Redrawing the Map of Global Capital Flows: The Role of Cross-Border Financing and Tax Havens

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Abstract

Global firms finance themselves through foreign subsidiaries, often shell companies in tax havens, which obscures their nationality in aggregate statistics. We associate the universe of traded securities with their issuer's ultimate parent and restate bilateral investment positions to better reflect the true financial linkages connecting countries around the world. We find that private capital flows from developed countries to firms in large emerging markets are dramatically larger than previously thought. The national accounts of the United States, for example, understate the U.S. position in Chinese firms by nearly $600 billion, while China's net credit position to the rest of the world may be half as large as is officially reported. We additionally show how taking account of offshore issuance is important for our understanding of the currency composition of external liabilities, the nature of foreign direct investment, and the growth of financial globalization.

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Global firms often access capital markets by issuing securities through cross-border affiliates. For example, due to the incentive to minimize taxes and withholding, to avoid capital controls and other regulations, and to access different investors, the corporate sector globally raises nearly 8 percent of its equity and 10 percent of its bond financing via foreign subsidiaries located in tax havens. Standard national and international statistics associate such offshore securities with the location of the issuing affiliates, rather than the country of their ultimate parents, so they offer a highly distorted view of global portfolios.

In this paper, we combine a new algorithm that matches foreign subsidiaries to their parents with a security-level dataset on global fund holdings and restate bilateral investment positions to reflect the true financial linkages across countries. We find that the scale of private capital flows from developed countries to emerging market companies is vastly understated when foreign issuance is not taken into account. Further, we demonstrate how the pervasive use of corporate subsidiaries to raise money overseas is important for assessing the scale of global imbalances, the currency composition of emerging markets' external liabilities, the nature of foreign direct investment (FDI), and the growth of financial globalization.

We start by developing an algorithm that combines information from seven main commercial sources to associate subsidiaries with their ultimate parent firm and with their ultimate parent firm's country. Each source uses its own methodology to form these matches and to assign firms to particular countries, and we establish majority and priority rules to resolve disagreements across sources. Further, our procedure compares and combines the different sources in a way that leaves the integrated data more useful for our purposes than the sum of its parts.[1] Our final dataset covers the universe of traded securities – bonds and equities – globally. Our algorithm is transparent, replicable, adaptable, and is available online for download and use.[2]

Next, we introduce this subsidiary-parent mapping into the dataset of global mutual fund and exchange traded fund (ETF) holdings provided by Morningstar and assembled in Maggiori, Neiman and Schreger (2019a, henceforth MNS). For each position in the data, we establish the residency (the country of incorporation) of the security's immediate issuer and, using our mapping, can also link the security to its ultimate parent issuer. For example,

[1] For example, consider the corporate ownership chain for China National Petroleum Corporation (CNPC), which has two subsidiaries in Bermuda with names that are variants of "Kunlun Energy Company." One of our data sources links the two subsidiaries to each other but not to the parent, while another of our sources only links one of the two subsidiaries to CNPC. Only when combining both sources, therefore, can we link all three entities and associate all the relevant Bermudian securities with China.

[2] See https://www.globalcapitalallocation.com/data.

in the Morningstar data, we observe billions of dollars of U.S. holdings of securities issued by Petrobras International Finance Company (PIFCO), a Cayman Islands-based subsidiary of Brazil's largest energy company. Most international financial statistics are reported on a "residency" basis, associating securities with the location of their immediate issuer, so they record these positions as U.S. investments in the financial sector of the Cayman Islands. Merging our mapping with the Morningstar holdings data, we can instead classify these positions as U.S. investments in Brazil's energy sector, a treatment consistent with a "nationality" basis, which registers the country of the issuer's ultimate parent.

We record the country of the immediate issuer and ultimate parent for all positions in the Morningstar data and, for each asset class, build a set of "reallocation matrices" that characterize how to convert a dataset of bilateral investment positions from a residency to a nationality basis. For example, one entry in our reallocation matrix for U.S. corporate bond positions specifies that 13 percent of all U.S. holdings in the Cayman Islands on a residency basis should be considered U.S. holdings in Brazil on a nationality basis. The value of U.S. holdings of PIFCO bonds – the example discussed above – contributes to our calculation of this 13 percent.

We apply these reallocation matrices to two widely-used, publicly available, and residency-based datasets – the U.S. Treasury's International Capital (TIC) data and the IMF's Coordinated Portfolio Investment Survey (CPIS) data – to transform them into nationality-based bilateral positions.[3] For example, we multiply the value in TIC of overall U.S. holdings of Cayman Island corporate bonds by 13 percent to calculate the value of those bonds that should under nationality be considered to be Brazilian. TIC and CPIS cover the universe of security positions held by each country's investors, a superset of those in the Morningstar data. Therefore, our key assumption is that our reallocation matrices, which are constructed entirely from investments made by funds in the Morningstar data, are representative of the overall set of securities investments, including those not made by mutual funds and any mutual funds not in the Morningstar data. We find that this assumption is supported by the alignment of country portfolio shares in these datasets and the Morningstar data expressed under residency. Furthermore, mutual funds and ETFs are often the largest cross-border investors in securities in any country. We apply this procedure and report nationality-based bilateral investment positions for nine developed economies with high quality fund hold-

[3]TIC covers all foreign portfolio investments in securities made by U.S. residents and is used by the Bureau of Economic Analysis to calculate the U.S. Balance of Payments and International Investment Position. The CPIS dataset covers the foreign bilateral portfolio investments of a large number of other countries.

ing data: the United States., the European Monetary Union (EMU), Great Britain (U.K.), Canada, Switzerland, Australia, Sweden, Denmark, and Norway.

Our nationality-based statistics paint a vastly different picture of global investment patterns than the original residency-based data and we highlight four broad patterns. First, we report significantly larger portfolio investments from developed markets to emerging markets, with the difference primarily reflecting issuance in tax havens. For example, whereas the national statistics for 2017 list the United States as holding $160 billion in Chinese equities, we find the position to be worth about $700 billion. These positions are largely associated with Variable Interest Entities (VIEs), structures designed to avoid China's capital controls that restrict foreign ownership in key industries.[4] We report that U.S. investments in Brazilian corporate bonds equal $44 billion, much larger than the $8 billion position listed in TIC. EMU holdings of Russian debt triples from $35 billion in CPIS to $107 billion in our restated tables. Similar patterns are found for U.K. investment in emerging market securities. The value of developed country positions in Bermuda, the Cayman Islands, Ireland, Luxembourg, the Netherlands, and Panama plunge. The Lucas (1990) paradox famously noted the economically small North-to-South investments; our work provides a sizable upward revision in such investments in large emerging economies such as Brazil, Russia, India, and China.

Second, in our restated data, foreign-currency corporate bonds account for a greater share of flows from large developed countries to large emerging markets. For some emerging markets, nearly all of the corporate sector's debt financing from developed market investors is intermediated through subsidiaries in tax havens. Emerging market sovereigns, by contrast, issue externally under their own name. As a result, the standard residency-based datasets overstate the relative importance of sovereign bonds relative to corporate bonds. For example, according to TIC, U.S. investors hold three times more Brazilian government bonds than Brazilian corporate bonds. Our nationality-based statistics imply the corporate bond positions are in fact worth more than twice the positions in government bonds. TIC implies that corporate bonds account for none of the overall U.S. position in Russian bonds, whereas our nationality-based statistics imply they account for half of it. The greater weight of corporate debt on a nationality basis joint with the fact that external corporate debt is overwhelmingly in foreign currency (see Du and Schreger, 2015) leads to a marked increase in the foreign currency share of external portfolio liabilities of emerging economies. For ex-

[4]The Chinese internet giants Alibaba, Baidu, JD.com, and Tencent, for example, are all VIEs that raise capital through shell companies located in the Cayman Islands, the British Virgin Islands, or Hong Kong.

ample, switching from residency to nationality reduces the local currency share of external portfolio debt from 80 to 50 percent for Brazil and from about 70 to 40 percent for Russia.[5]

Third, we show that for some countries a substantial portion of foreign investment positions in the residency-based data should, under nationality, not be considered foreign investment at all. For the U.S., we find that 7 percent of all foreign equities and 12 percent of all foreign bonds in official statistics are actually domestic investment. For the U.K. the percentages are 2 and 4 for equity and debt, respectively. In the case of the U.S., there has been a surge in collateralized loan obligations (CLOs) that are backed by leveraged loans to U.S. companies and are held by U.S. investors, but are issued by Cayman Island subsidiaries of U.S. firms.[6] We estimate that more than $200 billion of U.S. foreign investment in asset backed securities resemble this setup and should therefore not be considered foreign investment. Similarly, as is well known, many U.S. companies are headquartered in Ireland to reduce their tax bill. We find that $300 billion of U.S. foreign equity positions in these Irish firms should, under nationality, no longer be considered foreign positions. Analyses of financial globalization that use residency-based data, and policies aiming to influence the extent of cross-border investment, must account for these cases of spurious foreign investment.

Fourth, we show that offshore issuances cause what would otherwise be portfolio flows to instead be classified as FDI and demonstrate how, as as result, China's reported net foreign asset (NFA) position is nearly twice as large as its true value. When foreign investors take small equity positions in a country's companies, these positions constitute a portfolio liability in the country's external statistics such as its balance of payments (BoP) and international investment position (IIP). By contrast, if those foreign investors buy shares in offshore affiliates that themselves have a majority stake in a country's companies, then the affiliates' positions constitute an FDI liability in the country's BoP and IIP. Whereas portfolio liabilities are marked to market, FDI liabilities, far more often, are not. Consistent with this possibility, we demonstrate that during 2017, when China's offshore listed companies increased in market value by nearly $1 trillion, China's FDI liabilities barely moved. As a result, our analysis suggests that China's true NFA position is $1 trillion smaller than the $2.1 trllions officially reported.[7]

[5] On measuring foreign currency exposures, see also Eichengreen and Hausmann (1999), Eichengreen and Hausmann (2005), Lane and Shambaugh (2010), and Bénétrix et al. (2015). This literature is based on statistics under the residency principle.

[6] See Liu and Schmidt-Eisenlohr (2019) for a detailed description.

[7] This pattern of portfolio flows being masked as FDI flows due to offshore issuance likely holds around the world, not just in China, a possibility suggested in Blanchard and Acalin (2016). The potential mis-

This large reduction in China's net creditor position – one of the world's largest – is of first order importance for both policymakers and academics. A large literature has emphasized how capital flows between the U.S. and China only go in one direction, namely official Chinese purchases of U.S. treasury bonds. Our work highlights the comparable scale and under-appreciated importance of flows in the other direction, namely private U.S. holdings of Chinese corporate securities. Our estimates strengthen the view of the United States as a world banker of Despres et al. (1966).

Academic researchers cannot on their own simply adjust TIC or CPIS data from a residency to a nationality basis without our reallocation matrices because the underlying security-level data for such datasets are rarely accessible to outside researchers. This is the case, for example, for TIC. Further, many datasets in international macroeconomics are not even collected at the security (or even issuer) level, but are instead based on aggregate reporting by financial institutions. This is the case, for example, for data on many countries in CPIS, which are based on surveys run by the IMF. Our algorithm allows users to entertain different assumptions when adjusting residency-based datasets. For example, researchers or policymakers might be focused on tax havens per se, and therefore would only wish to reallocate positions away from countries like the British Virgin Islands or Guernsey. Others might focus on the issue of corporate control and would therefore also wish to treat issuances from Toyota Motors North America as Japanese securities (since the parent company, Toyota, is Japanese). Our procedure allows the flexibility to consider both exercises, and we present results from both treatments below.[8]

Our paper proceeds as follows. Section 1 presents our algorithm for matching parents and subsidiaries and details how we apply this subsidiary-parent mapping to security-level data on fund holdings. Section 2 then reports restated TIC and CPIS data under nationality, detailing the major differences and exploring key implications. Section 3 demonstrates how, due to offshore issuance, China's NFA is overstated in the official statistics. Finally, Section 4 concludes.

classification of portfolio and FDI flows carries important policy implications as countries often differentially regulate these flows based on the presumption they should exhibit very different dynamic behavior.

[8]The set of activities that one wishes to reallocate depends, of course, on the question at hand and on corporations' rationales for issuing offshore. Appendix Section B details the primary motivations and offers examples for each corresponding case. See also Fuertes and Serena (2016), who investigate how firms choose in which international markets to borrow.

Related Literature. The shortcoming of residency-based statistics has long been recognized and initiatives have been recently introduced at the Bank for International Statistics (BIS), the U.S. Federal Reserve, and the IMF to restate various investment flows on a nationality basis. Lane and Milesi-Ferretti (2018) and Avdjiev et al. (2018), for example, highlight the growing importance of tax havens in intermediating global capital flows, which renders standard datasets increasingly inadequate. Bertaut, Bressler and Curcuru (2019) offer a rich comparison of U.S. TIC data under residency and nationality and explore implications for home bias and the sustainability of the U.S. current account deficit. Damgaard, Elkjaer and Johannesen (2019) estimate FDI flows in the Coordinated Direct Investment Dataset (CDIS) once positions in tax havens are unwound. Our contribution is to offer a global analysis of portfolio flows for multiple countries and under different scenarios. Our approach stresses replicability for other researchers and open availability of code and data.[9] We aim to contribute a novel set of tools and analysis for others in the field to build on.

The implications of our restated bilateral investment positions touch a wide range of literatures and obviously have relevance for any analyses using TIC or CPIS data. For example, a voluminous literature uses gravity models to study these data including Portes and Rey (2005), Coeurdacier and Martin (2009), and Okawa and Van Wincoop (2012). Lucas (1990), Gourinchas and Jeanne (2013), and Alfaro et al. (2008) focus on the puzzling behavior of North-to-South capital flows. Most recently, Koijen and Yogo (2019) use CPIS data to estimate a demand system for financial assets across 36 countries.

Our result that offshore issuance leads to a massive overstatement of China's NFA is important for work on global imbalances, such as Bernanke (2005), Gourinchas and Rey (2007), Caballero et al. (2008), Gourinchas et al. (2011), Maggiori (2017), and Farhi and Maggiori (2018). While much of the focus in the literature has been on the impact on U.S. interest rates of large Chinese holdings of U.S. treasuries, we focus on the distribution of China's external corporate borrowing. This complements recent efforts to better document the global distribution of China's foreign lending by Horn, Reinhart and Trebesch (2019).

Finally, our paper contributes to a growing literature on the economic impact of tax havens, including Hines and Rice (1994), Desai et al. (2004), Gravelle (2009), Zucman (2013), Guvenen et al. (2018), and Tørsløv, Wier and Zucman (2018). Much of the previous literature

[9] All data sources we use are available for other researchers to purchase commercially from the data providers. Our code is available online and runs even if provided with only a subset of the commercial datasets we draw from. Additionally, we post aggregate statistics produced by our algorithm, subject to restrictions from data providers.

has focused on the use of tax havens by developed market firms to minimize corporate taxes. Our results emphasize their use by emerging market firms to access developed market capital.

1 Building the Reallocation Matrices

To unwind the impact of offshore issuance on bilateral investment positions, we develop investor-specific "reallocation matrices" that list the share of investment in any given country on a residency basis that should instead be considered investment in any other country on a nationality basis. In this section, we discuss how we combine publicly available aggregate data and commercially available micro data to generate these matrices, and we list examples of the specific corporate reallocations that underlie them. We consider this parent-matching algorithm a valuable contribution of interest for many applications, but in the interest of brevity we only provide here a brief overview. We provide full details in Appendix Section A, and our full code can be downloaded from globalcapitalallocation.com.

1.1 Corporate Ownership Chains

The units of observation in our analysis are security-issuing entities, such as governments and firms, and the securities that they issue. We uniquely identify issuers using CUSIP codes, which are issued and managed by CUSIP Global Services (CGS). CGS assigns a 9-digit identifier (the "CUSIP9") to the vast majority of securities issued globally, including equities and sovereign and corporate bonds, where the first 6-digits (the "CUSIP6") identify the issuer.[10] We work with the full $26,027,455$ securities present in CGS's CUSIP master file.

We combine information from seven commercially available data sources: (i) the CGS Associated Issuer (AI) database, (ii) the Refinitiv SDC Platinum New Issues database (SDC), (iii) the S&P Capital IQ platform (CIQ), (iv) the Dealogic Debt Capital Markets (DCM) feed, (v) Bureau van Dijk's Orbis database, (vi) the Factset Data Management Solutions database, and (vii) the Morningstar holdings sample of open-end mutual funds and ETFs. The sources

[10] For securities by issuers resident outside of the United States and Canada, the security codes assigned by CGS are formally known as CGS International Numbering System (CINS) codes, and follow the same structure as the CUSIP codes issued in the United States and Canada. For simplicity, we thus also refer to the CINS codes as CUSIP codes. There are securities that do not have a CUSIP, but might have an alternative identifier such as an ISIN or a FIGI. We hope in future work to include these cases.

cover overlapping but differentiated sets of issuers and contain information linking them to their ultimate parents or parents' geographies. CGS provides information on the residency, i.e. the place of incorporation of the immediate issuer, of every CUSIP-bearing security globally, which we use to calculate statistics on a residency basis.

We start by constructing mappings of issuers to their ultimate parents or operational headquarters, i.e. links of one CUSIP6 to another, for each of our data sources. For those sources listing ownership stakes, we consider an entity to be a parent if it owns more than 50 percent of the equity of the subsidiary. Next, we merge these mappings across data sources to develop integrated ownership chains, adopting various priority and majority rules to resolve any conflicts across sources. Throughout, we avoid reassigning ownership away from countries that are not tax havens and toward those countries that are tax havens, in order to avoid assigning ownership to shell holding companies. After all, little or no economic activity takes place in tax havens compared to the size of most security issuances.[11]

Table A.1 lists the countries that we consider to be tax havens. Our list is based on the European Council's grey and black lists of non-cooperative tax jurisdictions, as of May 2018 (European Council, 2019), and the main modifications we impliment are that we remove Switzerland and add Luxembourg, the Netherlands, and Ireland to the list.[12] There is no universal agreement on which countries are tax havens, and importantly the definition changes depending on the specific activity of interest. Our focus on securities issuance leads us to include Luxembourg, the Netherlands, and Ireland because issuance in these countries is dominated by local subsidiaries of multinational corporations which are set-up for the sole purpose of securities' issuance. We show that this pattern is very similar to that occuring in other tax havens such as Bermuda or the Cayman Islands. Under the same rationale, we exclude Switzerland from the list of tax havens because issuance there is dominated by domestic firms.[13]

[11] For example, suppose company A, headquartered in Italy, owns 51 percent of an issuing subsidiary B in Bermuda, and is in turn owned by a company C incorporated in the Cayman Islands. We would associate B and C with Italy on a nationality basis, not with the Cayman Islands or Bermuda.

[12] As detailed in the Appendix, we also make minor modifications by excluding a number of small countries that have a significant non-financial domestic sector and are not destinations of offshore securities issuance and include a number of offshore centers that, while very small, are routinely classified as tax havens (see for example Ernst & Young 2016 or Figuera & Lima Advogados 2019).

[13] Since firms that are truly headquartered and operating in Hong Kong and Luxembourg are also likely to account for a significant portion of local security issuance, we treat these cases differently. We compile a list of the largest firms headquartered and operating in Hong Kong and Luxembourg, and which do not have a foreign ultimate parent, based on the Factset dataset. Whenever a reallocation involves firms on these lists or their subsidiaries, we do not treat Hong Kong and Luxembourg as a tax haven.

Though most of the tax havens listed in Table A.1 are small countries that account for tiny shares of world GDP, issuance in tax-haven-resident affiliates accounts for a large and growing share of the overall financing of corporations around the world. The blue line in the top panel of Figure 1 shows that, by 2017, bonds issued by firms resident in tax havens account for 10 percent of the total value of corporate bond outstanding worldwide. The red dashed line demonstrates a similar scale for equities, with roughly 8 percent of all global equity outstanding resident in tax havens. Both lines exhibit mild upward trends over the past decade. The bottom panel of Figure 1 expresses the value of tax-haven-based corporate bonds relative to total cross-border bonds outstanding, where we now exclude domestic corporate bonds such as when the U.S. automaker General Motors issues a bond resident in the United States. The level of the lines is, by construction, higher, but the trend is also steeper showing that tax havens account for a growing share of cross-border corporate financing.

1.2 Firm-level Reallocations

Our algorithm described above generates a database that maps each CUSIP6 into the CUSIP6 of its ultimate parent or operational headquarters. Table 1 lists the issuer-parent mappings that constitute the largest reallocations away from key tax havens when we change from a residency to a nationality basis.[14] For example, the top row of Panel A shows that Vale SA, a Brazilian mining and logistics company, has a subsidiary called Vale Overseas Ltd. with a CUSIP6 of 91911T that is resident in the Cayman Islands. Using data from Factset and Bloomberg, we calculate that this latter entity issues $12.3 billion of bonds which, using our database, we instead associate with the Brazilian ultimate parent company. We emphasize that Vale might have multiple subsidiaries in the Cayman Islands corresponding to multiple CUSIP6 values, so this is a lower bound on the value of reallocated bond positions from the Cayman Islands to Brazil that our algorithm identifies with Vale's offshore issuance. In the second row, we see a $10.3 billion reallocation of bonds issued by one of the subsidiaries of Alibaba, the Chinese online retail giant.

[14] We obtain notional amounts outstanding for debt securities from the Factset Debt Capital Structure (DCS) database. For certain bonds not covered by DCS, we used auxiliary data obtained separately from Factset or obtained the data from Bloomberg. We obtain the market value of all shares of equity outstanding using the Factset Fundamentals database for equities. We perform several robustness checks to make sure that we cover the universe of outstanding securities for each firm and provide additional details in the Appendix.

Panel B of Table 1 focuses on equities. The largest reallocations from the Cayman Islands are all Chinese companies, including reallocations for Tencent and Alibaba valued at $493 billion and $442 billion, respectively. As discussed above, these companies all issue offshore as part of the VIE structure designed to skirt China's restriction on foreign ownership in strategic industries. The largest reallocations from Ireland, at the bottom of Panel B, are predominantly U.S. firms such as Accenture or Medtronic that performed tax inversions to avoid paying U.S. corporate taxes on their worldwide profits. We explore VIEs and tax inversions, and their aggregated impact on global capital flows, in Sections 2 and 3.

Overall, we see an interesting mix of parent companies from China, Brazil, Japan, Russia, Switzerland, and United Arab Emirates, among others, in these large-scale reallocations. Our procedure successfully reallocates to the United States bonds issued by Weatherford International, an oil and gas services company with legal registration in Bermuda but with operational headquarters in Texas, and by Bermudian affiliates of Aircastle Ltd., a Connecticut-headquartered owner of commercial jets. IHS Markit is incorporated in Bermuda and is publicly listed in the United States on the Nasdaq, but our proceedure successfully reflects the fact that the firm's operations are based in London. We link to Switzerland the significant debt financing raised by UBS and Credit Suisse through special-purpose vehicles in Jersey and Guernsey, jointly referred to as the Channel Islands, to avoid Swiss witholding tax on interest payments (Reuters, 2016). We also associate with Switzerland the equity of Glencore, a multinational commodity trading and mining company that is headquartered in Baar, Switzerland, even though it is registered in Jersey. Similarly, we associate Shire PLC, which is registered in Jersey, with Japan because it was acquired by Takeda, a Japanese pharmaceuticals company.[15] The largest reallocation of corporate bonds from the Netherlands comes from Petrobras Global Finance BV, a debt-issuing vehicle for the Brazilian parent that performs no industrial activity. Similarly, we associate the debt issuance of Luxembourg-based funding vehicle GAZ Capital International Funding Company with Russia, the country of its parent firm Gazprom.

Our algorithm reassigns the vast majority of securities away from small tax havens since almost none of the economic activity behind these capital allocations takes place in those

[15]This highlights one limitation of our methodology: it discards any chronological information associated with the parent-subsidiary corporate links, effectively only retaining the latest information available from each data source. In this case Shire plc was only acquired by Takeda Pharmaceutical in 2019, but our methodology imposes this link for earlier years. The influence of this limitation is muted by the fact that many corporate ownership changes and mergers result in the firm receiving a new CUSIP, which obviates the issue.

countries.[16] We can also apply our algorithm to offshore affiliates located in non-tax haven countries, such as to restate the securities of Toyota Motor North America, which are U.S. securities under residency, as Japanese securities, which is the proper classification under nationality. Whether one wishes to include non-tax haven reallocations in the analysis depends of course on the question at hand. One benefit of our procedure is that it is flexible enough to accommodate either choice. In fact, our baseline results below are presented both for the case in which we only reallocate tax-haven issuances and for the broader case in which we restate all issuances on a nationality basis.

1.3 Calculating Reallocation Matrices

Thus far we have demonstrated how we can restate the value of securities outstanding from a residency to a nationality basis. If all investor countries held the same portfolio of offshore securities, i.e. if Americans and Canadians held the same portfolios of Cayman Islands securities, then this is all we would need to restate bilateral investment positions on a nationality basis. As we demonstrate below, however, investor portfolios are very different. We therefore need to integrate information about each country's portfolio holdings. Toward that end, we now describe how we merge the above parent-matching algorithm with security-level data on the worldwide holdings of mutual funds and ETFs, obtained from Morningstar and introduced in MNS.

The Morningstar dataset provides good coverage of worldwide mutual fund and ETF assets under management (AUM). For example, in December 2017 it includes 61,000 funds reporting over 11 million individual positions amounting to $32 trillion in AUM. MNS offers further details on these data and below we provide evidence supporting their suitability for this paper's purposes.[17] Following the approach in MNS, we also treat the domicile of each fund as reflecting the nationality of its investors. For most of our analysis, we follow MNS

[16] We reallocate more than 90 percent of corporate bonds and equities issued by firms resident in all of Bermuda, Curacao, the Cayman Islands, the Channel Islands, Luxembourg, Macau, Panama, and the British Virgin Islands. Hong Kong, Ireland, and the Netherlands have lower reallocation rates – ranging from 34 percent to 73 percent – since, as discussed, these countries are destinations for offshore issuance but also have significant domestic issuance by companies atually operating there.

[17] MNS confirmed the accuracy of these holdings data by cross-checking against funds' regulatory filings, funds' own websites, and other commercial data sources. Chen, Cohen and Gurun (2019) also confirm the accuracy of Morningstar's security-level holdings data, though they criticize the accuracy of the summary descriptions of fund portfolios reported to Morningstar. These latter summary descriptions are not used in MNS nor in this paper. See Maggiori, Neiman and Schreger (2019b) and Lilley, Maggiori, Neiman and Schreger (2019) for additional applications using these these and related data.

and restrict this sample to funds domiciled in countries with high quality holding data: the United States, the EMU, Great Britain, Canada, Switzerland, Australia, Sweden, Denmark, and Norway.[18]

We highlight two related features of tax haven investments that our paper does not tackle and that differentiate us from the existing literature. First, by focusing on mutual fund investment originating from ten large developed countries, we are not aiming to explain outward investment originating from tax havens.[19] Second, by equating the nationality of the investors with the domicile of the mutual funds, we are not studying phenomena of tax evasions and accumulation of illicit offshore bank accounts. For countries in the European Monetary Union, we follow MNS and make an exception to the assumption that only domestic residents invest in domestic mutual funds. We only consider the EMU as a block since, as detailed in MNS, mutual funds are concentrated in Luxembourg and Ireland, but collect investments from the rest of the countries in the European Union.[20]

The fund holdings data include all equity and bond positions at the CUSIP9 level, which we can use together with our CUSIP6-to-CUSIP6 issuer-to-parent matching to assess any fund's holdings both under residency and under nationality. We aggregate across all funds' positions and construct, for each investor country and asset class, reallocation matrices that determine the share of investment in each country on a residency basis that would be reallocated to all other countries on a nationality basis.

For a given asset class, let $x^{\mathcal{R}}_{i,j}$ denote the dollar value of holdings in the Morningstar data of investor country j in securities issued by country i on a residency basis.[21] Let $x^{\mathcal{R}\to\mathcal{N}}_{i,k,j}$

[18]Relative to MNS, we exclude New Zealand because the value of its key bilateral holdings, particularly its holdings of U.S. and German bonds, are redacted in CPIS.

[19]For example, hedge funds often register their master fund in a tax haven like the Cayman Islands. The master fund obtains money to manage from feeder funds registered onshore in the US and other countries. Master-feeder offshore structure also exists for some mutual funds, but are much less common than for hedge funds and not the subject of our analysis. In the Morningstar data we do observe mutual funds owning shares in other funds and ETFs. In these cases we unwind the cross-holdings and attribute all positions (in proportion) to the original fund. This procedure, for example, avoids double counting funds of funds holdings.

[20]MNS use the CPIS data to document that 72% of investment in Luxembourg mutual funds comes from other EMU countries. Research by the central bank of Luxembourg estimates that the percentage might be lower at around 54%. Similarly, Irish mutual funds may also invest on behalf of non EMU countries. In order to be consistent with CPIS and EMU national statistics, we count all investment by mutual funds in Ireland and Luxembourg as originating from EMU residents. Future research should attempt to better unwind non-EMU investments in funds domiciled in these countries.

[21]To save on notation, we do not index these values by asset class. Our analyses of TIC separately study equities, corporate bonds, government bonds, and other bonds (sovranationals and structured finance securities). CPIS reporting of separate investment positions in sovereign and corporate bonds is limited, so for CPIS we pool all debt securities and compute the reallocation matrices accordingly.

denote the dollar value of these same holdings that, on nationality rather than residency, would be associated with issuer country k rather than i, such that $x^{\mathcal{R}}_{i,j} = \sum_k x^{\mathcal{R}\to\mathcal{N}}_{i,k,j}$. We can then define an entry $\omega_{i,k,j}$ in our reallocation matrix for country j as:

$$\omega_{i,k,j} = \frac{x^{\mathcal{R}\to\mathcal{N}}_{i,k,j}}{x^{\mathcal{R}}_{i,j}}. \tag{1}$$

Collecting $\omega_{i,k,j}$ over all rows i and columns k, we have country j's reallocation matrix Ω_j:

$$\Omega_j = \begin{bmatrix} \omega_{1,1,j} & \omega_{1,2,j} & \omega_{1,3,j} & \dots \\ \omega_{2,1,j} & \omega_{2,2,j} & \omega_{2,3,j} & \dots \\ \omega_{3,1,j} & \omega_{3,2,j} & \omega_{3,3,j} & \dots \\ \vdots & \vdots & \vdots & \ddots \end{bmatrix}, \tag{2}$$

where each row of Ω_j sums to one.

As an example, Table 2 shows selected entries from the reallocation matrix for U.S. investments in corporate bonds.[22] The fifth row corresponds to the Cayman Islands (CYM) and each column shows the share of U.S. corporate bond holdings that under residency are in the Cayman Islands that would be allocated under nationality to the country listed atop that column. For example, 12.6 percent of U.S. corporate bond investments in the Cayman Islands are reallocated to Brazil, 20.7 percent to China, and 35.1 percent to the United States itself. The diagonal elements show the fraction of investments in each destination that are not reallocated elsewhere. Each row's values sum to 100 percent (for ease of reading, we only list non-zero entries).

Equipped with these reallocation matrices, we can transform bilateral positions in any dataset from a residency to a nationality basis. Let $q^{\mathcal{R}}_j = \left[q^{\mathcal{R}}_{1,j}, q^{\mathcal{R}}_{2,j}, \dots\right]'$ denote the vector of positions of country j in issuer country i, observed in a residency-based dataset, and let superscript $'$ denote the transpose operator. We can then transform these data to a nationality basis by pre-multiplying the residency-based vector by the transpose of the reallocation matrix:

$$q^{\mathcal{N}}_j = \Omega'_j q^{\mathcal{R}}_j, \tag{3}$$

[22] We make these matrices in their entirety available to other researchers for download at globalcapitalallocation.com. The data in CPIS do not generally distinguish corporate and government bonds, so our restatement of CPIS tables pool the two. We nonetheless post online reallocation matrices that are computed separately for corporate bonds, as they are of independent interest.

where $q_j^{\mathcal{N}} = \left[q_{1,j}^{\mathcal{N}}, q_{2,j}^{\mathcal{N}}, \ldots\right]'$ is the resulting estimate of nationality-based positions for that dataset.

As noted above, if all investment portfolios were the same, one would not need the Morningstar holdings data for this transformation to nationality-based positions. In that case, data on issuance, together with our subsidiary-parent mapping, would be sufficient to do the restatement. For example, 83 percent of all equity issuances in the Cayman Islands are from offshore affiliates of Chinese firms. If countries all held the identical Cayman Islands stocks, then one could simply reallocate 83 percent of each country's investment in Cayman Islands equities to China. In other words, holdings data are not required for the exercise if reallocation matrices are the same across countries because, by market clearing, a common reallocation matrix constructed from the value of total outstanding securities would be sufficient.

In fact, we find that the reallocation matrices are not very similar across countries. One reason these reallocation matrices are so different relates to an interesting phenomenon: investors tend to disproportionately hold securities issued by the tax-haven affiliates of their own domestic firms, what we refer to as "home-bias in tax havens." The blue bars in the top panel of Figure 2 report for each investor country the share of its corporate bond investment in tax havens that is, under nationality, reallocated to its domestic firms. The red bars report the share of investment from the rest of the world (RoW) into tax havens that gets reallocated to that country. The fact that the blue bars are uniformly larger than the red bars shows how investors disproportionately hold tax-haven-resident corporate bonds that are issued by parents based in their own countries.[23] The bottom panel of Figure 2 plots the same statistic for equities and shows an equally pervasive home-bias in tax havens. Issuance data alone, we conclude, is not sufficient to restate bilateral accounts by nationality.

2 A New Map of Global Capital Flows

In this section, we apply our reallocation matrices to residency-based data on bilateral investment positions and restate them on a nationality basis. We emphasize three broad changes in the resulting map of capital flows on a nationality basis. First, we find that the scale of lending by advanced economies to large emerging markets increases significantly.

[23] The plot does not directly compare the entries of Ω_j matrices because it reports an aggregation across all tax havens. The point nonetheless holds for individual tax havens like the Cayman Islands or Bermuda.

Second, corporate bond flows to emerging markets play a far more prominent role relative to government debt. Third, for the United States and United Kingdom, there is a large share of foreign investment that is instead reclassified as a domestic flow, what we refer to as "spurious foreign investment." More broadly, we discuss implications of our restated investment tables for the Lucas Paradox, for measurement of the currency composition of external liabilities, and for financial globalization.

2.1 Restatement of TIC and CPIS

Before analyzing the restated bilateral investment positions in TIC and CPIS, we note the implication from equation (3) that the quality of the restatement depends on the representativeness for those datasets of each entry $\omega_{i,k,j}$ in the Morningstar data. Intuitively, our exercise assumes that the share of country j's investment in country i under residency that switches to k under nationality in the mutual fund and ETF holding data is representative of country i's overall holdings, which also include other large investors such as insurance companies and hedge funds. While we cannot directly test this assumption, we demonstrate that a related condition holds, namely that bilateral country shares in outward investment under residency are similar when comparing the Morningstar data to TIC/CPIS.

Panels A and B of Figure 3 compare the outward bilateral U.S. portfolio shares in the TIC dataset in 2017 to those in the Morningstar data on a residency-basis, separately for corporate bonds and equities. TIC and Morningstar offer a similar picture of U.S. bilateral outward portfolio investments, with most data points close to the 45-degree line.[24] The close alignment between Morningstar and TIC bilateral investment shares is perhaps not surprising since mutual funds account for nearly half of all cross-border holdings observed in TIC. Panels C and D of Figure 3 show that the Morningstar and CPIS data on EMU investments are similarly aligned for the total of all bonds (since CPIS does not allow us to separate corporates from government bonds) and equities.

Tables 3 to 4 report key entries in our nationality-based restatements of TIC for U.S. positions in corporate bonds and equities and Tables 5 to 6 do so for CPIS data on EMU positions in total bonds and equities.[25] The first three columns in those tables list the in-

[24] We obtain corporate bond positions in TIC starting from private debt and then removing asset-backed securities. Equities in TIC include both common shares, fund shares, and holdings in other types of equity assets such as investment trusts. Our calculations focus only on common shares since for most destinations they account for the vast majority of holdings.

[25] The tables in their entirety for all nine investor countries and all available asset classes are available for

vestment destination country, its iso code, and the value of the corresponding position when stated under residency in TIC/CPIS. Columns four and five, labeled "Tax Haven Only," report nationality-based positions, and the change relative to the residency-based positions they imply, when we only reallocate investments made in tax havens. In calculating these values, we only use the rows of the reallocation matrices corresponding to tax havens. This treatment is of interest since almost all applications would benefit from the reallocation of capital investments away from these tax havens and toward the country of the tax-haven affiliate's ultimate parent or operational headquarters. Columns six and seven, labeled "Full Nationality," report positions when we reallocate all investments from residency to nationality, regardless of where they are made. In this case we use all rows of the reallocation matrices. This treatment is of interest, for example, if one wishes to consider the geography of the entity that has ultimate control of the investment, as would be captured, for example, when we reallocate bonds issued by Toyota Motor North America from the United States under residency to Japan under "Full Nationality."

In the "Full Nationality" case, not only do we reallocate foreign positions but also reallocate domestic positions, something we are able to do using the Morningstar data because it, unlike TIC and CPIS, includes both domestic and foreign positions.[26] We impute domestic investment by asset class in TIC/CPIS based on the ratio of domestic to foreign investment in the Morningstar data. Specifically, we calculate:

$$q^{\mathcal{R}}_{j,j} = \frac{x^{\mathcal{R}}_{j,j}}{\sum_{i \neq j} x^{\mathcal{R}}_{i,j}} \left(\sum_{i \neq j} q^{\mathcal{R}}_{i,j} \right). \tag{4}$$

Intuitively, we assume that mutual funds and ETFs in the Morningstar data have a similar share of domestic over total investments as do the universe of all investors covered in TIC and CPIS.[27]

download at www.globalcapitalallocation.com.

[26] For example, U.S. resident institutions are only required to report to TIC those positions that are cross-border on a residency basis. This means that investments by U.S. residents in securities issued by U.S. subsidiaries of foreign companies are not reported to TIC since on a residency basis they constitute domestic investments. Since the data is not reported to TIC, our procedure even if applied to the micro data in TIC would miss those reallocations.

[27] This assumption is clearly imperfect but for most countries it is also likely to be conservative since mutual funds and ETFs are perhaps more likely to invest abroad, thus leading to lower reallocations in our procedure. The appendix provides a sensitivity analysis for this imputation of domestic positions and offers more detail on our treatment of this issue for the EMU, which is more nuanced given that Luxembourg, Ireland, and the Netherlands are both tax havens and domiciles of mutual funds in our data.

2.2 North-to-South Flows are Much Larger

It has long been puzzling to economists that an advanced economy like the United States invests so little in rapidly growing emerging economies such as Brazil, China, India, and Russia (the "BRIC" countries). For example, the corresponding rows in Table 3 show that U.S. investments in corporate bonds under residency total a mere $8 billion in Brazil, $3 billion in China, $6 billion in India, and nearly zero in Russia. These positions are tiny compared to the $390 billion invested in Canada, the $548 billion in the EMU, the $326 billion in the UK, and even the $144 billion allocated to Australia. Overall, BRIC economies account for only 1.1 percent of all foreign corporate debt investments made by the United States in 2017 on a residency basis. Famously, Lucas (1990) called this type of pattern a paradox since simple neoclassical theory predicts that much more capital should flow to these fast-growing economies given their model-implied high marginal product of capital.

Table 3 shows that our reallocation has a notable impact on these low allocations to emerging economies. Our "Tax Haven Only" estimates raise investment from the United States to BRIC economies in corporate bonds from $17 to $99 billion, a 480 percent increase. The increase is broad-based with Brazil increasing from $8 to $44 billion, China from $3 to $37 billion, and Russia from $0.4 to $12 billion. Other large emerging markets also receive capital in the reallocation: U.S. corporate bond investment in South Africa jumps from $1 to $5 billion and Indonesia moves from $5 to $7 billion. The positions in tax havens correspondingly drop by hundreds of billions of dollars.

This large increase in corporate bond holdings in emerging markets is even stronger in our "Full Nationality" treatment. This occurs because emerging market companies also own subsidiaries in the United States that issue bonds to U.S. investors.[28] This dynamic is important for India and South Korea, which become much more prominent destinations for U.S. corporate bond investment under the "Full Nationality" treatment. Panel A of Figure 4 summarizes these reallocations with a scatterplot that compares the residency-based positions with restated positions using our "Full Nationality" treatment. Countries below the 45-degree line see their positions reduced and include the Cayman Islands, Luxembourg, and Bermuda, among others. Countries above the 45-degree lines are the major recipients of these reallocated positions and include a number of large developed countries such as Brazil, China, India, and Russia, among others.

[28] For example, JBS is a Brazilian meat processing multinational that issues bonds to U.S. investors through its U.S. subsidiary.

Table 4 focuses on equity reallocations in TIC and highlights a large and concentrated pattern. In the TIC data, the United States holds $547 billion of common equities in the Cayman Islands, an amount similar to U.S. holdings of equities in Canada and bigger than those in Germany and France. U.S. investment in equities of Bermudian-resident companies equals $195 billion, larger than the positions in Indian companies. Our procedure completely reallocates these enormous investment positions away from tax havens. The United States receives a large share of these flows but, as is seen in Panel C of Figure 4, the bulk of these investments are reallocated to China.

In fact, the reallocation of holdings of Cayman Islands equities to China constitutes the single largest adjustment seen in North-to-South flows in our restated data. The top panel of Figure 5 shows the share of external equity portfolios invested in China for all nine investor countries in our data. The blue bars, which show China's share under nationality, pervasively and significantly exceed the red bars, which capture the same share under residency. Section 3 details the reason why so many Chinese firms issue equity in the Cayman Islands and elaborates the implications for global imbalances.

As seen in Tables 5 and 6, we additionally find large increases in investments in BRIC countries coming from the EMU. EMU investments in Russian bonds increase from $35 billion to $107 billion, largely reflecting reallocation from Ireland and Luxembourg. Table A.2 shows a related increase of U.K. investment in Russian bonds, going from $2 billion to $5 billion. The adjustment reflects the fact that the United Kingdom only buys Russian corporate debt issued by offshore subsidiaries. Comparing the blue and red bars in the bottom panel of Figure 5 shows for corporate bonds that the reallocation to the BRIC countries is a widespread phenomenon.

Our finding that nationality-based data feature large flows from North to South alleviates the Lucas Paradox (Lucas, 1990). Appendix Table A.9 shows that, on a residency basis, cross-border capital flows from the nine developed-countries in our data to emerging markets are 75 percent smaller than equivalent flows among developed markets when measured relative to GDP, and 44 percent smaller when measured as a share of securities' amount outstanding. Instead, on a nationality basis, flows to emerging economies are only 66 and 27 percent smaller, respectively. While capital flows to emerging markets remain comparatively small, our nationality-based statistics imply a less severe Lucas Paradox in securities investments than is found in residency-based data.[29]

[29]Relatedly, in Appendix C, we follow the large literature on gravity in international portfolio investment,

2.3 Increasing Importance of Corporate Bond Flows

The shift to the nationality view of bilateral investment increases the importance of bond inflows to private emerging market firms relative to governments. While the previous subsection reported massive increases in the inflow of corporate bond investment to emerging markets, Appendix Table A.6 shows that reallocations are minimal for government bonds. After all, governments almost always issue under their own name and not via affiliates. Even when sovereigns issue international bonds in foreign markets, such as when the Brazilian government issues a global bond, the immediate issuer is in fact that sovereign and the residency and nationality approaches coincide.[30]

TIC reports that only 24 percent of all bond positions of the United States in Brazil are corporate bonds. Under the "Full Nationality" view, this percentage is actually 63 percent. Similarly, whereas under residency U.S. bond investment in Russia is entirely dominated by government bonds, corporate bonds become equally important under nationality.

One important repercussion of this change in the importance of corporate bond flows under the nationality view is that it implies that emerging market debt held by foreigners has a higher foreign currency share. After all, most bonds issued by offshore affiliates and reallocated by our procedure to emerging markets are denominated in dollars or other foreign currencies.

Figure 6 quantifies the impact of the corporate reallocations on the currency composition of external debt for two large emerging markets: Brazil and Russia. As discussed in Eichengreen and Hausmann (1999, 2005), sovereign debt in emerging markets has transitioned away from "Original Sin," with a greater share denominated in local currency, even among the securities held by foreign investors. Indeed, the dashed lines in the middle panels of Figure 6 show steep increases in the local currency shares of Brazilian and Russian external sovereign debt during 2007-2017.[31] Du and Schreger (2015) document that a similar increase in the local currency share has not occurred for emerging markets' corporate debt held by foreigners. Indeed, we see this for Brazil and Russia in the solid lines, which are flat or declining

including Portes and Rey (2005), Coeurdacier and Martin (2009), and Okawa and Van Wincoop (2012), and explore the sensitivity of the estimated elasticities of gravity variables to our restatement of the bilateral investment accounts. Further, conditional on these variables, we show the negative effect of an emerging-market dummy on investment flows goes away when changing to a nationality basis in a gravity regression weighted by market size.

[30] The same of course applies to corporates issuing bonds in international markets, like the eurobond market, under their own name, rather than via a subsidiary.

[31] Appendix Table A.12 reports results for other countries in our sample.

from low values, in the middle panels of Figure 6. As discussed above, and as shown in the bottom panels of Figure 6, switching to a nationality view substantially increases the importance of corporate relative to sovereign debt in these countries' total debt. As shown in the top panels of Figure 6, therefore, the switch to a nationality view also substantially decreases the share of local currency debt in these countries' external portfolios. While the foreign-held debt of Brazil and Russia under residency have local currency shares in 2017 equal to 80 and 70 percent, under nationality, these shares drop to 50 and 40 percent.

These adjustments play an important role in our understanding of the wealth effects of currency movements.[32] For example, our results suggest that the influential estimates of financial exchange rates by Lane and Shambaugh (2010) understate the negative wealth effects from an emerging market currency depreciation because they do not take offshore issuance into account and so likely overstate the local currency share of foreign liabilities. Similarly, our new estimates call for a more prominent role for foreign-held corporate debt in models of emerging markets and sovereign default.

2.4 Spurious Foreign Investment

The recent wave of financial globalization has seen an unprecedented increase in the gross external assets and liabilities of developed countries. Furthermore, assets and liabilities strongly co-move over time. These patterns have become moments for theories of the dynamics of current accounts and IIPs to match. However, it has also been recognized for some time that part of these patterns might be spurious in the sense that they are accounted for by purely domestic investment being intermediated via offshore financial centers. Our algorithm and data allow us to provide a precise quantification of this phenomenon for our nine developed countries. While we focus here on quantifying the most prominent examples, our full estimates available online include many more instances than those analyzed here.

U.S. Companies' Tax Inversions in Ireland. Tax havens offer low corporate tax rates. Companies use various tools, collectively referred to as Base Erosion and Profit Shifting (BEPS), to shift profits to such low tax rates jurisdictions. A prominent tool is a tax inversion, in which a company in a high-tax jurisdiction acquires a foreign target in a lower-tax jurisdiction in order to relocate its headquarters and lower its tax rate. It is well-know

[32] We note the important caveat that the literature, this paper included, has not systematically studied currency hedging.

that such inversions account for a large amount of U.S. corporate activity in Ireland. U.S. multinationals have been particularly prone to tax invert because of relatively high U.S. corporate tax rates coupled with the U.S. tax system's prescription of taxing worldwide profits of U.S. headquartered companies.[33]

Tax inversions directly affect statistics on capital flows by moving the residency of companies from the domestic country to a foreign one. For example, consider Medtronic, one of the world's largest medical technology firms, which in 2015 purchased the Irish firm Covidien. Despite having 57 percent of its net sales in the United States and retaining its main operational offices and the bulk of its employment in the United States, Medtronic shifted its headquarters to Ireland, which accounts for less than half of one percent of its net sales. As a result of this tax inversion all U.S. equity investments in Medtronic, which were considered domestic investment up to January 2015, were subsequently moved in the official statistics of both the United States and Ireland to be U.S. foreign investments in Ireland.[34] That is, from one day to the next, U.S. residents' holdings in a U.S. company's stock listed on the NYSE are suddenly counted as foreign investment.

Panel A of Figure A.13 shows the composition of destination countries by market value for U.S. equity investment in U.S. tax inverted firms. Ireland clearly dominates, accounting for 62% of the investments, but the U.K. (16%) and Bermuda (8%) also account for meaningful shares. In fact, Ireland by now is completely dominated by the activity of U.S. firms, a phenomenon Paul Krugman dubbed "Leprechaun economics". Panel B of Figure A.13 quantifies the international portfolio investment aspect of this phenomenon by showing that the vast majority (74% in 2017) of U.S. equity investments in Ireland is in U.S. tax-inverted firms. Correspondingly, Table 4 shows our estimate that out of the $385bn of U.S. equity investment in Ireland officially reported in TIC only $71bn actually correspond to investments in Irish companies. Our procedure correctly reclassifies the remaining part as U.S. domestic investment.

U.S. tax inversions in Ireland do not just affect U.S. and Irish statistics; they also affect the statistics of any other third country that invests in those same companies. For example, Table A.3 shows that out of the $199bn of U.K. investment in Irish equity in CPIS, only $138bn

[33]Both incentives were allegedly reduced by the Trump administration tax reform. For a detailed analysis of the incentives to tax invert see Desai et al. (2006) and Zucman (2013).

[34]Medtronic is listed on the New York Stock Exchange. Its primary equity CUSIP before the tax inversion was 585055106 with $76bn of market value and U.S. listed as residency in the CUSIP master file. On January 27, 2015 the inverted company started trading under a new CUSIP (G5960L103), with stock market value of $107bn, and Ireland listed as residency.

are actually in Irish companies, with the rest being reallocated to be equity investments into the U.S. Table 6 shows a similar pattern for EMU investments in Irish equity, which move in this case from being domestic investments to being foreign investments in the U.S.

Our algorithm's final list of firms that are Irish under residency but U.S. under nationality includes all firms that Slangen et al. (2017) classify as tax inversions.[35] In addition to tax-inversion of the parent firm, our algorithm also picks up a debt-related BEPS pattern called debt shifting. As noted in Hines and Rice (1994), companies may choose to finance through tax haven subsidiaries, borrowing at a given interest rate, and transfer the funds to the parent company with an intracompany loan, offered at a higher rate, in order to shift after-interest corporate profits from high to low tax jurisdictions. Bilicka (2019) provides evidence for this mechanism in the case of U.K. firms.

Since our focus in on security issuance, we do not analyze cases in which firms set up subsidiaries in tax havens that do not issue securities, but might for example induce profit shifting by renting intellectual property at high fees to their parent companies. For example, our analysis does not not include some firms, like Apple, that use capital structures in Ireland to reduce their tax bill with means other than security issuance (Shay, 2013; Harvey, 2013).

Cayman Islands as a U.S. Structured Finance Hub. Our work has focused on securities issued by corporations, bonds and equities, but it is worth noting the role of other types of bonds, such as structured finance products. In the case of the U.S., foreign investments in structured finance bonds are relatively small in TIC except for one destination—the Cayman Islands—in which the U.S. invests $323 billion. These investments are in bonds issued by Special Purpose Vehicles (SPVs) registered in the Cayman Islands but almost always backed by U.S. leveraged loans and mortgages, and sponsored and serviced by U.S. banks (see Liu and Schmidt-Eisenlohr, 2019). Our procedure successfully reallocates these bonds to be domestic securities of the U.S. and as a result we reallocate $282 billion away from the Cayman Islands.[36] These bonds are primarily Collateralized Loan Obligations (CLOs), a type of structured finance product that securitizes corporate loans. Appendix Figure A.12

[35] This is a superset of the list of firms that the U.S. Congressional Budget Office lists as having tax inverted to Ireland. See Appendix D for full details.

[36] On a "full nationality" basis, the U.S. domestic position in net actually decreases by $28 billion. This occurs because of an offsetting large outflow from the U.S. due to structured finance issued by U.S. based subsidiaries of foreign banking groups. We are less confident that these reallocations make economic sense since it is difficult to establish, for example, whether Santander structured finance issuance in the U.S. should be aggregated back as a liability of the Spanish banking group. As a result, our preferred estimates for structured finance are the tax haven only estimates reported in Table A.7.

shows that their issuance in the Cayman Islands has skyrocketed after the financial crisis. The Cayman Islands SPVs offer "fiscal neutrality" to originators and investors in the sense that no taxes are imposed on either the income of the SPV or the income paid to the securities' holders (zero withholding tax). Since the financial crisis the Cayman Islands have also passed new legislation specifically aimed at upholding "bankruptcy remoteness", a crucial feature of a structured finance vehicle. the creditworthiness of which should not be contaminated by that of issuers, managers, and underwriters.[37] This latter feature is particularly important for CLOs since the managers actively change the pool of loans over the lifetime of the transaction, as opposed to more passive structures for other structured finance products, thus making a breach of bankruptcy remoteness a more likely concern. Such large offshore transactions have important consequences for financial stability: in a possible crisis any Fed intervention would also have to contend with a foreign jurisdiction over what is essentially a domestic transaction.

Offshore Regulatory Arbitrage: Jersey Bond Issuance and the EU's Market Abuse Regulation. Offshore securities issuance is also driven by regulatory arbitrage against onshore regulation. We analyze here a simple example. In July 2016, the EU approved the Market Abuse Regulation (MAR) which extends to corporate bonds (in addition to equities) obligations for issuers to disclose market-relevant inside information, including insiders' transactions, to all parties at the same time (Davis Polk & Wardwell LLP, 2016). The regulation applies to securities registered on any EU trading venue. Notably, the securities exchanges of Ireland and Luxembourg were previously unregulated. It was widely anticipated that the rules would mostly affect high-yield issuers since those issuers were less likely to already be subject to similar regulation.[38] The International Stock Exchange (TISE) in Guernsey actively marketed itself as an alternative venue for issuance in response to the MAR as being geographically close but outside of the EU.[39] Figure A.11 shows the share of new bond issuances by issuers resident in the EU and Channel Islands that is registered

[37] See https://iflr.com/Article/3097690/Cayman-SPVs-making-a-good-product-better.html.

[38] Public companies would already be subject to equity-related requirements and large investment grade firms were more likely to have bonds on multiple exchanges some of which were already regulated. High yield firms, instead, tended to place fewer bonds and all of them in the unregulated exchanges of Ireland and Dublin. See https://www.wsj.com/articles/companies-flock-to-issue-bonds-on-tiny-english-channel-island-11557743453.

[39] From the TISE promotional material (The International Stock Exchange, 2017): "TISE is becoming an increasingly popular listing venue for high yield bonds as issuers discover how the onerous nature of MAR contrasts with the robust and proportionate rules of our recognised exchange."

in the Channel Islands. We do this separately for high-yield and investment-grade issues. Before the introduction of the MAR, the share of both types of issuance done in the Channel Islands is virtually zero. After the introduction of the MAR in July 2016, the share remains flat for new investment-grade issues, but it spikes markedly for new high-yield issues, ending at 13% (or $40bn per year) in 2017, demonstrating a strong response of issuance decisions to the regulatory reform.[40]

North-to-North Flows Under Full Nationality. When we apply our aggregation algorithm to all destinations of investments and not just to tax havens, we observe an increase in reallocations among developed countries. For example, in the case of the U.S., many domestic investments are now considered foreign investments. For example, U.S. investments in bonds issued by Toyota Motor North America are now classified as U.S. foreign investment in Japan. Panel C of Table 3 indeed shows a drop of $234 billions in domestic investment, while Japan moves from receiving $80 billions of U.S. investments to $184 billions. Since our procedure, based on the reallocation matrices, does not alter total investment, this decrease in domestic investment exactly offsets the increase in foreign investment. We stress to the reader that this movement in foreign investment modifies the "portfolio investments" components of the gross assets and liabilities in the IIP and the current account, but does not necessarily imply a change in either the total gross assets and liabilities or the net foreign asset position and current account.[41]

[40] While a large part of this issuance occurred via bonds registered in the Channel Islands but issued by the parent firm or its domestic subsidiaries (and hence did not generate spurious foreign investment on a residency basis), firms also set up new Channel Islands-based physical subsidiaries to raise high-yield financing. An example is the British carmaker Aston Martin, which set up its Jersey-based financing subsidiary Aston Martin Capital Holdings in March 2017 for the purposes of issuing new high-yield bonds in excess of $1.1bn.

[41] In Appendix Tables 3 and 4, we include a robustness check on our imputation of the U.S. domestic position discussed above. The column labeled "Ex-Domestic" does not use the imputation in equation (4) and instead only reallocates away from the U.S. those investments that we actually observe (in actual level amounts) in the Morningstar data. The main effect is to reduce the increase in investments in other developed countries such as Canada and Japan. This occurs because in this robustness check we are not reallocating to Japan the entire estimated value of U.S. investments in debt issued by U.S. subsidiaries of Japanese firms, such as Toyota or Honda, but only the amounts of those investments that we observe directly in the MNS data.

3 NFA Measurement Implications of Offshore Issuance: The Case of China

We now turn to analyzing the large-scale reallocations in Chinese equities that are classified as investments in the Cayman Islands on a residency basis. We focus on them in detail both because of their aggregate scale, and because their structure raises potential vulnerabilities masked by the aggregate statistics. We review briefly the corporate legal structures, called Variable Interest Entities (VIEs), used by Chinese firms to raise foreign investment via tax havens. While this topic has received some attention in law and accounting research, it has not attracted much attention in economics. We review the legal structures only as necessary to understand the economics and refer the interested reader to the appendix and the legal studies literature.

3.1 VIE Legal Structure and Risks

As of 2019, there are more than 500 Chinese companies listed in the U.S. or in Hong Kong that use a VIE structure. The primary difference between a VIE and a standard corporate structure is that the former is designed to control "[a] company by means other than a majority of voting rights" (Whitehill, 2017). Chinese firms adopt this structure because Chinese law prohibits foreign ownership of firms in strategically important industries such as internet platforms, financial services, telecommunications, energy, agriculture, transportation, and education. The VIE structure is therefore expressly designed to honor the letter of the law while violating its spirit. Essentially, the same company needs to be able to tell foreign investors that they own the company while telling Chinese regulators that the company is wholly owned by Chinese citizens.

Figure 8 shows a diagram capturing the typical components of a VIE structure. The three core components of the VIE structure are the Operating Company, the Wholly Foreign-Owned Enterprise ("WFOE"), and the Listed Company. For concreteness, it is useful to reference these entities in terms of Alibaba's structure, but this structure applies more generally. The Operating Company is the firm based in China and is, for all intents and purposes, what investors (and economists) would think of as the "real" company. Since this firm operates in an industry in which foreign ownership is restricted, its equity is formally fully owned by Chinese citizens, as indicated by the arrow labeled G in the diagram.

The Listed Company is the entity listed on a global stock exchange. This company is generally resident in the Cayman Islands. For instance, investors that purchase shares of Alibaba (BABA ticker on the NYSE) are actually purchasing shares of Alibaba Group Holding Limited, a holding company based in the Cayman Islands. The corporate structure then involves a series of subsidiaries and bilateral contracts such that, for the purposes of international accounting and reporting, this Listed Company can effectively affirm to global investors that it owns the Operating Company.[42]

The first step in this ownership chain is represented by arrow B, in which the Listed Company wholly owns a shell company or a special purpose vehicle ("SPV" in diagram), which is most often based in Hong Kong. The next step is that this SPV owns a Wholly-Foreign Owned Enterprise (WFOE) in mainland China (arrow C). This flow from the SPV to the WFOE is where capital actually enters into China for the purposes of national accounting.[43] WFOEs are investment vehicles registered in mainland China that allow foreign investors to fully own the company without the restrictions usually associated with direct investment in China, such as joint venture or technology transfer requirements.[44] Importantly, the WFOE is registered and licensed to operate in an industry in which Chinese regulation allows foreign investment (Gillis, 2019).

The most tenuous links in the corporate structure are represented by arrows E and F. In these links, the WFOE, the Operating Company, and the Chinese owners of the Operating Company enter into a series of contractual relationships designed to mimic equity ownership while still satisfying the requirement that the Operating Company be considered Chinese-owned by Chinese regulators. Since the WFOE is prohibited from directly purchasing the equity of the Operating Company, it instead provides the Chinese owners of the firm a zero-interest loan with their equity in the firm pledged as collateral (arrow F). In addition, the Chinese owners of the firm grant the WFOE an exclusive call option, giving them the option of buying the firm at a pre-specified price. Presumably, because the WFOE cannot be licensed to operate in the industry in which the Operating Company actually does its

[42] In particular, it needs to be able to report its revenues on a consolidated basis under which the operating company is consolidated onto the balance sheet of the listed company. Financial Accounting Standards Board (FASB) Interpretation No. 46R provides that: "An enterprise that consolidates a VIE is the primary beneficiary of the VIE. The primary beneficiary of a VIE is the party that absorbs a majority of the entity's expected losses, receives a majority of its expected residual returns, or both, as a result of holding variable interests, which are the ownership, contractual, or other pecuniary interests" (Whitehill, 2017).

[43] Occasionally, VIEs do not use a Hong Kong-based SPV or Shell, and instead the ownership chain goes directly from the Listed Company to the WFOE (arrow D).

[44] See Harris (2018) for a discussion on the costs and benefits of WFOEs for foreign investors in China.

business, if this call option were ever exercised, the WFOE would find itself violating Chinese law. Many structures also include a proxy agreement or power of attorney given to the WFOE by the Chinese Owners. Putting all of these contracts together, the WFOE has something closely approximating equity control over the Operating Company.

While this relationship between the WFOE and the owners of the company might deliver control, it does not provide the other crucial component of ownership: a claim to all of the profits of the firm. The WFOE and the Operating Company enter into an exclusive technical services agreement (arrow E) in which the Operating Company hires the WFOE to provide technical services, such as "website maintenance, programming, sales support, fulfillment services, curriculum development, etc." (Gillis, 2019). The WFOE charges a fee for providing these services approximately equal to the entire profits of the Operating Company. In one of its SEC filings (Form F-1, May 2014), Alibaba reports that "the variable interest entity pays a service fee to the wholly foreign owned enterprise which typically amount to what would be substantially all of the variable interest entity's pretax profit (absent the service fee), resulting in a transfer of substantially all of the profits from the variable interest entity to the wholly foreign owned enterprise."

Overall, these structures both in terms of control and transfer of profits resemble a "game of mirrors" in which each side, the Chinese authorities and the foreigners, claims to see a different reflection of the very same object. Such illusions can be dangerous and prone to misinterpretation especially when, as we show next, more than a trillion dollars are at stake.

Companies using VIE structures generally include a disclaimer about their embedded risks in the "Risks Related to Our Corporate Structure" section of their U.S. SEC filings.[45] Indeed, many of the risks faced by investors arise from the possibility that Chinese authorities may recognize such structures as patently illegal leaving foreign investors holding worthless shares in a Cayman Island empty holding company. Other risks include: the Chinese owners taking control of the assets of the firm in a perceived contravention of the bilateral contracts with the WOFE;[46] and the possibility that Chinese authorities may prevent or tax profit

[45] Alibaba's prospectus for its IPO on the NYSE (SEC Form F-1) states: "If the [Chinese] government deems that the contractual arrangements in relation to our variable interest entities do not comply with [Chinese] governmental restrictions on foreign investment, or if these regulations or the interpretation of existing regulations changes in the future, we could be subject to penalties or be forced to relinquish our interests in those operations."

[46] The most famous example of this is Jack Ma seizing control of Alipay, despite Yahoo's firm belief that it owned a share through its ownership of the holding company. See Jiang and Yang (2017) for a detailed discussion of the Alipay/Alibaba controversy. See Ziegler (2016) for a discussion of Gigamedia, FAB Universal and others cases.

transfer.[47] Foreign owners have often found that they have little recourse since the contracts in arrows E and F occur within China, the side that does not recognize the structure to be equivalent to full ownership and control.

The financial risks are heightened by the retail ownership of public shares listed on U.S. exchanges. Many international equity mutual funds that invest in these securities are held by investors in their retirement accounts. It is hard to believe that when a U.S. retail investors buys Alibaba shares on the New York Stock Exchange she understands that she is buying a claim on a Cayman Islands based holding company with a complex and dubious relationship with the Chinese firm. Companies actively set the name of the Listed Company and the Operating Company to be almost identical and the financial press rarely draws the distinction.[48] While China might never enforce the law in fear of losing future access to capital markets, our paper highlights both the scale and complexity of this risk.

3.2 The Scale of Foreign Investments in VIEs and China's Net Foreign Asset Position

In Section 2 we showed that Chinese firms' use of VIE structures leads national statistics to dramatically understate the scale of developed market investment in China. From the perspective of national statistics of developed countries, the misstatements affect bilateral investments but do not affect the total gross or net international investment position. This occurs because developed countries are correctly booking the market value of their investments in Chinese VIEs, even though they are booked as investments in the Cayman Islands rather than China.[49]

In this section, we demonstrate instead that Chinese firms' use of the VIE structure

[47] This has led to much of the profits being kept inside of the Operating Company. As a result, Listed Companies have been reluctant to pay dividends to their shareholders. VIE payments to WFOEs could potentially be reclassified as a dividend payment. If Chinese authorities deemed this to be the case, the intra-company transfers could incur an effective tax rate in excess of 50%, dramatically reducing the value of the companies to offshore investors (Whitehill, 2017).

[48] For example, Appendix Figure A.15 shows screenshots of the Financial Times pages for Tencent and Baidu. In both cases, the reported details refer to the Operating Company in China and no mention is made of the VIE structure or the Cayman Islands in the company's profile.

[49] Figure 10 shows that the reported value of U.S. common equity investment in the Cayman Islands co-moves almost perfectly with the market capitalization of the VIEs. In addition, South Africa's FDI investment in China in CDIS co-moves perfectly with Tencent's market capitalization. Naspers, a South African company, owns 31% of Tencent throughout the sample period. Because the stake exceeds 10%, South African statisticians correctly book it as FDI. The stake is valued at market value using Tencent's Hong Kong listed share price.

has led China's gross liabilities to be severely understated, and therefore its net foreign asset position to be dramatically *overstated.* China's official statistics report a positive $2.1 trillion net foreign asset position (NFA) at the end of 2018, making it the world's second largest creditor after Japan's $3.1 trillion position. We show that correctly accounting for the market value of foreign investments in Chinese VIEs reduced China's NFA to $1.2 trillion, placing it closer to creditor countries like Norway and Switzerland than to Japan.

China's External Liabilities. Returning to Figure 8, the flow of capital from the rest of the world to China in a VIE structure occurs in arrow C, in which the SPV (or the Listed Company itself, with arrow D) owns the WFOE. Since this relationship entails complete equity ownership, it would be classified as a foreign direct investment (FDI) in China coming from the domicile of the immediate parent company, either the SPV based in Hong Kong or the Listed Company based in the Cayman Islands or another tax haven. The rest of the ownership chain entails other capital flows that do not affect China's liabilities. For instance, if foreign portfolio investors purchase shares in the listed company (arrow A), this entails a portfolio equity position from the residency of the investors to the Cayman Islands. The Listed Company's ownership of the SPV entails a foreign direct investment from the Cayman Islands to Hong Kong. Hong Kong should then register an equal FDI asset and liability: the asset in China, the liability to the Cayman Islands.

According to the IMF Balance of Payments and International Investment Position Manual Sixth Edition (BPM6), all assets and liabilities should be recorded at their current market value. By this standard, if foreign portfolio investors own 100% of the Listed Company, the Listed Company owns 100% of the SPV, and the SPV owns 100% of the WFOE, then the the value of portfolio equity investment in the Caymans should equal the value of the Caymans' FDI investment in Hong Kong, and similarly for Hong Kong's FDI in China. In other words, the value of the Cayman Islands and Hong Kong's net foreign asset position should be unchanged by this transaction, and the value of portfolio investment in the Caymans should equal the value of FDI into China. In practice it is generally only portfolio investments (equities and bonds) that are recorded at market value.[50]

[50]The OECD Benchmark Definition of Foreign Direct Investment Fourth Edition notes the challenges of recording FDI at market value:"Although market value is the recommended basis for valuation it is recognized that, in practice, values based on the books of direct investment enterprises (or investors) are often used to determine the values of direct investment positions (stocks) or transactions." In the BPM6 Manual, the IMF suggests six alternative methods to approximate the market value of FDI. The IMF notes: "In cases in which none of the above methods are feasible, less suitable data may need to be used as data inputs. For

We establish that China does not book its related FDI liability at market value. With publicly available statistics, however, we are unable to precisely determine exactly how they book the positions. Instead, we assume as our benchmark case that China books the FDI at a constant value equal to the value of the firm at the time of its latest public equity offering.[51] Figure 9 reports our estimate of the difference between these two valuations of the same positions for the universe of Chinese VIE companies listed abroad. The gap captures how much China's external liabilities would be understated if the positions were marked using this notion of cost rather than market value. The gap grows rapidly from almost zero in 2005 to $1.1 trillion in 2018.[52]

Why do Chinese statisticians not record FDI at market value using the listed share price in New York as a reference? While such an adjustment may seem straightforward in the simplified corporate structure of Figure 8, it can in practice appear daunting. Appendix Figure A.14 displays the full VIE corporate structure of Alibaba. Some of the ownership chains go directly from the Cayman Islands-based Listed Company to the WFOE, such as for Hangzhou Alimama Technology Co. Limited; others pass through Hong Kong-based shell companies (Taobao China Holding Limited) or British Virgin Islands-based shells (Alibaba.com Investment Holding Limited). It is not at all clear how any statistician would update the value of individual FDI positions in these onshore WFOEs in response to an increase in the share price of the Listed Company.

Panel A of Figure 9 establishes that China is not booking the full market value of the VIEs in its FDI liabilities. Using the IMF Coordinated Direct Investment Survey (CDIS), we focus on China's reported inward FDI from Hong Kong, the British Virgin Islands, and the Cayman Islands, the three most plausible sources. We plot this time series with a dashed green line.[53] By March 2018, the market value of the VIEs exceeds the total value of FDI

example, cumulated flows or a previous balance sheet adjusted by subsequent flows may be the only sources available."

[51] Our notion of cost is built by cumulating the equity capital raised by the VIEs in their equity offerings, and only marking a firm's equity to market when a firm performs a secondary equity offering following its IPO. Alternative criteria could be: (i) using the cumulated capital raised via IPOs over time but with no revaluation of existing shares, (ii) using the book value of the WFOE. We view our benchmark as conservative, as it accounts for the full value of the firm at the time of equity offerings, rather than just the capital raised. However, it is quite possible that China records the value of these transactions in a different way. For instance, the actual FDI flow into China could occur when the SPV or the Listed Company first established the WFOE. This may occur years before the actual IPO, and the valuation that Chinese statisticians would assign to such a transaction is very much uncertain.

[52] If we had assumed that China valued the FDI at the cumulative capital raised at the time of IPOs, then the gap would have been $1.4 trillion.

[53] The series begins in 2011Q1 because of data availability from CDIS.

from these countries.[54] We next examine whether the market value of the VIEs could have been booked in a component of China's external liabilities other than FDI. Panel B of Figure 9 shows that this cannot be the case. While the VIEs increased in market value by $1.1 trillion between 2016Q4 and 2018Q1, total recorded external liabilities of China (excluding official reserves and trade credits) only increased by $390 billion over the same period. Most of the increase in total liabilities came from a $180bn increase in portfolio debt liabilities. This component is perhaps the category that is least likely to include any of the VIE equity investments.

China's External Assets. Having documented how Chinese external liabilities are understated because of the VIE structure, we next turn to examining whether Chinese foreign assets might also be affected. If Chinese residents owned shares of the Listed Company, these holdings should be recorded as foreign assets of China. This is important to consider because China's NFA is only affected by the understatement of its foreign liabilities to the extent that there is not an offsetting understatement in its foreign asset. We show below that while this concern is valid, it is quantitatively small.

Returning to Figure 8, there are two different ways in which Chinese residents could hold equity in the VIE structures. They could directly own shares of the Listed Company issued in global markets (arrow I); or they could hold shares in foreign-based investment vehicles which in turn hold shares of the Listed Company (arrow H and L). We use two methods to estimate the scale of Chinese residents investments in the VIEs. The first method, which is more indirect, uses our nationality-based restatements of TIC and CPIS introduced in Section 2. We sum the estimated holdings of Chinese equities based in the Cayman Islands from our nine developed countries. We augment this estimate with Naspers' investment in Tencent and Softbank's investment in Alibaba. We calculate the share of the foreign positions as a fraction of total VIE market capitalization and assume that the residual is the Chinese ownership share.[55]

The second method directly collects data on the ownership composition of each Listed

[54] CDIS also includes an unspecified source "country" which contributes another $230bn billions to China's inward FDI in 2018. Even including this amount, however, barely matches the VIE market valuation. Also, this amount is roughly flat in the time series at the time in which the VIEs experience large market value gains, which makes implausible that the market value of these companies is booked through this category.

[55] The estimates for some investor countries are potentially overstated because CPIS reports equities and fund shares jointly. If many investments in the Cayman Islands are in fund shares rather than in common equity then our estimates of equity investments reallocated to China are biased upwards. This problem does not affect our U.S. estimates since TIC separates fund investments from common equity.

Company from public and commercial data sources. Direct holdings of Listed Company shares (arrow I) are most likely small and booked at market value in China's foreign assets as portfolio investments.[56] Both of these features make it unlikely that these holdings meaningfully affect our estimates. We measure indirect holdings (H and L) directly using additional data from Bloomberg. Using the Bloomberg Ownership database, we collect data on the primary holders of the largest 40 publicly traded VIEs. These 40 largest VIEs account for 90% of the market cap of all VIEs. Of these 40 firms, only 11.8% is actually owned by Chinese investors (see Appendix Table A.10). As we report in Appendix Table A.11, nearly all of these insider holdings are indirect and are through various offshore investment vehicles. For instance, of Alibaba founder Jack Ma's 6.4% ownership of Alibaba shares, 5.1% are in vehicles based in the British Virgin Islands, 1.3% are in Cayman Islands vehicles, and only a negligible share is held directly.

These two methodologies deliver remarkably similar results. In sum, we estimate that Chinese residents indirectly own 11.8% of the market capitalization of the VIEs via offshore investment vehicles (with additional direct household holdings totaling 1.1% of the market capitalization of the VIEs). The bulk of these holdings are from company founders and insiders via a complex web of foreign shell companies. To be conservative, we assume that these holdings have been booked in China's foreign assets positions using the same cost notion used for the assets.[57]

China's Net Foreign Assets. Figure 11 plots the official NFA of China as well as our new estimates. The solid blue line is China's official NFA position which in 2018 is $2,130 billion or 15% of China's GDP. The dashed red line is our estimate of China's actual NFA once net foreign holdings of VIEs are taken into account. The overstatement of China's NFA grows rapidly over time starting at zero in 2008 and reaching $962 billion by the end of 2018. Currently, China is only 50% as big of a creditor to the rest of the world as official statistics say it is.

Although China ran unprecedentedly large current account surpluses since the early

[56] Chinese citizens are generally restricted from directly owning foreign securities. Conditions are more relaxed for purchases of equities listed in Hong Kong due to a recent policy initiative (Stock Connect). However, the Hong Kong Stock Exchange reports that a mere 2.0% of the outstanding amount of the Hong Kong listed VIEs are owned by Mainland Chinese investors. This implies that only 1.1% of all worldwide shares of listed VIEs are directly owned by Chinese citizens via their Hong Kong listed shares.

[57] This is conservative in the sense that if we actually assumed that China's foreign investments in the VIEs are booked at market value, then any overstatement of the liabilities would directly translate in an overstatement of the net foreign assets.

2000s, China is surprisingly a much smaller net creditor today than statisticians, economists, and policymakers believe. While the common narrative is that of a one-way flow from China to the safe assets of the developed world (U.S. treasuries), we show that in the last decade there has been an important flow from developed market investors into China and that this flow is masked by official statistics. While much attention has been spent on the $1.1 trillion of U.S. treasuries held by China, almost no attention has been paid to the $700 billion of U.S. holdings in Chinese equities.

Our restatement of China's NFA has far-reaching consequences. We would like to briefly draw two. First, China's creditor position is often at the top of policymakers and academic concerns for a smooth re-equilibration of global imbalances. Our take is that a large adjustment has already happened during the period 2008-2018 without policymakers or academics noticing it due to data shortcomings. Going forward the adjustment required to dissipate global imbalances is significantly smaller than previously thought. Foreigners invested $500 billion in Chinese equities during the decade, but also realized a capital gain of more than 1,000%, thus leaving them today with substantial claims on China. Second, these gross external positions with China invested in U.S. safe assets and the rest of the world (with a big U.S. component) invested in Chinese equities not only reinforce the world banker view of global imbalances (Despres et al., 1966), but also come with legal complications and fragile offshore structures of an unprecedented scale.

4 Conclusion

We have provided a methodology to unwind corporate ownership chains and offshore issuance in tax havens globally. Our methodology is transparent and can be used directly or easily modified by other researchers. We show that correctly resolving global ownership chains is key in forming a consolidated view of global cross-border portfolios. Commonly used datasets significantly understate the magnitude of the corporate financing flowing from developed-market investors to emerging-market firms and incorrectly attribute these flows to tax-haven countries. The offshore structures that we uncover often mask portfolios flows under the cover of foreign direct investment. We show that this can impact, via valuation effects, the net foreign asset and current accounts of countries. We estimate that China's net-foreign-asset creditor position is 50% smaller than official statistics report.

While our procedure is certainly still imperfect, it provides the basis for a common

measurement framework of capital flows in international macroeconomics. Future research can build on these foundations and move the frontier further toward a fully-resolved and easily accessible set of statistics on global capital flows.

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Issuer CUSIP6	Issuer Name	Issuer Residency	Parent CUSIP6	Parent Nationality	Parent Name	Value Outstanding (USD Billions)
A. Corporate bonds reallocated away from selected tax havens						
91911T	VALE OVERSEAS LTD	CYM	P96620	BRA	VALE SA	12.3
01609W	ALIBABA GROUP HLDG LTD	CYM	01609W	CHN	ALIBABA GROUP HLDG LTD	10.3
71645W	PETROBRAS INTL FIN CO	CYM	P78331	BRA	PETROLEO BRASILEIRO SA	9.2
G2119W	CHINA EVERGRANDE GROUP	CYM	16891Y	CHN	CHINA EVERGRANDE GROUP	8.6
947075	WEATHERFORD INTL LTD	BMU	G48833	USA	WEATHERFORD INTL PLC	5.3
G7303Z	QTEL INTERNATIONAL FIN LTD	BMU	74866E	QAT	QATAR TELECOM QSC	3.6
G27631	DIGICEL GROUP LIMITED	BMU	G27631	JAM	DIGICEL GROUP LIMITED	3.5
00928Q	AIRCASTLE LTD	BMU	G0129K	USA	AIRCASTLE LTD	3.1
G91703	UBS GROUP FDG JERSEY LTD	JEY	H42097	CHE	UBS GROUP AG	7.2
225433	CREDIT SUISSE GROUP FDG GUERNSEY LTD	GGY	H3698D	CHE	CREDIT SUISSE GROUP AG	7.2
90351D	UBS GROUP FDG JERSEY LTD	JEY	H42097	CHE	UBS GROUP AG	7.0
G25296	CREDIT SUISSE AG	GGY	H3698D	CHE	CREDIT SUISSE GROUP AG	5.4
71647N	PETROBRAS GLOBAL FIN BV	NLD	P78331	BRA	PETROLEO BRASILEIRO SA	32.5
N1420M	BMW FINANCE NV	NLD	D0785N	DEU	BAYERISCHE MOTORENWERKE AG	22.3
L4191B	GAZ CAPITAL SA LUXEMBOURG	LUX	368287	RUS	GAZPROM PJSC	22.2
36164Q	GE CAP INTL FDG CO	IRL	369604	USA	GENERAL ELEC CO	17.5
B. Equities reallocated away from selected tax havens						
G87572	TENCENT HLDGS LTD	CYM	G87572	CHN	TENCENT HLDGS LTD	493.3
01609W	ALIBABA GROUP HLDG LTD	CYM	01609W	CHN	ALIBABA GROUP HLDG LTD	441.6
056752	BAIDU INC	CYM	056752	CHN	BAIDU INC	64.2
47215P	JD COM INC	CYM	47215P	CHN	JD COM INC	49.4
471115	JARDINE MATHESON HLDGS LTD	BMU	471115	HKG	JARDINE MATHESON HLDGS LTD	44.1
G47567	IHS MARKIT LTD	BMU	44962L	GBR	IHS MARKIT LTD	18.0
G2519Y	CREDICORP LTD	BMU	G2519Y	PER	CREDICORP LTD	16.5
G45584	HAL TRUST	BMU	G45584	NLD	HAL TRUST	14.5
G39420	GLENCORE PLC	JEY	G39420	CHE	GLENCORE PLC	75.3
82481R	SHIRE PLC	JEY	J8129E	JPN	TAKEDA PHARMACEUTICAL CO LTD	47.0
G9227K	UNITED COMPANY RUSAL PLC	JEY	G9227K	RUS	UNITED COMPANY RUSAL PLC	11.8
G4474Y	JANUS HENDERSON GROUP PLC	JEY	G4474Y	GBR	JANUS HENDERSON GROUP PLC	11.5
G1151C	ACCENTURE PLC	IRL	G1151C	USA	ACCENTURE PLC	129.1
G5960L	MEDTRONIC PLC	IRL	G5960L	USA	MEDTRONIC PLC	85.7
G29183	EATON CORP PLC	IRL	G29183	USA	EATON CORP PLC	17.4
N59465	MYLAN NV	NLD	N59465	USA	MYLAN NV	11.3

Table 1: **Largest issuer-level reallocations away from selected tax havens.** All amounts outstanding are as of December 2017. Panel A shows corporate bond reallocations, while panel B shows equity reallocations. Within each panel, we show the largest four reallocations away from the following tax havens: (i) the Cayman Islands; (ii) Bermuda; (iii) the Channel Islands; (iv) Ireland, Luxembourg, and the Netherlands. Amounts shown correspond to face value outstanding for bonds, and market values outstanding for equities.

	Share Reallocated To:															
Destination	**BMU**	**BRA**	**CAN**	**CHN**	**CYM**	**DEU**	**GBR**	**HKG**	**IND**	**IRL**	**JPN**	**LUX**	**PAN**	**RUS**	**USA**	**RoW**
BMU	1.6	0.5	1.0	1.1		0.4	9.3	1.2		1.6	1.1				65.7	16.6
BRA		100.0														
CAN		0.1	95.1	0.2		0.1	0.3				0.2				2.9	1.1
CHN				82.8			0.8									16.4
CYM		12.6	0.9	20.7	6.6	0.1	3.3	3.4		3.1	1.4				35.1	12.9
DEU						93.4	6.2								0.3	0.2
GBR		0.2	0.1				86.3		1.4		0.2				4.1	7.7
HKG				54.9		3.7	5.8	28.2	0.2							7.1
IND									100.0							
IRL				0.1		0.5	1.8			29.9	21.7			4.6	39.1	2.3
JPN											100.0					
LUX		4.7	1.2	0.1		2.8	1.5			0.4		4.5		10.9	44.7	29.1
PAN		2.3											5.4		77.2	15.2
RUS														100.0		
USA		0.3	0.7	0.1		0.8	1.3		0.1	0.3	1.7				92.3	2.3

Table 2: **Reallocation matrix, U.S. corporate debt investments.** This table shows the share of U.S. investment into selected destination countries (*rows*) that are distributed to each ultimate place of allocation (*columns*) under a nationality basis. Values are expressed in percentage points. The last column, Rest of World (RoW), shows the sum of the shares allocated to any remaining country. The rows of the matrix therefore sum to 100%. All data as of December 2017.

			Tax Haven Only		Full Nationality	
Destination	**ISO Code**	**TIC**	**Position**	**Δ**	**Position**	**Δ**
A. Selected Non-Tax Haven Countries						
Argentina	ARG	5	5	0	5	0
Australia	AUS	144	144	0	149	5
Brazil	BRA	8	44	36	61	52
Canada	CAN	390	392	2	410	20
China	CHN	3	37	34	44	42
France	FRA	118	120	2	109	-9
Germany	DEU	60	80	20	117	57
India	IND	6	6	1	21	15
Indonesia	IDN	5	7	1	9	4
Italy	ITA	16	29	13	34	18
Japan	JPN	80	95	15	184	104
Mexico	MEX	58	58	0	60	2
Russia	RUS	0	12	12	12	12
Saudi Arabia	SAU	0	0	0	0	0
Spain	ESP	16	19	2	52	36
South Africa	ZAF	1	5	4	6	5
South Korea	KOR	11	11	0	17	6
Turkey	TUR	4	4	0	4	0
United Kingdom	GBR	326	343	16	373	47
B. Selected Tax Havens						
Bermuda	BMU	30	0	-30	0	-30
Cayman Islands	CYM	80	5	-75	5	-75
Curaçao	CUW	0	0	-0	0	-0
Guernsey	GGY	13	0	-13	0	-13
Hong Kong	HKG	8	6	-3	7	-1
Ireland	IRL	63	24	-39	39	-24
Jersey	JEY	14	0	-14	0	-14
Luxembourg	LUX	72	3	-69	3	-69
Netherlands	NLD	179	94	-86	115	-65
Panama	PAN	3	0	-3	0	-3
C. Domestic Reallocation						
United States	USA	5,009*	5,132	122	4,775	-234

Table 3: **Estimated nationality-based outward U.S. corporate debt portfolios.** This table presents estimates of restated outward U.S. corporate debt portfolio positions using a nationality-based criterion, which we compare to the U.S. Treasury's TIC data. We present our estimates which only reallocate holdings away from tax havens (*Tax Haven Only*), as well as estimates obtained under an alternative estimation treatment that also reallocates holdings between countries that are not tax havens (*Full Nationality*). Positions in the *TIC* column with an asterisk (*) are estimated. Corporate debt is defined in TIC as private debt holdings minus holdings of asset-backed securities. All data as of December 2017.

			Tax Haven Only		Full Nationality	
Destination	**ISO Code**	**TIC**	**Position**	**Δ**	**Position**	**Δ**
A. Selected Non-Tax Haven Countries						
Argentina	ARG	9	11	1	17	8
Australia	AUS	181	182	1	184	3
Brazil	BRA	119	120	1	107	-13
Canada	CAN	493	500	8	527	34
China	CHN	154	694	540	694	540
France	FRA	434	447	14	458	24
Germany	DEU	375	385	10	402	27
India	IND	179	181	2	172	-7
Indonesia	IDN	40	40	0	31	-8
Italy	ITA	96	105	9	114	18
Japan	JPN	895	911	17	906	12
Mexico	MEX	64	64	0	61	-3
Russia	RUS	55	62	7	61	7
Saudi Arabia	SAU	0	0	0	0	0
Spain	ESP	123	123	0	130	7
South Africa	ZAF	100	100	0	101	1
South Korea	KOR	226	226	0	225	-1
Turkey	TUR	22	22	0	22	0
United Kingdom	GBR	1,019	1,140	121	1,000	-20
B. Selected Tax Havens						
Bermuda	BMU	195	1	-194	1	-194
Cayman Islands	CYM	547	0	-547	0	-547
Curaçao	CUW	36	0	-36	0	-36
Guernsey	GGY	14	0	-14	0	-14
Hong Kong	HKG	147	135	-12	135	-11
Ireland	IRL	385	71	-315	71	-314
Jersey	JEY	94	0	-94	0	-94
Luxembourg	LUX	33	4	-29	4	-29
Netherlands	NLD	339	272	-67	372	34
Panama	PAN	26	0	-26	0	-26
C. Domestic Reallocation						
United States	USA	19,284*	19,810	526	19,977	693

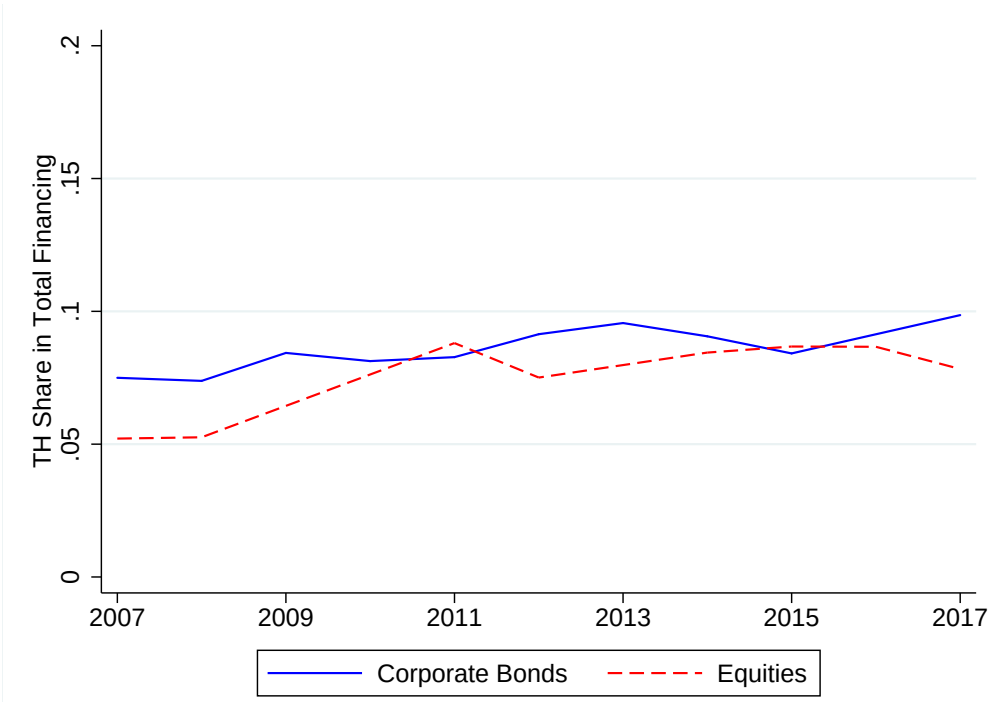
Table 4: **Estimated nationality-based outward U.S. equity portfolios.** This table presents estimates of restated outward U.S. equity portfolio positions using a nationality-based criterion, which we compare to the U.S. Treasury's TIC data. We present our estimates which only reallocate holdings away from tax havens (*Tax Haven Only*), as well as estimates obtained under an alternative estimation treatment that also reallocates holdings between countries that are not tax havens (*Full Nationality*). Positions in the *TIC* column with an asterisk (*) are estimated. All data as of December 2017.

			Tax Haven Only		Full Nationality	
Destination	**ISO Code**	**CPIS**	**Position**	**Δ**	**Position**	**Δ**
A. Selected Non-Tax Haven Countries						
Argentina	ARG	37	37	0	36	0
Australia	AUS	175	180	4	193	18
Brazil	BRA	49	119	70	133	84
Canada	CAN	190	196	6	203	13
China	CHN	19	68	49	82	63
India	IND	19	26	7	47	28
Indonesia	IDN	44	49	5	54	10
Japan	JPN	209	220	11	251	42
Mexico	MEX	97	99	2	110	13
Russia	RUS	35	107	71	107	72
Saudi Arabia	SAU	2	5	2	5	2
South Africa	ZAF	28	33	4	45	16
South Korea	KOR	23	24	1	25	2
Turkey	TUR	39	39	0	38	-1
United Kingdom	GBR	1,291	1,406	115	1,211	-80
United States	USA	1,912	2,111	199	2,092	181
B. Selected Tax Havens						
Bermuda	BMU	26	2	-24	2	-24
Cayman Islands	CYM	96	7	-89	7	-89
Curaçao	CUW	1	0	-1	0	-1
Guernsey	GGY	3	0	-3	0	-3
Hong Kong	HKG	20	11	-9	14	-6
Ireland	IRL	294*	133	-161	139	-155
Jersey	JEY	10	0	-10	0	-10
Luxembourg	LUX	536*	27	-509	27	-509
Netherlands	NLD	979*	517	-462	561	-418
Panama	PAN	8	5	-4	5	-4
C. Domestic Reallocation						
France	FRA	1,732*	1,757	26	1,643	-89
Germany	DEU	1,357*	1,622	265	1,635	278
Italy	ITA	1,474*	1,597	123	1,616	142
Spain	ESP	879*	957	77	1,011	132
European Monetary Union	EMU	8,555*	7,944	-611	7,996	-559

Table 5: **Estimated nationality-based outward EMU total debt portfolios.** This table presents estimates of restated outward EMU total debt portfolio positions using a nationality-based criterion, which we compare to CPIS data. We present our estimates which only reallocate holdings away from tax havens (*Tax Haven Only*), as well as estimates obtained under an alternative estimation treatment that also reallocates holdings between countries that are not tax havens (*Full Nationality*). Positions in the *CPIS* column with an asterisk (*) are estimated. All data as of December 2017.

Destination	ISO Code	CPIS	Tax Haven Only		Full Nationality	
			Position	Δ	Position	Δ
A. Selected Non-Tax Haven Countries						
Argentina	ARG	4	4	0	5	1
Australia	AUS	62	63	1	67	4
Brazil	BRA	53	54	0	46	-7
Canada	CAN	87	87	1	95	8
China	CHN	96	331	235	329	233
India	IND	85	85	0	85	-1
Indonesia	IDN	18	18	0	18	-1
Japan	JPN	316	316	0	317	2
Mexico	MEX	19	19	0	20	1
Russia	RUS	47	48	1	47	0
Saudi Arabia	SAU	2	2	0	2	0
South Africa	ZAF	33	33	0	34	1
South Korea	KOR	96	96	0	95	-1
Turkey	TUR	11	11	0	11	0
United Kingdom	GBR	593	675	82	612	18
United States	USA	1,708	2,035	326	2,064	356
B. Selected Tax Havens						
Bermuda	BMU	38	1	-37	1	-37
Cayman Islands	CYM	223	0	-223	0	-223
Curaçao	CUW	3	0	-3	0	-3
Guernsey	GGY	1	0	-1	0	-1
Hong Kong	HKG	64	48	-16	49	-16
Ireland	IRL	695*	346	-349	346	-349
Jersey	JEY	17	0	-17	0	-17
Netherlands	NLD	329*	278	-50	329	0
Panama	PAN	3	0	-3	0	-3
C. Domestic Reallocations						
France	FRA	1,315*	1,319	4	1,329	14
Germany	DEU	1,305*	1,306	0	1,303	-3
Italy	ITA	483*	488	5	489	6
Spain	ESP	262*	262	0	257	-5
European Monetary Union	EMU	4,761*	4,357	-404	4,405	-356

Table 6: **Estimated nationality-based outward EMU equity portfolios.** This table presents estimates of restated outward EMU equity portfolio positions using a nationality-based criterion, which we compare to CPIS data. We present our estimates which only reallocate holdings away from tax havens (*Tax Haven Only*), as well as estimates obtained under an alternative estimation treatment that also reallocates holdings between countries that are not tax havens (*Full Nationality*). Positions in the *CPIS* column with an asterisk (*) are estimated. All data as of December 2017. We drop holdings of the EMU in Luxembourg since the ultimate investments are accounted for by the foreign investments of Luxembourg.

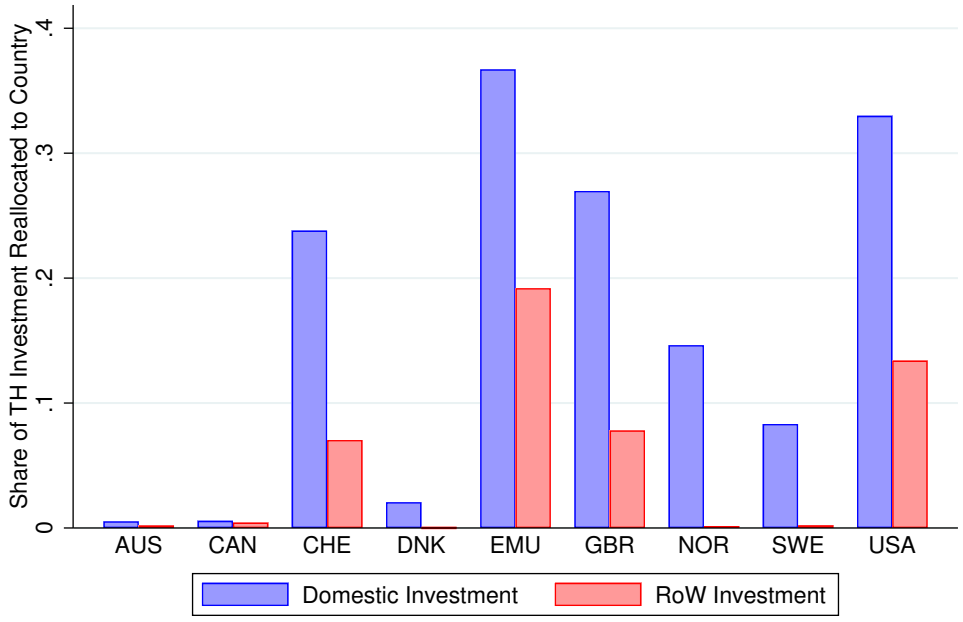


(a) Total Financing

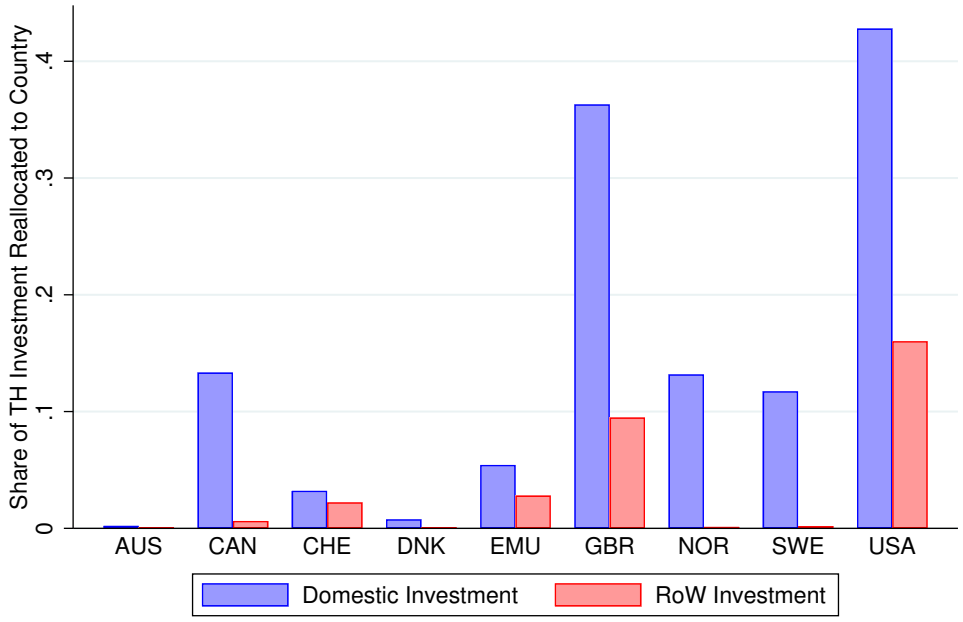


(b) Cross-Border Financing

Figure 1: **The rise of tax haven issuance.** Panel A shows the time series for the share of all equity and corporate debt securities worldwide that are issued using tax haven subsidiaries. Panel B shows the time series for the share of cross-border securities that are issued using tax haven subsidiaries. Cross-border securities include all securities issued by subsidiaries located outside the country of operations of their ultimate parent firm.

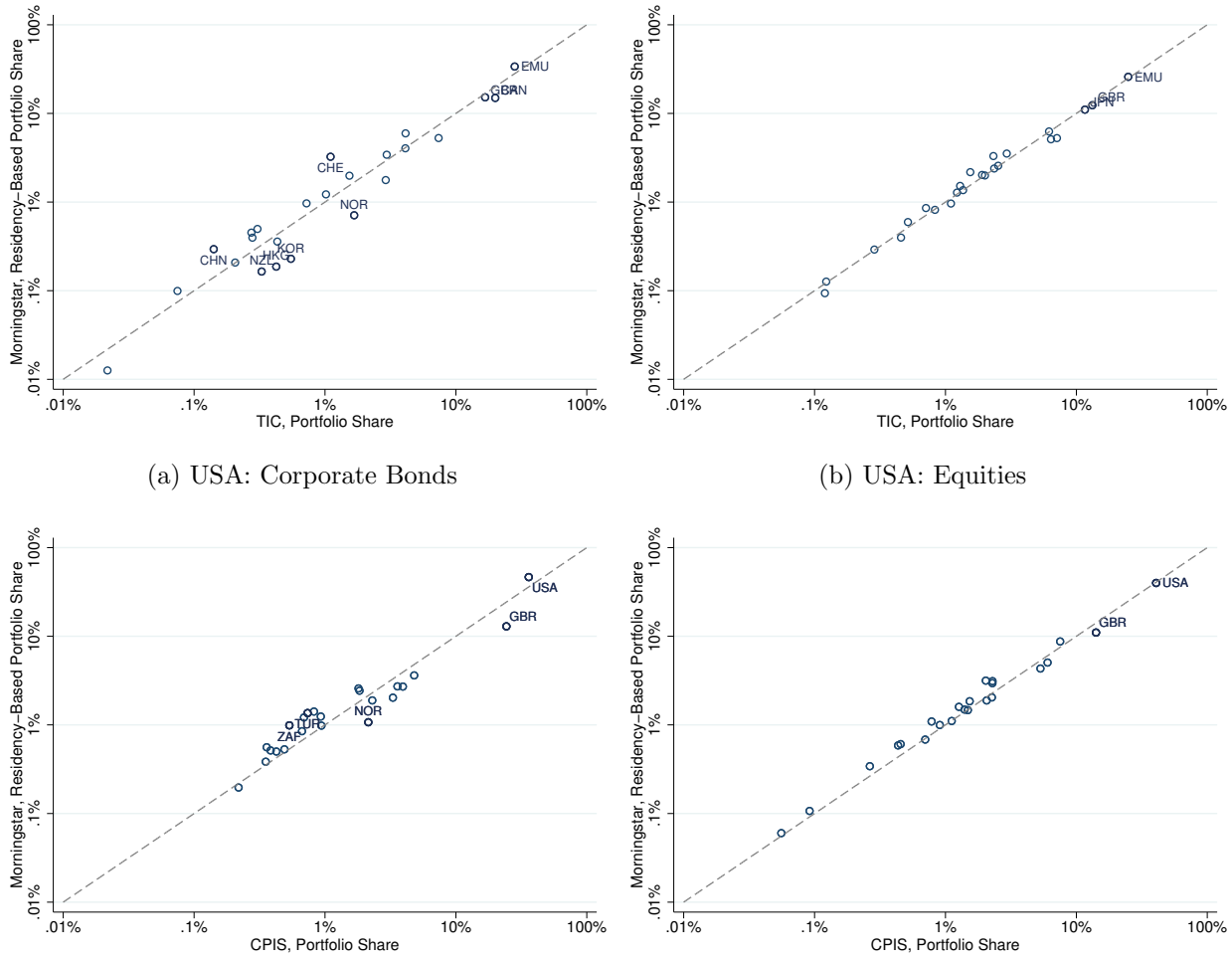


(a) Corporate Bonds



(b) Equity

Figure 2: **Home bias in tax havens.** For each investing country, we show the share of that country's tax haven investments that are reallocated domestically on a nationality basis (*blue bars*), and the share of all other countries' tax haven investments that are reallocated to that country on a nationality basis (*red bars*). Panel A plots these statistics for corporate bond portfolios; panel B does the same for equity portfolios. All data is for the year 2017.



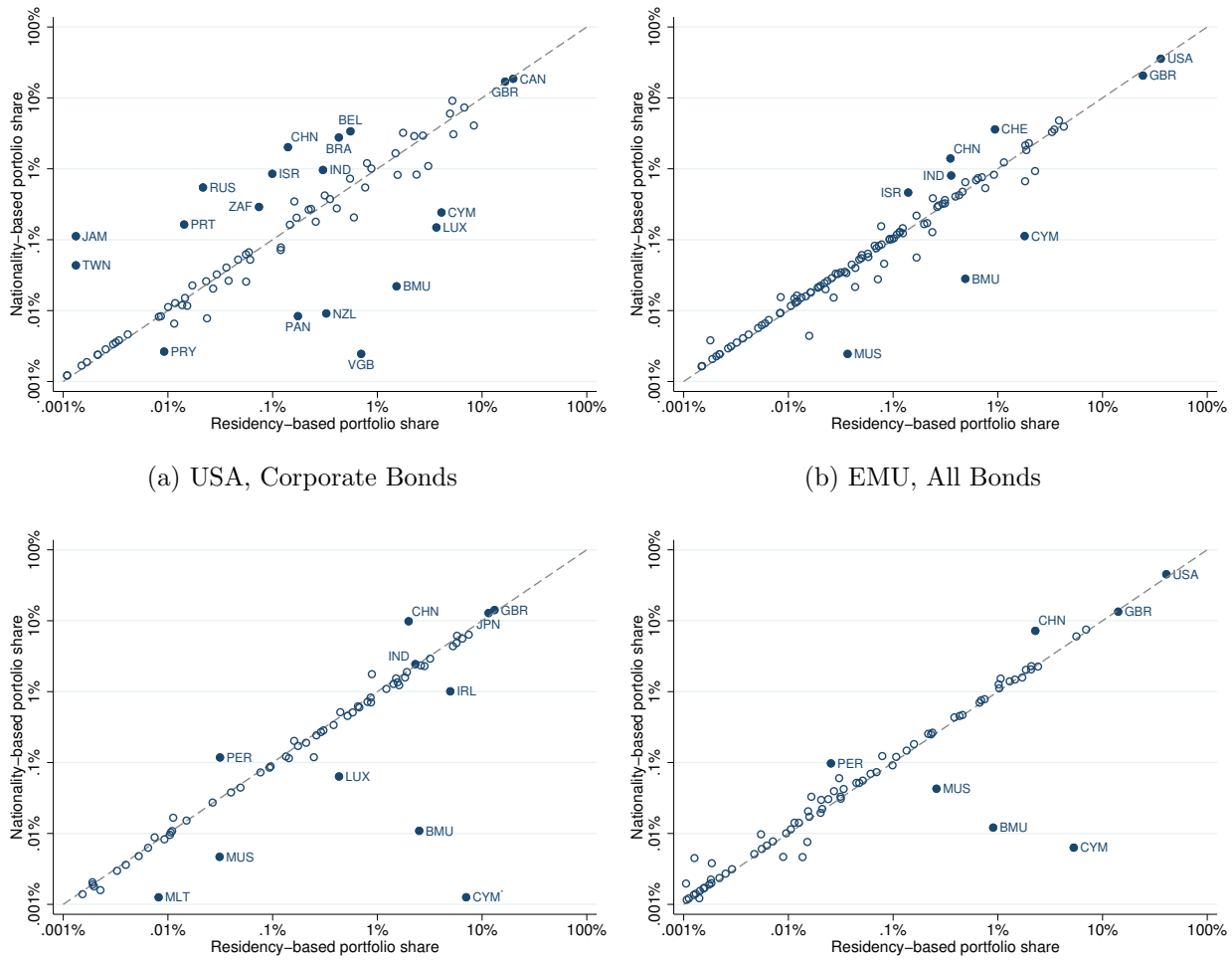
(a) USA: Corporate Bonds

(b) USA: Equities

(c) EMU: All Bonds

(d) EMU: Equities

Figure 3: **Alignment between official bilateral external portfolio composition and residency-based Morningstar data: USA and the EMU.** Panels A and B show the shares that each foreign destination country represents in USA outward portfolio holdings, both as computed in the Morningstar 2017 end-of-year sample using a residency criterion (*horizontal axis*), and as reported in the 2017 TIC data published by the U.S. Treasury (*vertical axis*). Panel A includes corporate debt securities; panel (b) includes all equity securities. Panels C and D repeat the same exercise for the positions reported by EMU member countries in CPIS. Panel C includes all debt securities; panel D includes all equity securities. Corporate debt positions are defined in TIC as holding of private debt minus holdings of asset-backed securities; TIC equity positions exclude holdings of fund shares.



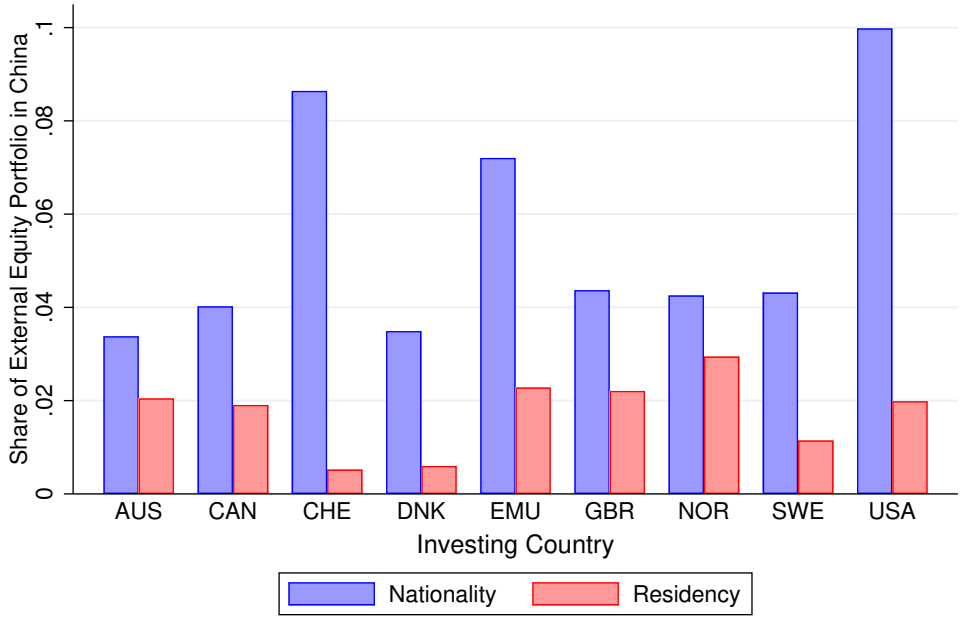
(a) USA, Corporate Bonds

(b) EMU, All Bonds

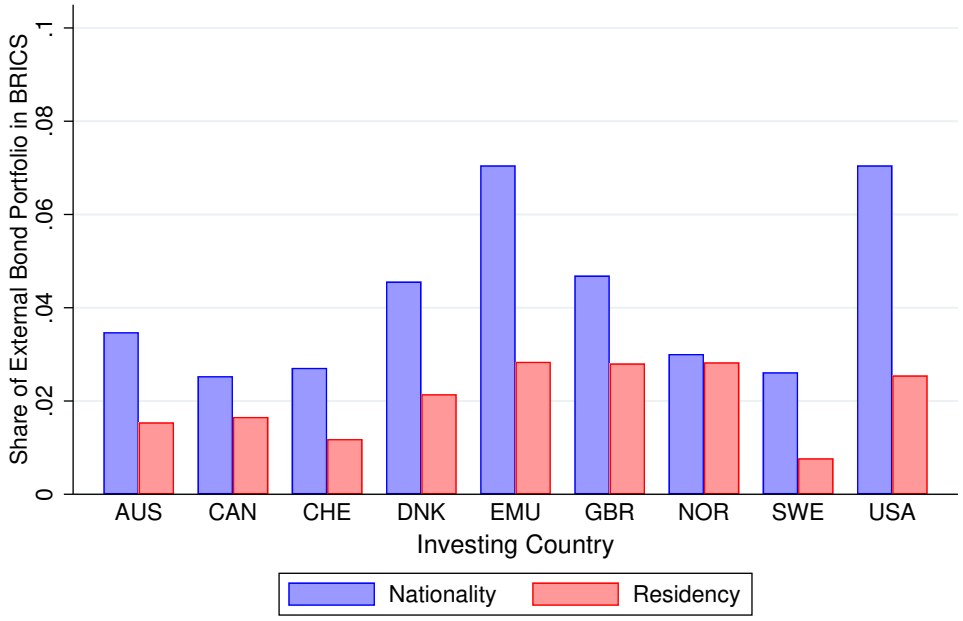
(c) USA, Equities

(d) EMU, Equities

Figure 4: **Bilateral shares of outward portfolios from USA and EMU: official vs. restated nationality-based TIC and CPIS positions.** This plot shows the shares that each foreign destination country represents in the outward portfolio holdings of the USA and EMU on a residency basis (*horizontal axis)* and on a nationality basis (*vertical axis).* The residency-based data come from the official TIC and CPIS releases, while the nationality-based data correspond to our restated versions of TIC and CPIS. Top panels shows corporate bond portfolios for the USA and bond portfolios for the EMU; bottom panels show equity portfolios. All data is for the year 2017. We use the "full nationality" estimates shown in Tables 3-6 in order to provide a full visualization of our reallocations. The plot is on a logarithmic scale.

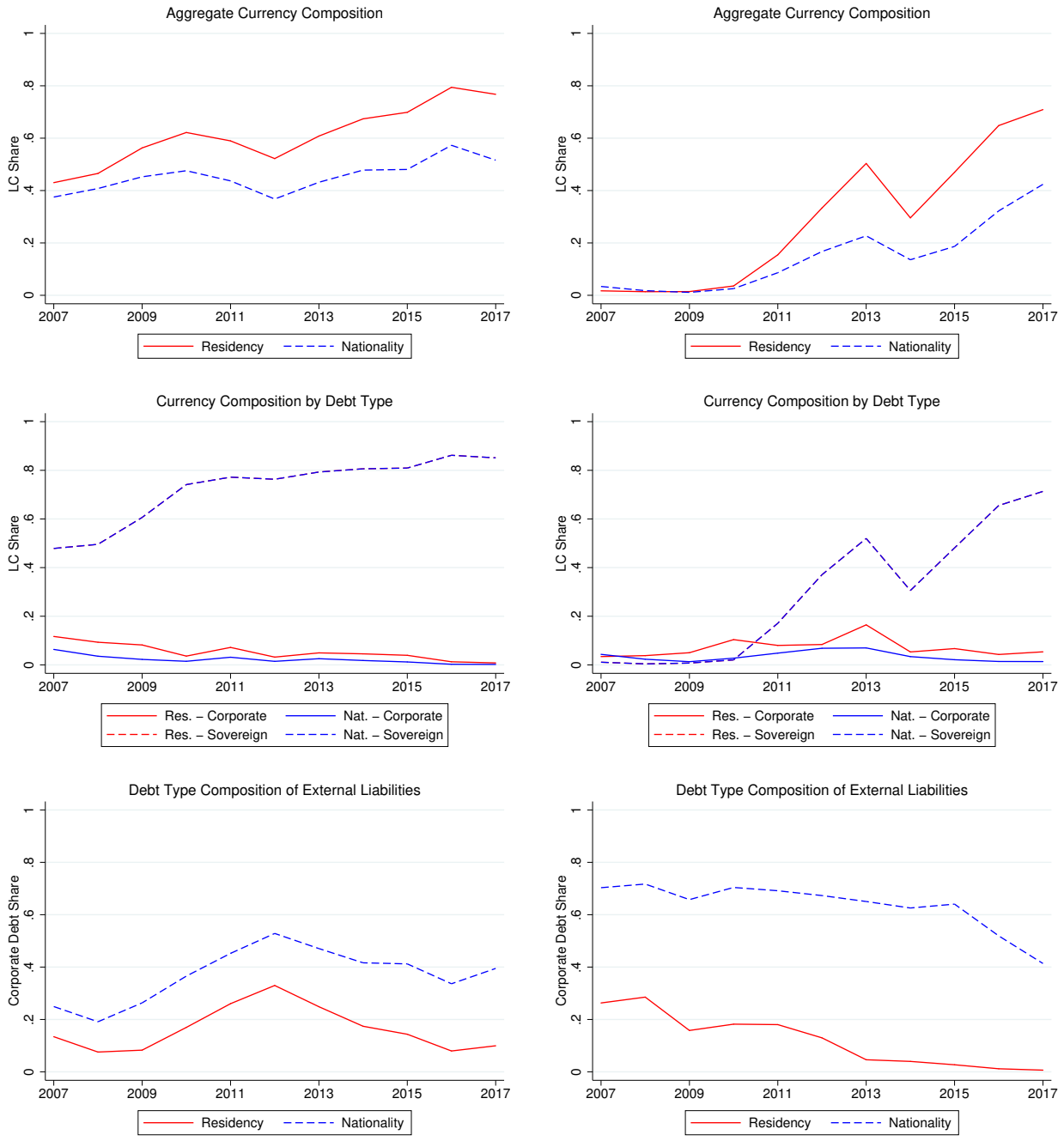


(a) Share of External Equity Portfolio in China



(b) Share of External Bond Portfolio in BRICS

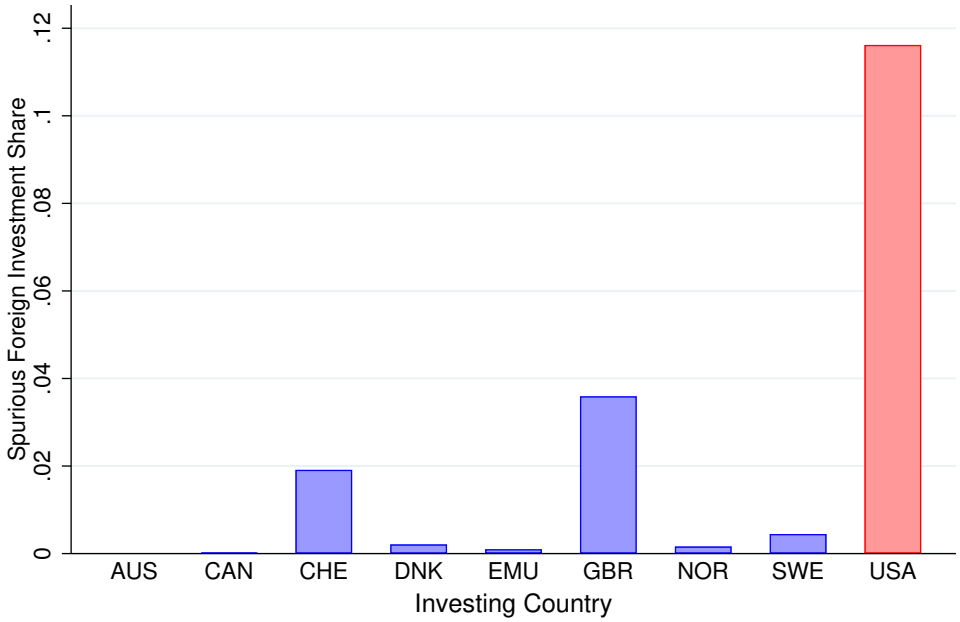
Figure 5: **Portfolio shares in Chinese equities and BRICS debt, across countries: residency vs. nationality.** Using our restated TIC/CPIS data for each investing country, we show the share of all external equity investments that are attributed to China (*panel A*), as well as the share of all external bond investments that are attributed to BRICS countries (Brazil, Russia, India, China, and South Africa; *panel B*). We show this on both a nationality basis and on a residency basis. Nationality bars use our tax haven-only estimates. All data is for the year 2017.



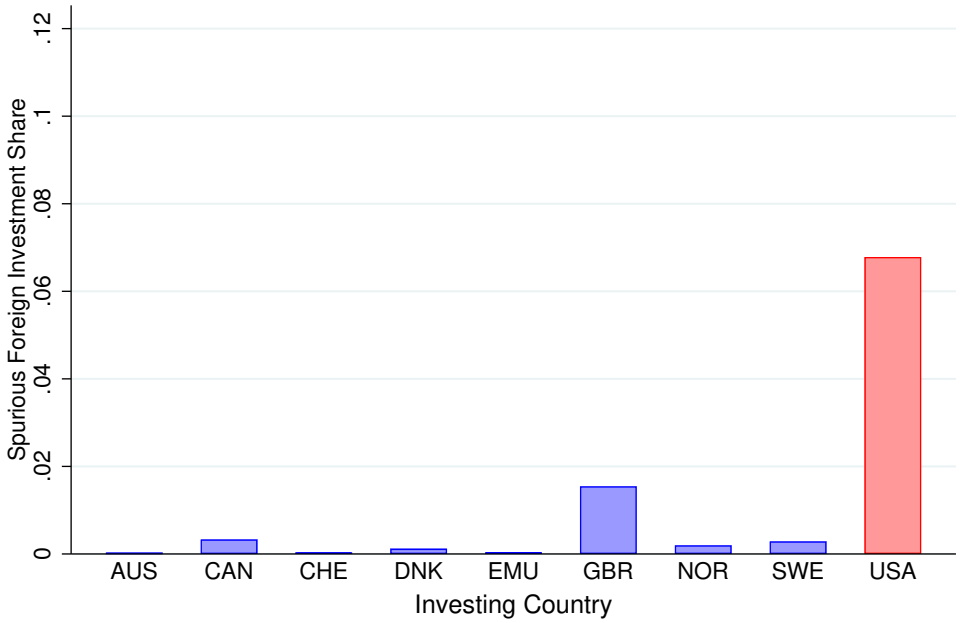
(a) Brazil

(b) Russia

Figure 6: **Understanding aggregate currency exposures in portfolio debt flows.** This graph shows the impact of our nationality-based restatement on the currency composition of portfolio debt flows to Brazil (*panel A, left side of figure*) and to Russia (*panel B, right side of figure*). The *top plot* in each panel shows the local currency share in portfolio debt flows from the ten developed countries in our sample to Brazil and Russia, under residency and under nationality. The *middle plots* show the local currency share under residency and nationality separately for corporate and sovereign debt flows. The *bottom plots* show the share of portfolio debt flows that are corporate under residency and nationality. On a nationality basis, the shift of aggregate portfolio debt flows toward local currency is mitigated, which happens nearly entirely because of the higher weight placed on corporate flows.



(a) Bond Investments



(b) Equity Investments

Figure 7: **Spurious foreign investment due to tax haven issuance.** This graph plots the share of all cross-border investment in bonds (*panel A*) and equities (*panel B*) of each of the ten investing countries in our sample that is reallocated away from tax havens and reclassified as domestic investment on a nationality basis. For the USA, we exclude equity investments in fund shares and other non-common equity.

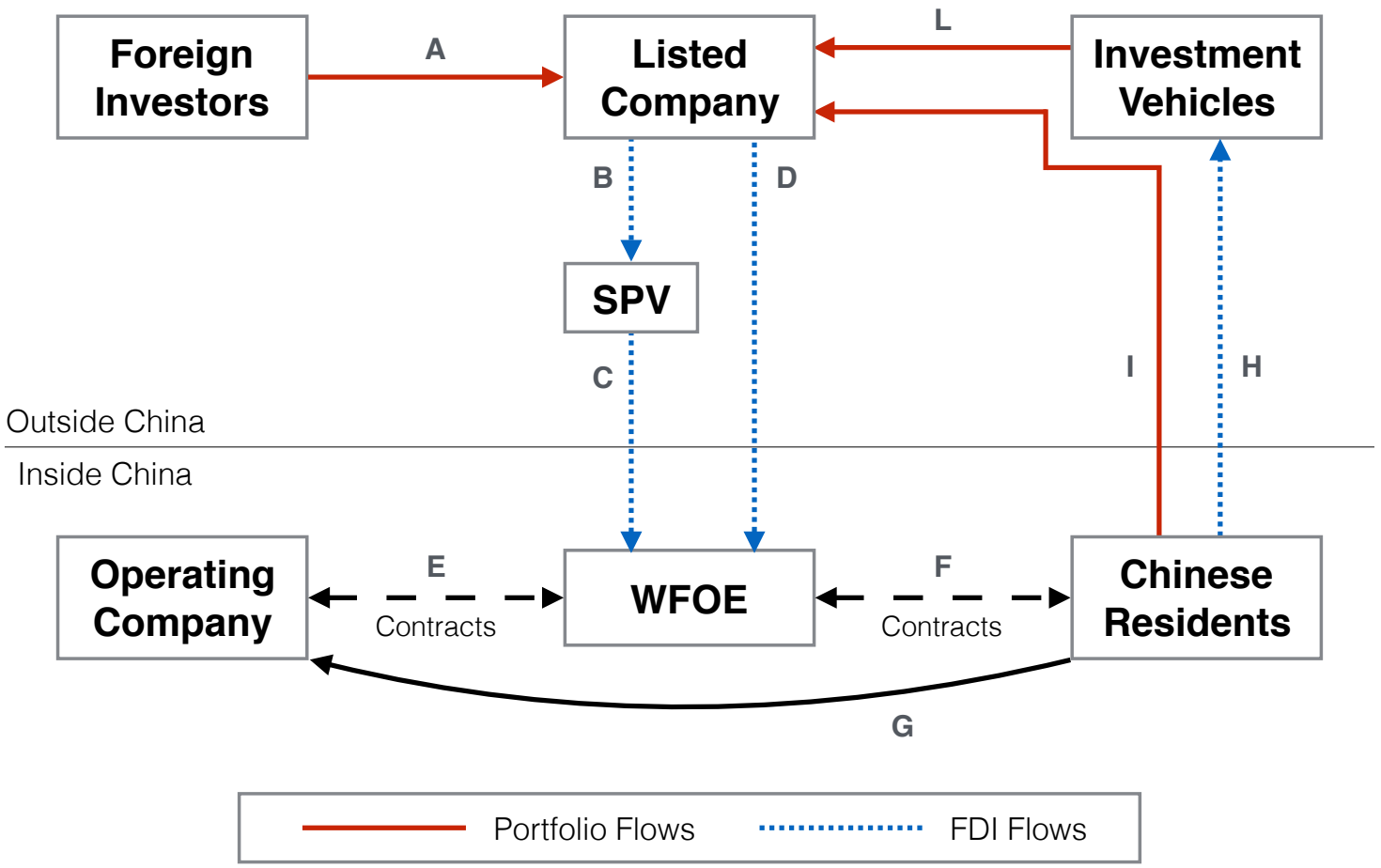
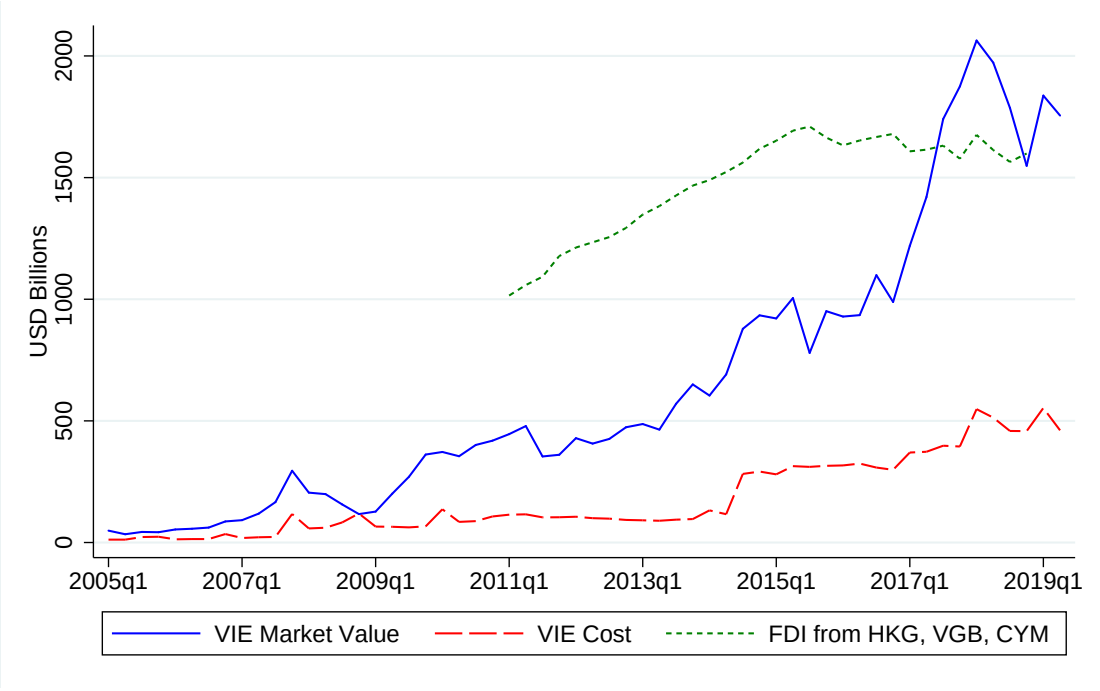
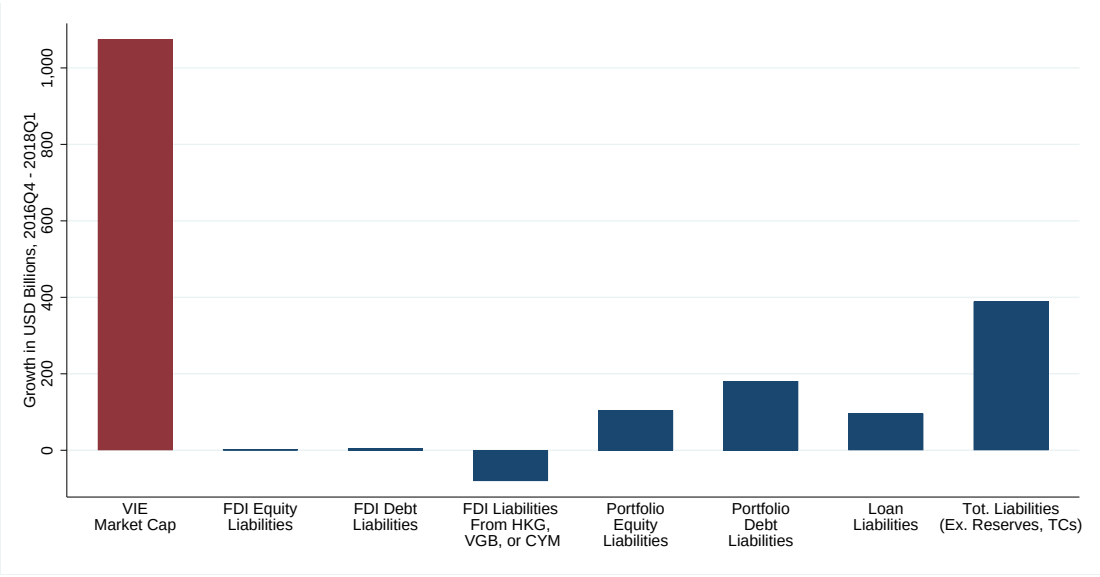


Figure 8: **VIE structure.** This graph displays a simplified characterization of the Variable Interest Entity (VIE) structure used by Chinese firms in order to access foreign capital. The domestic company in China is fully owned by Chinese residents (*arrow G*). The listed public company is located offshore, in the Cayman Islands: foreign investors (*arrow A*) and some Chinese residents (*arrow I*) can hold shares in it. Chinese residents may also own stakes in offshore investment vehicles (*arrow H*) that own shares in the listed company on their behalf (*arrow L*). The listed company owns a Wholly Foreign Owned Enterprise (WFOE) inside China (*arrow D*), oftentimes through a special purpose vehicle (SPV) located in Hong Kong or the British Virgin Islands (*arrows B and C*). The WFOE engages in contracts with the domestic company and its Chinese owners (*arrows Eand F*) designed to transfer the profits of the domestic company to the listed company. We highlight separately portfolio flows (*solid red arrows*) and FDI flows (*dashed blue arrows*) in the diagram.

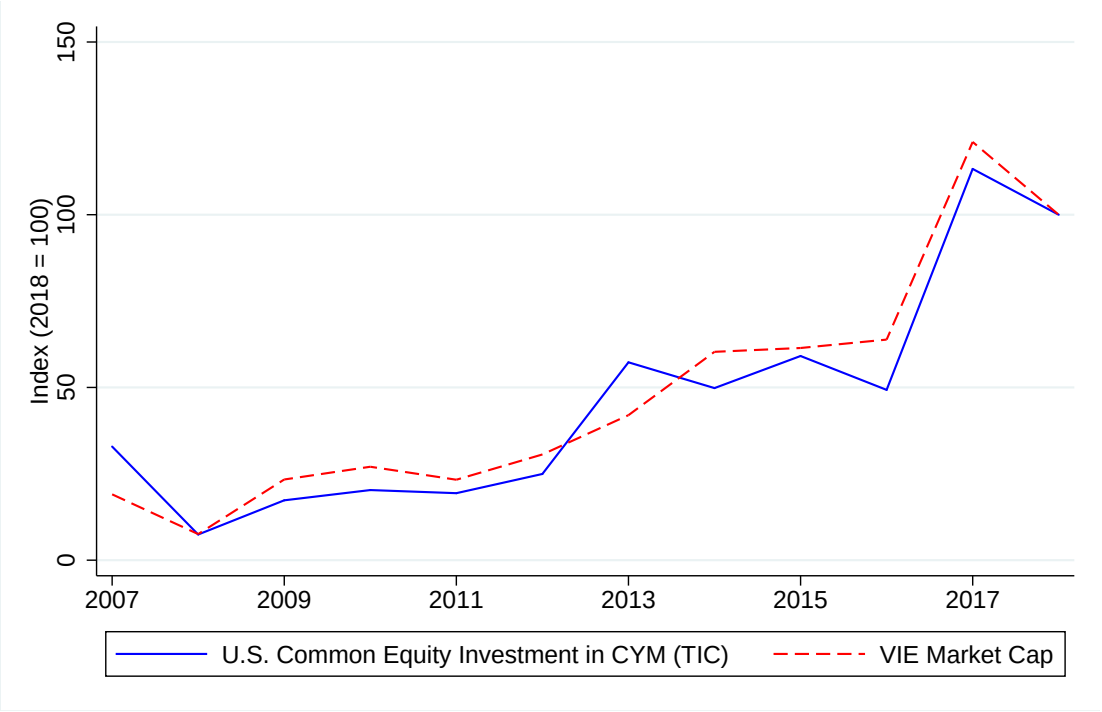


(a) VIE Market Value, Cost, and Inward FDI Flows

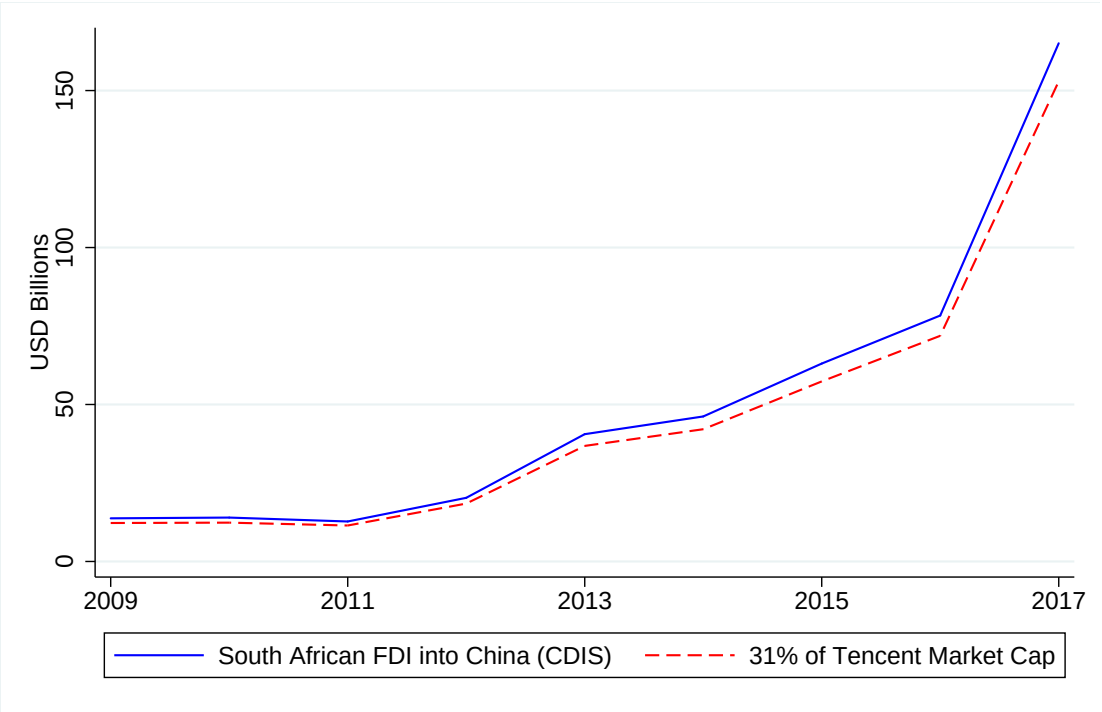


(b) VIE Market Value is Not
Booked in Other Liability Categories

Figure 9: **China's VIEs: market value, cost, and implausibility of market value accounting.** Panel A plots the total market value of all Chinese companies listed offshore via VIE structures (*blue solid line*), together with a measure of the value of those same companies accounted for at cost (*dashed red line*). We take cost to be the value of equity capital raised during public equity offerings, which we only mark to market whenever a secondary equity offering occurs. The graph also shows the total value of all inward FDI flows into China from Hong Kong, the Cayman Islands, and the British Virgin Islands (*dashed green line*). Panel B shows the valuation change for the VIE companies between 2016Q4 and 2018Q1, alongside the corresponding changes in various liability categories of China's Balance of Payments (source: China's State Administration of Foreign Exchange).



(a) U.S. Common Equity Investments in CYM



(b) South African FDI into China

Figure 10: **Counterexamples: VIEs are booked at market value elsewhere.** Panel A shows close co-movement of the U.S. position in Cayman Islands common equity investments (from TIC) and the market capitalization of the VIEs. Panel B shows close co-movement between South Africa's FDI position into China (from CDIS) and the market capitalization of Tencent: the South African FDI position is nearly entirely accounted for by the 31% ownership share of South African multinational Naspers in Tencent.

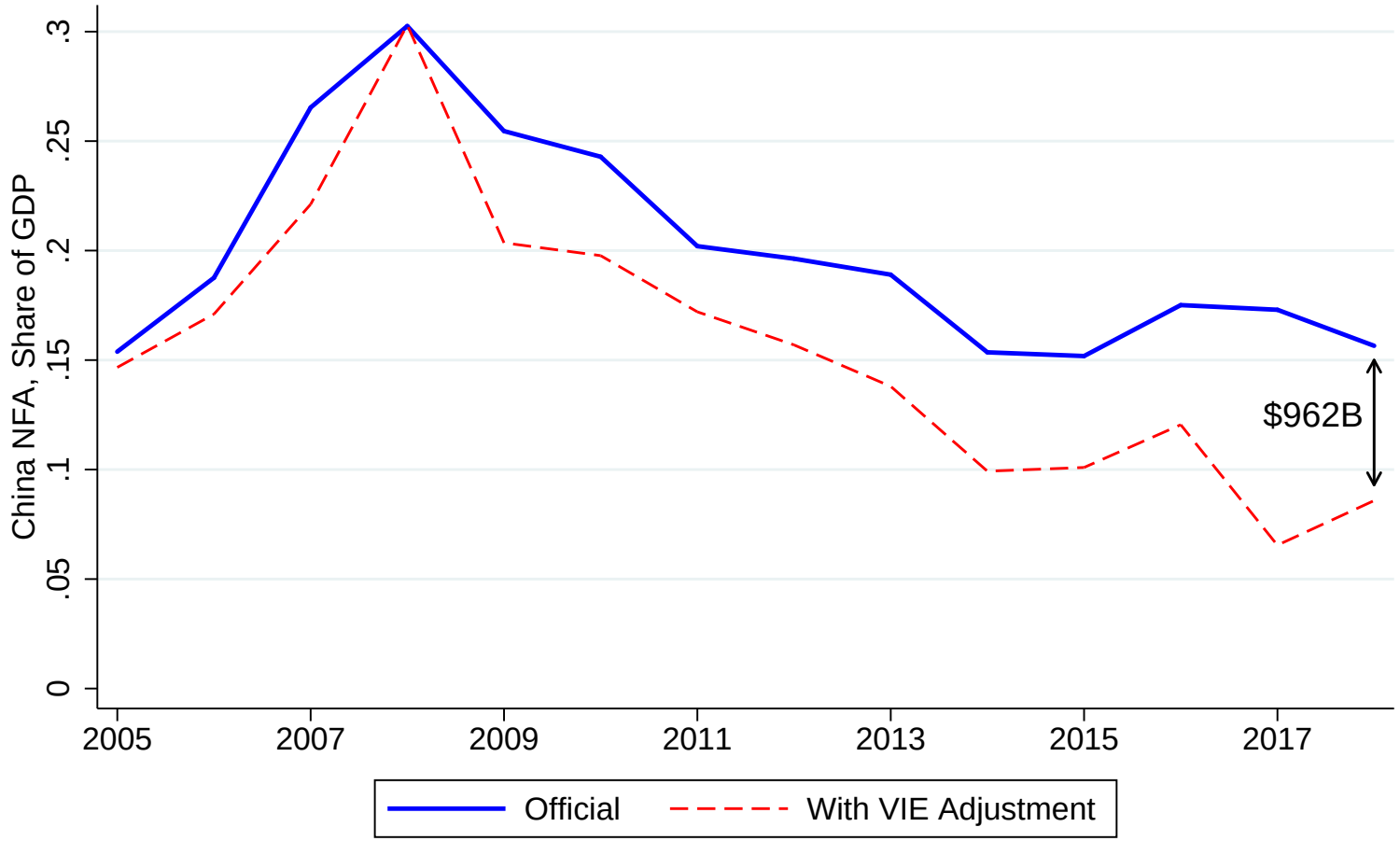


Figure 11: **Mismeasurement in China's Net Foreign Asset (NFA) position.** This graph shows China's official NFA position as a share of GDP (*solid blue line*), alongside our re-estimated NFA position which accounts for the valuation effects due to the market value gains of the Chinese companies listed offshore via VIE structures. Our restated NFA figure assumes that China's gross foreign liabilities are underestimated in the official data by an amount corresponding to the difference between the VIE's market value and their cost. It also assumes that China's official gross foreign assets are understated by an amount corresponding to the insider holdings of the VIEs by Chinese residents. The gap between the official and adjusted positions corresponds to $962 billion in 2018.