lightest shades now correspond to euro-denominated bonds, the medium shades are for US dollar denominated bonds, and the darkest shades are for assets in other currencies. While Euro Area investors have the bulk of their bond portfolios invested in euro-denominated bonds, the holdings of RoW investors are more heavily biased towards the dollar and other non-Euro currencies. This heterogeneity in portfolios held through OOFC funds—both in terms of destination country and of currency—has important consequences for our reassessment of the Euro Area's external financial positions, a topic that we return to and develop in detail in Section 3.

The quantitative importance and heterogeneity in OOFC intermediation activities is also evident when inspecting their role as domiciles of securities issuance. As shown in Figure 5, corporate bonds issued in OOFCs have accounted for a remarkably high share of cross-border holdings inside the Euro Area: about 33% of all cross-border holdings of corporate bonds within the EA (that is, bonds

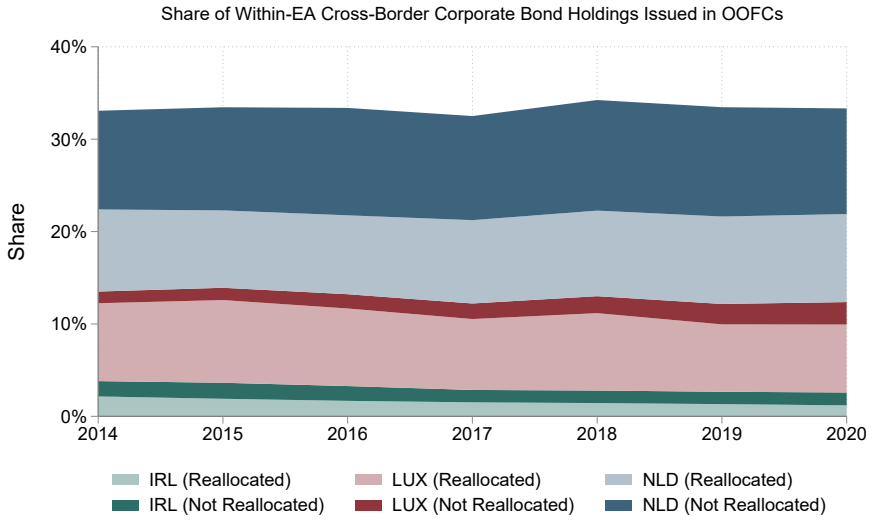
fund holdings in SHS minus the scaled up domestic and EA fund holdings. For Germany we assume that both domestic, other EA, and rest of world investors have the same share of their fund positions allocated across investment destinations.

Figure 4: **Heterogeneity in holdings through Luxembourg and Ireland funds: currency**



Notes: This figure decomposes the bond assets of investments funds domiciled in Luxembourg, Ireland, and Germany according to our estimates of who the ultimate investors are and which currencies the bond holdings are denominated in. Blue areas correspond to domestic investors, red areas to investors in the rest of the Euro Area (REU), and green areas are unaccounted for (RoW). Light shades correspond to investment in Euro-denominated bonds, medium shades to investment in US dollar-denominated bonds, and dark shades to investments in other denominations.

Figure 5: **Importance of bonds issued in OOFCs for within-EA cross-border holdings**

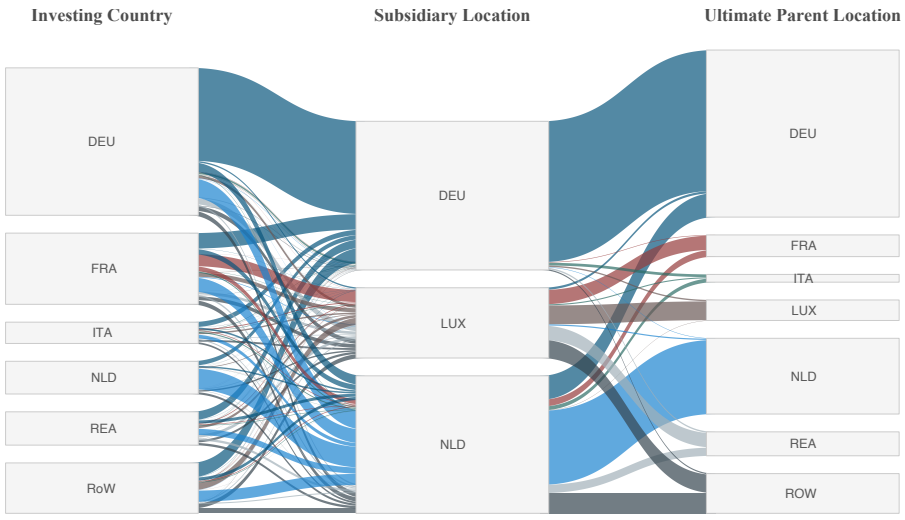


Notes: This figure considers the set of all cross-border holdings of corporate bonds within the Euro Area observed in SHS. We plot the share of these cross-border positions that are in bonds issued in the Netherlands (*blue area*), Luxembourg (*red area*), and Ireland (*green area*). *Light shades* correspond to bonds that are reallocated away from the OOFC on a nationality basis, while *dark shades* correspond to bonds that are not reallocated. We include bonds issued by ultimate parent firms with nationality in the Euro Area, and a position is classified as cross-border if the residency of the bond's immediate issuer is not equal to the investor's.

issued by European firms and held by Euro Area investors outside of their country of issuance) are in bonds issued in OOFCs, with Luxembourg and the Netherlands accounting for most of this phenomenon. The majority of these bonds are reallocated away from the OOFCs on a nationality basis. Darmouni and Papoutsi (2022) document the growing importance of bond financing of non-financial corporates in the Euro Area at the expense of more traditional (in Europe) loan financing from banks. In this context, OOFCs are likely to continue playing a crucial role for capital allocations in the Euro Area. In more recent years, a large part of corporate bond holdings within the EA has also been accounted for by the Eurosystem of central banks itself: these holdings have grown from virtually zero in 2015 to more than €300 billions in 2023.

Zooming in on the cross-section of firms, Figure 6 visualizes the nature of these corporate bonds issued in OOFCs. On the left, we show the relative amounts that Germany, France, Italy, the Netherlands, the rest of the Euro Area (REA), and the rest of the world (RoW) invest in corporate bonds issued in Luxembourg, the Netherlands, and Germany (again included for comparison). While 95% of funds invested in Germany on a residency basis remain in Germany on a nationality basis, only 27% of corporate bonds issued in Luxembourg on a nationality basis remain there. Instead, 47% are reallocated to other Euro Area countries, and 26% to the rest of the world. For the Netherlands, 54% of the funds remain, while 31% and 15% are reallocated to the rest of the Euro Area and the rest of the world, respectively.

Figure 6: **Understanding OOFCs' role as conduits for foreign firms' securities issuance**



Notes: This Sankey chart displays the relative amounts of bonds issued through entities resident in Luxembourg, Ireland, and Germany (column labeled "*Subsidiary Location*"). We link the securities to their country of nationality ("*Ultimate Parent Location*") and to the holders of these bonds ("*Investor*"). Data shown as of 2020.

2.4 Unwinding Holdings Through Luxembourg and Ireland Funds

In this section we provide further details on the *fund unwind* component of our methodology. Our strategy for unwinding positions held through Luxembourg and Irish investment funds is straightforward. The SHS data reports precisely which investment fund shares each sector in each country in the Euro Area owns. Therefore, whenever we see a given amount invested by a given sector in a Luxembourg or Ireland domiciled fund, we want to reclassify that investment as being in the underlying securities that the fund owns according to the securities' portfolio weight in the fund.[12] Because SHS is at the country-sector level, however, it does not have information on the holdings of individual funds in Luxembourg and Ireland. Therefore, the unwind cannot be performed within SHS data. For this information, we rely on estimates of security level holdings of each fund based on Morningstar data.[13] For each fund, we calculate the portfolio weight of all of its individual holdings, link this fund-security level information with the SHS data, and then reclassify the positions SHS records as investments in fund shares domiciled in the OOFCs into the underlying securities.

More formally, we let the euro value of a position in SHS to be $x^{a,f}_{j,i_c,c}$, where c corresponds to a security, j is the investing country, a corresponds to the security's asset class (equity, fund share, corporate bond, sovereign bond, or structured finance), and i_c is the destination country—which can be defined on either a residency or a nationality basis. The superscript f denotes whether the security is held directly by the investing country j, or alternatively via Ireland or Luxembourg funds, so that $f \in \{\text{Direct, IRL, LUX}\}$. We omit time subscripts here since many analyses are cross-sectional: we only include them when time-series clarity is necessary.[14]

Investments in particular Luxembourg and Ireland funds therefore correspond to those positions $x^{a,f}_{j,i_c,c}$ where $c \in \mathcal{F}_i$, with $\mathcal{F}_i$ the set of fund shares corresponding to funds domiciles in country $i \in \{\text{LUX, IRL}\}$. From the Morningstar fund holdings estimates, we obtain the portfolio composition for each of the Luxembourg and Ireland funds, which we denote as $\gamma_{c,c'}$: this is the share of the portfolio of the fund indexed by c that is invested in each other security c', with $\sum_{c'} \gamma_{c,c'} = 1$. The *indirect* positions of individual Euro Area countries through OOFC funds are therefore given by

$$x^{a,f}_{j,i_{c'},c'} = \sum_{c \in \mathcal{F}_i} \left(x^{a,f}_{j,i_c,c} \cdot \gamma_{c,c'} \right). \tag{1}$$

[12] We focus on unwinding funds in Luxembourg and Ireland, rather than anywhere in the Euro Area (or the world) because these two hubs distribute their funds widely. As illustrated in Figure 3 for Germany, the data in SHS shows only small investments by the rest of the Euro Area in funds domiciled in other EA-member countries.

[13] As discussed in Section 2.2, these estimates are assembled as in Maggiori et al. (2020) and Coppola et al. (2021), which implement various steps to improve the quality of the data, including standardization of security identifiers and characteristics, as well as unwinding of holdings of funds in other funds *within* the Morningstar data. In practice, we merge these estimates to SHS by mapping each fund share's ISIN to the corresponding fund identifier (*"Master Portfolio ID"*) in Morningstar.

[14] In practice, we also implement our procedure at the investor country by investor sector level. We omit sector indices for simplicity, as most of our analysis does not focus on heterogeneity across investment sectors.

Correspondingly, we can then estimate the total holdings of investor country j in asset c' as

$$x^{a}_{j,i_{c'},c'} = x^{a,\text{Direct}}_{j,i_{c'},c'} + x^{a,\text{LUX}}_{j,i_{c'},c'} + x^{a,\text{IRL}}_{j,i_{c'},c'}. \tag{2}$$

While we can only directly observe the fund share holdings of Euro Area investors, we can estimate the rest of the world's positions intermediated through OOFC funds as the difference between the OOFC's reported investment in an asset and those holdings that we can account for as intermediation of Euro Area investment. In particular, we estimate the rest of world's holding in security c through OOFC funds as

$$x^{a,f}_{\text{RoW},i_c,c} = \tilde{x}^{a}_{f,i_c,c} - \sum_{j \in \mathcal{J}_{EA}} x^{a,f}_{j,i_c,c}, \tag{3}$$

where $\mathcal{J}_{EA}$ is the set of euro area countries and $\tilde{x}^{a}_{f,i_c,c}$ are the direct holdings in security c of the fund sector of country $f \in \{\text{LUX, IRL}\}$ in the SHS data. Our unwind procedure keeps total wealth observed in SHS constant, since the estimated positions $x^{a,f}_{j,i_c,c}$ and $x^{a,f}_{\text{RoW},i_c,c}$ sum to the original fund assets $\tilde{x}^{a}_{f,i_c,c}$. We emphasize that there are a number of reasons why the definition of $x^{a,f}_{\text{RoW},i_c,c}$ might overestimate RoW holdings through Luxembourg and Ireland funds. First, if our commercial data does not contain the underlying positions of the mutual funds, then we cannot ascribe the holdings to a Euro Area investor. If these funds' holdings appear in the asset-side position of the OOFC, then we would be ascribing European-owned assets to the rest of the world.[15] More substantively, if Europeans are purchasing these funds through third countries (for instance, Switzerland) for tax, privacy, or other reasons, these holdings would not appear in SHS and therefore we would ascribe them to the rest of the world. Lastly, SHS data, while comprehensive, might not report all fund shares held by Euro Area residents because of incomplete data collection. In the interest of clarity, it is best to interpret the term "rest of the world holdings of funds in Luxembourg and Ireland" as what it is formally is in equation (3): the residual from known Euro Area positions in SHS. We return to this in Section 4.

Table 1 provides a summary of the match rates in our fund unwind procedure, focusing on the cross-section of data at the end of 2019. The overall holdings in Luxembourg or Ireland fund shares observed in the SHS data are €3,120 billion: these correspond to the fund share liabilities of Luxembourg and Ireland vis-à-vis Euro Area countries. Our overall match rate for these positions is 85.6%, meaning that we can map €2,749 billion worth of these fund share positions to fund portfolios $\gamma_{c,c'}$ in the Morningstar fund holdings estimates.[16] Of these matched positions, €2,209 billions

[15] This is quantitatively small given the high match rates, and in separate robustness checks we account for this issue by ascribing to the unmatched positions the same portfolio composition of the matched ones. Funds can also own fund shares in other funds. Within SHS some of these can be unwound by iterating the procedure. Fund holdings in Morningstar also include fund shares of other funds and Maggiori et al. (2020) and Coppola et al. (2021) implement a look-through to unwind them.

[16] We inspected the residual unmatched funds manually and they do not appear to be biased in a particular direction. In ongoing work, we are additionally using fund holdings data from Refinitiv Eikon, Factset, and hand-collected public sources to maximize the match rate.

Table 1: **Fund unwind: match rates**

		Luxembourg and Ireland	Luxembourg	Ireland
1	Total Fund Share Liabilities in SHS*	3,210	2,337	873
2	Matched to Holdings in Morningstar*	2,749	2,011	739
3	*Of which: Unidentified holdings*	540	353	188
4	*Of which: Identified holdings*	2,209	1,658	551
5	Share Matched	85.6%	86.0%	84.6%
6	Share Matched to Identified Holdings	68.8%	70.9%	63.1%

**Market values, shown in billions of Euros*

Notes: Row 1 shows the total amount of holdings of shares of funds resident in Luxembourg and Ireland observed in SHS: these correspond to the fund share liabilities of these OOFC countries vis-à-vis Euro Area investors. Row 2 reports the value of the positions that we match to fund holdings in Morningstar, while rows 3 and 4 break down these amounts according to whether the matched fund positions have an ISIN code (row 4) or not (row 3). The positions without an ISIN code are primarily cash instruments. We report these statistics for Luxembourg and Ireland funds separately, as well as jointly. Data shown as of 2019.

(68.8% of the starting €3,120 billions) are mapped to securities c' for which we have securities identifiers (ISIN code) in the Morningstar estimates. The rest of the matched positions (€540 billions) are mapped to fund assets without a corresponding ISIN code: we have inspected these positions comprehensively by looking at the funds' reported descriptions of them, and they consist primarily of cash and cash instruments.[17] These match rates are fairly similar when looking at Luxembourg and Ireland individually, as also shown in Table 1.

Table 2: **Summary statistics for fund unwind**

		Luxembourg and Ireland				Luxembourg Only				Ireland Only			
		Morningstar	SHS			Morningstar	SHS			Morningstar	SHS		
		Total	Total	Matched	Residual	Total	Tot.	Match.	Resid.	Total	Tot.	Match.	Resid.
1	Value, Total Holdings*	5,656	6,958	2,209	4,748	3,563	4,106	1,658	2,448	2,093	2,852	551	2,301
2	Value, Bonds & Equities*	4,357	5,922	1,967	3,955	2,803	3,538	1,450	2,088	1,554	2,384	518	1,866
3	Value, Bonds*	2,289	3,441	1,031	2,409	1,460	1,972	759	1,213	829	1,469	272	1,197
4	Value, Equities*	2,068	2,481	936	1,545	1,343	1,566	691	875	725	915	245	670
5	Share EUR (Bonds)	34.4%	31.4%	54.0%	21.8%	40.8%	39.6%	57.9%	28.2%	23.1%	20.5%	43.1%	15.3%
6	Share USD (Bonds)	46.1%	40.7%	32.9%	44.1%	43.2%	41.5%	30.2%	48.5%	51.3%	39.8%	40.7%	39.6%
7	Share GBP (Bonds)	7.1%	18.5%	4.6%	24.5%	4.7%	7.2%	3.7%	9.5%	11.4%	33.6%	7.2%	39.6%
8	Share EMU (Bonds)	31.1%	31.9%	46.0%	25.9%	36.2%	38.0%	49.0%	31.1%	21.9%	23.7%	37.5%	20.6%
9	Share EMU (Equities)	19.7%	21.7%	27.3%	18.3%	23.1%	25.0%	30.7%	20.5%	13.5%	16.0%	17.6%	15.4%

**Market values, shown in billions of Euros*

Notes: The columns marked *SHS* report summary statistics for the assets of Luxembourg and Ireland funds observed in the SHS data (*Total*), the subset of assets that are attributed to Euro Area ultimate investors through the fund unwind (*Matched*), and the subset of assets that are not (*Residual*). We exclude assets corresponding to the unidentified holdings shown in Table 1. The columns marked *Morningstar* report statistics for the assets of Luxembourg and Ireland mutual funds in the Morningstar data. We show the value of total holdings (row 1), the value of equity and bond holdings (rows 2 to 4), the currency composition of bond holdings (rows 5 to 7), and the share of assets that are invested in EMU securities by residency (rows 8 and 9). Data shown as of 2019.

Diving further into the details of the fund unwind, Table 2 reports summary statistics for the assets of Luxembourg and Ireland funds observed in the SHS data and in the Morningstar estimates, including by breaking down the SHS assets into matched and residual components—where the residual components are attributed to RoW investors as per the definition in equation (3).[18] The fund assets in SHS and in the Morningstar-based estimates align quite well, although

[17] Not all fund assets are reportable in SHS. Examples include assets that are not securities, such deposits, alternative assets such as real estate or loans, and derivatives. Also, SHS focuses primarily on securities held as portfolio assets (where each holder has less than a 10 percent stake, since otherwise it is classified as FDI).

[18] Table 2 excludes the positions that are matched to unidentified securities (primarily cash instruments)

some discrepancies are expected since the SHS data includes not only mutual funds and ETFs, but also other types of investment funds that are not covered in Morningstar, as discussed below. For Luxembourg funds, total assets in the Morningstar estimates are €3,563 billion, as compared to €4,106 billion in SHS, with very similar composition in terms of asset class, currency of denomination (for bond assets), and geographical destination in the two datasets.

For Ireland funds, the Morningstar estimates contain assets of €2,093 billion, as compared to €2,282 billion in SHS, and there is a notable difference in the currency composition of bond holdings: while the British pound (GBP) share of bond holdings is 11.4% in the fund holdings data, it is a much higher 33.6% in SHS. These differences are accounted for by the fact that Irish fund sector holdings as reported in SHS also incorporate the positions of British liability-driven investment (LDI) funds that are resident in Ireland, and which do not instead enter into Morningstar given their organizational structure. These LDI vehicles channel the assets of British pension funds and are authorized by the Central Bank of Ireland: in recent years, they have held in the aggregate upwards of €300 billion in British gilts (Rowland 2022). Since these gilt holdings are virtually all GBP-denominated, the inclusion of LDI funds results in the tilt towards the British pound that we observe in SHS, and also for part of the gap in total assets.

Table 2 also makes clear that the portfolios of Euro Area and RoW investors held through OOFC funds are highly heterogeneous, consistent with the results shown in Section 2.3. For instance, as already noted in the case of Ireland, the currency composition of the bond holdings attributed to Euro Area ultimate owners and RoW investors is markedly different. For Luxembourg funds, 57.9% of the bond positions linked to EA investors are Euro-denominated, in contrast with a 28.2% in the residual component attributed to RoW investors, which instead tilts much more heavily towards the US dollar and the pound. For Ireland funds, the bond holdings attributed to RoW investors have a 39.6% GBP share: it is reasonable in this case to think of these RoW investors as being primarily United Kingdom residents, as they will account for virtually all of the liabilities of British pension funds which hold gilts in Ireland through LDI vehicles. Similarly, for both OOFC countries, and for both bond and equity holdings, the holdings attributed to Euro Area investors are biased towards EA assets, while the holdings attributed to RoW investors tilt towards non-EA assets.

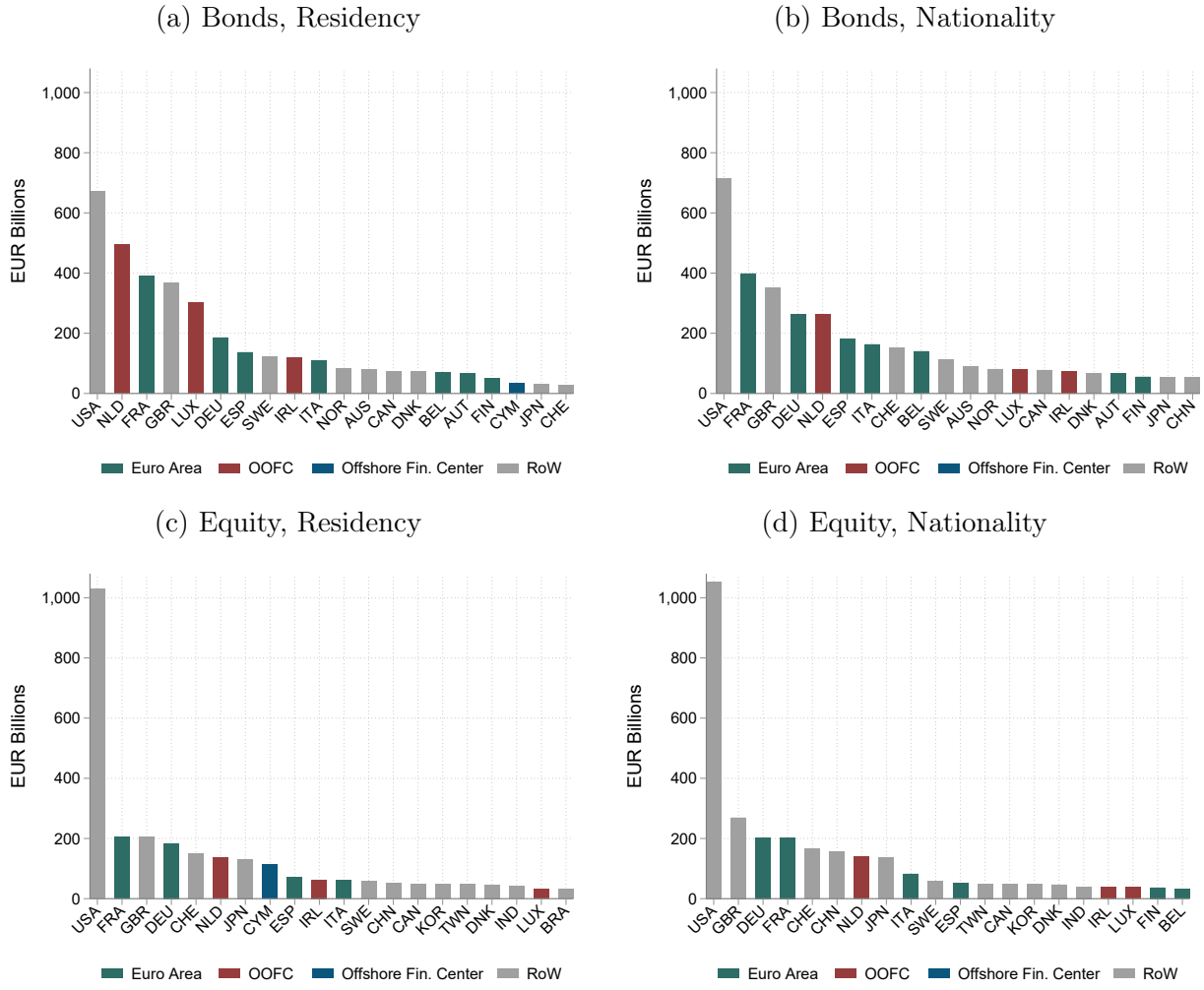
2.5 Aggregating Securities to Ultimate Corporate Parents

We next turn to outlining further results on the *securities aggregation* component of our methodology, exploring how looking through corporate financing affiliates resident in both European OOFCs and global offshore financial centers (such as the Cayman Islands or the British Virgin Islands) affects our understanding of the geography of European investment. To link securities to their ultimate corporate parent and hence assign them a country of nationality, we use a version of the algorithm in Coppola et al. (2021), which combines information from various commercial data sources to generate a map linking each bond and equity security traded worldwide (a total of over

from both the SHS total and SHS residual columns.

27 million securities) to this information of interest. Using this algorithm, we are able to match 99.9% of all equity holdings and 92.5% of all corporate bond holdings in SHS.

Figure 7: **Reallocations from security issuance: cross-border investment**



Notes: We display the residency-based cross-border positions in bonds (*Panel A*) and equities (*Panel C*) of various countries by Euro Area investors as SHS, as well as the corresponding positions on a nationality basis after reallocating positions by linking securities to their ultimate corporate parents (*Panels B and D*).

In Figure 7, we document the change in Euro Area investment patterns coming from restating the SHS holdings data from a residency to a nationality basis. Panels A and C report the aggregate bilateral cross-border positions of Euro Area investors in SHS in bonds and equities of countries around the world, on a residency basis: red bars correspond to positions in European OOFCs, green bars to the rest of the Euro Area, blue bars to offshore financial centers outside the EA (such as the Cayman Islands), and gray bars to the rest of the world. Panels B and D show the same bilateral cross-border positions, but estimated instead on a residency basis. As we move from residency to nationality, the holdings in European OOFCs are substantially reduced, much like those in offshore financial centers. The positions are instead reallocated to other EA countries such as France, Germany, or Italy, as well as to countries outside the Euro Area.

Table 3: **Euro Area investment in large emerging markets: residency vs. nationality**

		Euro Area Holdings (€B)		
Asset Class	**Destination**	**SHS**	**Restated**	**Δ**
Equities	China	124	340	216
Corporate Bonds	Brazil	5	27	22
	China	14	120	106
	India	9	19	10
	Russia	1	15	14
	South Africa	3	9	6

Notes: We show the positions of Euro Area investors in the equities and corporate bonds of firms in large emerging markets. The column labeled *SHS* shows the aggregate value of these positions in the raw SHS data, which reports them on a residency basis. The column labeled *Restated* shows the corresponding nationality-basis position, which also includes securities issued by these firms through affiliates in foreign jurisdictions. Data shown as of 2020.

The fact that firms outside the Euro Area also issue securities in European OOFCs was similarly evident in Figure 6, with a sizable portion of the holdings in Luxembourg and the Netherlands reallocated to RoW. Examples include the Brazilian state-owned oil giant Petrobras, which raises bond capital through its Netherlands-based financing subsidiary Petrobras Global Trading BV. Moreover, while for fund intermediation only European OOFCs played a role, this is not the case for securities issuance: European OOFCs play this role alongside offshore financial centers outside of the Euro Area. In Table 3, we examine the consequences of our reallocations for Euro Area investment in RoW firms—focusing in particular on reallocations for large emerging markets, which are especially sizable. A few key findings arise. Euro Area investment in Chinese firms increases many-fold, with equity positions going from €124 billion in 2020 to €340 billion, and corporate bond positions going from €14 billion to €120 billion. For bonds, we see significant reallocations beyond China. Investment in Brazil on a nationality basis increases by €22 billion, or 340%, and we see a similar €14 billion increase Russia from a residency-based baseline of €1 billion.[19] In Section 3, we show that this contributes to the overstatement of Euro Area gross financial positions.

3 The Role of OOFCs in Euro Area Capital Allocation

We now turn to a deeper and more formal analysis of the consequences of OOFC intermediation for our understanding of the Euro Area's integration within the monetary union and with the rest of the world.

[19]These results are broadly consistent with Coppola et al. (2021), who estimate similar patterns for large developed economies including the Euro Area. The estimates in the present paper align particularly well for countries, such as China, which rely on offshore financial centers outside the EA, while they are lower for countries which instead mostly use European OOFCs, such as Brazil or Russia. In this paper, we find that EA-domiciled mutual funds are more likely to invest in emerging markets via tax havens than are other types of European investors. We also find that this is even more likely for assets of Luxembourg and Ireland funds held by RoW investors.

3.1 Euro Area Integration With RoW and Currency Exposures

Figure 8 demonstrates the magnitude of the adjustment to the Euro Area's aggregate external position arising from looking through investment fund intermediation in the OOFCs. The blue lines in these plots report the overall amount of non-EA bonds and equities held by Euro Area investors in the official SHS data, prior to our fund unwind correction. The dashed red lines show these quantities after we remove the bonds and equities that are owned by RoW investors through Luxembourg and Ireland funds. The size of the Euro Area's external assets shrinks dramatically: holdings of foreign bonds go from €5 trillion to less than €3 trillion, nearly a 50% reduction. Holdings of foreign equities similarly go from €4 trillion to €2 trillion. These very large adjustments are the result of two phenomena: (i) Luxembourg and Ireland are one of the main avenues through which EA residents invest in securities in the rest of the world; and (2) approximately 50 percent of fund holdings in these jurisdictions are held by RoW investors.

The forces in (i) and (ii) have an interesting interaction. Consider three portfolios. First, the *direct portfolio* of bonds and equities held directly by EA member countries. Second, the *EA indirect portfolio* of bonds and equities held indirectly by EA member countries via funds in Ireland and Luxembourg. Third, the *RoW indirect portfolio* of bonds and equities held via funds in Ireland and Luxembourg. The exposure to RoW securities is strongly increasing going from portfolio one to three. The large drop in RoW securities for the overall Euro Area in Figure 8 arises from a level effect, the third portfolio being large even compared to the sum of the first two portfolios, and a composition effect, the third portfolio being substantially more exposed to RoW securities than portfolio one or two, as previewed in Figure 3.

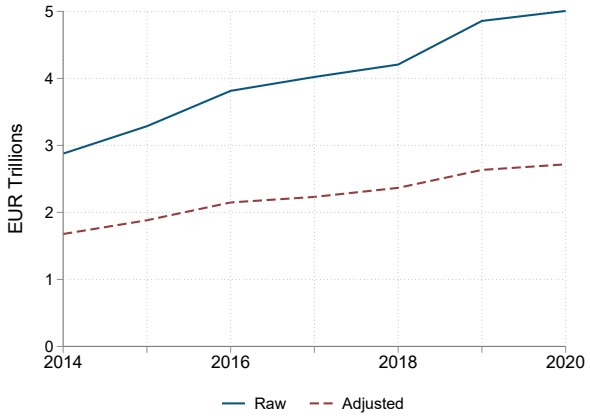
The shrinkage of Euro Area foreign asset holdings is matched (in part) by a decrease in liabilities, since fund shares of RoW investors also inflate the Euro Area's gross liabilities, so the adjusted gross liabilities of the Euro Area correspondingly shrink. As a result, the effective gross external position of the Euro Area is reduced. Removing the *RoW indirect portfolio* makes a large difference in computing Euro Area risk exposures to the rest of the world. This netting is appropriate for many economic analyses because of the nature of fund intermediation. While legally funds own the securities they invest in, and hence international financial statistics consider them the immediate owner, from an economic perspective they pass on all the risks and returns (net of fees) to the underlying investors in the fund. This is not to say that there are no important economic consequences of this intermediation ranging from allocative effects to taxation and financial stability, which we discuss further below.

Strikingly, the currency composition of the Euro Area's bond investment as a whole is also heavily affected by the fund unwind.[20] In Panel A of Figure 9, we plot the level of foreign investment in foreign currency (non-euro denominated bonds) for the Euro Area before and after adjusting for RoW investment in OOFC domiciled funds. By the end of 2020, we estimate that of the €3.8 trillion of foreign currency bond investments, only €1.6 trillion is actually owned by Euro Area

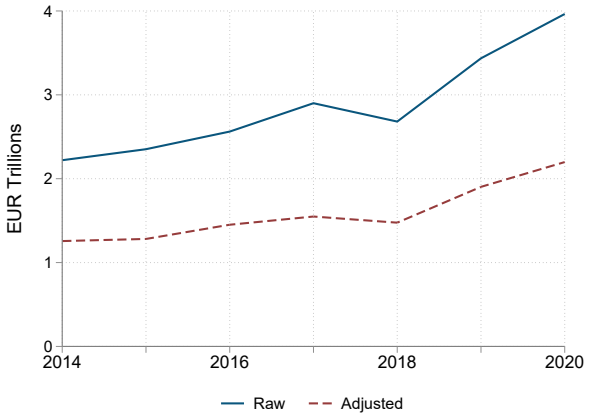
[20] On the importance and measurement of international currency exposures, see Lane and Shambaugh (2010) and Bénétrix, Lane and Shambaugh (2015).

Figure 8: **The Euro Area's gross external position is smaller**

(a) Non-EA bonds held by EA residents



(b) Non-EA equities held by EA residents



Notes: We plot the overall amounts of bonds and equities by issuers outside of the Euro Area held by EA investors in SHS before (*blue lines*) and after (*red line*) our fund unwind adjustment.

investors. This reduces the share of Europe's bond portfolio that is denominated in foreign currency from 23% to 12%. This large drop in exposure to foreign currency bonds is again the result of a level and composition effect in the investment in OOFC domiciled funds. The exposure to foreign currency bonds increases going from the direct portfolio, to the EA indirect portfolio, to the RoW indirect portfolio. Intuitively, most EA member countries do the bulk of their foreign currency bond investment via Luxembourg and Ireland, but RoW investors choose a portfolio of bonds even more skewed toward foreign currency than do EA investors in funds domiciled in Luxembourg and Ireland (as previewed in Figure 4).

The change in currency exposure at the EA level on the foreign asset side is not offset by a change in currency exposure on the bond liabilities. Instead, the liabilities that offset these foreign currency bonds are fund shares, a form of equity, even if some of these shares are denominated in the same currency as the bonds.

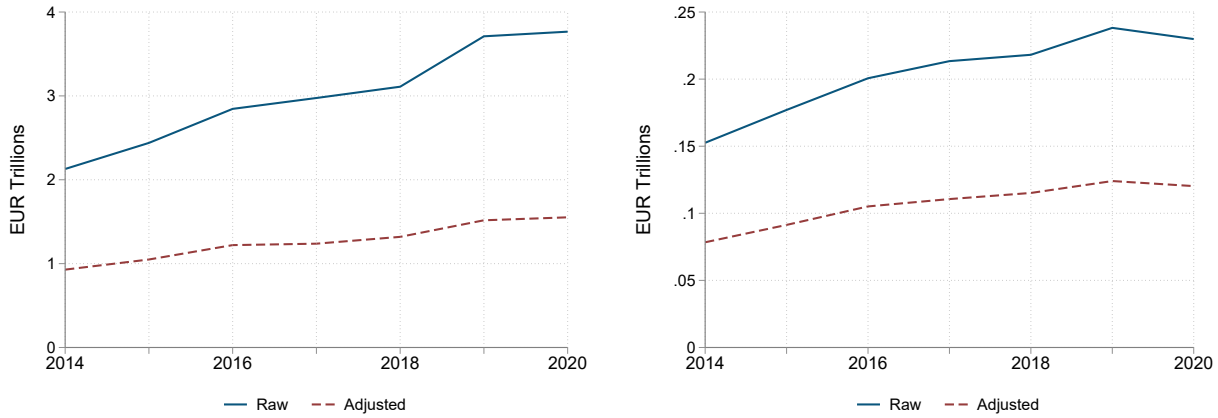
3.2 A Regression Framework for Analyzing Financial Integration

We begin with a simple benchmark, based on the international CAPM, in which full financial integration corresponds to each country owning every security according to the security's weight in the global market portfolio (French and Poterba 1991, Lewis 1999). This very simple benchmark is both the subject of a large literature in international finance and of major policy relevance since it can be used as a metric to measure progress toward the Capital Markets Union in the Euro Area.[21]

[21] See also Solnik (1974), Adler and Dumas (1983), Dumas and Solnik (1995), Coval and Moskowitz (1999), Fidora et al. (2007), Engel and Matsumoto (2009), Coeurdacier and Gourinchas (2016), and De Marco et al. (2022).

Figure 9: **Euro Area external position has larger net Euro exposure**

(a) Foreign currency bonds held by EA residents (b) Share of FC bonds in EA portfolio



Notes: Panel A plots the overall amounts of bonds denominated in non-Euro currencies held by EA investors in SHS before (*blue lines*) and after (*red line*) our fund unwind adjustment. Panel B plots the share of the overall EA bond portfolio that is in non-Euro denominated bonds, again before (*blue lines*) and after (*red line*) our fund unwind adjustment.

We quantify deviations from this simple benchmark. For country j we define portfolio weights as

$$\omega_{j,i,c}^{a,\text{Total}} = \frac{x_{j,i_c,c}^{a}}{\sum_{c' \in \mathcal{C}} x_{j,i_{c'},c'}^{a}}, \qquad \omega_{j,i,c}^{a,f} = \frac{x_{j,i_c,c}^{a,f}}{\sum_{c' \in \mathcal{C}} x_{j,i_{c'},c'}^{a,f}}, \tag{4}$$

where $\mathcal{C}$ is the set of all securities outstanding worldwide at a point in time, irrespective of whether country j holds any. Note that here $\omega_{j,i,c}^{a,\text{Total}}$ denotes the weights in country j's overall portfolio, while $\omega_{j,i,c}^{a,f}$ conditions on a particular route of investment (direct or through Luxembourg or Ireland funds).[22] We let $\bar{x}_{i,c}^{a}$ be the outstanding value of a security, so CAPM weights are:

$$m_{i,c}^{a} = \frac{\bar{x}_{i,c}^{a}}{\sum_{c' \in \mathcal{C}} \bar{x}_{i,c'}^{a}}. \tag{5}$$

Notice that CAPM weights are defined over the universe of world securities.[23] Deviations from a simple benchmark of perfect financial-market integration and diversification based on the international CAPM can be estimated via a simple linear regression:

$$\omega_{j,i,c}^{a,f} = \alpha^{a,f} + m_{i,c}^{a} \sum_{k \in \mathcal{K}} \beta_{k}^{a,f} \mathbf{1}_{c \in k} + \epsilon_{j,i,c}^{a,f}. \tag{6}$$

where we denote sets of mutually exclusive and collectively exhaustive characteristics by $k \in K$.

[22] When writing down general empirical specifications with $\omega_{j,i,c}^{a,f}$ on the left-hand side, from here onward we always implicitly include the case in which $f = \text{Total}$.

[23] We obtain the market value outstanding of each security worldwide from CSDB. The securities covered by CSDB are not limited to those held only by Euro Area investors. Appendix Section A discusses how we build this global issuance file and benchmarks the market value of securities outstanding to common aggregate sources like the World Federation of Exchanges and the BIS Debt Statistics.

The simplest version of this regression is to include no characteristics at all, so that we would run

$$\omega_{j,i,c}^{a,f} = \alpha^{a,f} + m_{i,c}^{a}\,\beta_{\text{CAPM}}^{a,f} + \epsilon_{j,i,c}^{a,f}. \tag{7}$$

If the international CAPM held perfectly, this regression would have an R^2 of 1, with $\hat{\alpha}^{a,f} = 0$ and $\hat{\beta}_{\text{CAPM}}^{a,f} = 1$, meaning that every investor holds every security precisely in proportion to its share of the world market portfolio. We show dimensions along which various investors in the Euro Area deviate from this benchmark by focusing on three sets of characteristics: the residence of the issuing entity, the currency of a bond, and whether or not a security is issued in an OOFC. We then extend this framework to other characteristics, such as the industry of the issuer, the relative size of the issuer, the legal and tax regime governing the security, and so on.

Fixing a country j, asset class a, and investment route f, summing both sides of equation (6) over the entire set of securities in $\mathcal{C}$, and recalling that both country j's portfolio share and market shares have to sum to 1 over this set, we obtain:

$$1 = \sum_{c \in C} \sum_{f} \omega_{j,i,c}^{a,f} = N\hat{\alpha}_{j}^{a,f} + \sum_{k \in K} \hat{\beta}_{j,k}^{a,f} m_{k}^{a}, \tag{8}$$

where N is the number of securities in the set $\mathcal{C}$, and $m_k^a = \sum_{c \in k} m_{i,c}^a = \sum_{c \in \mathcal{C}} m_{i,c}^a \mathbf{1}_{c \in k}$ is the market share of all securities with characteristic k. The above identity describes the deviations of the portfolio of country j from the CAPM along the dimensions set out in the regression analysis. This formulation makes it easier to quantify which deviations are big or small in terms of their overall impact on the portfolio. If country j is overweight one characteristic, say being overweight securities issued by EA residents ($k = \text{EA}$) so that $\hat{\beta}_{j,\text{EA}}^{a,f} > 1$, then it must be underweight on some other characteristic, such as securities issued by the rest of the world, e.g. $\hat{\beta}_{j,\text{RoW}}^{a,f} < 1$. The extent of this depends on market weights, so that for a given β the impact is proportional to market weight (for instance, being very overweight—a high beta—securities with very low market weight does not need much of an offset somewhere else in the portfolio).[24]

3.3 Measures of OOFC Heterogeneity at the Security Level

Geography. We document the heterogeneity in how different investor groups utilize investment funds resident in Luxembourg and Ireland to invest both in the EA and the RoW. In particular, in Table 4 we estimate a geography-based version of equation (6) by focusing on the characteristic of whether a security is issued by an entity resident in the Euro Area or the Rest of the World:

$$\omega_{j,i,c}^{a,f} = \alpha^{a,f} + m_{i,c}^{a}\left[\beta_{\text{RoW}}^{a,f}\mathbf{1}_{c \in \text{RoW}} + \beta_{\text{EA}}^{a,f}\,\mathbf{1}_{c \in \text{EA}}\right] + \epsilon_{j,i,c}^{a,f}. \tag{9}$$

[24] Given that even this augmented CAPM-style specification will fit far from perfectly, we will continue to estimate the regression with an intercept to allow for this misspecification.

As a starting point for analyzing how EA-member countries invest, column 1 of Table 4 reports results from the above specification for all individual EA countries excluding Luxembourg and Ireland.[25] The results show that each individual European country is significantly overweight bonds issued in the EA, with a point estimate of 2.32. This contrasts sharply with bonds issued by entities resident in the rest of the world, where the coefficient is only 0.07. Of course, this EA coefficient conflates investment in the home country with the rest of the Euro Area, and we separate these two effects further below.

In the next three columns, we contrast this baseline effect with investment going through Luxembourg. In column 2, labeled "Raw", we run the regression for all investment from Luxembourg funds as reported in SHS. We observe stark differences in the loading on the EA: while still above the CAPM level of 1, it is well below the non-OOFC countries' "Direct" level in column 1. In addition, the coefficient on the rest of the world (RoW) increases approximately four-fold. Therefore, while we do find that Luxembourg funds are biased towards the Euro Area and away from the rest of the world, the pattern is much less stark than when Euro Area countries invest directly. In column 3, we report the same specification but restricted to those investments through Luxembourg funds that we match to Euro Area underlying investors. The coefficients on $m \times$ EA and $m \times$ RoW are in between those obtained for direct investments of non-OOFC countries and of Luxembourg. In column 4, we run the same specification for the investments by Luxembourg funds that we ascribe to non-Euro Area investors and the coefficient on EA bonds is halved, but that on the RoW is 60% larger than for Euro Area investors. In the next three columns, we perform the same exercise for investments intermediated via Irish funds and find a very similar pattern.

This immediately provides a quantification of a key question of the paper: how do OOFCs impact investment portfolios? For investment funds, they facilitate European investors' access the rest of the world, and the rest of the world's access to Europe. However, they do not perform these functions symmetrically. The heterogeneous matching between investors and investment funds makes it valuable to provide a full unwind at the fund level of intermediation in Luxembourg and Ireland, rather than relying on representativeness assumptions or collapsing all Euro Area holdings together. In Table 5, we perform the same exercise for equities and find similar qualitative patterns. The primary difference between bonds and equities is that both EA investors and the RoW are more diversified in the RoW for OOFC investments in equities than they are for bonds.

Currency. We next turn to analyzing deviations from full financial integration along the dimension of currency. We introduce an indicator for the characteristic that bonds are denominated in euros or denominated in all other currencies and estimate:

$$\omega_{j,i,c}^{a,f} = \alpha^{a,f} + m_{i,c}^{a} \left[\beta_{\text{EUR}}^{a,f} \mathbf{1}_{c \in \text{EUR}} + \beta_{\text{NonEUR}}^{a,f} \mathbf{1}_{c \in \text{NonEUR}} \right] + \epsilon_{j,i,c}^{a,f} \tag{10}$$

[25] We include the Netherlands because while it acts as an OOFC for security issuance, it does not for investment fund intermediation.

Table 4: **Heterogeneity in OOFC use: Bond geography**

	Non-OOFC	Luxembourg			Ireland		
	Direct	Raw	EA	RoW	Raw	EA	RoW
$m \times$ EA	2.324***	1.189***	1.641***	0.849***	0.800***	1.149***	0.354***
	(0.425)	(0.115)	(0.235)	(0.092)	(0.051)	(0.052)	(0.020)
$m \times$ RoW	0.067***	0.331***	0.237***	0.390***	0.518**	0.308***	0.729**
	(0.010)	(0.072)	(0.061)	(0.091)	(0.239)	(0.083)	(0.364)
Constant	0.000***	0.000**	0.000**	0.000**	0.000	0.000**	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Obs.	8,603,139	506,067	506,067	506,067	506,067	506,067	506,067
R^2	0.022	0.364	0.362	0.234	0.083	0.249	0.054

Notes: This table estimates equation (9). The dependent variable is the share of the a particular bond in an investor's bond portfolio. The independent variable is the share of a given security in the global bond portfolio, m, interacted with indicator variables for whether the security was issued by an entity resident in the Euro Area (EA) or the rest of the world (RoW). Non-OOFC Direct refers to investments from all individual Euro Area countries other than Luxembourg and Ireland, as reported in the SHS data. A heading of "Luxembourg" refers to investment from Luxembourg on a residency basis, with "Raw" denoting the unadjusted SHS data, "EA" denoting investment from Luxembourg on behalf of identified Euro Area investors, and "RoW" denoting investment from Luxembourg on behalf of investors that were not matched to the Euro Area. The "Ireland" heading is defined equivalently for investment from Ireland. Standard errors clustered at the investor-issuer country level in column 1 and at the issuer country level in all other columns. $^{*}p < .1$,$^{**}p < .05$,$^{***}p < .01$.

Table 5: **Heterogeneity in OOFC use: Equity geography**

	Non-OOFC	Luxembourg			Ireland		
	Direct	Raw	EA	RoW	Raw	EA	RoW
$m \times$ EA	2.615***	2.581***	2.522***	1.895***	1.480***	1.658***	1.281***
	(0.643)	(0.385)	(0.396)	(0.238)	(0.173)	(0.201)	(0.162)
$m \times$ RoW	0.387***	0.731***	0.744***	0.823***	1.012**	1.073**	0.997***
	(0.075)	(0.232)	(0.240)	(0.255)	(0.391)	(0.423)	(0.379)
Constant	0.000***	0.000	0.000	0.000	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Obs.	711,467	41,851	41,851	41,851	41,851	41,851	41,851
R^2	0.013	0.436	0.455	0.429	0.559	0.579	0.541

Notes: This table estimates equation (9). The dependent variable is the share of the a particular equity in an investor's equity portfolio. The independent variable is the share of a given security in the global equity portfolio, m, interacted with indicator variables for whether the security was issued by an entity resident in the Euro Area (EA) or the rest of the world (RoW). Non-OOFC Direct refers to investments from all individual Euro Area countries other than Luxembourg and Ireland, as reported in the SHS data. A heading of "Luxembourg" refers to investment from Luxembourg on a residency basis, with "Raw" denoting the unadjusted SHS data, "EA" denoting investment from Luxembourg on behalf of identified Euro Area investors, and "RoW" denoting investment from Luxembourg on behalf of investors that were not matched to the Euro Area. The "Ireland" heading is defined equivalently for investment from Ireland. Standard errors clustered at the investor-issuer country level in column 1 and at the issuer country level in all other columns. $^{*}p < .1$,$^{**}p < .05$,$^{***}p < .01$.

where $\mathbf{1}_{c\in\text{EUR}}$ is an indicator for a bond denominated in euros and $\mathbf{1}_{c\in\text{NonEUR}}$ is an indicator for a bond denominated in any currency other than the euro. If investors do not display a currency bias, we would have $\beta^{a,f}_{\text{EUR}} = \beta^{a,f}_{\text{NonEUR}}$, and if they are perfectly diversified according to market weights, both coefficients would equal 1.

In column 1 of Table 6, we again begin by running this regression for the non-OOFC Euro Area countries as a benchmark. We find strong home currency bias, as in Maggiori et al. (2020), with the coefficient on euro-denominated bonds approximately 40 times higher than that on non-euro denominated bonds. Columns 2 and 5 report the results for all investment by Luxembourg and Ireland funds: home currency bias from Luxembourg is significantly lower than in column 1 but above one, and for Ireland the coefficient is actually below one. Columns 3 and 6 focus on those positions in Luxembourg and Ireland funds, respectively, that are attributed to Euro Area underlying investors. Here, home currency bias is both stronger for Luxembourg and actually present in Ireland funds. By contrast, in columns 4 and 7, we observe significant bias away from euro-denominated bonds for the Luxembourg and Ireland fund positions attributed to the RoW ultimate investors. The results for Ireland are connected to the earlier discussion in Section 2.4 (see also Section 4) of British investors having a dominant role in Irish fund intermediation. These investors, much like the Euro Area ones, have a home currency bias that leads the overall (raw) Irish fund portfolio to have a large position in pound-denominated bonds.

This has important implications for assessing the extent of home currency bias in the Euro Area as well as the exposure of neighboring bond markets, such as the UK, to Euro Area investors. Hence work which relies on representativeness assumptions or collapses all Euro Area holdings together overestimates Euro Area investors' exposures to foreign currencies (i.e., underestimates home currency bias), especially those of countries like the UK, whose investors intermediate their savings via Luxembourg and Ireland.[26] In Appendix Table A.II, we perform this analysis restricting it to corporate bonds and find the results are qualitatively similar.

3.4 Financial Integration and Biases of the Euro Area

We next turn to exploring the full extent of Euro Area financial integration along a number of dimensions. In particular, we contrast how individual European countries invest directly in the SHS data, as compared to how they invest via Luxembourg and Ireland. Finally, we contrast these patterns with the full picture of their investment, which combines the direct investment and the indirect investment intermediated via fund holdings in the OOFCs.

To provide a benchmark, we begin by estimating the baseline international CAPM specification in Table 7. For bond investment, the international CAPM is a better description of the data for investment intermediated via Luxembourg and Ireland than for the direct holdings. In addition to a slightly higher coefficient on the global portfolio shares m, we observe a large increase in the fit

[26] For example, Sweden is another country with access to Luxembourg and Ireland fund intermediation via EU legal harmonization. Indeed, we find unusually high holdings of bonds denominated in Swedish krona in the raw data of Ireland and Luxembourg funds.

Table 6: **Heterogeneity in OOFC use: Currency, all bonds**

	Non-OOFC	Luxembourg			Ireland		
	Direct	Raw	EA	RoW	Raw	EA	RoW
$m \times$ EUR	2.369***	1.208***	1.679***	0.851***	0.798***	1.173***	0.342***
	(0.424)	(0.118)	(0.238)	(0.092)	(0.052)	(0.051)	(0.020)
$m \times$ Non-EUR	0.060***	0.328***	0.231***	0.390***	0.518**	0.305***	0.731**
	(0.010)	(0.071)	(0.060)	(0.090)	(0.239)	(0.083)	(0.365)
Constant	0.000***	0.000**	0.000**	0.000**	0.000	0.000**	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Obs.	8,556,372	503,316	503,316	503,316	503,316	503,316	503,316
R^2	0.022	0.370	0.376	0.234	0.083	0.255	0.055

Notes: This table estimates equation (10). The dependent variable is the share of the a particular bond in an investor's bond portfolio. The independent variable is the share of a given security in the global bond portfolio, m, interacted with indicator variables for whether the bond is denominated in euros ("EUR") or a currency other than Euros ("NonEUR"). Non-OOFC Direct refers to investments from all individual Euro Area countries other than Luxembourg and Ireland, as reported in the SHS data. A heading of "Luxembourg" refers to investment from Luxembourg on a residency basis, with "Raw" denoting the unadjusted SHS data, "EA" denoting investment from Luxembourg on behalf of identified Euro Area investors, and "RoW" denoting investment from Luxembourg on behalf of investors that were not matched to the Euro Area. The "Ireland" heading is defined equivalently for investment from Ireland. Standard errors clustered at the investor-issuer country level in column 1 and at the issuer country level in all other columns. $^{*}p < .1$,$^{**}p < .05$,$^{***}p < .01$.

of the regression as measured by the R^2. Nevertheless, there is only a small difference in the fit of the CAPM between the raw data and our fully unwound data. However, this similarity is itself an important result. As previewed in the aggregate patterns on the heterogeneity in holdings through Luxembourg and Ireland in Figures 3 and 4, one important facet of our fund unwind procedure is that it allocates *more than half* of the OOFC holdings to the rest of the world rather than Euro Area countries, and so given the large amounts of bonds investors own directly, reallocating the OOFC positions owned by individual EA countries does not have a large quantitative effect on their total position. However, if rather than undertaking this fund-level unwind procedure we were to naïvely proportionally reallocate *all* of the holdings of the OOFC fund sector to Europe, or consolidate all holdings at the Euro Area level, we would have erroneously estimated a *large* increase in the fit of the CAPM. This effect can be seen in the first two columns of Appendix Table 4, where we see a dramatically higher fit of the CAPM for the RoW investment through OOFCs than we do for the EA's investment through these same countries. For bonds, this can largely be understood as arising from the home currency bias results of the last section, where even conditional on investing through the OOFCs, Euro Area investors disproportionately buy euro-denominated securities, generating a large deviation from the international CAPM where the bulk of securities would be in US dollars and other currencies.

In columns 5 through 8, we perform the same exercise for equity investments, and we find an even more striking role for OOFC intermediation. First, the estimate $\hat{\beta}^{a,f}_{\text{CAPM}}$ for direct investment is 0.50 as compared to 0.84 for equity investment via Luxembourg and 1.19 via Ireland. Looking at the R^2 of the regressions, we find that the R^2 of 0.01 for direct investment increases to 0.30 and 0.49 for investment via Luxembourg and Ireland, respectively. Considering that these results pool

Table 7: **CAPM regressions**

	Bonds				Equities			
	Direct	via LUX	via IRL	Unwound	Direct	via LUX	via IRL	Unwound
m	0.347***	0.475***	0.408***	0.355***	0.499***	0.843***	1.187***	0.626***
	(0.068)	(0.050)	(0.049)	(0.064)	(0.078)	(0.069)	(0.114)	(0.077)
Constant	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***	0.000	0.000***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Obs.	8,603,139	8,603,139	8,603,139	8,603,139	711,467	711,467	711,467	711,467
R^2	0.004	0.047	0.048	0.005	0.007	0.299	0.486	0.016

Notes: This table estimates equation (7). The dependent variable is the share of the a particular bond in an investor's bond portfolio. The independent variable is the share of a given security in the global bond portfolio, m. "Direct" refers to investment originating from a given country as reported in SHS, "via LUX" and "via IRL" refers to investment done by a given country that is intermediated through Luxembourg and Ireland, respectively, by our fund-level unwind of the OOFCs. "Unwound" refers to our estimated total investment position of a country from combining direct investment in SHS with our indirect positions via Luxembourg and Ireland. Standard errors clustered at the investor-issuer country level. * p < .1, ** p < .05, *** p < .01.

together the larger countries like Germany and France with much smaller countries like Latvia and Slovenia that own fewer funds in the OOFCs, the strength of this fit is remarkable. It is clear that in the realm of equities, the OOFCs provide global diversification. Turning to the "Unwound" column, we can see a 25% increase in the point estimate and a more than doubling of the R^2, despite the fact that the overwhelming share of equity investment continues to be done directly.

Next, we turn to understanding the geographic sources of these deviations from the international diversification benchmark. To do so, we extend our geographic characteristics beyond equation (9) to separate the Euro Area into the home country of the investor ("Home") and the Rest of the Euro Area ("REA"):

$$\omega^{a,f}_{j,i,c} = \alpha^{a,f} + m^{a}_{i,c}\left[\beta^{a,f}_{\text{RoW}}\ \mathbf{1}_{i_c\in\text{RoW}} + \beta^{a,f}_{\text{REA}}\ \mathbf{1}_{i_c\in\text{EA}-j} + \beta^{a,f}_{\text{Home}}\ \mathbf{1}_{i_c=j}\right] + \epsilon^{a,f}_{j,i,c} \tag{11}$$

We report the results in Table 8 where we pool the regression results for all non-OOFC Euro Area countries. Beginning with bonds, Euro Area investors are significantly underweight in the RoW in their direct holdings (as in Table 4). However, we now see that they are actually slightly overweight the rest of the EA with a coefficient of 1.22. Of course, this is dramatically lower than the 2.32 coefficient on the EA in Table 4, because investors are roughly 20 times overweight their home bonds, in line with the large literature on home bias (French and Poterba 1991, Lewis 1999). Via Luxembourg and Ireland, Euro Area investors are significantly overweight the rest of the Euro Area's bonds in addition to increasing their exposure to the rest of the world. Interestingly, the estimate $\hat{\beta}^{a,f}_{\text{Home}}$ falls by an order of magnitude from 20 to around 2 and is similar in magnitude to the weight placed on the rest of the Euro Area. For Euro Area investors going through Luxembourg and Ireland, it is about Euro Area bias more so than home bias per se. Nonetheless, it is interesting that even when investing via Luxembourg and Ireland, Euro Area investors are overall biased towards their home country.

In the last four columns of Table 4, we perform the equivalent exercise for equities. The major

Table 8: **CAPM regressions: Home, Euro Area, and RoW**

	Bonds				Equities			
	Direct	via LUX	via IRL	Unwound	Direct	via LUX	via IRL	Unwound
$m \times$ RoW	0.067***	0.225***	0.268***	0.078***	0.387***	0.760***	1.157***	0.518***
	(0.010)	(0.019)	(0.050)	(0.010)	(0.075)	(0.072)	(0.121)	(0.076)
$m \times$ REA	1.220***	2.253***	1.388***	1.280***	1.167***	2.348***	1.759***	1.408***
	(0.116)	(0.216)	(0.071)	(0.109)	(0.167)	(0.144)	(0.090)	(0.139)
$m \times$ Home	20.573***	2.103***	1.592***	19.265***	28.202***	3.482***	1.778***	24.733***
	(5.820)	(0.527)	(0.265)	(5.333)	(6.059)	(0.800)	(0.192)	(5.234)
Constant	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***	−0.000	0.000***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Obs.	8,603,139	8,603,139	8,603,139	8,603,139	711,467	711,467	711,467	711,467
R^2	0.102	0.141	0.089	0.105	0.064	0.358	0.492	0.083

Notes: This table estimates equation (11). The dependent variable is the share of a particular bond in an investor's bond portfolio. The independent variable is the share of a given security in the global bond portfolio, m, interacted with indicator variables for whether the security was issued by an entity resident in the Rest of the World (RoW), the Rest of the Euro Area (REA), defined as the Euro Area excluding the investor country's residency, the Home, a bond where investor and security residency coincide. "Direct" refers to investment originating from a given country as reported in SHS, "via LUX" and "via IRL" refers to investment done by a given country that is intermediated through Luxembourg and Ireland, respectively, by our fund-level unwind of the OOFCs. "Unwound" refers to our estimated total investment position of a country from combining Direct investment in SHS with our indirect positions via Luxembourg and Ireland. Standard errors clustered at the investor-issuer country level. $^{*}p < .1$,** $p < .05$,*** $p < .01$.

difference here is that conditional on investing through the OOFCs, the individual Euro Area countries buy relatively more assets from the rest of the world than the rest of the Euro Area, generating more global diversification than diversification within the Euro Area. As is the case for bonds, we continue to see the striking pattern of home bias in OOFCs with $\hat{\beta}^{a,f}_{\text{Home}}$ significantly greater than 1 for investment in equities via both Luxembourg and Ireland. Understanding the incentives of households and institutions to acquire domestic assets even when they invest via the OOFCs rather than directly is a promising avenue for shedding further light on the economic consequences of OOFC intermediation. It also opens the possibility of shedding light on the underlying causes of home bias as being driven by preferences, information, or other factors.

In both bonds and equities, the fully unwound data shows lower home bias than the direct data of Euro Area members (excluding Luxembourg and Ireland). This result is consistent with the analysis by Vivar et al. (2020) and Carvalho and Schmitz (2021), who find lower home bias once accounting for the diversification Euro Area member countries obtain from their fund investment in Luxembourg and Ireland. The quantitative impact is limited by the combination of a level and composition effect: (i) home investments via the direct route are large compared to the fraction of Luxembourg and Ireland funds that are attributed to Euro Area members; and (ii) the portfolio of Euro Area investors in Luxembourg and Ireland features more home and Euro Area bias than the portfolio of the rest of the world via the same funds' jurisdictions.

4 The Rest of the World in the OOFCs

We have analyzed the systematic differences in holdings by funds known to be held by EA investors and those that are unaccounted for in SHS. Quantitatively, unaccounted-for investors hold approximately 50% of fund investments undertaken by Luxembourg and Ireland. Throughout the preceding sections, we have referred to these unaccounted-for holdings as RoW investments. In this section, we dive deep into who these "RoW" investors actually are. Here, we bring to bear new data on the immediate counterparties of these funds and demonstrate that the bulk of non-EA positions are accounted for by the holdings of the United Kingdom. The positions of the United Kingdom are much larger than what the United Kingdom itself reports owning on a residency basis to the IMF Coordinated Portfolio Investment Survey (CPIS).

We present evidence that this discrepancy may arise due to both incomplete reporting by the United Kingdom of positions where its households are the ultimate owners, as well as likely custodial holdings of the UK where it is acting as an intermediary for non-resident wealth around the world. We confirm the findings of Zucman (2013) that Switzerland generates part of the overall missing global assets due to custodial bias. Our analysis emphasizes that understanding the activities of the United Kingdom is key to accounting for the missing wealth.

4.1 The Missing Wealth: €3.2trn.

The scale of the missing wealth in Luxembourg and Irish funds is enormous. As of December 2020, Ireland and Luxembourg report portfolio investment fund-share liabilities to foreign investors of €3.0trn and €4.9trn, respectively.[27] At the same time, Ireland and Luxembourg also report foreign portfolio equity liabilities of €624bn and €47bn, respectively.[28] All other countries combined, however, report owning only €2.0trn and €3.3trn of portfolio equity and fund shares in Ireland and Luxembourg, respectively.[29] Hence, at the end of 2020 there are holdings of approximately €1.6trn of fund shares and equity unaccounted in each of Ireland and Luxembourg, a staggering amount that has attracted the attention of academics, policy markers, and statisticians.

In principle this should not happen since for every country that registers an asset somewhere else in the world, another country should correspondingly register a liability by the same amount, while the statistical recording on both sides should follow the IMF's Balance of Payments Manual. In practice, however, it is well-known that globally net foreign asset positions (NFAs) do not sum to zero, which is to a large extent driven by portfolio investment equity. There are several possible explanations for this missing wealth.

First, a part of the gap between global portfolio investment equity liabilities and assets may

[27] As in the ECB's Statistical Data Warehouse for Ireland and Luxembourg (retrieved on March 1, 2023).
[28] As in the ECB's Statistical Data Warehouse for Ireland and Luxembourg (retrieved on March 1, 2023).
[29] According to BPM6 criteria fund shares are classified as equity since they are a claim to the equity (net asset value) of the funds. Consequently, international investment statistics often report holdings of equity and fund shares in a single category. The numbers provided here are from the IMF's CPIS, a bilateral portfolio investment dataset that indeed does not split equity and fund shares (Felettigh et al. 2008).

be accounted for by countries that do not report any data on portfolio investment assets. Second, there may be discrepancies in the statistical compilation methods used by various countries. Third, and likely most importantly, there may be an incomplete coverage of asset ownership, especially for households and non-financial corporations (Gervais and Bui-Quang 2019). In particular, this could occur because of hidden wealth in tax havens that goes unrecorded in official statistics. Zucman (2013) attributes the gap to this latter source and provides evidence that the underlying investors are wealthy residents of the EA and USA. Another possibility is that not all equity being held is recorded as portfolio investment, as some could be recorded as foreign direct investment (FDI). For example, if an entity owns fund shares that account for more than 10% of the outstanding fund shares of a specific fund, then this position may be reported as FDI.[30] Unfortunately, FDI statistics do not separate out fund shares, making it difficult to analyze the relevant breakdown. For the broader category of FDI equity there is evidence that global assets exceed liabilities (Angulo and Hierro 2017) which may suggest that some of the globally unrecorded portfolio equity assets are in fact recorded in FDI equity (Schmitz 2021).

International financial statistics differ in the criteria used for recording the asset and liability side of the external balance sheet of countries due to the different information available to a country about its assets and liabilities. While some countries do not have any information available on the residency of the foreign holders of the securities issued in their country, other countries report liabilities based on the residency of the immediate counter-party. Consider the case of a bank in London holding a fund share issued by a fund domiciled in Ireland. The Irish statisticians register a fund share liability in portfolio investment for Ireland toward the UK. Indeed, all that the Irish statisticians may know is that the immediate counterpart is based in the UK. UK statisticians, however, have more information on who the actual holder of the fund share is. In particular, international financial statistics are built, on the asset side, based on the residency of the holder (a distinct concept from the residency of the issuer as discussed earlier in this paper). UK statisticians record the position very differently depending on whether the holder of the security is a UK resident or a non-resident. If the holder is a UK resident, e.g. a UK resident household owns an account at the bank which purchased the fund share on her behalf, then the UK statisticians record a UK asset in the form of a portfolio investment (or FDI if the holding is above the 10% threshold) in fund shares in Ireland. If the holder is determined to be a non-resident, e.g. a non-resident household with a bank account in London, then the UK statisticians record no asset at all: in principle, the country of residency of that household records the asset.

The problem is that principle and practice can differ substantially. The two tend to coincide, for example, in situations when automatic exchanges of information are available. A prominent example is the construction of SHS statistics itself. Within the EA each national central bank provides information about assets held by its domestic financial institutions (mainly custodians) on behalf of residents of other EA countries, and the assets are then recorded by the appropriate

[30] See Paragraph 593 of the OECD Benchmark Definition of Foreign Direct Investment, Fourth Edition.

country of residency.[31] Principle and practice are very different in the case of hidden wealth: the country of residency of the investor might never know that she has a bank account in London in which she holds fund shares in Ireland. This is obviously the case for wealth that goes unrecorded to tax authorities and is stashed away in tax havens.

Understanding the source of missing wealth has important ramification in many areas. In international macroeconomics, it affects both the gross and the net balance sheet of countries. In attributing the missing wealth to EA and USA residents, Zucman (2013) concludes that these countries are much larger creditors (or less of a debtor) to the rest of the world than previously understood. In finance, Luxembourg and Ireland are among the largest owners of securities in the world but little is known about the underlying investors and their preferences. In public finance, the source of the missing wealth affects estimates of inequality: if the missing wealth belongs to individuals at the top of the wealth distribution, recording it correctly can substantially increase inequality (Alstadsæter et al. 2018).

4.2 Who Accounts for the Missing Wealth?

To better understand who accounts for the missing wealth of Luxembourg and Ireland, we bring to bear several pieces of information. First, we use information from SHS on the exact amount that each EA country owns of each fund share (at the ISIN level) issued by funds domiciled in Luxembourg and Ireland. Second, from the IMF Coordinated Portfolio Investment Survey (CPIS), we use information on country-level holdings of the sum of fund shares and equities in Luxembourg and Ireland. Third, we use information from Morningstar about the securities held by each fund domiciled in Luxembourg and Ireland as well as information on the fund shares issued by these funds (by amount, currency, and country in which they are available or registered for sale). Fourth, we use administrative data provided by the Central Bank of Ireland and the Commission de Surveillance du Secteur Financier (CSSF) for Luxembourg on the country of the immediate counterparts of the fund shares. These entities are often financial intermediaries (e.g., custodians) and hence different from the ultimate owner of the fund shares.

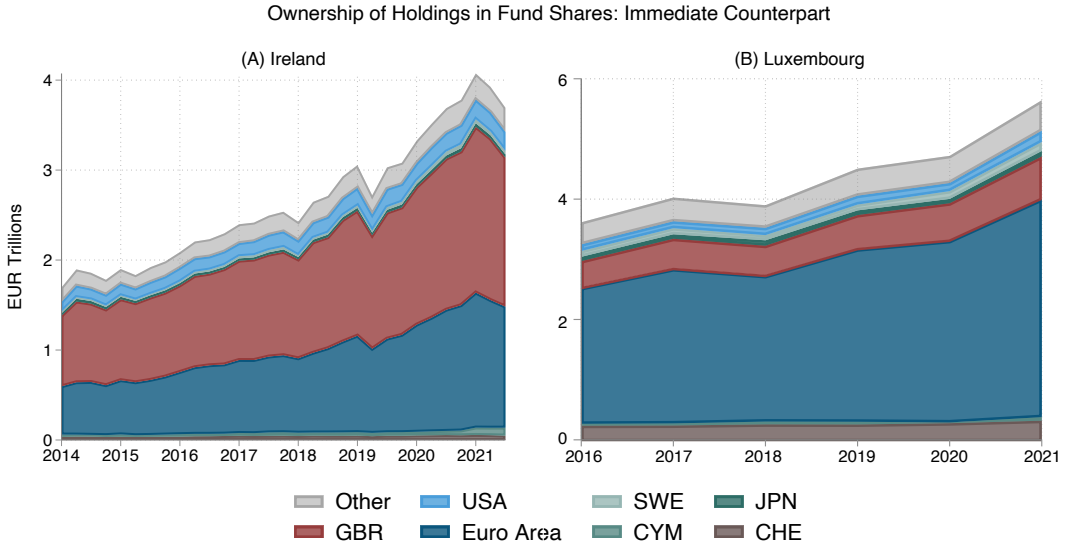
In Figure 10, we plot the geography of the immediate ownership of Irish and Luxembourg fund shares using the administrative data. The data from the Central Bank of Ireland and the CSSF both tell us where the immediate owner of a fund is based. However, and importantly, if this immediate position is being held on behalf of a non-resident, say on a custodial basis, then the country of residency of the investment and the immediate basis might differ. For both Ireland and Luxembourg, the data covers the universe of investment funds, including non-UCITS funds.[32]

Using the immediate counterparty data, we document how a number of important facts emerge. Beginning with Ireland, we see that on an immediate counterparty basis, the overwhelming share of

[31] In order to avoid double reporting, only assets held in custody for non-financial investors (mainly households and non-financial corporations) are included in SHS.

[32] We thank the Central Bank of Ireland and the Commission de Surveillance du Secteur Financier for providing this data, and for their generous assistance in working with it.

Figure 10: **Geography of investors' holdings in fund shares**



Notes: We use data from the Central bank of Ireland and the Luxembourg Commission de Surveillance du Secteur Financier (CSSF) to decompose the assets of Ireland and Luxembourg funds according to the immediate counterpart owners of the fund shares.

the funds are owned by either Euro Area or UK investors. The UK component is the most striking, with British counterparties accounting for around half of all Irish fund share liabilities. Just as important, however, are the countries that are revealed to not be major owners of the Irish funds. We see that Switzerland, much like global tax havens like the Cayman Islands, accounts for a very small share of Irish funds, even on an immediate counterparty basis. Although we might not expect these tax havens to be major final holders of the securities, if non-residents purchased securities via these countries, then on an immediate counterparty basis we would have expected to see more reported claims.

For Luxembourg, the picture is similar. We see that the overwhelming share of ownership of the Luxembourg funds are accounted for by Euro Area and UK investors. However, in this case, a large share of the Euro Area total position is actually accounted for by Luxembourg itself. For instance, in 2020, Luxembourg accounts for €1,230 billion of the Euro Area's holdings of Luxembourg funds. Of course, Luxembourg's holdings of its own fund shares highlights the limitations of the immediate counterparty data, as it is very likely that these holdings are actually on behalf of ultimate investors based outside of Luxembourg. In the case of Luxembourg, this large position most likely represents the large custodial positions of the country. We once again see that Switzerland and global tax havens account for a relatively small share of ownership of the Luxembourg funds on an immediate counterparty basis. This analysis, is consistent with Ciccone et al. (2022) that find, for the period of June 2019, that countries that are part of the EU and EFTA, but not the EA, accounted for 29.4 percent of Luxembourg UCITS fund holdings on an immediate counterpart basis.

4.3 Immediate Counterparty vs. Residency

We next turn to comparing these immediate counterparty holdings to the positions that each country itself reports owning in Ireland and Luxembourg. Importantly, we do not expect these positions to match, as countries' asset-side reports only contain the holdings of their own residents, whereas the regulators have told us the ownership by the immediate holders, regardless of the final investors' residency. Of course, in the scenario in which the residents all held securities directly and their national governments reported the national positions accurately, these two sets of positions would coincide. Therefore, we shed light on the nature of the true owners by examining the difference between these two measures.

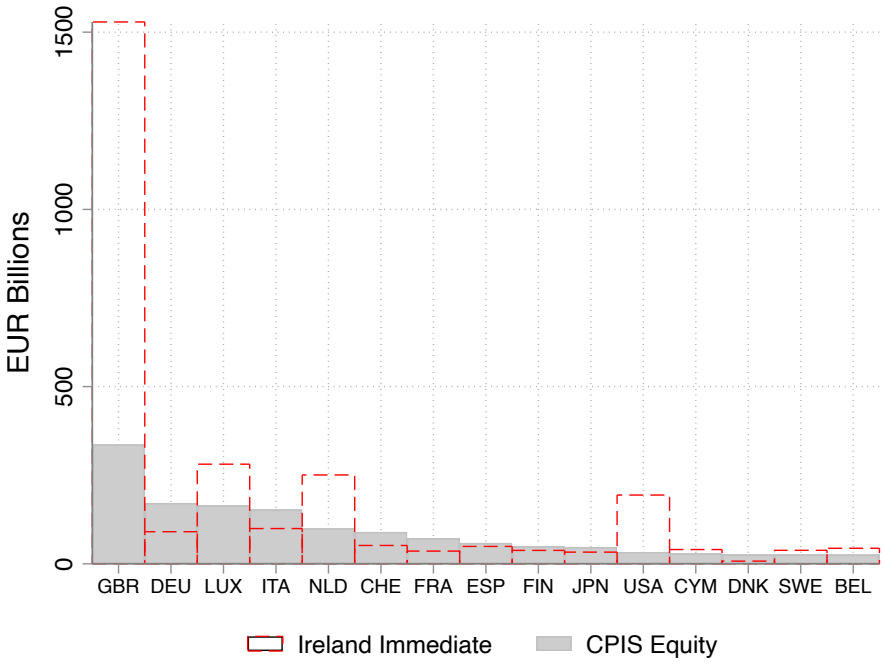
Due to confidentiality restrictions in the SHS data, we report each country's claims on Ireland and Luxembourg based on the self-reported positions in the IMF Coordinated Portfolio Investment Survey (CPIS). However, the CPIS data pools together standard equity claims (common equities as well as preferred equities) and fund shares. For Luxembourg, this is unlikely to be a large concern as there is very little regular equity relative to the size of the fund sector, but this is more likely to be a concern for the larger Irish economy, particularly given that investment in American firms that tax-invert to Ireland will also be included. Given that this latter bias is likely to be a particularly large concern for American investors, for the United States position, we are able to use the reported investment in Irish (and Luxembourg) fund shares using the Treasury International Capital (TIC) data, dropping positions in common equity and preferred shares. Unfortunately, this split between fund shares and equity is not available for other countries. Despite the drawbacks of pooling equity and fund shares by using CPIS rather than SHS, one important benefit is that we can consider the positions of non-EA countries.

In both panels of Figure 11, we see that the United Kingdom is a huge outlier in terms of appearing as a much larger immediate owner of Irish and Luxembourg funds than it itself reports owning in CPIS. For Ireland in particular, this is all the more surprising because—given the close financial, political, and cultural connections between the United Kingdom and Ireland—one might have expected the CPIS data on the UK's holdings in Ireland to be particularly high, since it appears to be likely to invest heavily in Irish equities. Despite this, we see a huge discrepancy in the position, with the recorded liabilities by Ireland vastly exceeding (at €1,529bn) the assets recorded by the UK. The UK does not separately report fund shares and equity portfolio investment in Ireland, but the total of the two is only €336bn in CPIS. The difference at €1.2trn is extremely large, and likely a lower bound since it assumes all the position in CPIS to be in fund shares. While smaller than for Ireland, the discrepancy is also enormous for Luxembourg, with Luxembourg authorities reporting €637bn but the UK only reporting holdings of €134bn of fund shares and equities combined.

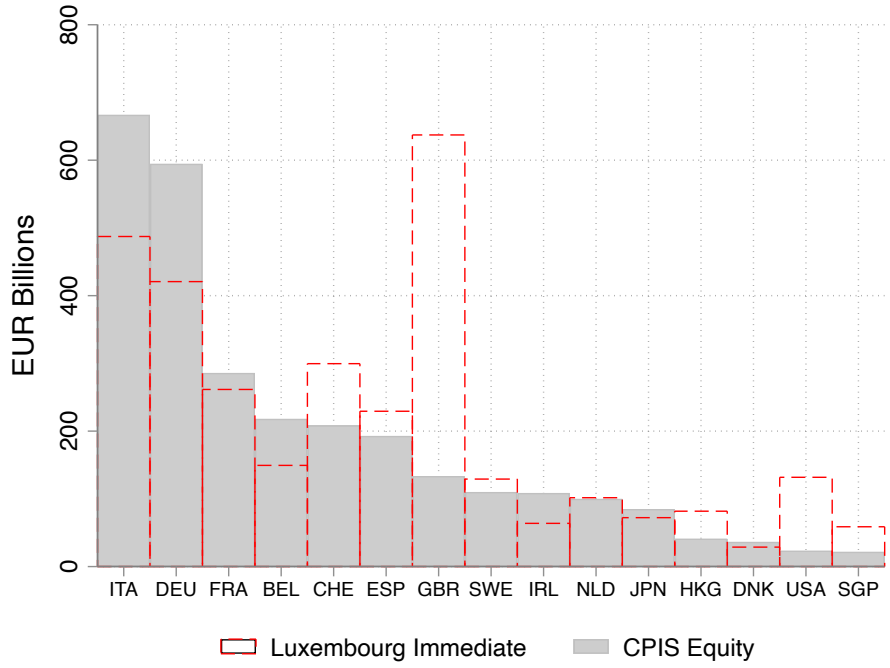
The role of the United Kingdom. The major question is then how much of the UK position represents custodial positions on behalf on non-UK residents versus incomplete reporting of the United Kingdom of the true positions in the funds by its households and other sectors. There are reasons to believe both channels are important. Beginning with the possibility of incomplete

Figure 11: **Immediate owners of funds vs. residency-basis claims**

(a) Ireland Funds



(b) Luxembourg Funds



Notes: This figure compares the amount of funds the regulatory authorities (Central Bank of Ireland and CSSF) report to be owned by each country on an immediate counterparty basis (dashed red bars) to the amount of fund shares and equity that each country reports owning in CPIS (solid gray bars). For the United States, instead of CPIS, the amount of fund shares owned from TIC are used instead. All data shown are as of the end of 2020.

reporting, in the CPIS metadata, the UK acknowledges that it does not directly collect data for the holdings of the household or the non-profit sector. While households are likely to have small direct holdings of foreign bonds and equities, they are likely to important holders of foreign investment funds. For instance, in December 2020, in the Enhanced CPIS Table 3.A, Italian households account for 46% ($86bn of $186bn) of Italy's equity and fund share investment in Ireland and 53% ($433bn of $816bn) of their investment in Luxembourg. The composition of the unaccounted portfolio holdings, particularly in Ireland, as well as the publicly disclosed pension fund holdings of Ireland-resident LDI funds investing in gilts, points to a significant component of these investment funds having British ultimate owners.

The results in Table 2 further point to the importance of the UK as an ultimate investor. There, we see that while 33.6% of Irish fund bond holdings are denominated in British pounds, only 7.6% of the matched holdings of Euro Area investors that we identify in the data are. By contrast, 39.6% of the unaccounted-for bond holdings of Irish funds are denominated in pounds. While British investors invest a very high share of their bond portfolio pounds, the rest of the world generally denominates very little of their assets in pounds (Maggiori et al. 2020). Because in 2020 there were €1.2 trillion in unaccounted bond positions in Ireland, this means that there were €474 billion in pound-denominated assets alone. If these positions are largely owned by British investors, then this would point to large-scale underreporting of UK positions, in addition to the other assets that UK investors are likely to own.

However, given the magnitude of the discrepancy, it is likely that a significant portion of this UK investment must be done on behalf of non-UK residents. The sheer magnitude of the positions implies that if all of the securities recorded as belonging to the UK in the administrative data on a residency basis were actually owned by British residents, the UK net foreign asset position would be (directly) massively underreported. In addition, examining the holdings of some of the individual funds that Europeans do not report owning in the SHS data, it appears very likely these funds are owned by non-UK and non-European investors. For instance, some major funds measure their returns in currencies such as the Hong Kong dollar, with their marketing material clearly indicating that they are targeting a non-European and non-UK investor base. In ongoing work, we are exploring the characteristics of these funds that are not declared to be owned by Europeans in the SHS data in order to shed further light on who the ultimate investors are.[33]

Putting this together, it is clear that the key to a complete understanding of the missing wealth in Luxembourg and Ireland is understanding what share of UK investments in these countries on an immediate basis is actually on behalf of British residents, and then which foreign investors own the remaining funds via the UK.

The Euro Area, Switzerland, and tax havens. At present this questions remains unsettled, but we note that it is unlikely that EA investors would be using the UK to custody wealth

[33]In Appendix Figure A.VII, we note that the UK is a major under-reporter in its own cross-border claims towards the United States in CPIS, relative to the estimates of US liabilities towards the UK in the Treasury International Capital Data.

that is unreported to the tax authorities in the EA. First, the UK has substantial transparency and exchanges of information agreements with the EA, making it a less likely destination for tax evasion of this massive scale. Second, as we have shown in Section 2, the portfolio of securities held by RoW investors via Irish mutual funds is very different on observables such as currency and country of the issuer from the portfolio that EA residents are known to hold via the Irish funds. If the RoW holdings were actually masking hidden wealth by EA investors via the UK, then one would have to explain such marked differences in investment preferences for these two investment routes by the same investors.

Despite the clear importance of the UK, there is still much we can learn from the other positions in Figure 11. For both Luxembourg and Ireland, we see that Germany, Italy and France all report owning more fund shares and equity than the country reports them owning on an immediate basis. The overall pattern is consistent with exchanges of information within the EA on security holdings, so that some shares issued by Irish funds and held on an immediate counter-party basis by a custodian—for example in Luxembourg (i.e., an Irish immediate counter-party liability toward Luxembourg)—appear on the asset side of the EA country where the ultimate owner of the share resides. Of course, we cannot rule out under-reporting as another source of the discrepancy. Interestingly, we see that the United States reports significantly less ownership of Luxembourg and Irish fund shares in its official Treasury International Capital data than the two countries report Americans owning on an immediate basis.

The next question is how Switzerland and global tax havens fit into the picture. We see that Switzerland and global tax havens do not account for a particularly large portion of the position.To better understand the potential role of Switzerland, we update the result of Zucman (2013) using Switzerland's data on investments held on behalf of non-residents. If we assume all shares held in custody in Switzerland are shares of funds in Luxembourg, this channel would account for 48 percent of the discrepancy (€802bn of the €1641bn).[34] On the one hand, this assumption is likely to overestimate the amount invested by Swiss non-resident accounts in Luxembourg because some of these fund shares are probably in other destinations. More importantly, if this were the pattern of investment, we would have expected the CSSF administrative data to report a much higher amount of Luxembourg fund shares to be owned by Switzerland on an immediate counterparty basis. On the other hand, we do find the time series correlation (of first differences) between the Luxembourg discrepancy and the Swiss custody holdings to be high at 80 percent, supporting the view that the two series are indeed related.

[34]The data is provided by the Swiss National Bank in both the "Annual Banking Statistics" and "Monthly Banking Statistics", series "Securities holdings in bank custody accounts – by category of security, investment currency and domicile of issuer – monthly". The data provides holdings in Swiss custody on behalf of non-residents of units in collective investment schemes (i.e., fund shares). The number reported is based on the more comprehensive annual dataset; the monthly survey shows a value of €790bn. We subtract from the total holdings the part held in "Swiss collective investment schemes pursuant to CISA", to obtain the investments from these custody accounts in fund shares worldwide outside of Switzerland.

5 Wealth Transfers and Sector-Country Heterogeneity

5.1 Limited integration between North and South.

We further explore how capital is allocated within the Euro Area along a policy-relevant dimension: the North-South divide. Risk exposures to countries within the monetary union with higher sovereign risk have been an important policy focus in the Euro Area since the sovereign debt crisis of 2012. If there were a new sovereign debt crises, how would the losses (even only mark-to-market) be distributed? To understand the geography of these wealth transfers, we run a regression of the following form:

$$\begin{aligned}\omega_{j,i,c}^{a,f} = \alpha^{a,f} + m_{i,c}^{a} \Big[& \beta_{N\to N}^{a,f} \mathbf{1}_{\{j\in N, i_c \in N\}} + \beta_{N\to S}^{a,f} \mathbf{1}_{\{j\in N, i_c \in S\}} \\ & + \beta_{S\to N}^{a,f} \mathbf{1}_{\{j\in S, i_c \in N\}} + \beta_{S\to S}^{a,f} \mathbf{1}_{\{j\in S, i_c \in S\}} \Big] + \epsilon_{j,i,c}^{a,f}.\end{aligned} \tag{12}$$

For instance, $\mathbf{1}_{\{j\in N, i_c\in S\}}$ is an indicator variable indicating the investor j is a Northern Euro Area country and the nationality of the issuer of the security $i(c)$ is a Southern Euro Area country, with all other indicator variables defined analogously. We define the Northern Euro Area as including Austria, Belgium, Finland, France, Germany, and the Netherlands, and we define the Southern Euro Area as including Portugal, Italy, Spain, and Greece. We estimate the regression in equation (12) for five different asset classes: all bonds, all euro-denominated bonds, euro-denominated corporate bonds, euro-denominated sovereign bonds, and equities. In every specification, we restrict the set of securities to be those issued by either Southern or Northern Euro Area issuers, and we restrict the set of investors to Southern or Northern Euro Area countries. Importantly, we drop all domestic positions where the nationality of the issuer is the same as that of the holder.

Table 9 reports the results of this North to South analysis. First, by comparing $\beta_{S\to S}$ to $\beta_{N\to S}$, we find that for bonds, Southern Euro Area investors hold a much larger share of their portfolio in other Southern Euro Area countries than do Northern Euro Area investors.[35] Turning to columns 2-4, we find that this asymmetry in capital allocation to Southern countries is driven by Southern Euro Area investors holding disproportionately more in the sovereign debt of other Southern Euro Area countries than do Northern Euro Area investors. In the wake of the European sovereign debt crisis and recent financial turmoil, this points to an important asymmetry in the adjustment mechanism. While one might expect increases in sovereign risk in Southern Europe to result in a wealth transfer from Northern European countries to the South via valuation effects, our results imply that a disproportionate share of the losses would fall on other Southern European investors.

Second, we show that Northern Euro Area investors are also more likely to invest more of their bond portfolio in other Northern Euro Area countries, but the Southern Euro Area is largely underweight the bonds of the Northern Euro Area. Once again, this effect is largely coming from asymmetries in holdings of sovereign bonds. For equities, the primary finding is the very limited cross-border investment into Southern Euro Area equities. This comes with a higher level of mea-

[35] By dropping domestic positions, this result is not mechanically driven by home bias.

sured home bias in the data. When considering investment into Northern Euro Area equities, we find that once again the North is relatively overweight compared to the South.

Recent theoretical work has pointed to inefficiencies in private decision (both financial and in the real economy) that underpin a rationale for state-contingent transfers among Euro Area member countries and/or ECB bond buying programs (Farhi and Werning 2017, Farhi and Tirole 2018).[36] In this context, our results provide an empirical benchmark of the private market portfolio choices that can be useful in assessing and quantify such inefficiencies.

Table 9: **North and South financial integration**

	All Bonds	EUR Bonds	EUR Corp.	EUR Sov.	Equities
$m \times (N \to N)$	1.752***	1.727***	0.104	1.588***	2.430***
	(0.389)	(0.388)	(0.075)	(0.369)	(0.768)
$m \times (N \to S)$	1.112***	1.072***	−0.123	0.909***	0.254***
	(0.163)	(0.165)	(0.086)	(0.198)	(0.084)
$m \times (S \to N)$	0.403***	0.375***	−0.041*	0.299**	1.598***
	(0.072)	(0.074)	(0.022)	(0.115)	(0.249)
$m \times (S \to S)$	2.280***	2.241***	0.031	2.085***	0.369***
	(0.518)	(0.519)	(0.362)	(0.536)	(0.139)
Constant	0.000***	0.000***	0.000***	0.000***	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Obs.	2,770,920	2,461,104	2,330,280	56,844	72,144
R^2	0.079	0.073	0.002	0.126	0.228

Notes: This table estimates equation (12). The dependent variable is the share of a particular bond in an investor's bond portfolio. The independent variable is the share of a given security in the global bond portfolio, m, interacted with indicator variables for whether the investor and issuer are in the Northern Euro Area ("N") or Southern Euro Area ("S"). All data are on a nationality basis and account for funds intermediated through the OOFCs. "All Bonds" includes all bonds, "EUR Bonds" restricts to bonds denominated in euros, "EUR Corp." restricts to corporate bonds denominated in euros, "EUR Sov." restricts to sovereign bonds denominated in euros, and "Equities" refers to any equity. Standard errors clustered at the investor-issuer country level. $^{*}p < .1$,$^{**}p < .05$,$^{***}p < .01$.

5.2 Sectoral Heterogeneity in Fund Usage

The extent of usage of funds domiciled in Ireland and Luxembourg and the portfolio chosen within those funds differ substantially both among countries and sectors within the Euro Area. Figure 12 illustrates this heterogeneity by displaying the results of our fund unwind procedure at the level of each investing country-sector pair. We focus on eight sectors that collectively describe all holders of securities in each country: banks, investment funds, government entities, households, insurance

[36]Indeed, the prominent role of sovereign bonds in our North-South results has to be understood in the context of Eurosystem central banks' purchase programs in sovereign bonds.

companies, non-financial corporations, other financial corporations, and pension funds.[37]

Panel A of Figure 12 shows the percentage of the securities portfolio of each country-sector pair that is invested in fund shares, either domestic or foreign. For each sector, displayed on the horizontal axis, the vertical bubbles display the share for each Euro Area country (excluding Ireland and Luxembourg), while the relative sizes of the bubbles are proportional to the overall fund shares position of the given country-sector pair. Across all countries, banks intermediate little of their securities portfolios via funds. Households, insurance companies, and pension funds have a higher fraction of their portfolio (often above 40 percent) invested in fund shares, and within each sector there is considerable heterogeneity at the country level. Panel B focuses on the percentage of holdings in fund shares that is accounted for by shares of Ireland and Luxembourg domiciled funds.

There is substantial heterogeneity both within and across sectors. For example, the rightmost column of Panel B shows that Italy has 69 percent of its fund shares investment in these two OOFC countries, while the corresponding value for Germany is 23 percent. Within Germany, households and funds approximately 40 percent of fund shares goes through the two OOFCs, while insurance companies have less than 20 percent. German households, for instance, have a percentage invested in OOFC fund shares closer to that of Italian households (61 percent), despite much larger country-level differences. Taken together, Panels A and B, show that the unwind of fund-based investment, and in particular of funds in Luxembourg and Ireland, is essential to analyze the securities portfolios of sectors such as households, insurance companies, and pension funds.[38] The unwind will instead have a smaller effect on the measured portfolios for banks and non-financial corporations, since they rely less on investment fund intermediation.

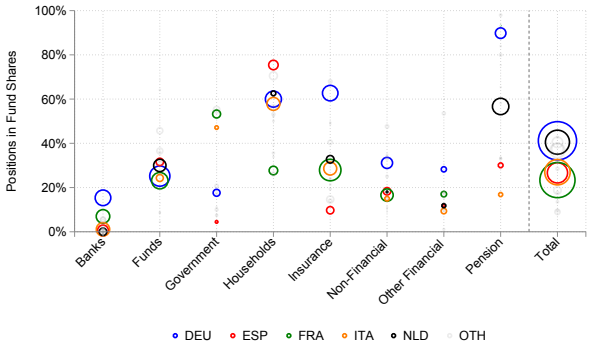
Panels C through F of Figure 12 focus on salient characteristics of the indirect portfolios held by each country-sector via Ireland and Luxembourg funds: the percentage invested in bonds rather than equities (panel C), the percentage of bonds that are euro denominated (panel D), the percentage of bonds and equities that are issued by domestic entities (panel E), and the percentage of bonds and equities that are issued by entities resident in the rest of the Euro Area (panel F). While Luxembourg and Ireland funds overall invest approximately half of their portfolio in bonds and half in equities, this share varies significantly depending on the country-sector of the investor. For example, Italian households have an indirect portfolio that is 60 percent in bonds, while German households only hold 40 percent in bonds. Of these bonds, German households have a higher fraction in euros, at 63 percent, than Italians do (45 percent). Most country-sector pairs show a concentration of positions in domestic entities and heterogeneity in holdings of REA securities (especially the insurance sector).

[37] These sector definitions aggregate the institutional sectors reported in SHS which are based on the classification of the European System of Accounts (ESA 2010). "Banks" includes sector 122. "Funds" includes sectors 123 and 124. "Government" includes sectors 1311, 1312, 1313, 1314, and 13U. "Households" (together with non-profit organisations serving households) includes sectors 14, 15, and 1MU. "Insurance" includes sectors 128. "Non-Financial" includes sector 11. "Other Financials" includes sectors 125A and 125W. "Pension" includes sector 129.

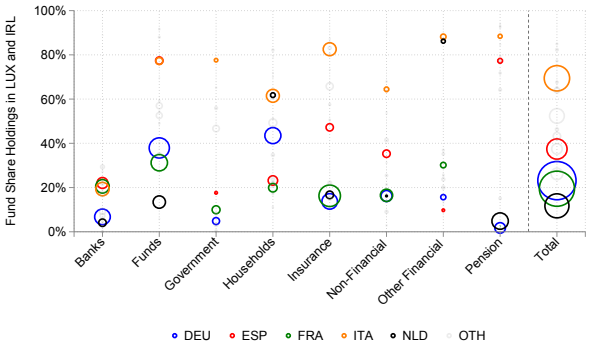
[38] Funds hold other funds' shares most notably due to the "fund of funds" business model. Insurance companies delegate a substantial part of their portfolio management to investment managers and therefore hold fund shares (Coppola 2022).

Figure 12: **Heterogeneity in portfolios held via OOFCs across countries and sectors**

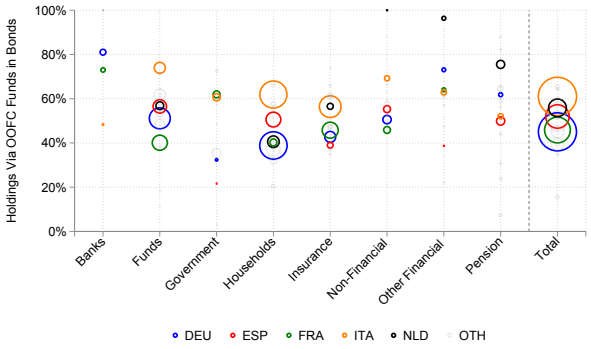
(a) Positions in Fund Shares (%)



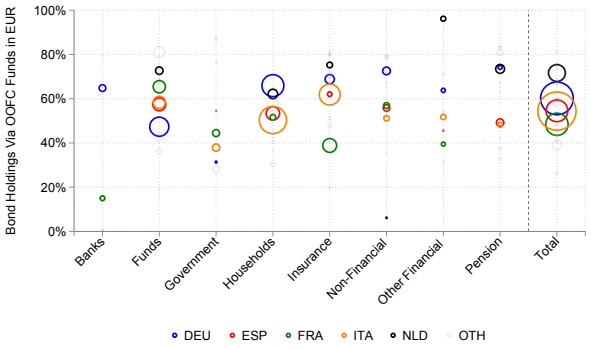
(b) Fund Share Positions in OOFC Funds (%)



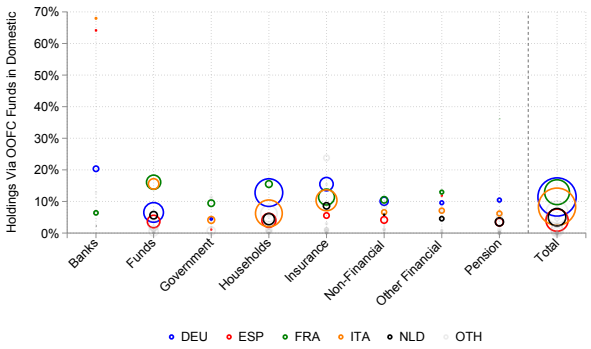
(c) Indirect Positions in Bonds (%)



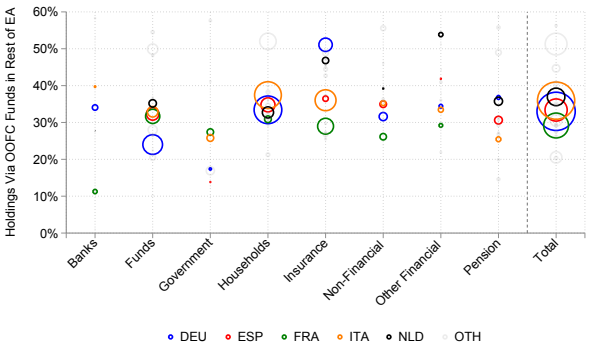
(d) Indirect Bonds Positions in EUR (%)



(e) Indirect Positions in Domestic (%)



(f) Indirect Positions in REA (%)



Notes: We characterize the holdings of country-sector investment pairs in SHS. Sectors are on the horizontal axis. Fixing a sector, each bubble corresponds to a country. Major countries are colored, while smaller countries are in gray. The relative sizes of the bubbles are proportional to the corresponding positions. Panel A shows the fraction of each sector-country holdings that is in fund shares. Panel B shows the fraction of fund share positions that are in Luxembourg or Ireland funds. Panels C through F show the composition of the indirect portfolio held by each country-sector through Luxembourg or Ireland funds: Panel C plots the share of the indirect portfolio that is in bonds (out of indirect bond and equity holdings), Panel D plots the share of indirect bond holdings that is in euro-denominated bonds, Panel E plots the share of indirect holdings by each country in securities issued by its domestic entities, and Panel E plots the share of indirect holdings that is in securities issued by entities resident in the rest of the Euro Area (REA).

5.3 Heterogeneity and Wealth Transfers

An important economic and policy question for the Euro Area is the extent to which financial risks have been shared widely, at least within the currency union, by private agents. As we highlighted above, providing a reliable answer to this question for private portfolio holdings has been difficult, given the intermediation via the OOFCs. For example, the exposure of German households to Southern European sovereign bonds depends quantitatively on the portfolio that these households choose in OOFCs funds. We therefore return to the econometric framework introduced in Section 3.2, in order to analyze the wealth transfers implied by Euro Area portfolio allocations under hypothetical asset price movement scenarios—for instance, a collapse in the value of sovereign bonds issued by Southern European countries.

We let $\Delta x_{j,i,c,d}$ be the wealth transfer for country j and sector d implied by a movement in security price Δp_c, where $\Delta p_c = \frac{P_c' - P_c}{P_c}$ is a percent change. We are interested in comparing this wealth transfer to a counterfactual scenario in which country-sector pair (j,d) has a weight in security c of $m_{i,c}$, the CAPM weight, rather than $\omega_{j,i,c,d}$. We express wealth transfers as a percentage of the overall portfolio wealth of country-sector (j,d), so that we can compare across countries and sectors with different wealth levels. We compute the wealth transfer as:

$$\Delta x_{j,i,c,d} = \frac{\Delta p_c \; x_{j,i,c,d}}{\sum_{c',i'} x_{j,i',c',d}} = \omega_{j,i,c,d} \; \Delta p_c. \tag{13}$$

We are interested in the counterfactual $(\omega_{j,i,c,d} - m_{i,c})\Delta p_c$, which corresponds to the deviation of the wealth transfers from the CAPM benchmark. Substituting into equation (6), we have:

$$(\omega^{a,f}_{j,i,c,d} - m^a_{i,c})\Delta p_c = \alpha^{a,f}_{j,d}\Delta p_c + \left(\sum_{k\in\mathcal{K}} \beta^{a,f}_{j,d,k}\mathbf{1}_{c\in k} - 1\right) m^a_{i,c}\Delta p_c + \varepsilon^{a,f}_{j,i,c,d}\Delta p_c. \tag{14}$$

We now consider a vector of price shocks $\Delta\overrightarrow{p_c}$. Summing the above security-level effect over the entire portfolio, we obtain the portfolio-level counterfactual wealth transfer deviation:

$$\begin{aligned}\sum_{c\in\mathcal{C}}(\omega_{j,i,c,d} - m^a_{i,c})\Delta p_c \;\; &= \;\; \alpha^{a,f}_{j,d} \; \bar{\Delta p_c} \, N + \sum_{c\in\mathcal{C}}\left(\sum_{k\in\mathcal{K}} \beta^{a,f}_{j,d,k}\mathbf{1}_{c\in k} - 1\right) m^a_{i,c}\Delta p_c \\ &+ \;\; \mathrm{Cov}_c\left(\varepsilon^{a,f}_{j,i,c,d}, \Delta p_c\right) N,\end{aligned} \tag{15}$$

where $\bar{\Delta p_c}$ is the average of the elements of vector $\Delta\overrightarrow{p_c}$, meaning the average percentage price change. The term $\mathrm{Cov}_c\left(\varepsilon_{j,i,c}, \Delta p_c\right) N$ comes from $\sum_{c\in C} \; \varepsilon^{a,f}_{j,i,c,d} \to 0$, assuming that the model is estimated separately for each country-sector pair (j,d). Given our focus on a set of mutually exclusive characteristics $\mathcal{K}$, we impose that all securities with a characteristic k have the same price change. Then, the above equation further simplifies to:

$$\sum_{c\in C}(\omega_{j,i,c,d} - m^a_{i,c})\Delta p_c = \alpha^{a,f}_{j,d} \; \bar{\Delta p_c} \; N + \sum_{k\in\mathcal{K}}(\beta^{a,f}_{j,d,k} - 1) m^a_k \Delta p_k + \; \mathrm{Cov}_c\left(\varepsilon^{a,f}_{j,i,c,d}, \Delta p_c\right) N \tag{16}$$

The terms in the equation above are intuitive. The first term is coming from the constant shift of portfolio weights away from CAPM. If we restrict our attention to mean-zero price vectors, this term drops out. The middle terms show the wealth transfers that arise from systematic bias of the portfolios away from CAPM. Thus, they relate the betas estimated from the micro data to aggregate wealth transfers. A bias towards a characteristic (e.g., $\beta_{\text{Home}} \neq 1$) generates a bigger wealth transfer differential relative to the CAPM benchmark if: (i) the bias is larger (as measured by the absolute difference of the estimated beta from 1); (ii) the market share associated with that characteristic is larger (e.g., m_{Home} is large); and (iii) that characteristic has a large corresponding price change. The last term arises from the covariance between the regression errors and the vector of price changes.

To illustrate the relationship between wealth transfer and our regression estimates, we compare the transfers to Italy and Germany induced by a hypothetical 20 percent drop in the prices of the sovereign bonds of Southern European countries.[39] Taking into account the estimated biases away from the market portfolio (that is, the betas in the regression model above), this hypothetical shock to sovereign bond prices would induce losses of 0.54 and 9.49 percentage points on the overall bond portfolios of German and Italian investors, respectively. In the counterfactual scenario in which all countries hold instead the market portfolio—where we neutralize the systematic biases estimated via our methodology—the losses to both countries amount to 0.81 percentage points: hence in this scenario, German investors fare 51 percent worse, while Italian investors fare 91 percent better, as compared to the baseline case.

German investors do relatively better than Italian ones in this scenario compared to a portfolio at market weights because they are relatively more underweight Southern European sovereign bonds. This comes from two distinct effects. First they are overweight their own sovereign (the home effect). Second, among the rest of the Euro Area sovereigns, they are more underweight the Southern European ones compared to the Northern ones relative to Italian investors (the North-South bias that we documented above). Italian investors have the opposite pattern: they are not only overweight their own sovereign (which is a Southern one and therefore affected by the price shock in this example), but they are also relatively overweight other Southern European sovereigns compared to German investors.

6 The Allocative Effects of OOFC Use Among Firms

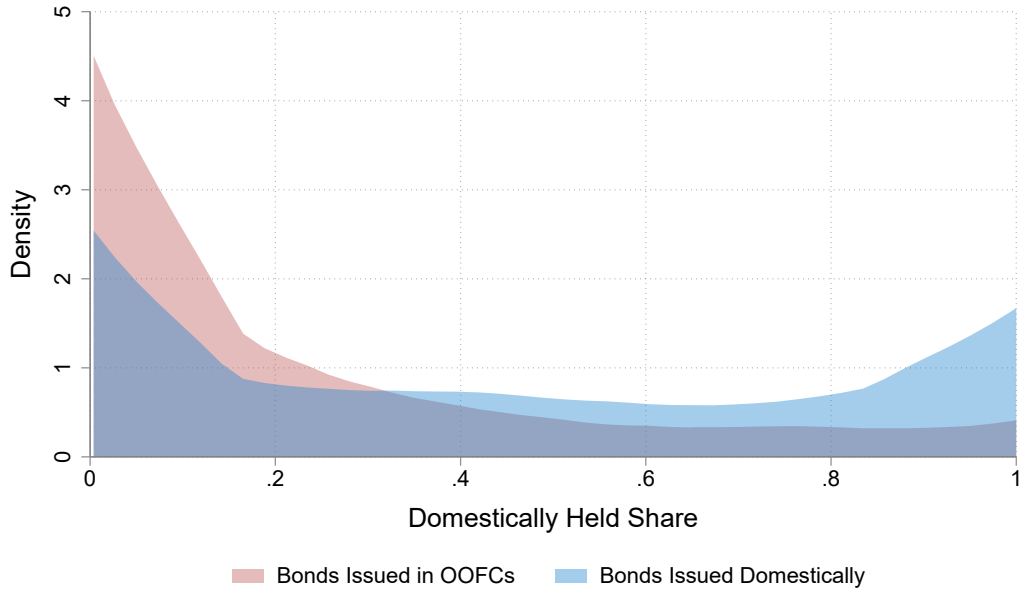
While the preceding sections have focused on the aggregate measurement consequences of our adjustments, here we study the consequences that OOFC usage has for capital allocation in the cross-section of Euro Area firms. Financial integration in the Euro Area skews heavily towards those

[39] The underlying regression model restricts the asset class a to be bonds, allows for varying betas across sovereign and corporate bonds, it only includes investment destinations in Southern or Northern Europe, it is estimated at the country level, and it selects as characteristics for the regression (the set $\mathcal{K}$) geography (partitioned as home, plus the rest of the EA split into North and South) and currency (euro and non-euro). This incorporates North-South biases since it is estimated individually for each investing country.

firms that use OOFC financing structures to raise bond capital from investors, a pattern which we establish not only by examining capital allocation across firms, but also by exploiting within-firm variation—which is made possible by the fact that many large European firms issue bonds through financing subsidiaries resident in multiple jurisdictions.

Figure 13 looks at the cross-section of bonds issued by Euro Area ultimate parent firms, and it shows a dramatic divergence in the likelihood that domestic investors (those whose residency corresponds to the firms' nationality) hold bonds issued in the firms' domestic resident jurisdictions versus via financing vehicles resident in OOFCs.[40] The blue density shows a kernel estimate of the distribution of the domestically held share for the former bonds (those held domestically), while the red density shows a kernel estimate for the latter type (those issued in OOFCs). The red distribution is clearly much more concentrated towards its lower boundary, implying that most bonds issued in OOFCs are not held by domestic investors, in contrast with domestically issued bonds. The average domestically held share is 23 percent in the red distribution, while it is 44 percent in the blue distribution, nearly twice as large.

Figure 13: **Bonds issued in OOFCs are held much more widely across borders**



Notes: For each bond issued by a European ultimate parent firm in the sample, we compute the share held by domestic investors, after accounting for indirect holdings through our fund unwind step. The *blue density* shows kernel estimates of the distribution of domestically held shares for bonds issued via domestic entities, while the *red density* shows the same but for bonds issued through OOFC affiliates. The data is shown as of 2020, and ultimate parent firms with nationality in Luxembourg, Ireland, or the Netherlands are excluded.

Bonds issued in European OOFCs are therefore held far more widely across borders, so that European financial integration is concentrated in firms that have OOFC financing subsidiaries. This

[40]To achieve a clear distinction between domestic issuances and OOFC issuances, this figure excludes ultimate parent firms with nationality corresponding to Luxembourg, Ireland, or the Netherlands.

pattern could in principle be due to both selection and treatment effects: while it might be that if a bond is issued in a European OOFC, that causes the bond to be relatively more attractive to non-domestic investors, it may also be simply the case that non-domestic investors prefer firms with unobserved characteristics that also independently make those firms more likely to raise capital through OOFCs. To resolve this, we turn to within-firm variation, comparing bonds that are issued by the same firms but in different residencies.

Since this approach requires the use of high-dimensional fixed effects, we deviate here from the approach of comparing empirical portfolio shares to CAPM-implied portfolio shares used in the preceding sections. Rather, to make estimation practical, we use a Poisson Pseudo-Maximum Likelihood estimator (PPML), as in Silva and Tenreyro (2006), which allows us to model a multiplicative impact of characteristics on portfolio shares (as in a log-linear model, and consistent with our preceding analysis) while accommodating zero shares and a high number of fixed effects.

Specifically, we let $\theta_{k,i,t}$ be the share of bonds by firm k issued through subsidiaries resident in country i that are held domestically as of year t. The specification estimated through PPML is then

$$\theta_{k,i,t} = \exp\{\alpha_t + \gamma_k + X_{k,i,t}\,\beta\} + \varepsilon_{k,i,t}, \tag{17}$$

where $X_{k,i,t}$ is a vector of characteristics associated with the observation $\theta_{k,i,t}$. In particular, we include in the vector $X_{k,i,t}$ a set of mutually exclusive (and collectively exhaustive) dummies capturing the countries of residency of the immediate entities issuing the bonds: (1) an *OOFC* dummy takes the value of one if the country of residency i is Luxembourg, Ireland, or the Netherlands; (2) a *rest of the Euro Area* dummy takes the value of one if the country of residency i is in the Euro Area but is not an OOFC and does not correspond to firm k's domestic jurisdiction; and (3) a *rest of the world (ROW)* dummy takes the value of one if the country of residency i is outside of the Euro Area. The excluded indicator is therefore the *domestic dummy*, capturing whether the bond is issued in the ultimate parent firm's domestic jurisdiction—so that all effects are estimated relative to domestically-issued bonds. The inclusion of firm fixed effects γ_k at the ultimate parent level in this specification is crucial, as it absorbs any selection that might be due to firm characteristics.

Table 10 reports the estimates from the PPML estimator applied to the specification in equation (17), using the full panel of observations for the years 2014 through 2020. We restrict the sample to Euro-denominated bonds, as foreign-currency denominated bonds are often not targeted towards Euro Area investors' holdings. We show the estimated marginal effects, $\hat{m} = e^{\hat{\beta}} - 1$, as we vary the extent of fixed-effects saturation in the empirical specification. The estimated marginal effect in the saturated specification is $\hat{m} = -.33$: given the specification, the marginal effect takes on a semi-elasticity interpretation, implying that being issued by an entity in an OOFC jurisdiction causes on average a 33 percent reduction in the share of the bond that is held domestically.

To better understand these magnitudes, consider that the average domestic share $\theta_{k,i,t}$ in the sample for German and Italian firms is, respectively, 45 and 61 percentage points: therefore the estimated multiplicative 33 percent marginal effect from the homogeneous-effects model would imply

Table 10: **Within-firm allocative effects**

	Domestically Held Share ($\theta_{k.i.t}$)	
	(1)	**(2)**
OOFC Dummy†	$-.48^{***}$	$-.33^{***}$
	(.04)	(.06)
Firm FE	N	Y
Year FE	Y	Y
Nationality FE	Y	Y
Identifying Observations	12,930	11,827
R^2	.22	.84

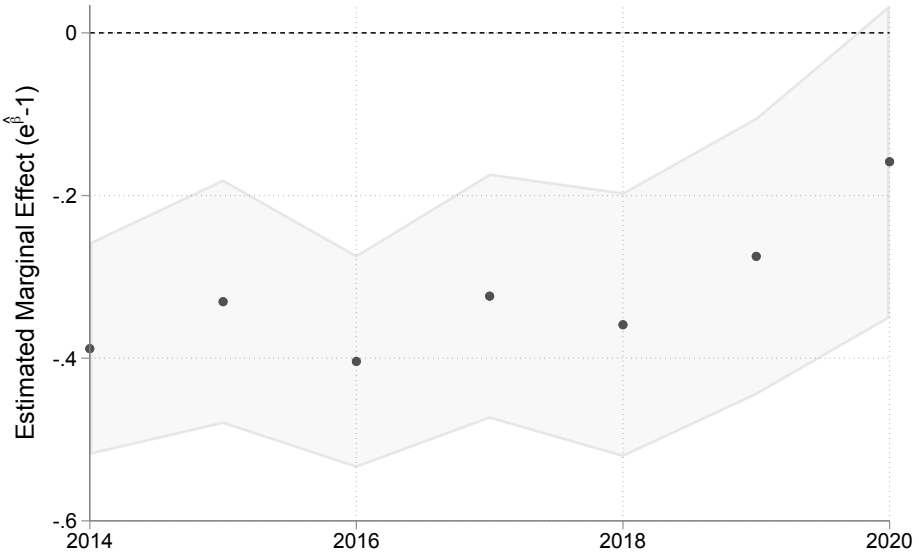
†*Marginal effect* $e^{\hat{\beta}} - 1$ *shown*

Notes: We estimate the specification in equation (17), which regresses the domestically held share $\theta_{k,i,t}$ of Euro-denominated bonds by firm k issued in residency i in year t on dummies capturing issuance location categories. We show the estimated marginal effect for the OOFC dummy, and the specification also includes dummies for residency i in the rest of the Euro Area (excluding the firm's domestic jurisdiction) and the rest of the world. The excluded category corresponds to domestically issued bonds. We include fixed effects for ultimate parent firm, year, and ultimate parent firm nationality. All specifications use the Poisson pseudo-maximum likelihood (PPML) estimator, as in Silva and Tenreyro (2006), and they are weighted by the log of the total amount outstanding for bonds in a given (k, i, t) category. Standard errors for the estimated PPML coefficient $\hat{\beta}$ are clustered at the firm level, and they are converted to standard errors on marginal effects $\hat{m} = \exp\{\hat{\beta}\} - 1$ via the delta method. Ultimate parent firms with nationality in Luxembourg, Ireland, or the Netherlands are excluded. $^{*}p < .1, ^{**}p < .05, ^{***}p < .01$.

a reduction in the domestic share of 15 percentage points for German firms, and of 20 percentage points for Italian firms. Importantly, the estimates are similar (although naturally somewhat larger in magnitude) when we exclude the firm fixed effects, with a point estimate of $\hat{m} = -.48$ in the non-saturated specification. This evidence is consistent with the interpretation that the aggregate pattern seen in Figure 13 is in large part due to treatment rather than selection: the legal, regulatory, and withholding tax environment in OOFCs makes foreign investors more likely to hold securities issued in these jurisdictions. Figure 14 shows the estimated marginal effects when we estimate the same specification year-by-year: the estimates remain large and negative throughout the time series, with a slight upward trend in the last two years of the sample, although we cannot formally reject the hypothesis that the treatment effect is constant across the sample.

Disaggregating the estimates shown in Table 10 further reveals interesting heterogeneity in this treatment effect across countries. We display this heterogeneity in Figure 15, where we plot the estimates, again done year-by-year, separately for German firms (in *red*) and for Italian firms (in *blue*). The heterogeneous-treatment estimates for Italy are much larger in magnitude than those for Germany: issuance in a European OOFC lowers the domestically share of Italian firms' bonds by a large amount, about 70 percent on average, while the corresponding effect for German firms is about 20 percent on average. This form of heterogeneity may reflect investors' economic rationales. While we cannot conclusively prove this, it may be the case that foreign investors are particularly averse to the legal environment surrounding bonds issued domestically in Southern European countries such as Italy. For example, investors outside of Italy may be especially wary of potential bankruptcy

Figure 14: **Within-firm allocative effects: estimates by year**



Notes: We plot the estimated marginal effects for the same specification as in Table 10, inclusive of firm fixed effects, but with the estimation repeated separately for each year. We show point estimates and the corresponding 95% confidence band. Standard errors for the estimated PPML coefficient $\hat{\beta}$ are clustered at the firm level, and they are converted to standard errors on marginal effects $\hat{m} = e^{\hat{\beta}} - 1$ via the delta method. Ultimate parent firms with nationality in Luxembourg, Ireland, or the Netherlands are excluded.

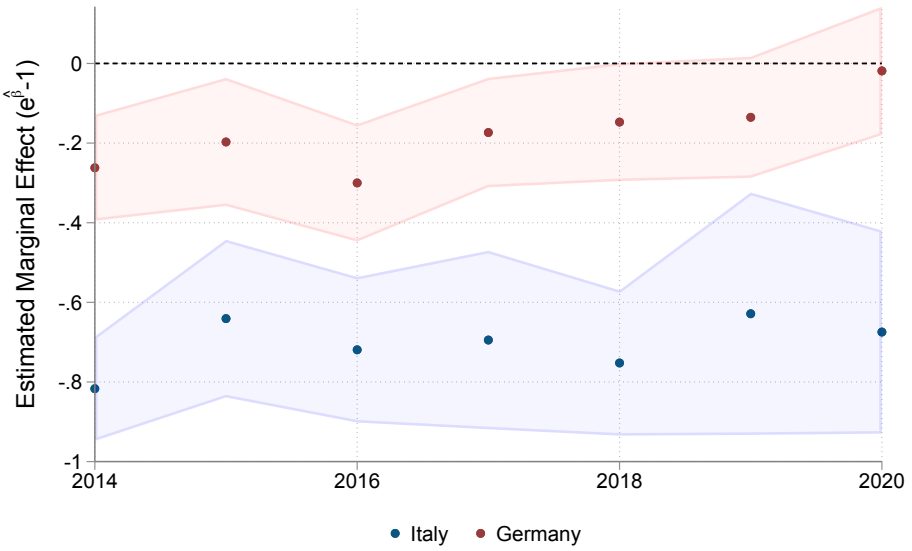
proceedings in Italian courts, preferring instead the bankruptcy regulations associated with Dutch-resident issuing entities, while being less cautious of the better-functioning German courts.

Regardless of the underlying economic mechanism driving the heterogeneity across countries, however, it holds true that the use of financing structures in OOFCs helps European firms overcome some of the frictions in cross-border financial integration, and that this is particularly true for firms in certain Southern European countries such as Italy, as opposed to German firms. In this sense, capital allocation in Europe is not neutral to the presence of corporate financing affiliates in OOFCs, as firms' access to foreign investors and bondholder composition are strongly shaped by the decision to set up such a structure or not. To the extent that setting up OOFC financing affiliates involves fixed costs (as in the costs of hiring specialists in international tax and financial planning), the effects we have documented here might skew capital markets integration towards those firms that are largest, most productive, and most sophisticated.

7 Conclusion

We reassess European financial integration, looking through the financial activities taking place in three *onshore offshore financial centers* within the Euro Area: Luxembourg, Ireland, and the Netherlands. Using extensive micro data on security-level portfolio holdings, we document the large impact on Euro Area financial statistics generated by the dual roles of OOFCs, as hubs of

Figure 15: **Within-firm allocative effects: Italy vs. Germany**



Notes: We plot the estimated marginal effects for the same specification as in Table 10, inclusive of firm fixed effects, but for the two subsamples of Italian (*blue estimates*) and German (*red estimates*) ultimate parent firms. The estimates are done separately for each year in the sample. We show point estimates and the corresponding 95% confidence band. Standard errors for the estimated PPML coefficient $\hat{\beta}$ are clustered at the firm level, and they are converted to standard errors on marginal effects $\hat{m} = e^{\hat{\beta}} - 1$ via the delta method.

financial intermediation and as places of securities issuance. We look through both of these roles by attributing fund investments to their ultimate underlying owners, and by linking securities issued in these jurisdictions to their ultimate corporate parents. Our estimates of Euro Area investment reveal a number of salient patterns. The Euro Area is less financially integrated with the rest of the world and more biased towards domestic and euro-denominated assets than it appears in official data. Within the Euro Area, the extent of financial integration that does occur is tilted towards those firms that raise capital through OOFC financing vehicles, which help these firms overcome prominent biases—including home bias and North-South bias by Euro Area investors. Activities taking place in OOFCs have important consequences for both international financial measurement and for the allocation of capital in the Euro Area and beyond.

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Appendix for
"The Geography of Capital Allocation in the Euro Area"

Roland Beck Antonio Coppola Angus Lewis
Matteo Maggiori Martin Schmitz Jesse Schreger

February 2023

A Issuance Data and Benchmarks

[To be added]

B Aggregate EA Investment Patterns: Further Details

In Figure A.I, we summarize the Euro Area's aggregate investment pattern in four key asset classes: (a) corporate bonds, (b) sovereign bonds, (c) equity, and (d) investment fund shares. In each panel, we consider the aggregates holdings of the full euro area, but split the investments into the residency of the investments in the SHS data. In particular, we classify the positions according to whether they are invested domestically (*"Domestic"*), in other countries in the Euro Area excluding the OOFCs (*"Other EMU"*), in the OOFCs of Luxembourg, Ireland and the Netherlands (*"LUX/IRL/NLD"*), in *"Global Tax Havens"* such as the Cayman Islands, or in countries outside the EMU not classified as tax havens (*"Rest of World"*) such as the United States and Japan. Across the four categories of investment, we see major heterogeneity. In Panel (a), we see that corporate bond investment is primarily domestic, and in the rest of the world, with a major role for the OOFCs but only a limited role for global tax havens. We see that investment in the OOFCs accounts for xxx% of total investment in 2020 and xxx% of non-domestic investment.

By contrast, in Panel (b), we see that sovereign bonds are much more concentrated in domestic holdings or other Euro Area countries, with the OOFCs and global tax havens essentially playing no role. In Panel (c), we see equity holdings concentrated home or in the rest of the world, with a smaller role for the rest of the EMU, and the OOFCs and global tax havens. The pattern for investment fund shares in Panel (d) looks unlike any other investment categories. Here, we see that essentially all investment in fund shares are either domestically or through the OOFCs. Given that in 2020 there is nearly $3 trillion of euro area investment in OOFC-resident fund shares (and here, the Netherlands plays essentially no role), this raises the important quesiton of what these fund share claims of Europe actually own.

Interaction of geography and currency. In Table A.I, we extend the specification to examine home currency bias along with the broad geographic regions of the Euro Area and the rest of the world. Column 1 shows that, conditioning on currency, non-OOFC Euro Area investors are not

Figure A.I: **Euro Area aggregate investment patterns in SHS**



Notes: This figure plots the pattern of investment holdings in the SHS data. Domestic refers to securities owned by investors of the same residency as the issuer, LUX/IRL/NLD refers to Luxembourg, Ireland, and Netherlands, Other EMU refers to all countries in the Euro Area other than Luxembourg, Ireland, and Netherlands and the domestic market. Global tax havens refers to investments resident in tax havens and Rest of World refers to investment in all other countries.

biased towards Euro Area bonds. In fact, the estimates imply that not only are they underweight non-euro bonds in the rest of the world, but they are also underweight Euro Area bonds that are not denominated in euros. The next six columns contrast the investments flowing through the OOFCs on behalf of all investors, Euro Area, and RoW investors. For the raw Luxembourg fund sector, we find that euro-denominated bonds are held in proportion to their market value. Positions by funds intermediating portfolios for Euro Area investors are overweight euro denominated bonds, but not Euro Area bonds once controlling for currency. The rest of the world is significantly underweight bonds in Euro issued by Euro Area entities. The results for Ireland are even more striking, as the rest of the world's investment via Irish funds tends to be invested relatively more in the non-euro denominated bonds issued by Euro Area entities.

Table A.I: **Heterogeneity in OOFC use: Geography and currency, all bonds**

	Non-OOFC	Luxembourg			Ireland		
	Direct	Raw	EA	RoW	Raw	EA	RoW
$m \times$ EA	−0.138	0.184	−0.150	0.565**	0.700***	0.038	0.890***
	(0.295)	(0.367)	(0.479)	(0.252)	(0.190)	(0.408)	(0.226)
$m \times$ RoW	0.060***	0.328***	0.232***	0.389***	0.518**	0.305***	0.731**
	(0.010)	(0.071)	(0.061)	(0.091)	(0.239)	(0.084)	(0.365)
$m \times$ EUR	2.504***	1.022***	1.822***	0.290	0.101	1.130***	−0.545**
	(0.269)	(0.373)	(0.491)	(0.248)	(0.198)	(0.414)	(0.229)
Constant	0.000***	0.000**	0.000**	0.000**	0.000	0.000**	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Obs.	8,556,372	503,316	503,316	503,316	503,316	503,316	503,316
R^2	0.022	0.371	0.377	0.235	0.083	0.255	0.055

Notes: This table estimates a version of equation (6). The dependent variable is the share of the a particular bond in an investor's bond portfolio. The independent variable is the share of a given security in the global bond portfolio, m, interacted with indicator variables for whether the security was issued by an entity resident in the Euro Area (EA) or the rest of the world (RoW) and whether the bond is denominated in Euros ("EUR"). Non-OOFC Direct refers to investments from all individual euro area countries other than Luxembourg and Ireland, as reported in the SHS data. A heading of "Luxembourg" refers to investment from Luxembourg on a residency basis, with "Raw" denoting the unadjusted SHS data, "EA" denoting investment from Luxembourg on behalf of identified Euro Area investors, and "RoW" denoting investment from Luxembourg on behalf of investors that were not matched to the Euro Area. The "Ireland" heading is defined equivalently for investment from Ireland. Standard errors clustered at the investor-issuer country level in column 1 and at the issuer country level in all other columns. $^{*}p < .1$,$^{**}p < .05$,$^{***}p < .01$.

Table A.II: **Heterogeneity in OOFC use: Currency, Corporate Bonds**

	Non-OOFC	Luxembourg			Ireland		
	Direct	Raw	EA	RoW	Raw	EA	RoW
$m \times$ EUR	2.134***	1.067***	1.381***	0.666***	0.605***	1.158***	0.399***
	(0.328)	(0.156)	(0.239)	(0.104)	(0.091)	(0.220)	(0.078)
$m \times$ non EUR	0.109***	0.488***	0.333***	0.641***	0.416***	0.419***	0.601***
	(0.019)	(0.114)	(0.077)	(0.169)	(0.101)	(0.109)	(0.152)
Constant	0.000***	0.000**	0.000**	0.000	0.000**	0.000**	0.000**
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Obs.	4,495,735	264,455	264,455	264,455	264,455	264,455	264,455
R^2	0.017	0.226	0.205	0.161	0.106	0.107	0.072

Notes: This table estimates equation (10). The dependent variable is the share of the a particular bond in an investor's bond portfolio. The dependent variable is the share of a given security in the global bond portfolio, m, interacted with indicator variables for whether the bond is denominated in Euros ("EUR") or a currency other than Euros ("nonEUR"). Non-OOFC Direct refers to investments from all individual euro area countries other than Luxembroug and Ireland, as reported in the SHS data. A head of "Luxembourg" refers to investment from Luxembourg on a residency basis, with "Raw" denoting the unadjusted SHS data, "EMU" denoting investment from Luxembourg on behalf of identified Euro Area investors, and "RoW" denotes investment from Luxembourg on behalf of investors that were not matched to the Euro Area. The "Ireland" heading is defined equivalently for investment from Ireland. Standard errors clustered at the investor-issuer country level in column 1 and at the issuer country level in all other columns. * p $< .1$, ** p $< .05$, *** p $< .01$.

Table A.III: **Heterogeneity in OOFC use: Geography and Currency, Corporate Bonds**

	Non-OOFC	Luxembourg			Ireland		
	Direct	Raw	EA	RoW	Raw	EA	RoW
$m \times$ EA	0.000	0.088	−0.196	0.367**	0.362***	−0.030	0.658***
	(0.155)	(0.203)	(0.262)	(0.160)	(0.134)	(0.250)	(0.171)
$m \times$ RoW	0.123***	0.538***	0.400***	0.676***	0.423***	0.476***	0.594***
	(0.025)	(0.132)	(0.096)	(0.186)	(0.113)	(0.127)	(0.165)
$m \times$ EUR	2.114***	0.908***	1.482***	0.250	0.233*	1.108***	−0.249*
	(0.228)	(0.222)	(0.294)	(0.153)	(0.126)	(0.256)	(0.138)
Constant	0.000***	0.000**	0.000**	0.000	0.000**	0.000**	0.000**
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Obs.	4,495,735	264,455	264,455	264,455	264,455	264,455	264,455
R^2	0.017	0.236	0.217	0.165	0.107	0.113	0.072

Notes: The dependent variable is the share of the a particular bond in an investor's bond portfolio. The dependent variable is the share of a given security in the global bond portfolio, m, interacted with indicator variables for whether the security was issued by an entity resident in the Euro Area (EMU) or the Rest of the World (RoW) and whether the bond is denominated in Euros ("EUR"). Non-OOFC Direct refers to investments from all individual euro area countries other than Luxembroug and Ireland, as reported in the SHS data. A head of "Luxembourg" refers to investment from Luxembourg on a residency basis, with "Raw" denoting the unadjusted SHS data, "EMU" denoting investment from Luxembourg on behalf of identified Euro Area investors, and "RoW" denotes investment from Luxembourg on behalf of investors that were not matched to the Euro Area. The "Ireland" heading is defined equivalently for investment from Ireland. Standard errors clustered at the investor-issuer country level in column 1 and at the issuer country level in all other columns. * p < .1, ** p < .05, *** p < .01.

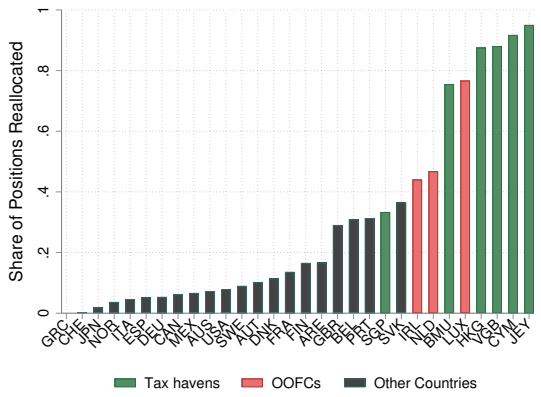
Table A.IV: **CAPM regressions: ROW via OOFCs**

	Bonds		Equities	
	RoW via LUX	RoW via IRL	RoW via LUX	RoW via IRL
m	0.447***	0.682**	0.877***	1.012***
	(0.092)	(0.313)	(0.240)	(0.357)
Constant	0.000**	0.000	0.000*	0.000
	(0.000)	(0.000)	(0.000)	(0.000)
Obs.	506,067	506,067	41,851	41,851
R^2	0.209	0.053	0.399	0.539

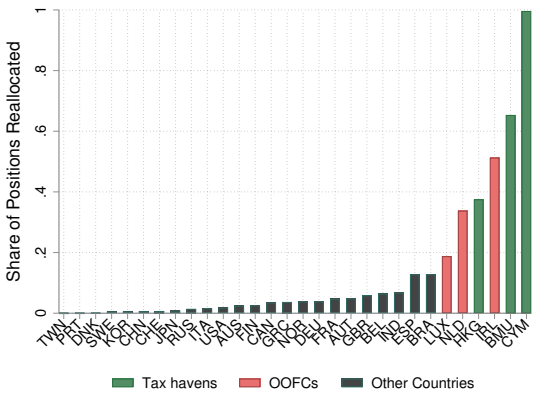
Notes: The dependent variable is the share of the a particular bond in an investor's bond portfolio. The dependent variable is the share of a given security in the global bond portfolio, m. "Direct" refers to investment originating from a given country as reported in SHS, "via LUX" and "via IRL" refers to investment done by a given country that is intermediated through Luxembourg and Ireland, respectively, by our fund-level unwind of the OOFCs. "Unwound" refers to our estimated total investment position of a country from combining Direct investment in SHS with our indirect positions via Luxembourg and Ireland. Standard errors clustered at the investor-issuer country level. * p < .1, ** p < .05, *** p < .01.

Figure A.II: **Share of EMU holdings on a residency basis reallocated on nationality basis**

(a) Corporate Bonds



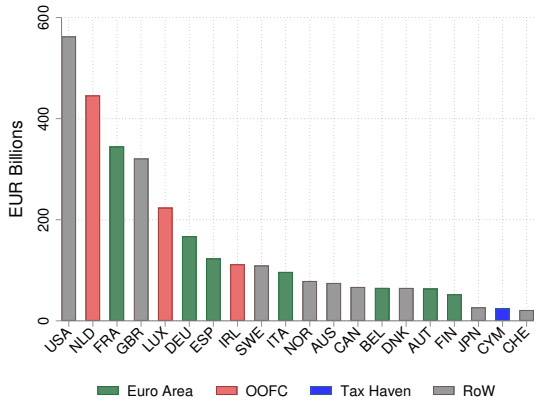
(b) Common Equity



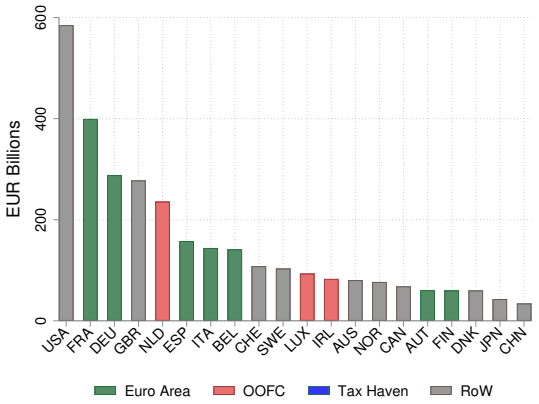
Notes: Priority rule: LUX/IRL/NLD, Domestic, EMU, TH, RoW

Figure A.III: Reallocations from Security Issuance: Cross-Border (Residency) Investment

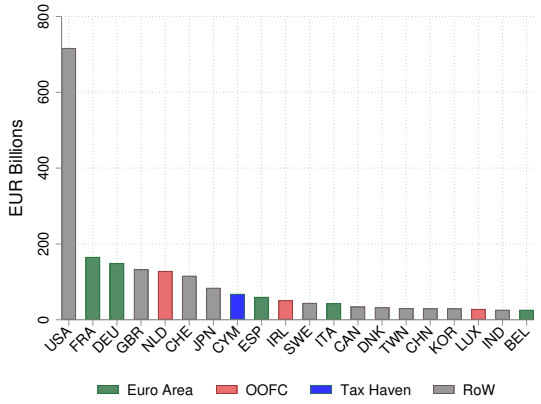
(a) Bonds, Residency



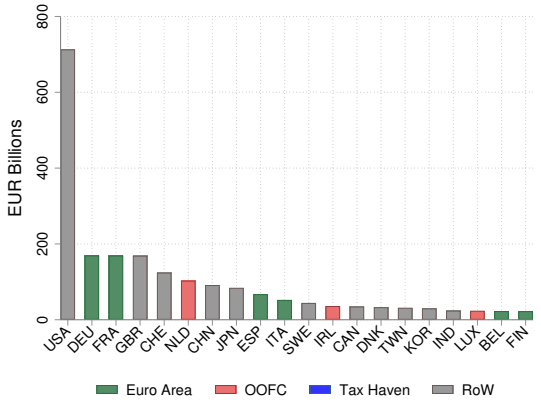
(b) Bonds, Nationality



(c) Equity, Residency



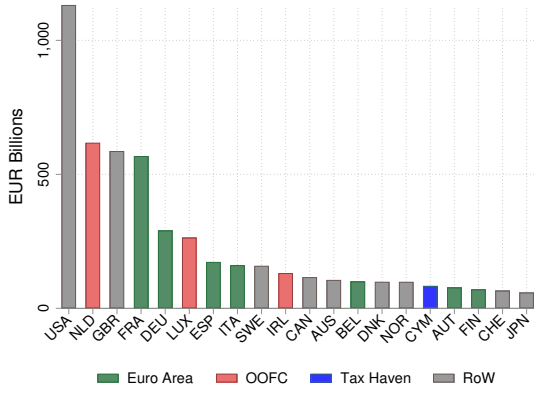
(d) Equity, Nationality



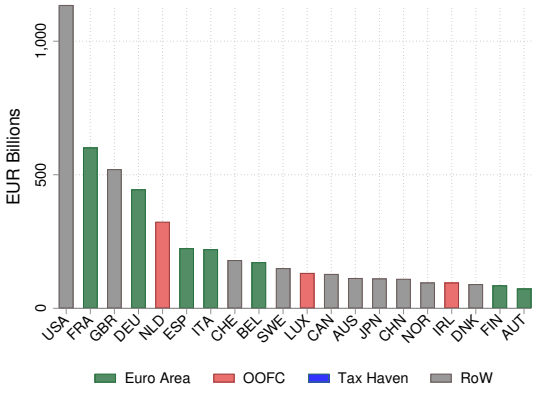
Notes: EXCLUDES INVESTMENT FROM LUXEMBOURG AND IRELAND

Figure A.IV: Reallocations from Security Issuance: Cross-Border (Residency) Investment

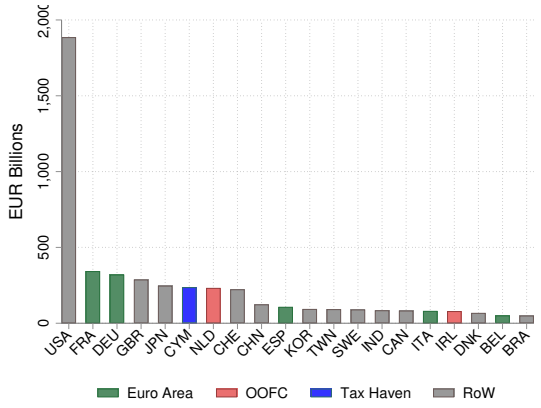
(a) Bonds, Residency



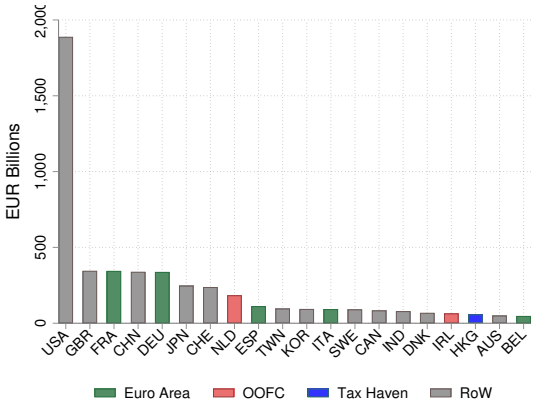
(b) Bonds, Nationality



(c) Equity, Residency



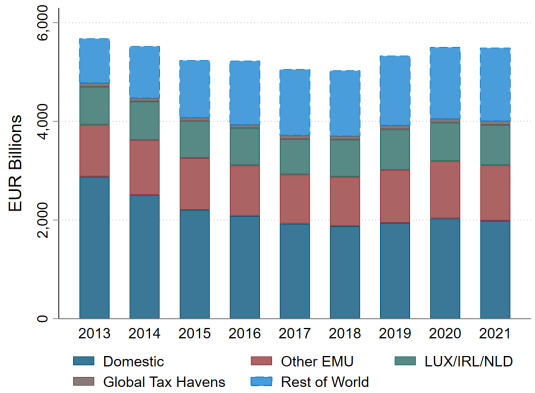
(d) Equity, Nationality



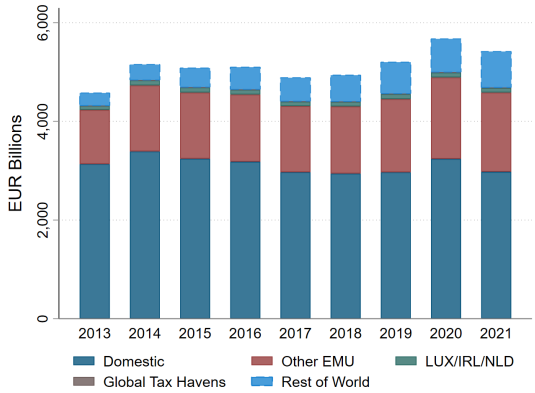
Notes: INCLUDES INVESTMENT FROM LUX AND IRL, NOT UNWOUND

Figure A.V: EMU (Excluding LUX and IRL) Aggregate Investment Patterns in SHS

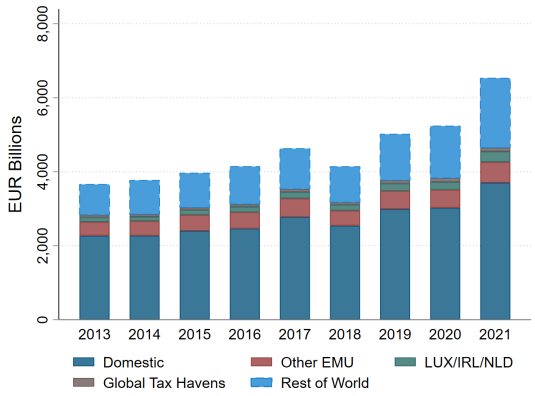
(a) Corporate Bonds



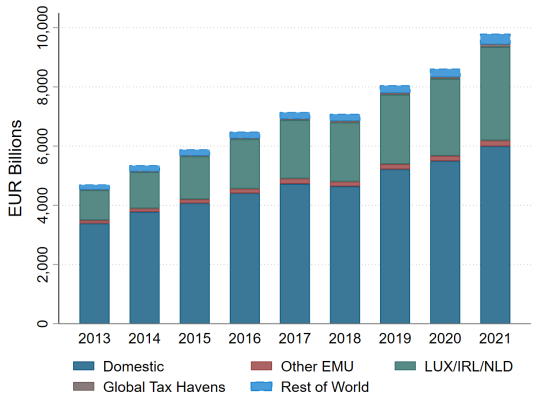
(b) Sovereign Bonds



(c) Equity



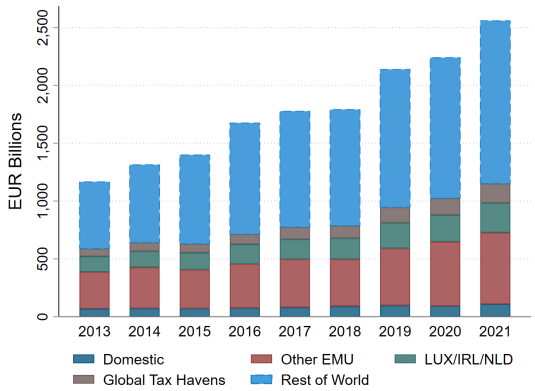
(d) Fund Shares



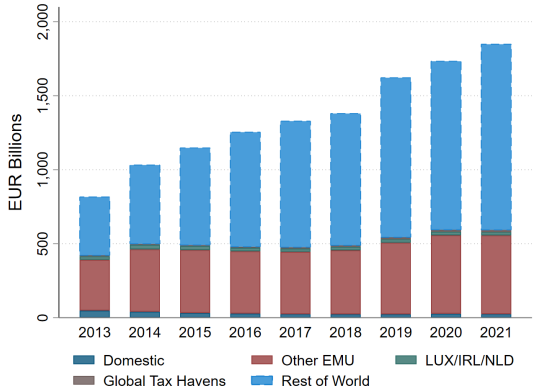
Notes: Priority rule: LUX/IRL/NLD, Domestic, EMU, TH, RoW

Figure A.VI: LUX and IRL, Aggregate Investment Patterns in SHS

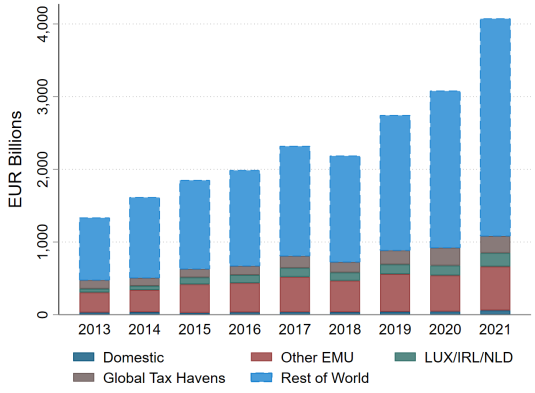
(a) Corporate Bonds



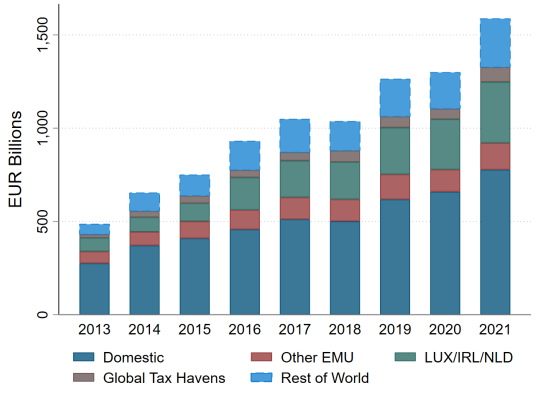
(b) Sovereign Bonds



(c) Equity

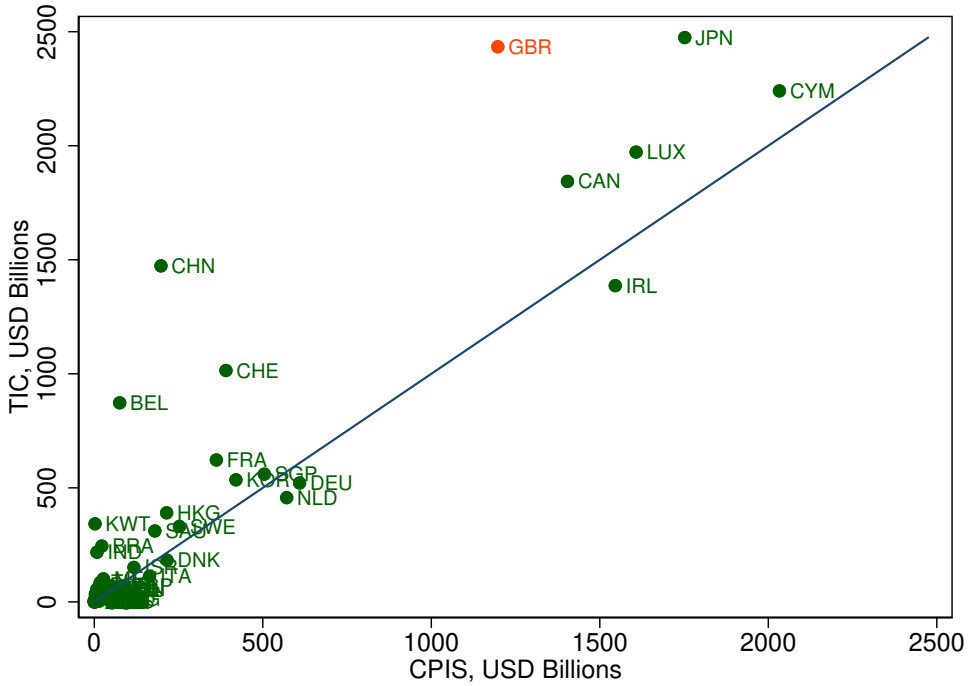


(d) Fund Shares



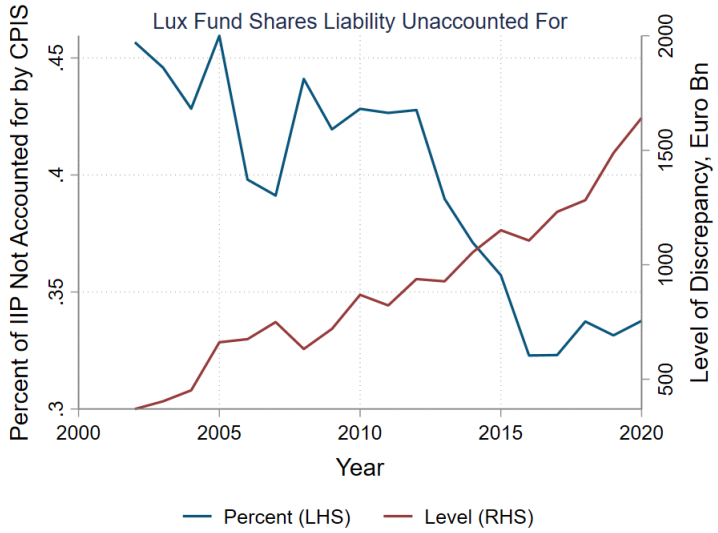
Notes: Priority rule: LUX/IRL/NLD, Domestic, EMU, TH, RoW

Figure A.VII: **Claims on US in TIC vs. CPIS, June 2022**



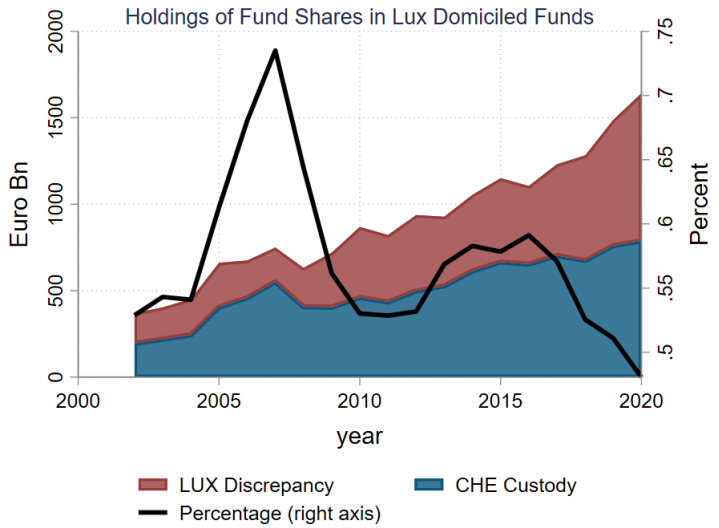
Notes: The y-axis is how much the US reports owing to each country in the Treasury International Capital Data and on the x-axis we plot how much each country claims on the United States in CPIS.

Figure A.VIII: Percentage and Level of Luxembourg Unaccounted Found Shares



Notes:

Figure A.IX: Percentage and Level of Swiss Custody of Fund Shares



Notes: