Global Capital Allocation

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Abstract

We survey the literature on global capital allocation. We begin by reviewing the rise of cross-border investment, the shift towards portfolio investment, and the literature focusing on aggregate patterns in multilateral and bilateral positions. We then turn to the recent literature that uses micro-data to document patterns in global capital allocations. We focus on the importance of the currency of denomination of assets in international portfolios and the role that tax havens and offshore financial centers play in intermediating global capital. We conclude with directions for future research in this area.

1 Introduction

The first step in answering many important questions in international macroeconomics and finance is understanding who owns what around the world. Large increases in cross-border financial positions have led academics and policymakers to find new ways to study global asset ownership to provide a better understanding of a range of topics including: sudden stops arising from the differential tendency of foreigners to sell their financial assets in bad times, segmented models of exchange rate determination driven by the holdings of global financial intermediaries, hidden wealth and financial stability risks arising from wealth concentration in tax havens and offshore financial centers, and the role of the dollar in global financial markets. In this article, we review the academic literature on the measurement, drivers, and consequences of changing patterns in global capital allocation, with a focus on recent work that aims to answer questions in international macroeconomics using micro-level data on global investment.

This survey article serves three primary purposes. First, we summarize major patterns of cross-border investment, with a focus on gross positions. Second, we review the recent empirical and theoretical literature that studies global capital allocation. Third, we lay out the methods for conducting empirical research in this area, discussing the key datasets used, and highlighting their strengths and weaknesses. Our hope is to lower the barriers to new researchers entering this area of scientific inquiry.

We begin by reviewing the basics of the Balance of Payments (BoP) and International Investment Position (IIP) statistics and use them to document the changing nature of cross-border investment. The total value of global cross-border positions has risen from a mere 20% of world GDP in 1980 to more than double world GDP today. Financial globalization, at least by this metric, has progressed quickly and unabated. The work of Lane and Milesi-Ferretti (2001, 2007), with their External Wealth of Nations estimates, constituted a major step forward in understanding multilateral capital allocation patterns. This empirical work was instrumental in moving the field of international macroeconomics from focusing on net financial position (NFA and current account, see Obstfeld and Rogoff (1995)) to considering gross financial positions, including portfolio models that could generate large gross financial positions (Pavlova and Rigobon (2007), Devereux and Sutherland (2011), Tille and Van Wincoop (2010)). It also led to an interest in how different components of the foreign assets and liabilities move over time and in response to shocks, including work focusing on the flightiness of foreign capital (Caballero and Simsek (2020)).

The multilateral IIP data reveal a number of striking changes in the nature of global capital allocation. We document a rise in the importance of portfolio investment (stocks and bonds), and a related decline in the relative importance of "Other" investments (primarily bank lending and cross-border deposits). This rise in the global importance of portfolio investment, a form of non-

bank financial intermediation, motivates the focus of much of the recent literature and this review article on this type of investment.

Advances in the measurement and estimation of bilateral investment are now being combined with theoretical models to explain these positions and use their variation to identify and quantify market frictions. We discuss recent work in the area, such as Koijen and Yogo (2019) applying a demand-based asset pricing system to bilateral data on global portfolio positions, Pellegrino, Spolaore and Wacziarg (2022) characterizing the network of global cross-border investment in a multi-country general equilibrium framework, and Kleinman, Liu, Redding and Yogo (2022) jointly analyzing the network of trade and capital allocations to discipline an open-economy neoclassical growth model.

We then turn to reviewing the use of micro-data to investigate global capital allocation. We explore in more detail two salient features of cross-border portfolio investment: the role of the currency of denomination of assets and the importance of tax havens and offshore financial centers in interme-diating global investment. On the role of currencies in international portfolios, Maggiori, Neiman and Schreger (2020) use micro-data on mutual funds to document a strong asymmetry in how do-mestic and foreign investors lend to firms in large developed countries. While domestic investors overwhelmingly lend to domestic firms in local currency, foreign investors rarely do so in the corpo-rate bond market. The dollar is the major exception to this pattern and as a result foreigners are disproportionately willing to invest in corporate bonds denominated in dollars and issued by US firms, a form of exorbitant privilege for the US in global capital markets.

We then turn to the role of tax havens in global capital allocation. Using both multilateral IIP data and aggregate bilateral data, we review the massive amount of global cross-border investment officially recorded as flowing to tax havens as destinations of investment and coming from tax havens as sources of investment. Beginning with tax havens as destinations of investments, Coppola, Maggiori, Neiman and Schreger (2021) show how to look through this role of tax havens and assign investments to their economically relevant destination. In particular, they highlight how official residency-based statistics understate the exposure of investors to large emerging markets, most importantly China.

We next review the role of tax havens as sources of investment. If international investment statistics were recorded perfectly, the world's net foreign asset (NFA) position should be zero. Every cross-border asset of one country should be recorded as a liability of another country. In practice, there are large imperfections and the world as a whole is a net debtor by approximately $8 trillion dollars. This "missing wealth" has been the focus of important research by Zucman (2013) who presents evidence that the source of this discrepancy comes from hidden wealth in tax havens. Combining novel data from the Panama papers with cross-border investment statistics, Alstadsæter, Johannesen and Zucman (2018) estimate who owns the wealth in tax havens around the world and across the income distribution. Reallocating the holdings of assets by tax haven countries to the

countries of the ultimate investors is an open and challenging research area. Beck, Coppola, Lewis, Maggiori, Schmitz and Schreger (2023) combine the ECB Securities Holdings Statistics with the security-level holdings at the fund-level to re-allocate the investment positions of Luxembourg and Ireland to other Euro Area countries.

Finally, we conclude by suggesting directions for future research. We highlight how research in the area of global capital allocation can help us better understand investment heterogeneity and price impact in financial markets, the nature of international financial market segmentation, China's role in the international financial system in an era of increasing geopolitical competition, and the real effects of tax havens.

2 NFA, BoP, and IIP

The starting point for many questions in international macroeconomics is a country's net foreign asset (NFA) position. A country's foreign assets (A) are those assets that its residents hold in other countries and foreign liabilities (L) are the domestic assets held by foreign residents. At each point in time t, the NFA_t is the difference between foreign assets and liabilities and measures the country's net lending position vis-a-vis the rest of the world:

$$NFA_t = A_t - L_t,$$

Figure 1 panel (a) displays the NFA in 2021 measured in nominal dollars for a cross-section of countries. On the left of the figure, the US is the largest net debtor with a negative NFA position of \$18 trillion, while on the right Norway, China, Germany, and Japan are net creditors. Figure 1 panel (b) plots the NFA scaled by GDP for each country to account for differences in economic size.

The dynamics of a country's net foreign asset position can be accounted for as:

$$NFA_t = NFA_{t-1} + CA_t + VC_t + OA_t$$

where CA_t is the current account balance and VC_t are valuation effects on the outstanding stock of assets and liabilities, and OA_t are other adjustments. The current account, which is the sum of the trade balance (exports minus imports), net foreign income, and unilateral transfers, tracks the country's net borrowing within that time period.

The NFA is the relevant state variable in many models of international macroeconomics because it tracks the net financial position of a country vis-a-vis the rest of the world. In many classic papers all assets are assumed to be perfect substitutes so that netting assets and liabilities is appropriate

**Figure 1:** Net Foreign Asset Positions, 2021
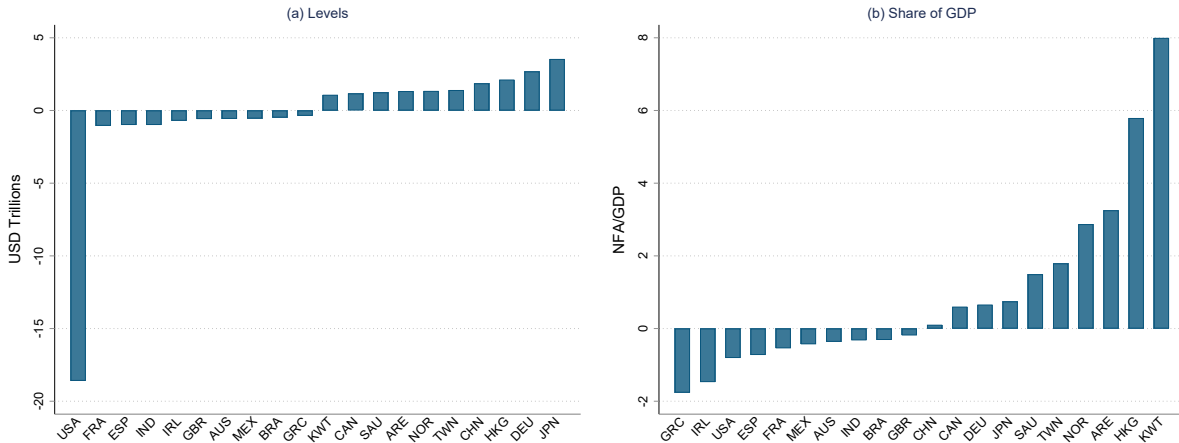
Notes: This figure shows the Net Foreign Asset Position (NFA) for the ten countries with the most positive and negative NFA. Panel (a) reports the positions of these countries in US dollars and panel (b) reports the positions as a share of each country's GDP. Data from the External Wealth of Nations.

and models only need to keep track of net positions. Following the logic of the intertemporal approach to the current account of Obstfeld and Rogoff (1995), an unusually negative NFA should lead to future current account surpluses as the country, for example, runs trade surpluses to repay the outstanding net debt. Subsequent research by Gourinchas and Rey (2007) emphasized that the NFA adjustment could instead occur via favorable valuation effects, or changes in the market value of the existing stock of assets and liabilities. Curcuru et al. (2008) emphasize the importance of separately tracking true valuation effects VA_t and other adjustments OA_t that reflect statistical discrepancies or, for example, the discovery by national statisticians of previously unaccounted for assets and liabilities.

Figure 2 shows that the value of world gross foreign assets and liabilities has increased enormously in the last several decades, approximately $200 trillion (asset side) in 2020. Figure 2 also shows that there is a significant (nearly $10 trillion) discrepancy between global assets and liabilities. This gap is primarily the result of missing wealth in tax havens, as will be discussed in more detail in Section 5. With the production of the External Wealth of Nations dataset, Lane and Milesi-Ferretti (2001, 2007) advanced the literature's understanding of multilateral gross capital allocation patterns. This empirical work was instrumental in moving the field of international macroeconomics from focusing only on net financial position (NFA and current account) to considering gross financial positions. It stimulated international macroeconomic research to produce portfolio models that could generate large gross financial positions (Pavlova and Rigobon (2007), Devereux and Sutherland (2011), Tille and Van Wincoop (2010), Coeurdacier (2009)). It also lead to an interest in how

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different components of the foreign assets and liabilities move over time and in response to shocks.[1] We turn to these components next.

Figure 2: The Growth of Cross-Border Investments
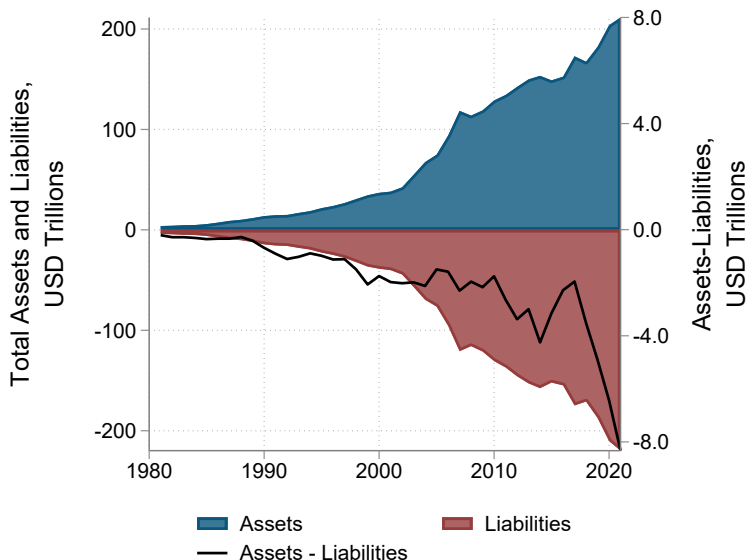
Notes: This figure shows the evolution of gross cross-border assets and liabilities summing over each country in the world, constructed using External Wealth of Nations data. "Assets - Liabilities" is the difference between the sum of assets (excluding gold) and liabilities. This calculation includes countries whose net international investment position is either missing or excluded from EWN but for which assets and liabilities estimates are available.

2.1 The Components of Cross-Border Investment

Foreign assets and liabilities can be decomposed into four major categories.[2] The first category is Portfolio Investment and it covers holdings of equity and bond securities, excluding those assets held as reserves (see below). In addition, shares in investment funds such as mutual funds and exchange-traded funds are considered part of equity holdings irrespective of the underlying investment focus of the funds. The second category is Foreign Direct Investment (FDI), which identifies both equity and debt investments where the investor holds a significant degree of control over the recipient of the investment, as well as those that give rise to such control or influence. Generally, the threshold for control is defined to be when an investor holds 10% of the outstanding equity securities of an enterprise. FDI debt consists of lending between parties with a control or influence relationship.

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[1]There have been several papers exploring how financial liberalization and foreign capital inflows affect the efficiency of the domestic allocation of capital. See, for instance, Gopinath et al. (2015), Varela (2018), and Bau and Matray (2023).

[2]The fifth category of derivatives was introduced more recently but its accounting is notoriously poor and we will not focus on it in this review chapter.

The third category is the poorly named Other Investment. This category consists mostly of the cross-border activity of the banking sector such as bank loans and deposits, as well as miscellaneous categories like SDR allocations and other equity. The fourth category is Reserves. These assets (generally bonds) held mostly by central banks are not included in portfolio investment on the asset side of the holding country. However, these same holdings will be accounted for as portfolio liabilities of the country issuing the corresponding securities (there is no Reserves category in foreign liabilities).

The composition of a country's balance sheet can be a key channel through which international shocks are either amplified or dampened. Consider, for instance, a net debtor country whose liabilities are composed entirely of portfolio equity and debt. These types of liabilities are often referred to as being driven by "hot money," a form of foreign capital particularly flighty during crises. Generally, policymakers worry that a country may be more vulnerable to capital outflows in response to global shocks if foreigners find it easy to sell their assets (Forbes and Warnock (2012), Caballero and Simsek (2020)). By contrast, if a country's liabilities are primarily in the "Other" category, then the country is particularly reliant on foreign bank finance, potentially linking its financing conditions to the health of the global banking system.

After experiencing a series of sudden stops, policymakers in emerging economies have aspired to attract what they perceive to be a more stable form of foreign financing, foreign direct investment. Since FDI involves a long-term commitment and presumably an institutional commitment on the investor side, the idea is that it would be harder for investors to liquidate the investment in bad times. While this is true for traditional FDI, like a foreign firm building a plant in the country, new research has shown that in recent years FDI often consists of intracompany transfers for tax purposes (Damgaard et al. (2019), Tørsløv et al. (2023)) or masks portfolio investment due to securities issuance by foreign affiliates of domestic firms (Coppola et al. (2021)).

In Figure 3, we explore the changing nature of cross-border investment patterns over the last several decades. We document a major decline in the share of assets and liabilities in the Other Investment category. An overwhelming share of cross-border investment in the 1970s, 80s, and 90s was intermediated by the banking sector making the Other category very large. The fall in cross-border bank intermediation is offset by the rise of market-based finance, with the share of cross-border assets in portfolio investment rising rapidly from 1980 to present. In addition, we observe an increase in the share coming from FDI. Finally, at a global level, we observe a decline in the share of assets accounted for by reserves.

Figure 3: Cross-Border Investment by Category, World
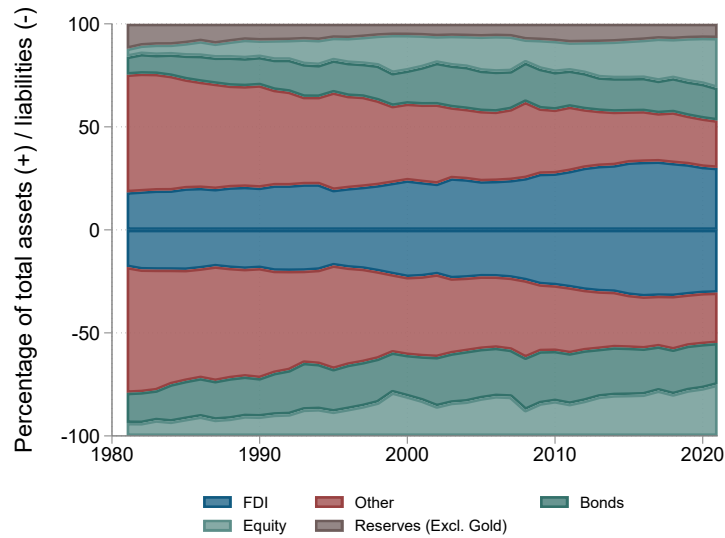
Notes: This figure shows the breakdown of cross-border investment into its IIP components for the world. Source: External Wealth of the Nations database. The positive (negative) region of the vertical axis shows asset (liability) breakdown.

In Figure 4, we split the sample into emerging and developed markets.[3] The fall in global reserves as a share of cross-border assets is driven by the effective disappearance of reserve holdings by developed economies.[4] The liability side of emerging market balance sheets displays a striking change during this period. While in the mid-1990s, 62% of these countries' liabilities came in the form of bank-dominated "Other" investment, this share was only 26% by 2021. For developed economies, while the decline of Other finance is also visible, it is the rise of cross-border portfolio investment on both the asset and liability side that dominates the historical trend.[5]

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[3]As shown in Appendix Figure A.I, developed markets continue to have a higher level of gross assets and liabilities relative to GDP than do emerging and developing countries.

[4]The category reserves is to be interpreted with caution. With the advent of Sovereign Wealth Funds and other state-controlled investment vehicles the asset holdings of the state can vastly exceed the reserves. Reserves technically include only those liquid foreign currency assets that the monetary authorities can easily access (directly or via indirect control) and making the determination of which assets fall in this category is not straightforward.

[5]Appendix Figure A.II shows the US and China as specific examples of the changing composition of cross-border investment.

Figure 4: Cross-Border Investment, by Category and Economy Type
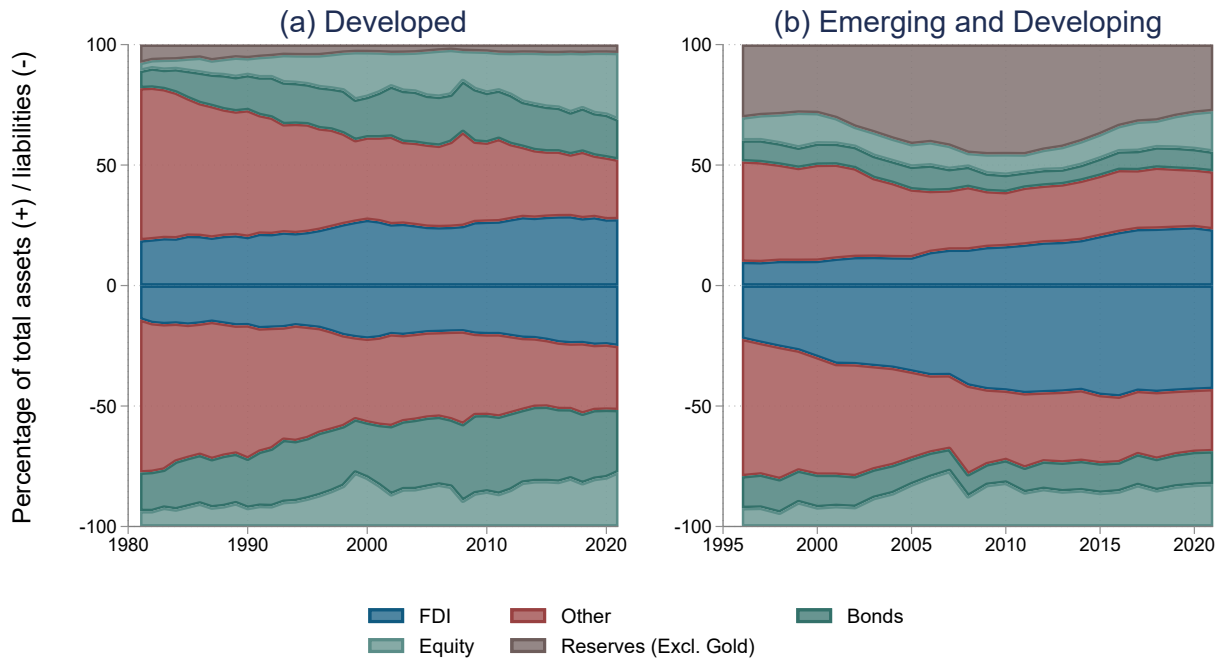
Notes: This figure shows the breakdown of cross-border investment into its IIP components for the group of Developed Markets (DM) and Emerging and Developing Markets (EM-DEV). Source: the External Wealth of Nations database. The positive (negative) region of the vertical axis shows asset (liability) breakdown. Panel (b) starts in 1995 due to missing information on components breakdown for a subset of important economies before this date. Table A.I provides the list of countries in each group.

2.2   The Geography of Global Investment

While we can learn much from the composition of a country's assets and liabilities at the multilateral level, these patterns leave many questions unanswered. The more recent literature has made a remarkable degree of progress in characterizing the geography of investment around the world using a new generation of bilateral data sources. In particular, the IMF Coordinated Portfolio Investment Survey, introduced in 2001, was a significant advance for research on global capital allocation. The IMF introduced a survey of countries' bilateral portfolio positions, with an increasing emphasis in recent years on the sector and currency of investment. This allowed researchers to go beyond asking only whether countries are home-biased, and instead explore where countries allocate their international investment among the many foreign destinations. An early literature building on these new data adapted the gravity regressions from goods trade (Anderson and Van Wincoop (2003), Head and Mayer (2014)) to trade in financial assets. Portes and Rey (2005) characterize the bilateral pattern of portfolio investment in much the same way trade papers characterize bilateral goods trade and early micro-foundations of the gravity literature for financial flows and positions can be found

in Martin and Rey (2000) and Martin and Rey (2004). Okawa and Van Wincoop (2012) provides an insightful formulation of the theoretical underpinnings of gravity models in international finance.[6]

The IMF Coordinated Direct Investment Survey (CDIS) plays a similar role to CPIS but focuses on bilateral FDI investments instead, with countries reporting their outward and inward FDI separately. For bank loans, researchers frequently use the Bank for International Settlements Locational Banking Statistics (BIS LBS). In addition to geography, the BIS LBS statistics data includes information such as the sector of the investor and issuer and the currency of the loans. Reserves are substantially harder to decompose either bilaterally or by currency.[7] Didier et al. (2023) add up the data from these bilateral datasets and find an increase in bilateral capital allocations of emerging economies to other emerging economies.

The analysis of the geography of capital allocation naturally brings up the question of what defines the country of destination of an investment and how it is measured in these public data. Financial globalization and the rise of multinational firms has made researchers' life more difficult but also more interesting in this respect.

2.2.1 The Concepts of Residency and Nationality in International Financial Statistics

Assigning an international investment a destination location is a crucial and non-trivial part of measuring global capital allocation. Official statistics like the IIP and bilateral datasets such as CPIS and CDIS are compiled on a "residency" basis: the country of an investment is assigned to be the location of the immediate entity receiving the investment (e.g. the country in which the company issuing a bond is registered). If a Canadian bank has a subsidiary based in London and this subsidiary issues a bond that is in turn held by a US resident investor, this bond investment is recorded as a portfolio holding of the US in the UK. If all decisions made by this subsidiary are made by the Canadian parent, then researchers may instead want to classify the investment destination to be Canada. This latter concept, based on the residency of the ultimate parent entity, is referred to as "nationality."

For a large part of international investment, the concept of residency and nationality coincide. For instance, if the Brazilian sovereign issues a US Dollar denominated bond in New York, this bond is Brazilian on both a residency and nationality basis. This is because the Brazilian government issues

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[6]In gravity models of international financial flows, distance is generally seen as a proxy for information frictions rather than physical shipping costs as in goods trade.

[7]Recent work by Ito and McCauley (2020) makes progress by using national central bank data to measure the USD, EUR, JPY, and GBP share of countries' reserves. The IMF COFER dataset only reports the aggregate currency composition of global reserves and does not disclose the bilateral composition.

directly and residency and nationality can only differ when issuance occurs via a legally distinct entity such as a financing subsidiary, and not simply when issuance takes place in international capital markets.

The distinction between residency and nationality has grown significantly over the last two decades (Avdjiev et al. (2016)). The primary reason is the rise of issuance via affiliated entities registered in offshore financial centers and global tax havens. While in the case of the hypothetical Canadian bank issuing via its UK subsidiary, it is not a priori obvious whether one prefers to record this as a Canadian or British liability, the decision is much more straightforward in the case of subsidiaries in countries where little or no local economic activity is taking place. For example, in the case of a firm that issues debt via a Cayman Islands based financing subsidiary that does nothing more than pass-through the proceeds to the parent company, it is not economically meaningful to call this bond a liability of the Cayman Islands. Of course, it is interesting to know and understand why the bond is being issued by that subsidiary (taxes, regulation) and to understand the economic impact of the firm financing strategy. However, researchers would like to know where the capital ends up, since it is clearly not being used to finance local economic activity. As we review in detail in Section 5, official statistics are so dominated by investments into and out of these tax havens and offshore centers to make their use in research very challenging.

2.3   In Search of a Bilateral International Macro-Finance Model

One of the most promising developments in the last few years has been the rise of theoretical frameworks that seek to explain the network of bilateral investment positions and use the model structure to identify and quantitatively assess the key frictions needed to match the data. By leveraging the full network of bilateral global capital allocations rather than simply analyzing multilateral external positions, this research agenda opens the door to a better analysis of the nature of market segmentation.

Koijen and Yogo (2019) apply a demand-based asset pricing system to bilateral data on portfolio investment positions to decompose the drivers of exchange rates and asset price movements around the world. Jiang et al. (2022a) build on this demand-based framework to quantify the drivers of the dynamics of the US net foreign asset position, and in subsequent work apply their framework to decompose dollar exchange rate movements (Jiang et al. (2022b)). Shen and Zhang (2022) adapt this framework to study cross-border bank lending and document how differentiated credit supply elasticities affect cross-border risk-sharing.

Pellegrino et al. (2022) characterize the network of global cross-border investment in a multi-country general equilibrium framework. They use their estimated model to argue that barriers to global

capital allocation account for sizable welfare losses. Combining an Armington model of trade with an Eaton and Kortum (2002) model of financial investment, Kleinman et al. (2022) jointly analyze the network of trade and capital allocations to discipline an open-economy neoclassical growth model and demonstrate how trade and financial openness interact to drive the rate of convergence to steady state.

At present, we do not have a canonical model of bilateral investment around the world. Developing such a framework is a very promising avenue for future research. Among many potential applications, it could be used to: explain current capital allocations, assess the size of distortions (tax havens, but also trade barriers or capital controls), estimate third-country effects of shocks or policies (e.g. effect on Vietnam of a China-US specific shock), and document segmentation along geography but also political affiliation[8] or level of development.

3   Global Capital Allocation with Micro Data

While aggregate bilateral datasets are a major improvement over multilateral data, they still limit the range of questions that can be asked and answered. In the last few years, new datasets have become available that offer an exciting opportunity to researchers: access to micro level data (e.g. by each investor and security) that is sufficiently extensive as to aggregate up to a large fraction (or even the entirety) of the macro bilateral and multilateral data.

The benefits of these new datasets for research have come in several dimensions: (i) they have vastly expanded the variation that can be used to causally identify economic effects of interest, (ii) on classic results they have allowed researchers to dig deeper often providing a different interpretation of these existing results, (iii) they have allowed researchers to provide new facts along dimensions of the data that were previously unavailable, (iv) they have increased the confidence in the accuracy of stylized facts.

This new wave of data is still ongoing and data availability keeps improving every year. It is useful to understand why this new wave of data is being created. At some level, it is largely technological progress. The ability to collect, store, and manipulate the data has expanded greatly, and the digitalization of the world economy means that most economic transactions result in digital data in the first place. These factors are common across many fields of social and hard sciences. More interestingly and specific to our area of research, however, it is the product of an intellectual shift toward understanding the importance of financial imperfections. International macroeconomics, like much of macroeconomics and finance, had too often ignored these imperfections in recent

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[8]See Kempf et al. (2023) for evidence on the role of politics in global capital allocation.

years, relegating the question of "who owns what" to be of purely micro interest with no macro consequences. The financial crisis of 2007-09 proved this view to be a catastrophic mistake. The assets and liabilities exposures of institutions such as AIG and Lehman Brothers turned out to generate some of the largest and most devastating macroeconomic shocks. As a result, there was an intellectual paradigm shift that has brought the question of "who owns what" back to the center of scientific inquiry in (international) macroeconomics and finance.[9] In response to this shift, government organizations, the private sector, and academics have all stepped up their data collection efforts. Harnessing the full potential of these data for economic analysis is one of the most exciting research avenues for the future. In this article, we focus on the approach of our research lab, the Global Capital Allocation Project (GCAP), of combining micro-data on portfolio investment by mutual funds, exchange traded funds (ETF), insurance companies, sovereign wealth funds, and micro datasets from official institutions (such as the European Central Bank) to improve our understanding of global portfolios.[10]

3.1 Commercial and Official Data

The data on capital allocation generally covers three areas, especially when focusing on global portfolios. The first area is data on the universe of securities outstanding at a point in time and their characteristics (e.g. for a bond: notional amount, currency, maturity, legal framework, etc.). The second area is data on who owns the securities (e.g. a mutual fund domiciled in the US, or a German bank). The third area is data on who issued the security (e.g. which firm is the immediate issuer, where is that firm registered in the world, who owns that firms, etc.). There has been remarkable progress in the last few years on all three aspects of the data. Here we focus on a brief summary comparing commercial data on holdings to official data.

The most obvious differences between commercial and official data are cost, accessibility, coverage, and level of detail. For each source of data, there are pros and cons, and we review here some of the most common that should be of interest to new researchers entering this area.

Official data are collected via a regulatory or legislative mandate. This generally provides an advantage because compliance of the reporting entities within the mandate is high. For example, in the US regulation requires that custodian intermediaries report cross-border portfolio investments to the U.S Treasury and these data are then used to compile TIC and the portfolio component of the US IIP. Coverage within the mandate is very high (e.g. all type of investors, very comprehensive within type). Similarly, the ECB SHS database is collected via regulatory disclosures. The main

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[9]This is closely related to the question of who has excess leverage.

[10]The lab makes available estimates of global capital allocations in support of our research papers at www.globalcapitalallocation.com.

drawback is that the mandates often do not include important parts of the data from a research perspective. For example, the US Treasury data does not include domestic positions, so that it is not possible within that mandate to observe all the holdings of securities by an entity, but just the cross-border part. The ECB SHS data, instead, does observe the entire portfolio (domestic and foreign) of each entity, but in most cases the data made available for researcher is not at the holder level (only available at the country-sector-of holder level, i.e. all German funds together and not fund by fund).[11]

Commercially available data comes from two sources: data collected and resold by data providers and regulatory data that is available for purchase. The main advantage of commercially available data are its availability to most researchers (direct access, often no nationality requirement) and the ability to combine various data sources to assemble the desired dataset for research. The main drawback is the potential lack of coverage of the underlying universe. In the US, for example, commercial data on holdings is available for mutual funds, ETFs, and insurance companies, but extensive coverage of pension funds is more difficult, and coverage of hedge funds is very limited. In many other countries, with the exception of Japan and Norway, securities holdings of large sovereign wealth fund are not publicly available.

As an illustrative example, consider the outward US portfolio position. The official data are from TIC. For commercial data, we use US domiciled open-end mutual funds and ETFs and insurance companies.[12] Of course, funds and insurance holdings are only a subset of total positions, and the data does not include households, banks, hedge funds, and non-financial corporations. However, the TIC annual report for 2020 shows that investment funds and insurance companies are by far the largest cross-border investor types and account for 55.34% of the United States external portfolio investment. The commercial data provides nearly universal coverage of these investor types in the US and, therefore, accounts for a large share of aggregate US foreign investment, rather than simply being a small representative slice of it. In addition, these commercial datasets contain all domestic investment positions and the data are available quarterly. Domestic positions are, of course, much larger than cross-border ones and account for the majority of these investors' holdings.

Figure 5 compares the geographic composition of foreign equity and bond investment available in commercial data to the United States official TIC data. We compute, for each dataset, the share of overall outward investment in that asset class going to each destination. The two datasets offer a remarkably similar picture. The (across-destination) correlation among the two estimates of these shares for common equity is 0.9940 in 2007, 0.9970 in 2015, and 0.9920 in 2020, respectively.

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[11]For a survey of research done using SHS data, see Boermans (2022). Boermans and Vermeulen (2020) use the SHS data to document sectoral heterogeneity in investor currency preferences. For other recent contributions using the SHS micro-data, see Bergant, Fidora and Schmitz (2020), Papoutsi, Piazzesi and Schneider (2021), and Darmouni and Papoutsi (2022).

[12]For mutual funds and ETFs the data are from Morningstar. For insurance companies the data are from the National Association of Insurance Commissioners (NAIC) obtained via S&P Global Market Intelligence.

For bond investment the correlations are 0.9370, 0.9889, 0.9865, respectively. The close alignment between the data occurs for two reasons: first, the commercial data directly accounts for a large share of the total positions, and the observed positions are largely representative of total in this dimension. The correspondence between the micro-data and administrative data tightens in recent years, perhaps as a mutual funds, ETF, and insurers account for a larger share of the aggregate positions.

Figure 5: Mutual Funds and Insurance Positions Compared to TIC

(a) Common Equity

(b) All Bonds
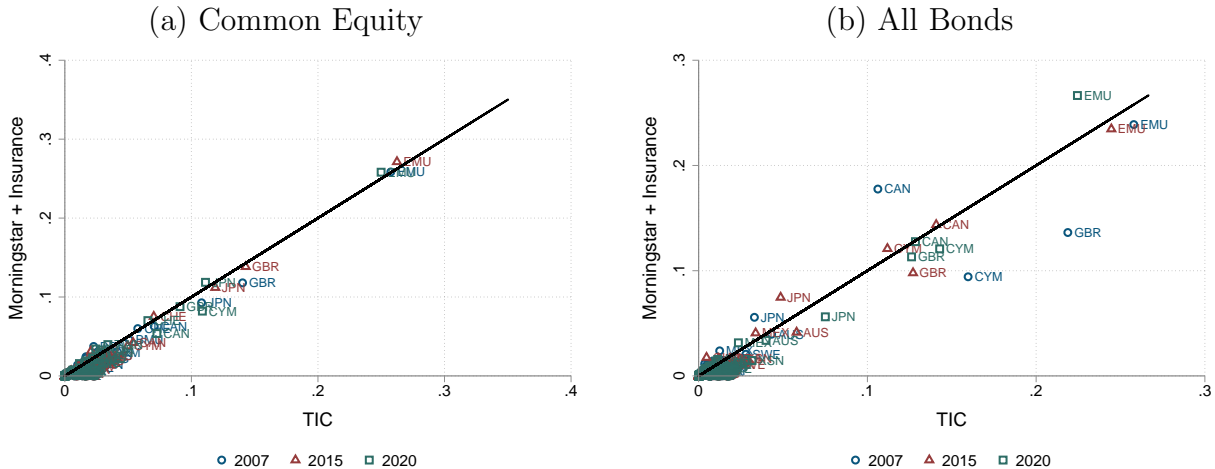
Notes: This figure benchmarks commercial data on security holdings of mutual funds and insurance companies against comparable public data on common equity and bond holdings obtained from the Treasury International Capital (TIC) System. Commercial data for mutual funds is obtained from Morningstar while data for insurance companies is disclosed to the National Association of Insurance Commissioners (NAIC) and obtained via S&P Global Market Intelligence.

There certainly are dimensions along which the commercial data differs from the aggregate due to differences in investor holdings by type. An illustrative example of investor heterogeneity (even within the commercial data) is the currency composition of bond portfolios. In Figure 6, we compare the currency composition of cross-border bond portfolios held by US mutual funds and insurance companies. Even conditional on investing abroad, well over 90% of insurance company bond holdings are denominated in US dollars compared to slightly more than 60% of mutual fund foreign bond holdings. Insurers are more likely to want to hold dollar bonds to match the fact that their liabilities (e.g. insurance policies) are in dollars, while mutual funds might want to offer some foreign currency exposure to their underlying investors.

The heterogeneity between insurance and fund holdings is of more general interest with respect to the differential propensity to fire-sell assets. Coppola (2022) uses the micro-data on funds and insurers' holdings to document (both domestically and internationally) that funds are disproportionally likely to fire sell bonds during periods of aggregate market stress. Insurers, on the contrary, are "safe

hands" in a crisis, but also unconditionally trade the bonds less, making the bonds that they hold endogenously less liquid in normal times but more resilient to market crashes. Coppola (2022) cleverly uses the variation in purchases of the bonds at issuance (on the primary market) by large insurers as an instrument for holdings to provide a causal interpretation of his results.

Figure 6: Currency Denomination of Cross-Border Investment, 2020
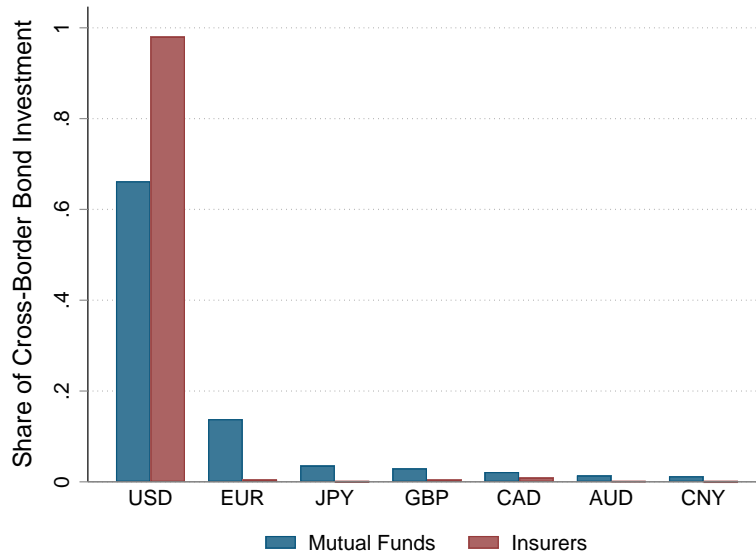
Notes: The bar chart shows the sectoral heterogeneity in shares of cross-border bond investment by currency of denomination. The blue bars are shares for US mutual funds and the red bars are shares for US insurance companies. Source: Mutual fund data is from Morningstar and insurance data is disclosed to the National Association of Insurance Commissioners (NAIC) and obtained via S&P Global Market Intelligence.

4   The Role of Currency in International Portfolios

One area of research where the power of the micro-data has changed our understanding of global capital allocations is the role of the currency denomination of assets in driving investment portfolios. Two factors contributed to these questions being left relatively unexplored until recently. On the one hand, from a theoretical perspective the assumption of perfect financial markets (complete markets and in the absence of frictions) implies that currency risk can be traded (hedged) separately from the purchase of the underlying assets and therefore cannot be a source of distortions in the allocation. Indeed, this is the logic used in Van Wincoop and Warnock (2006, 2010), Engel and Matsumoto (2009), and Coeurdacier and Gourinchas (2016) to argue that exchange-rate risk cannot be responsible for home-country bias in equities. On the other hand, from an empirical perspective data limitations meant that the currency composition of investment portfolios was largely

unknown.[13]

4.1 The Currency of Cross-Border Investment

Figure 7 shows an updated version of Figure 2 of Maggiori et al. (2020). For 9 developed countries, or currency areas in the case of the European Monetary Union, we contrast the share of domestic corporate bond investment in the investor country's local currency (left) with the share of foreign investment in the recipient country's local currency (right). There are two key takeaways: first, for every developed country, the overwhelming share of domestic investment is in the investor's local currency; second, for every country except the United States, the overwhelming share of foreign investment is *not* in the recipient's local currency.

In Maggiori et al. (2020), the authors show that foreign portfolio investment in corporate bonds is largely denominated either in the investors' home currency or the international currency, the US dollar.[14] Despite Figure 7 only reporting a country level aggregate, this figure shows the benefit of beginning with commercial fund data relative to standard cross-border datasets because they include domestic holdings, allowing for a clear comparison of investor heterogeneity across the domestic and foreign domain.

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[13]The reason is that while bilateral datasets like CPIS report the country of destination of investment, and for more recent years they increasingly report the currency denomination of aggregate investment, they normally not report the currency of denomination of investment by geography, let alone at the issuer-level needed to understand allocative differences. While one can use a dataset like CPIS to ask the market value of Canadian holdings of British bonds (Table 1 of CPIS), or the value of bonds Canada holds denominated in British pounds (Table 2 of CPIS), one cannot observe the market value of British bonds denominated in pounds owned by Canada. In addition, because these datasets only consider cross-border investment, one cannot see how different foreign and domestic investment are.

[14]See Burger et al. (2018) for an analysis of the importance of currency in driving international portfolios.

Figure 7: Share of Corporate Bond Investment by Investor and Currency Type, 2020
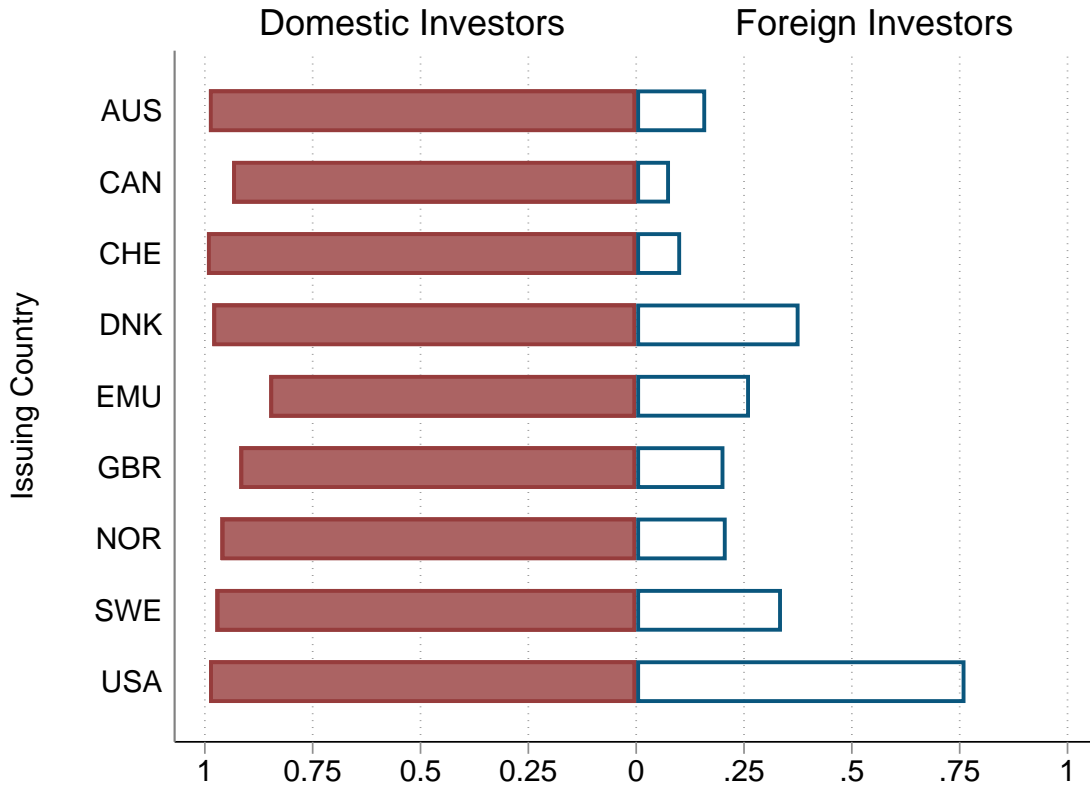
Notes: Share of corporate bond investments denominated in the issuer's local currency. The filled bars show for each issuing country the share of bonds denominated in the issuer's local currency out of all domestic investment in its corporate bonds. The open bars show for each issuing country the share of bonds denominated in the issuer's local currency out of all foreign investment in its corporate bonds.

4.2 Currency Heterogeneity Between Sovereigns and Corporates

Using the GCAP cross-country micro-data, we next turn to documenting the heterogeneity in the way sovereigns and firms borrow internationally in the bond market. In Figure 8, we plot the share of foreign-owned sovereign and corporate debt in each country that is denominated in the issuer's local currency. A few key features emerge. First, a wide range of both developed and emerging market sovereigns primarily borrow from foreign investors in their local currency. In an important contribution, Eichengreen and Hausmann (1999) highlighted the tendency of emerging and developing markets to borrow in foreign currency as a key source of macroeconomic fragility, terming the phenomenon "Original Sin." Lane and Shambaugh (2010) and Bénétrix et al. (2015) combine data from CPIS, UNCTAD, and the BIS to estimate the net currency exposure of a large panel of countries. They document significant heterogeneity between emerging and developed countries,

and a major shift of developing and emerging markets away from foreign currency liabilities.

As Figure 8 makes clear, by 2020 a significant fraction of emerging markets have more than half of their foreign-held sovereign bond debt denominated in local currency while no country, emerging or developed, other than the United States raises half of their foreign-held corporate bond finance in their local currency.

There is now an extensive literature exploring the factors pushing emerging markets sovereigns to borrow in local or foreign currency. Du and Schreger (2022) document the heterogeneity between sovereign and corporate external currency compositions for emerging markets and study the interaction between the currency composition of sovereign and corporate debt as a driver of sovereign default risk. For the sovereign's choice of the currency composition of debt, Ottonello and Perez (2019) highlight variation in the costs of inflation, Engel and Park (2022) point to an important role for commitment issues, and Du et al. (2020) focus on the interaction between limited commitment and risk premia as a driver of the the issuance decision. Wu (2020) considers how sovereign risk premia are affected by the currency composition of corporate debt. Devereux and Wu (2022) illustrate how foreign reserves can lead emerging markets to issue more sovereign debt in their own currency. Arslanalp and Tsuda (2014a,b) construct country-level datasets on the currency composition of external sovereign debt, including sectoral holdings data for many countries.

On the corporate side, Salomao and Varela (2022) consider the optimal choice of the currency composition of corporate borrowing in a dynamic model in which firms trade-off the lower cost of foreign currency debt against the volatility it induces arising from currency mismatch. Maggiori, Neiman and Schreger (2023) provide a simple model of the currency composition of corporate debt in which debt markets are segmented by currency and firms hedge the currency risk from foreign currency debt issuance.

Figure 8: Share of Cross-Border Bond Investment in Issuer's Local Currency, 2020
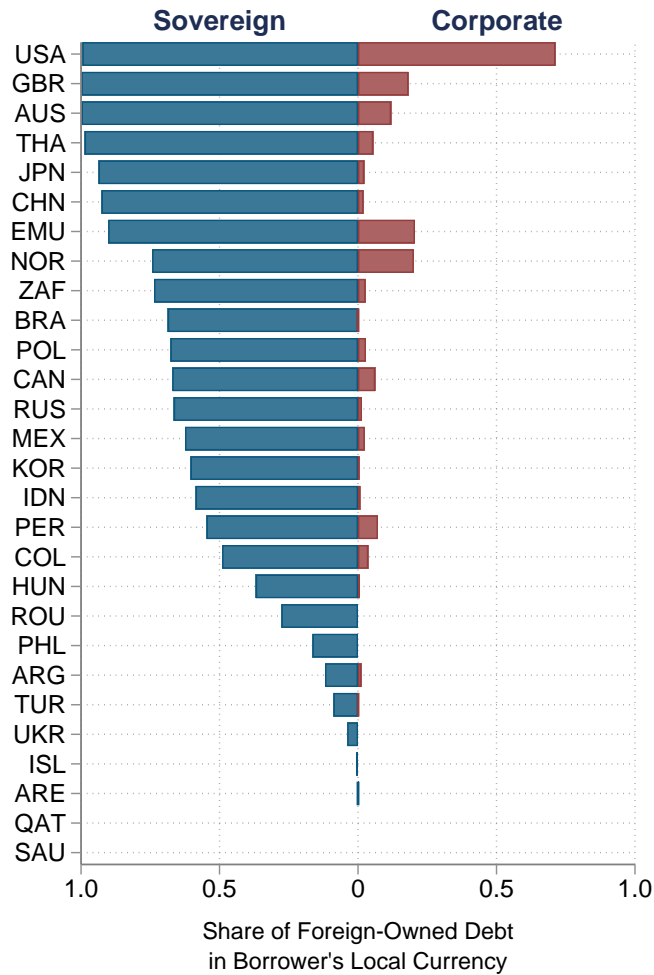
Notes: For each country, the figure plots the share of foreign-held bonds denominated in the country's local currency. The left half of the figure shows local currency share of foreign-held sovereign bonds, while the right half shows the local currency share of corporate bonds. The bonds are classified using the nationality criterion.

Corporate-Sovereign Currency Composition Puzzle. Despite the striking regularity seen in Figure 8, there is still no generally accepted explanation for the difference in the external debt composition between sovereigns and corporates. Here, we briefly discuss a few possibilities. One reason may be that sovereigns and corporates have different exposures to exchange rate fluctuations. The government's primary source of revenue is taxes and might be heavily tilted toward local currency denominated non-tradables. By contrast, the firms borrowing in foreign currency may tilt more towards exporters, and so perhaps they differ from a risk perspective.[15] Alterna-

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[15]See Colacito et al. (2022) for an analysis of the connection between exporting and debt denomination.

tively, sovereign and corporates may differ in their concern about any externalities imposed by their borrowing decisions. If foreign currency debt is a source of aggregate volatility for the economy, then perhaps the sovereign internalizes this externality but firms do not. This would lead the two types of agents to choose different compositions of the debt outstanding.[16]

Of course, in equilibrium foreign investors can choose which type of debt to hold out of the outstanding stock, especially as many countries have relaxed capital controls. For example, the overwhelming share of foreign-owned local currency sovereign debt in emerging markets is actually issued in their respective local market. Foreign investors that own local currency sovereign debt acquire the bonds by coming onshore. There are also significant amounts of domestically issued local currency corporate debt available for these foreign investors to buy, but the data on holdings reveal that they choose not to. We summarize this puzzling allocation in Figure 9. The pattern in the bottom left corner offers a challenge to existing theories of how countries graduate from original sin. For example, if foreign investors were previously unwilling to hold local currency bonds due to inflation risk, then once graduation occurs this should have led to foreign holdings of local-currency bonds issued by both the sovereign and corporate sector. Similarly, if foreign investors were simply unfamiliar or had a distaste for the corporates, then this should have manifested in low holdings of the foreign-currency denominated debt of the corporates.[17] The micro data also excludes explanations that are purely compositional: while the set of corporates that issues in the domestic currency and in foreign currency is different, the result that foreign investors only buy the foreign-currency debt holds even within each corporate group (comparing debt issued by the same firm).

What makes foreign investors willing to hold domestic local currency sovereign debt but not domestic local currency corporate debt? Some possibilities include the desire to avoid domestic law bankruptcy procedures that are more relevant for corporate than sovereign debt, the desire of investors to separate currency and credit risk, or perhaps market frictions like differential liquidity. At present, this differential currency composition of sovereign and corporate debt remains a puzzle for models to explain. The solution might help us shed light on the key frictions in international capital markets.

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[16]Bruno and Shin (2017) present evidence emerging market firms borrow in foreign currency to run a carry-trade.

[17]For investors located in emerging markets, there is currently no clear evidence on their holdings of debt denominated in foreign currency and issued by their own sovereign or their country's firms.

Figure 9: Corporate-Sovereign Currency Composition Puzzle

Notes: A checkmark indicates that a given investor type buys a particular form of debt. The X indicates that a given investors generally does not purchase a particular form of debt. The $\sim$ signs in the top quadrants for domestic investors are to be read as "we do not know."

4.3   Home Currency Bias

If investors are not lending to corporates in the currency of the borrowing country, how are they lending? The answer is dollars or in the investors' home currency. We begin by documenting the sense in which foreign investment is tilted to investors' home currency. To do so, we use the GCAP data and follow Maggiori et al. (2020) and run regressions of the form:

$$s_{j,p,c} = \alpha_{j,p} + \beta_j 1_{Currency_i=Country_j} + Controls + \epsilon_{j,p,c} \tag{1}$$

where $s_{j,p,c}$ is the share of the total holdings in our data of a particular corporate bond c issued by parent firm p that is held by investors from country j, $\alpha_{j,p}$ is a fixed effect for the parent firm, and $1_{Currency_i=Country_j}$ is an indicator variable denoting that the security is denominated in the *investor's* home currency. The key coefficient of interest is β_j, measuring how much more of a given security, all else equal, investors own when it is denominated in their own currency. The key idea is that if β_j is zero, investors do not display any tilting of their portfolio to assets denominated in their home currency, but if it is positive, then this means that investors tilt their portfolios toward their home currencies. The firm fixed effects sharpen the focus on currency since any firm invariant characteristics (i.e. size, industry, exporter status) are absorbed.

Table 1: Home Currency Bias, 2020

	CAN	EMU	GBR	SWE	USA
Currency	0.849***	0.622***	0.479***	0.609***	0.690***
	(0.008)	(0.009)	(0.017)	(0.076)	(0.014)
Obs.	31,266	31,266	31,266	31,266	31,266
# of Firms	3,201	3,201	3,201	3,201	3,201
R^2	0.947	0.870	0.822	0.876	0.894
Firm FE	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes

Notes: This table reports estimates of the regression in Equation 1, similar to Maggiori et al. (2020). The set of bonds are those in the holdings data for investors domiciled in Australia, Switzerland, Denmark, Norway, and New Zealand (omitted from the table for space) and the countries reported in the table. The dependent variable is the share of each security (at the CUSIP 9-digit level) help by each country's investors in our sample: $s_{j,p,c}$. We include fixed effects at the ultimate-parent entity level, and number of firms are the issuer entities that are not absorbed by the fixed effects. Controls include maturity and coupon bins. USA data is the sum of mutual fund and insurance data. All other countries are mutual fund holdings only. Standard errors in parentheses are clustered at the ultimate-parent firm level. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table 1, reports large estimates of β_j showing that home currency bias is remarkably strong. For example, in column 2 the estimated β_j for Canada is 0.849. This means that if a security is denominated in Canadian dollars, then Canadian funds own 84.9% more of the amount owned by mutual funds globally than what they hold of securities that are not denominated in Canadian dollars but issued by the same issuer. Given Canada's small share of global portfolio investment, this is a huge degree of bias.[18] In Appendix Table A.II, we explore sectoral heterogeneity in home currency bias for American-domiciled mutual funds and insurance companies. While both sectors are strongly home currency biased, we showed that insurance companies are more so, echoing the findings in Figure 6.

The strength of home currency bias in explaining investors' international bond positions naturally raises the question of the strength of this effect relative to classic home *country* bias. The influential work of French and Poterba (1991) found that investors disproportionately hold equity securities issued by domestic firms. The subsequent literature demonstrated that the same is true, to an even greater extent, for bonds. However, as we have emphasized, data limitations have meant that traditional analyses have not included information on currency. Maggiori et al. (2020) explore this

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[18]While all currency areas display significant home currency bias, the result is attenuated for the Euro Area. Beck et al. (2023) combine SHS regulatory data and commercial data on funds to show that this is driven by foreign ownership of the Luxembourg and Irish mutual funds. Many of the funds domiciled in Luxembourg and Ireland are not owned by Euro Area based investors and Beck et al. (2023) show that these finds disproportionally invest in foreign currency bonds compared to those funds held by Euro Area investors. For the Euro Area, home currency bias regressions that do not adjust for funds held by non-Euro Area investors understate the degree of home currency bias.

question by adding a dummy for a security being issued by a firm from an investor's home country to Equation 1.[19] They show that conditional on the currency of denomination of a bond, the home country effect explains a surprisingly small amount of the variation in investors' portfolios. At least for corporate bonds, inference of home-country bias is confounded by the presence of home-currency bias.

### 4.3.1 Implications of Investor Currency Preferences

Home currency bias has interesting implications for firms, capital allocation, and exchange rate determination. For firms, even those of developed countries, Maggiori et al. (2020) show a clear pecking order in the currency of issuance and a size dependency in which firms issue in foreign currency. In each country, foreign currency issuance increase with firm and borrowing size and the dollar is often the chosen foreign currency. The selection of which firms issue bonds in foreign currency, combined with home currency bias on the investor side, means that in equilibrium foreign investors have their corporate bond portfolio in each destination country concentrated in a subset of firms. Maggiori et al. (2023) present a stylized model with investor home-currency bias and firms that issue bonds in foreign currency (and hedge) in segmented capital markets. In the presence of a fixed cost of issuing in foreign currency, it is the larger and more productive firms that decide to access the foreign currency bond market. The authors show that the international role of the dollar provides a privilege to the US in terms of better and cheaper allocation of capital to the corporate sector since foreign investors are especially willing to hold dollar bonds (in addition to their local currency). Liao (2020) presents evidence that firms choose the currency composition of their borrowing to minimize their hedged borrowing costs. Much more structural work is going to be needed to assess the real economic impact of these frictions.

The exceptional role of the US dollar in the cross-border denomination of private assets has also increased in recent years. Figure 10 updates the results in Maggiori et al. (2020) by plotting the euro and dollar shares in cross-border corporate bond holdings (dropping intra-Euro-Area holdings) and documents a sharp increase in the international use of the dollar at the expense of the euro in the wake of the Global Financial Crisis and European Sovereign Debt Crisis.[20]

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[19]Because the country of a firm, defined on a nationality basis, does not change across bond issuances, this requires dropping the firm fixed effect.

[20]Maggiori et al. (2019) document the role of the dollar and euro across more domains like loans, reserves, and trade invoicing.

Figure 10: Share of Cross-Border Corporate Bond Investment By Currency
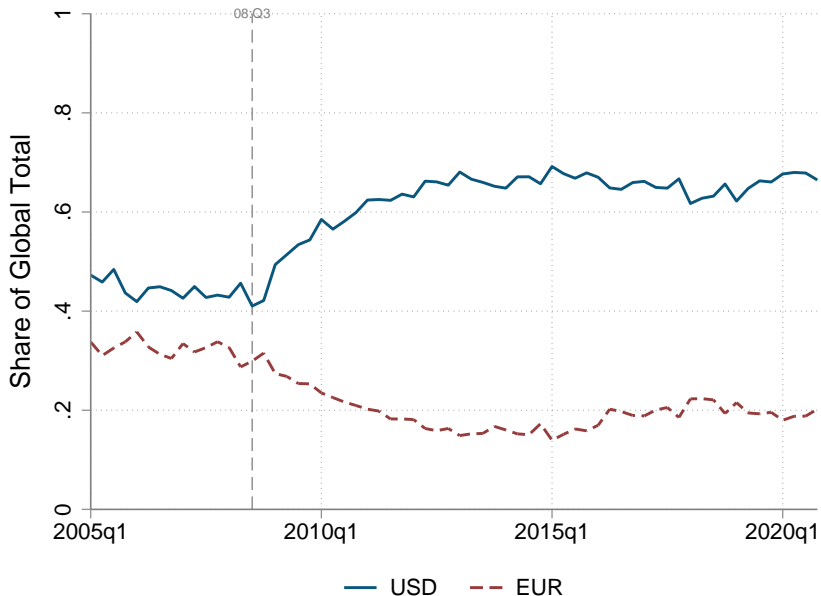
Notes: The dollar and euro shares of cross-border corporate bond positions in global mutual fund and ETF holdings.

The special role of the dollar in international investment portfolios has been playing an increasingly important role in international macroeconomic models that try to better explain financially driven patterns of exchange rate determination. Jiang et al. (2021) and Jiang et al. (2020) argue that fluctuations in foreign demand for dollar-denominated assets is a key driver of exchange rates. Kekre and Lenel (2021) explore the consequences of time-varying demand for safe dollar bonds for global business cycle. Devereux et al. (2023) endogenize fluctuations in this dollar preference via dollar assets' differential value as collateral.[21]

More broadly, home currency bias lends support to models in which most agents within a country do not trade foreign currency bonds or treat them asymmetrically. For example, Gabaix and Maggiori (2015) break the assumption that households in each country frictionlessly trade bonds in different currencies with each other and assume instead that they trade foreign currency in very limited ways. The bonds in different currencies are instead intermediated by a global financial intermediary sector with limited risk bearing capacity. Preferred habitat models (Vayanos and Vila (2021)) have recently been adapted to an open economy setting in Greenwood et al. (2023) and Gourinchas et al. (2022).

Another avenue for research is to develop behavioral models of home currency bias. For example,

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[21]For empirical measures of the specialness of US Treasuries as a safe asset, see Du et al. (2018) and Diamond and Van Tassel (2021).

a model in which households perceive bonds in their own currency as safe, but mentally cluster foreign currency bonds in a "risky" investment bucket like equities, thus overestimating the risks of foreign currency investments (i.e. underestimating the Sharpe ratio from adding foreign currency bonds to their portfolio).

Jiang et al. (2023) use an SDF-approach to show that wedges in each country's asset pricing equations for domestic and foreign currency bonds play a crucial role in allowing a general class of models to match classic "puzzles" of international macroeconomics and finance such as the exchange rate disconnect, the failure of the Backus-Smith condition, and the profitability of the carry trade. In this view, home currency bias is a wedge penalizing foreign currency bonds in the pricing equation.

4.4   FX Hedging and its Costs

Currency trading also involves derivatives, such as currency forwards and swaps. Regulations introduced in many advanced economies in the aftermath of the Global Financial Crisis require the disclosure of derivative transactions (e.g. the European Market Infrastructure Regulation (EMIR)). The resulting data repositories offer an opportunity for researchers to better understand the nature and extent of financial hedging and currency preferences more broadly. Cenedese, Della Corte and Wang (2021) use the EMIR data to demonstrate that balance sheet constraints cause CIP deviations at the dealer level. For mutual funds, Sialm and Zhu (2021) use new public disclosures of US-domiciled funds to document currency trading via forwards in addition to investment in foreign-currency bonds. Liao and Zhang (2020) provide evidence of hedging for pension funds and insurers and introduce a model of exchange rate determination with incomplete hedging in segmented markets. Du and Huber (2023) explore the hedging behavior of different types of investors holding US dollars around the world. Nathan and Zeev (2023) explore how hedging demand affects CIP deviations and Nathan and Zeev (2022) explore how global equity markets drive hedging demand.

In the context of home-currency bias, hedging is interesting in several dimensions. On the investor side, it is important to assess whether funds tend to hedge even those (relatively few) bonds that they do buy in foreign currency. For example, many developed sovereigns almost exclusively issue in their own currency (e.g. the US only issues in dollars) and the decision of buying that sovereign cannot be disentangled from the currency without separately trading derivatives. Second, in assessing whether the more active mutual funds use derivatives to actively trade currencies, funds may actually use derivatives to implement the carry trade rather than hedge currency risk. Sialm and Zhu (2021) provides evidence for both of these possibilities for US mutual funds.

On the firm side, an interesting question is whether the foreign currency issuance is unhedged, or whether it is operationally or financially hedged. Some larger corporations have started reporting

their hedging strategy and there is evidence for some specific countries (e.g. Alfaro et al. (2021) for Chile), but providing systematic evidence is an open research opportunity. One potential conjecture is that financial hedging is more likely in large developed currencies that have liquid derivatives markets while operational hedging is more likely in emerging market currencies. For example, a Euro Area corporation might issue in dollars and then hedge to capture a lower cost of capital, but that same corporation issuing in Brazilian Real (BRL) might instead be more likely to do so to finance a local operation in Brazil with BRL costs or BRL-linked assets.

5   Tax Havens, Nationality, and the Geography of Capital Allocation

One of the primary challenges of studying global capital allocation is confronting the role of tax havens.[22] Tax havens have long been a focus of research in public finance (see for instance Hines and Rice (1994), Desai et al. (2006), Hines (2010), Zucman (2015), Dharmapala and Hines Jr (2009)) but only became a focus for research in international macroeconomics more recently. Lane and Milesi-Ferretti (2008) and Lane and Milesi-Ferretti (2011) highlight the important role that small offshore financial centers play in global bilateral investment patterns. More recently, there has been significant progress in understanding and adjusting for the role of these tax havens in international financial positions.[23]

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[22]Appendix Table A.III includes the list of countries considered a tax haven for the purpose of this chapter.

[23]An important step forward came from the Bank for International Settlements with their Debt Security Statistics. These data on international issuance provide the statistics on a residency and nationality basis.

Figure 11: The Role of Tax Havens in Global Capital Allocation, 2021
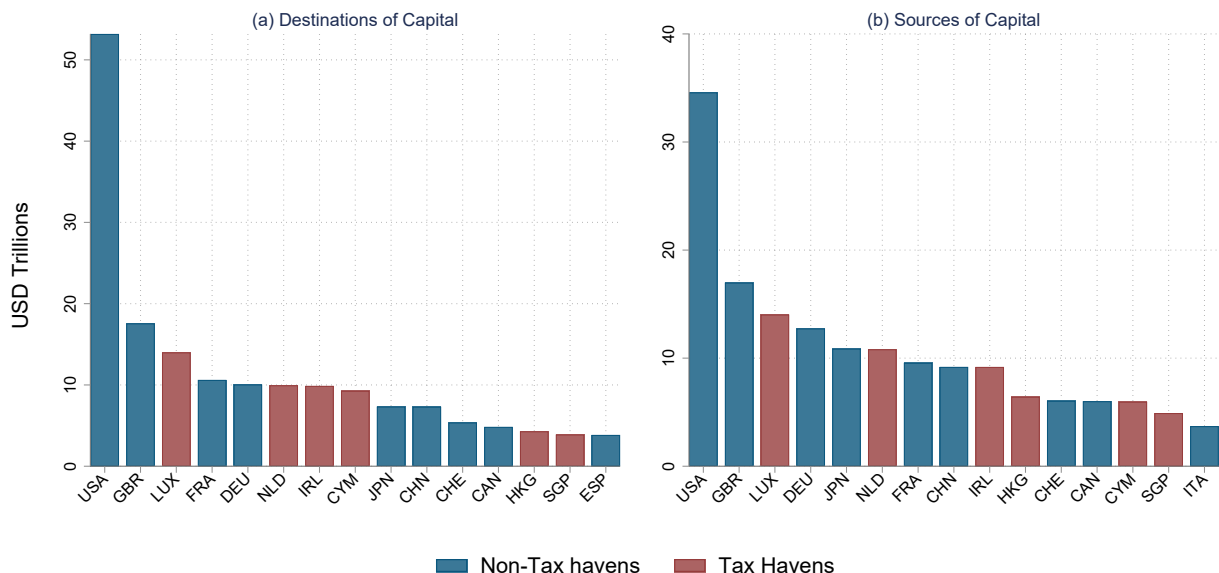
Notes: This figure shows the dollar value of total foreign assets (excluding gold) and total liabilities from the External Wealth of Nations dataset. Tax haven classifications follow Appendix Table A.III.

5.1   Tax Havens as Investment Destinations

In Figure 11, we combine data from each country's multilateral international investment position to illustrate the importance of tax havens as sources and destinations of cross-border investment. In panel (a) While the United States is the largest destination for investment followed by the UK, many of the next countries are tax havens such as Luxembourg, Ireland, and the Cayman Islands. Many of these destinations are recorded as receiving capital in amounts that far exceed any notion of domestic activity, so that it has long been clear to economists that the capital is just passing through to its ultimate destination.

To illustrate why so much cross-border investment is recorded as involving tax havens as destinations, it is useful to consider a concrete example: how the Brazilian oil-company Petrobras raises capital from foreign investors. Figure 12 illustrates the capital allocations for this example. One might have expected that Petrobras raised bond finance from foreign investors by selling bonds directly –i.e. as a Brazilian parent company– to foreign investors. In practice this is not the case. Crucially, however, this does not mean that Petrobras does not borrow from foreign investors. Instead, Petrobras operates a number of financing subsidiaries such as Petrobras International Finance Company (Pifco) in the Cayman Islands and Petrobras Global Finance in the Netherlands. When foreign investors purchase these bonds, they recognize that their meaningful economic exposure is

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to the Petrobras group. However, for the purposes of international financial statistics, a US investor owning a bond issued by Pifco is recorded as a portfolio debt investment with the Cayman Islands as destination. As we discussed in Section 2.2.1, this is because international financial statistics are recorded on a residency basis, whereby the geographic location of an activity is ascribed to the immediate counterparty (i.e. Pifco in the Caymans). Statistics that instead record economic activity according to the location of the parent or controlling entity (i.e. Petrobras parent company in Brazil) are instead referred to as nationality-based statistics.

Figure 12: How Petrobras Raises Capital From Foreign Investors
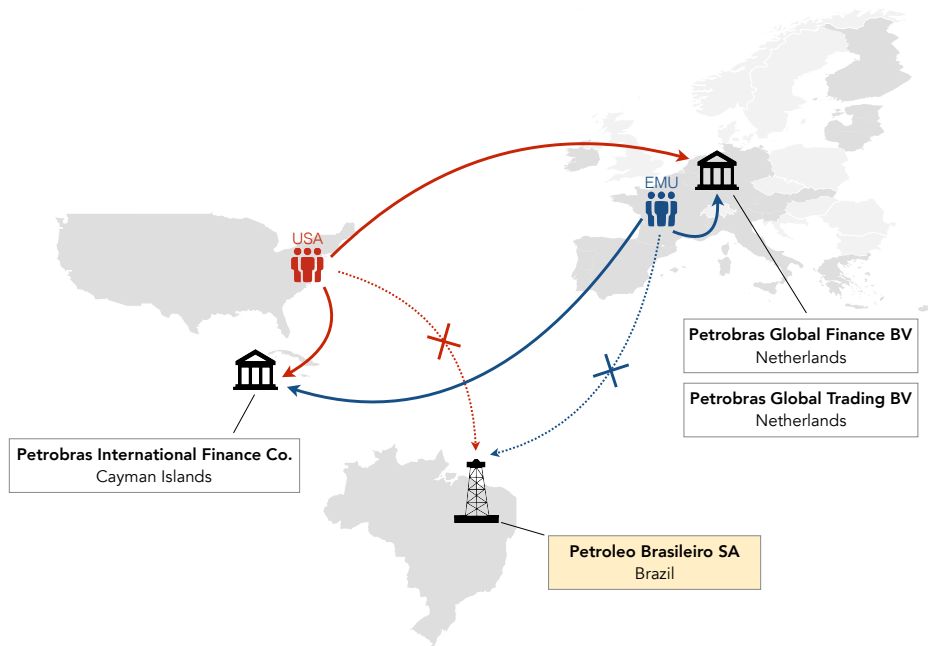
Notes: This figure provides a schematic representation of how Petrobras raises money from American and European investors via financing subsidiaries in the Cayman Islands and the Netherlands.

Coppola et al. (2021) undertake a systematic effort to restate global portfolio positions on a nationality basis, with a focus on looking through the role of global tax havens. In order to do so, they match every security to both its immediate issuer and the ultimate parent (and their respective countries), and use this to restate both the stock of securities outstanding (issuance) as well as micro-data on securities holdings for large developed countries.[24] They estimate the share of investment different countries make in every country around the world in each asset class that is reclassified as going to another country when moving from a residency to a nationality basis. The authors focus on providing restatements of countries' external investment positions reallocating tax

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[24]They use mutual fund and ETF positions for 9 large developed countries as well as US insurance company holdings, and positions of the Norwegian sovereign wealth fund.

haven resident investment. Abstracting from investor-specific heterogeneity conditional on investing in tax havens, Coppola et al. (2021) also provide a nationality-based restatement of global portfolio investment for all countries that report to CPIS with further breakdowns available for a subset of larger developed investors.[25]

In Figure 13, using data from 2020, we update two findings from Coppola et al. (2021) where looking through tax havens is particularly important. In panel (a), we plot the share of 9 countries' external bond portfolios that are allocated to the BRICS (Brazil, Russia, India, China and South Africa). The US share increases from approximately 1% to 6%, and other countries experience comparable increases. In the case of equity positions, reported in panel (b), the largest adjustment concerns China as a destination. The share of the US external position invested in China goes from around 3% to 13%, an increase of $850 billion. As discussed in detail in Coppola et al. (2021) and Clayton et al. (2023a), this massive adjustment for China arises because of the use by Chinese firms of the variable interest entity (VIE) structure. Chinese regulations forbid firms in sensitive industries, including much of the technology sector, from receiving foreign equity investment. Alibaba, Tencent, Baidu and other Chinese tech firms side-step these restrictions with a VIE structure that simultaneously allows the firms to sell equity claims on a Cayman Island based shell to foreign investors and tell Chinese regulators that the local companies in China only have domestic equity owners.

Nationality is not the only possible criterion that researchers can use to reallocate investments away from the residency criterion. Rather than relying on the binary classification of firms as belonging entirely to a single country, Coppola et al. (2021) also classify exposure to a country by scaling the investment position according to where a firm actually earns its revenue.[26] For some theoretical applications this revenue-based measure of exposure may be more relevant than either a residency or nationality approach. Figure 14 provides an example of the difference between the three statistical notions focusing on US portfolio investment toward China. While the residency-based US exposure to China is roughly constant as a share of investment, we see sharp increases in the nationality and sales-based measures.

Damgaard et al. (2019) undertake a related exercise for FDI statistics using the IMF CDIS data. They separate reported foreign direct investment into "Real FDI" and "Phantom FDI," where the latter indicates FDI into a shell company unlikely to undertake actual economic activity in the recorded geography. Then, using data from the OECD and Orbis, they assign Real FDI to geography of ultimate parents. There is currently no equivalent restatement of cross-border bank

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[25]Bertaut et al. (2019) provides a nationality adjustment of the US TIC data. Beck et al. (2023) provide a restatement for Euro Area countries using ECB SHS data. See also Aminadav and Papaioannou (2020) and Fonseca et al. (2022) on corporate control around the world.

[26]Consider, for example, US funds owning $100 in an American-resident firm that earns 50% of its revenue in the United States, 40% of its revenue in China, and 10% of its revenue in Canada. Under this sales-weighted portfolio measurement, one would consider US investors owning a position of $50 in the United States, $40 in China and $10 in Canada.

lending that reclassifies borrowers according to their ultimate parent.

Figure 13: Residency and Nationality: Examples

(a) Share of External Bond Portfolio in BRICS
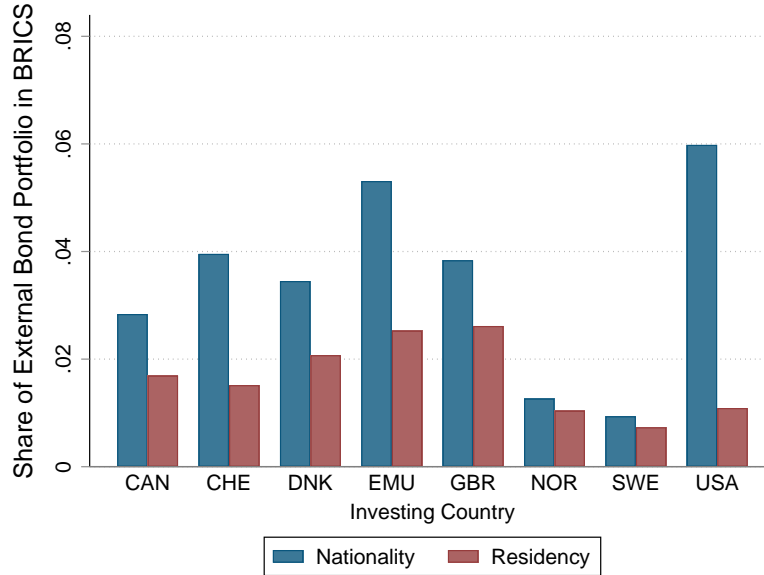
(b) Share of External Equity Portfolio in China
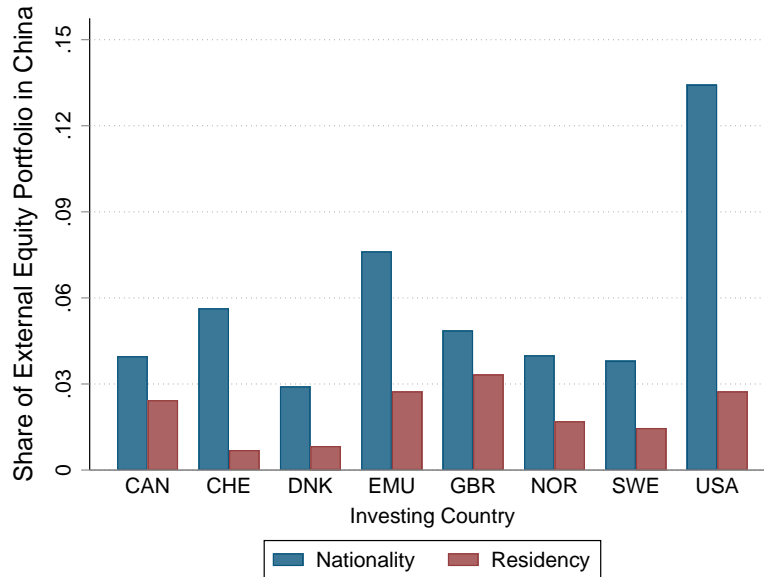
Notes: Figure (a) uses GCAP's restated TIC and CPIS data for each investing country to show the share of all external bond investments that are attributed to BRICS countries (Brazil, China, India, Russia, and South Africa) on a nationality basis and on a residency basis. Figure (b) uses this data to show the share of all external equity investments that are attributed to China on a nationality basis and on a residency basis. Both figures use the latest available year of 2020 and reallocate investment only from tax havens.

Figure 14: US Portfolio Equity Exposures to China
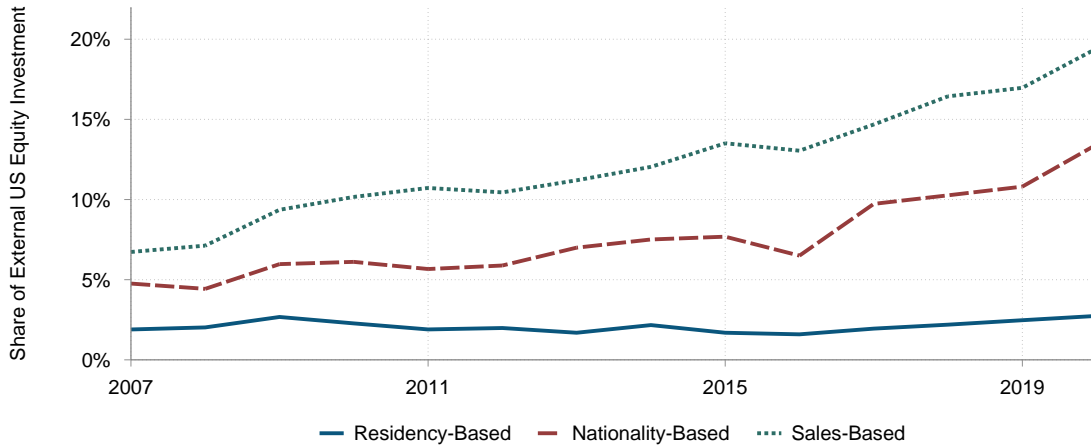
Notes: Based on TIC official data (blue line), our estimates of holdings of Chinese firms' securities by nationality based on holdings of US domiciled funds and insurance companies (red line), and our estimates of exposures to China in the holdings of US domiciled funds and insurance companies based on issuers' final sales (green line). Nationality estimates are constructed through mutual funds and insurance data as previously mentioned, and sales estimates constructed through Factset GeoRev data.

5.2 Tax Havens as a Source of Investment

The right panel of Figure 11 shows that tax havens also play a major role in international financial statistics as a source of capital. While the US is the largest source of cross-border investment, tax havens feature prominently as large holders of investments made all over the world. In the case of portfolio investment, much of this effect arises from the investment fund sector being headquartered in financial centers. Funds are considered the legal owners of the assets, so that, for example, all securities held by a mutual fund domiciled in Ireland are included in Irish portfolio investment assets. Ireland also reports a portfolio equity liability, corresponding to the fund shares held by foreign investors. An important question is who own the fund shares, i.e. who exactly are these funds invested on behalf of. Identifying these ultimate owners is an active research question with important implications for international macroeconomics and public finance.

5.2.1 Global Missing Wealth

If international investment statistics were recorded perfectly, the world's NFA would be zero, because every cross-border asset of one country would be recorded as a liability of another country. As shown in Figure 2 there are large imperfections and the world as a whole is a net debtor by approximately

$8 trillion dollars.[27] This "missing wealth" has been the focus of significant research. Zucman (2013) argues that the source of this discrepancy comes from hidden wealth in tax havens. The idea is that if, say, a German investor stashed money in Switzerland, and then used these funds to purchase an investment fund in Luxembourg that this would be missing from the asset side of countries international investment positions. The reason is that for balance of payment purposes, the Luxembourg fund is owned by a German-resident, not a Swiss resident. If Switzerland knows that the funds flowing through are not actually Swiss, they would not report owning the asset, but if the investor does not report this investment to German authorities, then they also won't report it. Luxembourg instead reports the liability, irrespective of which foreign investor holds it. This missing wealth is so large that Zucman (2013) argues that attributing it to Euro Area or US investors would meaningfully change these countries' NFA. Combining novel data from the Panama papers with cross-border investment statistics, Alstadsæter et al. (2018) estimate who owns the wealth in tax havens around the world.

More generally, reallocating the holdings of assets by tax haven countries to the countries of the ultimate investors is an open and challenging research area. Beck et al. (2023) combine the ECB Securities Holdings Statistics with the security-level holdings at the fund-level to re-allocate the investment positions of Luxembourg and Ireland to other Euro Area countries. To date, no comparable exercise has been undertaken yet for the Cayman Islands, Bermuda, or other small tax havens given data limitations.

6   Conclusions and Directions for Future Research

The literature on Global Capital Allocation has been growing over the past few years as the questions it studies have gained importance for global economic policy and datasets capable of answering them have became available. We conclude this chapter by highlighting a few directions for future research that we believe are particularly promising:

Investor Heterogeneity and Price Impact.   A particularly fruitful research avenue is likely to be analyzing the risk-taking of global financial intermediaries. For example, Morelli, Ottonello and Perez (2022) collect security-level data on global financial institutions holdings of emerging market debt and use an identification strategy based on exposure to Lehman's bankruptcy to show

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[27]We calculate missing wealth as global assets (excluding gold) minus global liabilities as measured in the External Wealth of Nations database. One could alternatively rely on official net international investment positions or exclude small financial centers under the idea that their NFAs should be balanced as they are financial pass-throughs (see Milesi-Ferretti (2022)). For the Cayman Islands, estimated liabilities in EWN vastly exceed assets. This could be partly because of the Chinese VIEs structures discussed in the previous section and could be partly driven by incomplete coverage.

that these institutions' financial constraints play an important role in determining asset prices in emerging markets. Using data on global mutual fund and insurance holdings, Coppola (2022) demonstrates that who owns global assets has an important causal effect on how these assets' prices behave in response to shocks. A particularly promising avenue for future research is to build on this approach using new administrative datasets, such as a SHS, that cover the universe of investment sectors across a geographic area.

The Nature of International Market Segmentation. Recent theories of exchange rate determination have emphasized segmented capital markets as an essential ingredient. Lustig and Verdelhan (2016) document the challenges that incomplete market models, without segmentation, have in resolving exchange rate puzzles. However, while the theoretical literature has emphasized the promise, and perhaps even the necessity, of segmented markets, we are still far from understanding the exact nature of segmentation and its causes.[28] Consider for instance the home currency bias reviewed in Section 4.3: while we reviewed the evidence that bond markets are segmented by currency, we did not present any evidence on its underlying root causes. The patterns in the data could be consistent with heterogeneous preferences, behavioral biases, financial frictions, or regulation. Similarly, models such Gabaix and Maggiori (2015) rely on the importance of an intermediary bridging the currency markets, but little is known about precisely who the relevant intermediary is or how to observe its actual portfolio in the data. As this class of models is becoming used for policy analysis (see Basu et al. (2020), Adrian et al. (2020). and Adrian et al. (2022)), utilizing data on global portfolio positions to discipline the models is likely to be a fruitful area of research.[29]

China's Role in the International Financial System. Horn et al. (2021) and Dreher et al. (2022) document a striking rise in the importance of Chinese state-owned banks in cross-border bank lending to low-income countries. While official data on these investments is hard to come by, the project-level loan dataset compiled by AidData offers interesting insights into the nature of Chinese cross-border lending. As China's role as a global creditor via the Belt and Road Initiative and other lending program grows, and as more countries indebted to China enter debt distress, understanding how this new bilateral creditor interacts with other investors around the world is a promising direction for research. Bahaj and Reis (2020) explore how the introduction of a network of central bank swap lines served to jumpstart the international use of the Chinese renminbi. Clayton et al. (2022) explore how China staggered the entry of different types of foreign investors as it

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[28]Hau and Rey (2006) investigate the effect of market segmentation and portfolio rebalancing on asset prices and exchange rates. To identify the effect of portfolio rebalancing on asset prices and exchange rates, Raddatz et al. (2017) and Williams (2018) use index rebalancing and Camanho et al. (2022) use granular instrumental variables and mutual fund positions.

[29]See Maggiori (2022) for a review of the class of models and further suggestions on taking them to the data and Lilley et al. (2022) for a reduced form analysis of the relationship between financial flows and exchange rates.

attempts to gain credibility for renminbi-denominated bonds a store of value. As China's role as a global lender potentially puts it in conflict with the United States and global institutions like the IMF and World bank, there is a need to better understand the geopolitical role of international investment (Clayton et al. (2023b), Clayton et al. (2024)).

Real Effects of Tax Havens   We have emphasized the role that tax havens play in distorting global financial statistics, but little is presently known about the role that these tax havens play in distorting actual global capital allocation. While understanding where capital flows is important in and of itself for researchers and practitioners, one important step is to make progress on the crucial question of whether restricting the ability of tax havens to operate would change which firms access capital.[30]   Fundamentally, this is an exercise that involves a policy counterfactual and so progress is likely to be made by combining the sorts of data discussed in this paper with a model capable of capturing the key forces at play.

As ever-richer sources of micro-data become available and researchers continue to improve international macro-finance models capable of capturing the full network of international investment positions, the above are but a few of the important research questions that we believe can be addressed in the coming years.

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[30]Suárez Serrato (2018) explores the real effects of eliminating the ability of mainland United States firms from shifting profits to Puerto Rico.

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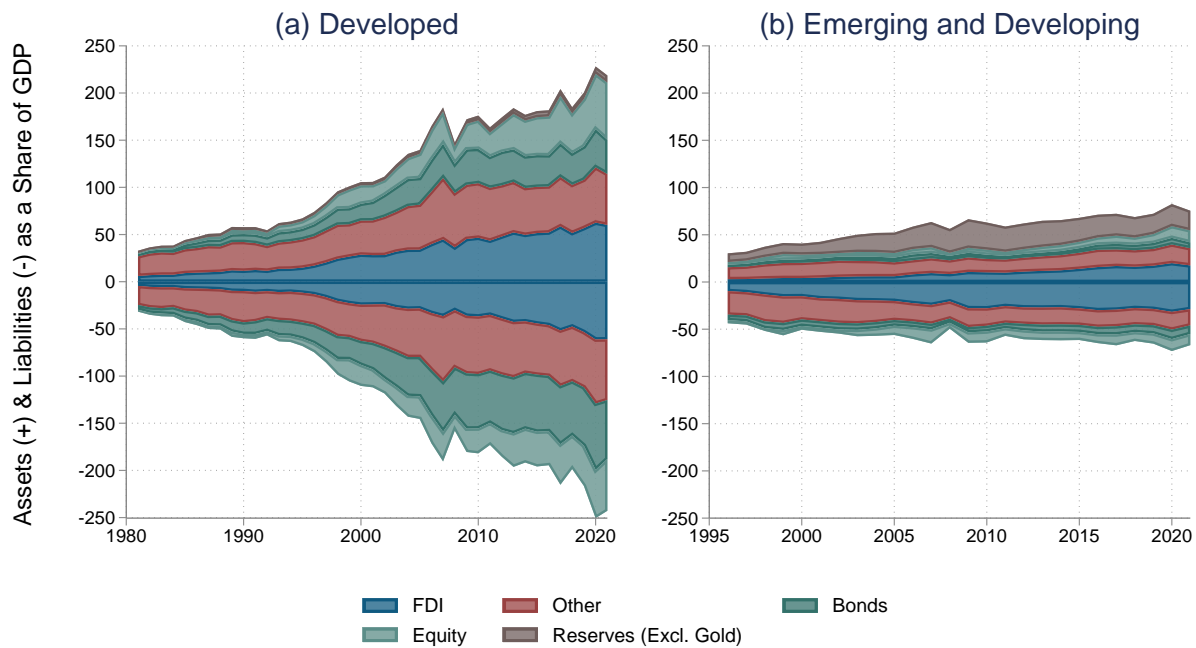
Sergio Florez-Orrego   Matteo Maggiori   Jesse Schreger
Ziwen Sun   Serdil Tnda

August 2023

A   The Components of Cross-Border Investment

Figure A.I: Breakdown of cross-border investments as a share of GDP

Notes: This figure shows the breakdown of cross-border investment into its IIP components as a share of the GDP for the group of Developed Markets (DM) and Emerging and Developing Markets (EM-DEV). Source: the External Wealth of Nations database. The positive (negative) region of the vertical axis shows asset (liability) breakdown. Panel (b) starts in 1995 due to missing information on components breakdown for a subset of important economies before this date. Table A.I provides the list of countries in each group.

Figure A.II: Breakdown of cross-border investments, USA vs. CHN
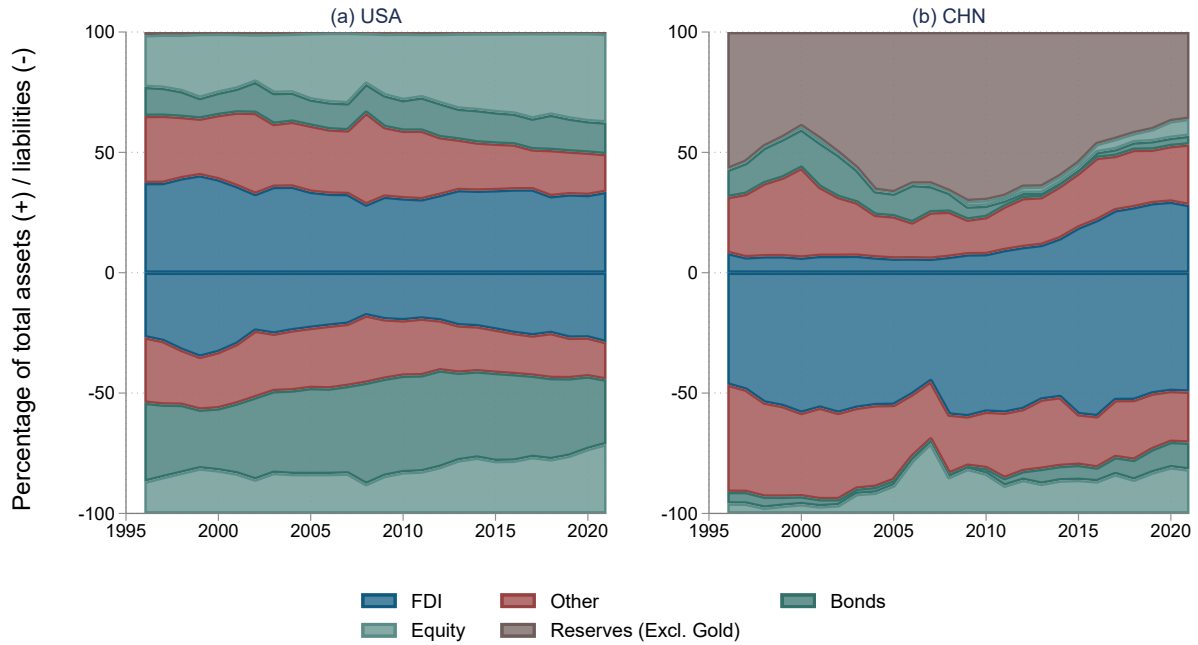
Notes: This figure shows the breakdown of cross-border investment into its component asset classes for the USA and China, using the External Wealth of Nations database. The positive (negative) region of the vertical axis shows asset (liability) breakdown. Figure starts in 1995, as cross-border investment breakdown is not available for China prior to this year.

Table A.I: Countries Included in Cross-Border Components Analysis

Developed	Brunei Darussalam	India	Paraguay
Australia	Bulgaria	Indonesia	Peru
Austria	Burkina Faso	Iran	Philippines
Belgium	Burundi	Iraq	Poland
Canada	Cambodia	Israel	Qatar
Czech Republic	Cameroon	Jamaica	Romania
Denmark	Cape Verde	Kazakhstan	Russia
Finland	Central African Rep.	Kenya	Rwanda
France	Chad	Kiribati	Saudi Arabia
Germany	Chile	Korea	Senegal
Greece	China	Kuwait	Serbia
Iceland	Colombia	Kyrgyz Republic	Sierra Leone
Italy	Comoros	Laos	Sint Maarten
Japan	Dem. Rep. of Congo	Latvia	Solomon Islands
New Zealand	Republic of Congo	Lesotho	Somalia
Norway	Croatia	Libya	South Africa
Portugal	Côte d'Ivoire	Lithuania	South Sudan
Slovak Republic	Dominican Republic	Madagascar	Sri Lanka
Slovenia	Ecuador	Malawi	Sudan
Spain	Egypt	Malaysia	Suriname
Sweden	El Salvador	Mali	Syria
Switzerland	Equatorial Guinea	Mauritania	Taiwan
United Kingdom	Eritrea	Mexico	Tajikistan
United States	Estonia	Moldova	Tanzania
Emerging and Developing	Eswatini	Mongolia	Thailand
Afghanistan	Ethiopia	Montenegro	Timor-Leste
Albania	Faroe Islands	Morocco	Togo
Algeria	Fiji	Mozambique	Trinidad and Tobago
Angola	French Polynesia	Myanmar	Tunisia
Argentina	Gabon	Namibia	Turkey
Armenia	Gambia	Nepal	Turkmenistan
Azerbaijan	Georgia	New Caledonia	Tuvalu
Bangladesh	Ghana	Nicaragua	Uganda
Belarus	Guatemala	Niger	Ukraine
Benin	Guinea	Nigeria	United Arab Emirates
Bhutan	Guinea-Bissau	North Macedonia	Uruguay
Bolivia	Guyana	Oman	Uzbekistan
Bosnia and Herzegovina	Haiti	Pakistan	Venezuela
Botswana	Honduras	Palau	Vietnam
Brazil	Hungary	Papua New Guinea	Yemen

B   Sectoral Heterogeneity in Home Currency Bias

Table A.II analyzes home currency bias by estimating regressions as in Equation 1 for the sum of US mutual funds and insurers ("Pooled") and then for each of the two U.S. sectors of holder separately. The first three columns use ultimate parent firm fixed effects and bond level controls (as in the main-text) and the last three columns drop the fixed effects and controls. The first three columns provide strong evidence of home currency bias across sectors using only within-firm variation. The last three columns drop the fixed effects in order to facilitate comparison of the magnitude of home currency bias across the sectors, and thus include potential compositional effects. Since the constant in these latter specifications is the estimated average share of the holdings data of non-USD denominated assets owned by each sector, we observe that U.S. mutual funds account for a much larger share of foreign currency debt than do insurance companies. By comparing the estimated β to the constant, we observe that insurance companies display much stronger home currency bias than do mutual funds, even though mutual funds also display very strong home currency bias themselves.

Table A.II: Home Currency Bias by US Sectors, 2020

	Pooled	Mutual Funds	Insurers	Pooled	Mutual Funds	Insurers
Currency	0.690***	0.417***	0.274***	0.763***	0.345***	0.417***
	(0.014)	(0.013)	(0.015)	(0.012)	(0.012)	(0.010)
Constant				0.082***	0.074***	0.008***
				(0.011)	(0.011)	(0.001)
Obs.	31,266	31,266	31,266	31,266	31,266	31,266
# of Firms	3,201	3,201	3,201	3,201	3,201	3,201
R^2	0.894	0.645	0.736	0.785	0.323	0.322
Firm FE	Yes	Yes	Yes	No	No	No
Controls	Yes	Yes	Yes	No	No	No

Notes: This table reports estimates of the regression in Equation 1, similar to Maggiori et al. (2020), but in this case for US mutual fund and insurance holder sectors. The dependent variable is the share of each security (at the CUSIP 9-digit level) bought by each sector in our sample: $s_{j,p,c}$. Fist three columns include fixed effects at the ultimate-parent firm level. Controls include maturity and coupon bins. Pooled columns use the sum of mutual fund and insurance data. Standard errors in parentheses are clustered at the ultimate-parent firm level. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

C   Tax Havens and Offshore Financial Centers

Table A.III: List of Tax Havens and Offshore Financial Centers

Andorra	Cyprus	Liechtenstein	Panama
Anguilla	Djibouti	Luxembourg	Saint Kitts and Nevis
Antigua and Barbuda	Dominica	Macao	Saint Lucia
Aruba	Gibraltar	Maldives	Saint Martin
Bahamas	Grenada	Malta	Saint Vincent and the Grenadines
Bahrain	Guernsey	Marshall Islands	Samoa
Barbados	Hong Kong	Mauritius	San Marino
Belize	Ireland	Micronesia	Seychelles
Bermuda	Isle of Man	Monaco	Singapore
Cayman Islands	Jersey	Montserrat	Tonga
Cook Islands	Jordan	Nauru	Turks and Caicos Islands
Costa Rica	Lebanon	Netherlands	Vanuatu
Curaçao	Liberia	Niue	Virgin British Islands