REDRAWING THE MAP OF GLOBAL CAPITAL FLOWS: THE ROLE OF CROSS-BORDER FINANCING AND TAX HAVENS*

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Global firms finance themselves through foreign subsidiaries, often shell companies in tax havens, which obscures their true economic location in official statistics. We associate the universe of traded securities issued by firms in tax havens with their issuer's ultimate parent and restate bilateral investment positions to better reflect the financial linkages connecting countries around the world. Bilateral portfolio investment from developed countries to firms in large emerging markets is 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. Further, we demonstrate how offshore issuance in tax havens affects our understanding of the currency composition of external portfolio liabilities and the nature of foreign direct investment. Finally, we provide additional restatements of bilateral investment positions, including one based on the geographic distribution of sales. *JEL Codes:* E01, E44, F21, F23, F32, F34, G11, G15, G32.

I. INTRODUCTION

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

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other regulations, and to access different investors, the corporate sector globally raises 7% of its equity and 9% of its bond financing via foreign subsidiaries located in tax havens. Standard economic data 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. Financial globalization has left bilateral investment statistics that do not adjust for offshore security issuance ill-suited for many questions of economic and policy interest.

In this article, we match foreign subsidiaries located in tax havens to their parents with a security-level data set on global fund holdings and restate bilateral investment positions to reflect the true financial linkages across countries. We find that the scale of bilateral portfolio investment from developed economies to emerging market countries is vastly understated when offshore issuance is not taken into account. Furthermore, we demonstrate how the pervasive use of corporate affiliates to raise money overseas is important for assessing the scale of global imbalances, the currency composition of emerging markets' external portfolio liabilities, and the nature of foreign direct investment (FDI). Finally, we offer additional restatements of bilateral investment positions useful for understanding other aspects of our increasingly globalized world, including one restatement that links investment in a firm with the geographic distribution of its sales and another that links all foreign affiliates, even those not in tax havens, with the location of their ultimate parents.

We start in Section II by developing an algorithm that combines information from seven commercial sources to associate subsidiaries that issue securities in tax havens with their ultimate parent firm and with their ultimate parent firm's country.[1] Our data set covers the universe of traded securities—bonds and equities—globally. We merge this subsidiary-parent mapping with a data set of global mutual fund and exchange-traded fund (ETF) holdings provided by Morningstar and assembled in Maggiori, Neiman, and Schreger (2020, henceforth MNS). For each position in the data associated with an issuer in a tax haven, 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, in the

1. Our algorithm and all key results are available online for download and use at globalcapitalallocation.com.

Morningstar data, we observe billions of dollars of Eurozone 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 Eurozone investments in the financial sector of the Cayman Islands. Merging our mapping with the Morningstar holdings data, we can instead classify these positions as Eurozone investments in Brazil's energy sector, a treatment consistent with a "nationality" basis, which registers the country of the issuer's ultimate parent. Aggregating over all investments by each country in each asset class, we build a set of reallocation matrices that characterize how to convert a data set of bilateral investment positions from a residency to a nationality basis.

In Section III, we apply these reallocation matrices to two widely used, publicly available, and residency-based data sets—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.[2] For example, one entry in our reallocation matrix for U.S. corporate bond positions specifies that 20% 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.[3] We multiply the value in TIC of overall U.S. holdings of Cayman Islands corporate bonds by this 20% to calculate the value of those bonds that should under nationality be considered to be Brazilian. We apply this procedure and report nationality-based bilateral investment positions for nine developed economies with high-quality data on fund holdings: the United States, the European Monetary Union (EMU), the United Kingdom, Canada, Switzerland, Australia, Sweden, Denmark, and Norway.

2. TIC covers foreign portfolio investments in securities made by U.S. residents and is used by the Bureau of Economic Analysis to calculate the U.S. external accounts. The CPIS data set covers the foreign bilateral portfolio investments of a large number of other countries. Coverage of cross-border activity in these data sets is likely high, though as noted in the TIC documentation, "Transactions by or holdings of individuals or institutions that fall below the mandatory reporting levels will not be captured."

3. The value of U.S. holdings of PIFCO bonds—analogous to the example for Eurozone investors—contributes to our calculation of this 20%.

TIC and CPIS aim to 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 security investments, including those not made by funds or made by funds excluded from the Morningstar data. We directly corroborate this assumption by showing the close similarity of restated positions computed using our fund holdings data with restatements that are based on the holdings of insurance companies in the case of the United States and the sovereign wealth fund (SWF) in the case of Norway.

The resulting nationality-based statistics paint a vastly different picture of global capital allocation than the original residency-based data. We organize our discussion of this redrawn map around two important patterns. First, the revised positions involve significantly larger bilateral portfolio debt investments from developed markets to large emerging markets including Brazil, China, India, Russia and South Africa (the BRICS countries). Firms in those countries disproportionately issue bonds through affiliates that are resident in tax havens in part to minimize the burden of withholding taxes that apply to interest payments on foreign-held bonds. As a result, our revised positions reveal that U.S. investments in Brazilian corporate bonds, for example, equal $50 billion, much larger than the $8 billion position listed in TIC. EMU holdings of Russian debt triples from $36 billion in CPIS to $107 billion in our restated tables. Similar patterns are found for the investments in emerging market debt securities of the rest of the developed economies in our study. The value of debt holdings by each of the nine developed economies in Bermuda, the Cayman Islands, Ireland, Luxembourg, the Netherlands, and Panama plunges. Furthermore, corporates often issue in foreign currency via their tax haven affiliates, whereas sovereigns issue externally under their own names. Our restatements therefore highlight that standard residency-based data sets overstate the importance of sovereign relative to corporate bonds and understate the foreign currency share in the external portfolio liabilities of large emerging markets.

Second, the revised positions involve a massive increase in the bilateral holdings of Chinese equities by each of the advanced economies. These positions predominantly reflect investment in variable interest entities (VIEs), opaque corporate structures

designed to circumvent China's capital controls that restrict foreign ownership in key industries.[4] For example, whereas the national statistics for 2017 list the United States as holding $154 billion in Chinese common equities, we find the position to be worth about $700 billion. We estimate that the EMU's exposure to Chinese equities exceeds $320 billion, more than triple the value listed in official statistics. Further, we demonstrate that this reliance on equity issuance through affiliates in tax havens results in a large upward bias in China's reported net foreign asset (NFA) position. The reason for this mismeasurement stems from the fact that when foreign equity investors buy shares in tax haven affiliates that have a majority stake in Chinese companies, only the affiliates' holdings constitute external liabilities in China's international accounts. These holdings reflect a complex series of corporate linkages embodied in the VIE structure that are likely recorded as FDI rather than portfolio investment, and their value does not closely comove with the stock market price of the listed affiliate.[5] For example, we show that when China's offshore listed companies increased in market value by nearly $1 trillion during 2016–2018, China's external liabilities moved by dramatically less. We do not take into account other potential sources of mismeasurement, but demonstrate that adjusting the value of China's external accounts to reflect the equity market values of the VIEs on its own halves China's NFA. This adjustment shrinks China's officially reported net creditor position of $2.1 trillion—one of the world's largest—by $1.1 trillion.

In Section IV, we discuss the role played by security-level micro data in our analyses. We start by explaining why our restatements cannot be performed using existing publicly available aggregate data sets. Next we calculate nationality-based bilateral investment statistics for all investor countries in CPIS—not just the nine for which we have holdings data—using micro data on the total amount of each security outstanding globally. Although we

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.

5. This pattern of portfolio investment being masked as FDI due to offshore issuance likely holds around the world, not just in China, a possibility suggested in Blanchard and Acalin (2016). The potential misclassification of portfolio and FDI positions carries important policy implications because countries often differentially regulate these types of investments based on the presumption that they exhibit different dynamic behavior.

view these expanded results as useful for broader cross-country analyses, we demonstrate that, when possible, country-specific holdings data should be used as the basis for such restatements. One reason that holdings data are preferable is that they capture the pattern that investors skew their tax haven portfolios toward affiliates of parent companies located in their home country, a phenomenon we dub "home bias in tax havens."

We conclude our analysis with Section V, which emphasizes that answering different economic questions may require different types of restatements of standard residency-based statistics. Our baseline treatment, for example, only reallocates positions away from tax havens like the British Virgin Islands or Guernsey as nearly all economic analyses are better informed by associating the issuances of tax haven affiliates with their ultimate parents.[6] Our algorithm easily allows users to reallocate the issuances of subsidiaries that are not in tax havens. Analyses focused on corporate control or worldwide group financing, for example, might want to bundle securities issued by Toyota Motors North America, a U.S.-resident company, with those issued by its Japanese parent company, a treatment we refer to as "full nationality." We also move beyond classifying companies as belonging to a single country and instead reallocate them to multiple countries in proportion to where they earn their revenue, a treatment that may be most useful for calibrating the geographic exposures of investors' wealth to demand shocks in multicountry trade and macro models. Relative to our other measures, this sales-based reallocation reduces investors' exposures to economic activity in their own countries and reveals an even larger rise in the importance of China in advanced economy portfolios.

I.A. Related Literature

Our article contributes to a growing literature on the economic impact of tax havens, including Hines and Rice (1994), Desai, Foley, and Hines (2004), Gravelle (2009), Zucman (2013), Guvenen et al. (2018), and Tørsløv, Wier, and Zucman (2018). Much of the literature has focused on the use of tax havens by wealthy households to shield assets from taxation and by developed market firms to minimize corporate tax exposures. Our results shed

6. Online Appendix A.I details the primary motivations for offshore issuance and offers examples for each corresponding case. See also Fuertes and Serena (2016), who investigate how firms choose in which international market to borrow.

light on a different role of tax havens as conduits for emerging market firms to access developed market capital.

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), Avdjiev, McCauley, and Shin (2016), and Warnock and Cleaver (2003), for example, highlight the growing importance of financial centers and tax havens in intermediating global capital flows, which renders standard data sets increasingly inadequate. The BIS has spearheaded the production of statistics for international debt securities outstanding by country under both residency and nationality. 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 Survey (CDIS) after accounting for positions in tax havens. Our contribution is to offer a global analysis of bilateral portfolio investment for many countries and under different conceptual treatments. Our approach stresses open availability of code and data and aims to contribute a novel set of tools and analysis for others in the field to build on.[7]

The implications of our restated bilateral investment positions touch a wide range of literatures and have clear 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). Forbes (2010) studies the determinants of global investment into U.S. securities. Most recently, Koijen and Yogo (2019) and Jiang, Richmond, and Zhang (2020) use CPIS data to estimate a demand system for financial assets.

Finally, our result that offshore issuance on its own leads to a large mismeasurement in China's NFA is important for work on global imbalances, such as Bernanke (2005), Gourinchas and Rey (2007), Caballero, Farhi, and Gourinchas (2008), Gourinchas, Govillot, and Rey (2011), Maggiori (2017), and Farhi and Maggiori (2018). Although much of the focus in the literature has been

7. 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 data sets we draw from.

on the effect on U.S. interest rates of large Chinese holdings of U.S. Treasuries, we focus on the distribution of China's external corporate financing. This complements recent efforts to better document the global distribution of China's official foreign lending by Horn, Reinhart, and Trebesch (2019).

II. Residency, Nationality, and Our Methodology

Official data on international portfolios are typically compiled on a residency basis, which means that they associate a security with the immediate location of the issuer of that security. This residency concept, for example, guides countries' production of their balance of payments (BoP) and the international transactions appearing in their national accounts. Although residency-based data can be particularly helpful in certain cases, nationality-based data that associates securities with the location of the issuer's ultimate parent is often more useful, particularly when tax havens are involved. In this section, we discuss these concepts and describe our procedure for restating residency-based data on bilateral investment positions on a nationality basis.

II.A. Residency-Based Statistics

Residency-based statistics on bilateral investment positions have some clear advantages. Associating an investment with the issuer's registered location offers administrative ease and avoids conceptual ambiguity. Furthermore, when firms issue through operating affiliates located in countries that are not tax havens, the residency concept may in some cases best represent the location where capital is deployed.[8] However, the amount invested by foreigners in securities issued by firms resident in tax havens vastly exceeds the scale of these economies, making it implausible that the residency-based treatment reflects true economic activity. For example, total foreign portfolio investment in the Cayman Islands reported in CPIS in 2017 is $3.9 trillion, while the Cayman Islands' GDP is only $5 billion, a thousand-fold difference. We describe our methodology that associates bilateral investment positions that are linked to tax havens on a residency basis with their geography when treated on a nationality basis.

8. Furthermore, if capital raised from investors never passes through the parent company, tracing out the full use of that capital might be best accomplished with residency-based investment positions plus data on intercompany lending.

II.B. Nationality-Based Statistics

Our baseline results only apply a nationality-based restatement to investments in tax havens because this type of relationship most clearly lacks economic content and is not relevant for most economic analyses.[9] In principle, however, one might want to associate all security issuances with the location of their ultimate parent company, whether tax havens are involved or otherwise. For example, if an economic question focuses on issues of corporate control or group-level financing, one may wish to associate investment in Toyota Motors North America, a U.S.-resident company, with its Japanese parent. More broadly, the most appropriate concept in accounting for these positions will depend on the question at hand. Some analyses, for example, may wish to associate given investments with multiple countries based on the distribution of sales or other variables. We will turn to such restatements in Section V. Online Appendix Table A.I lists the countries that our analysis treats as tax havens.[10] Securities issued by affiliates of foreign companies in these tax havens account in 2017 for 7% and 9%, respectively, of the total value of equities and corporate bonds outstanding worldwide.

II.C. Mapping Subsidiaries to Parents

Our first step is to connect security issuers, defined by their six-digit CUSIP identifier (the CUSIP6), to their parents. To do this, we combine information from seven commercially available data sources, including CUSIP Global Services (CGS) and map each issuer of the 26 million stocks and bonds in CGS's master file to a single ultimate parent company.[11] Each source uses its own

9. One prominent exception, of course, is the analysis of taxes paid or collected (either withholding for investors or corporate taxes for the firm) by locating activity in tax havens. Even then our analysis that associates affiliates in tax havens with companies located in non–tax havens is an important input.

10. As detailed in Online Appendix A.II, our list of tax havens is based on Hines (2010), which itself is an update on the list in Hines and Rice (1994) and is commonly used in the tax haven literature, including in Dharmapala, Foley, and Forbes (2011) and Desai, Foley, and Hines (2006). Like Tørsløv, Wier, and Zucman (2018), we add the Netherlands to this list because it is a large securities issuance center for multinational companies. We remove Switzerland from the list because our focus is on security issuance rather than taxation or illicit bank accounts, and Switzerland is not a large center for offshore security issuance.

11. The seven sources are (i) the CGS Associated Issuer (AI) database, (ii) the Refinitiv SDC Platinum New Issues database (SDC), (iii) the S&P Capital IQ

methodology to form these mappings, and we establish majority and priority rules to resolve disagreements across sources. Online Appendix A.III offers a detailed description of our methodology.

Our algorithm reassigns the vast majority of securities issued in tax havens. For instance, it reallocates more than 90% of corporate bonds and equities issued by firms resident in Bermuda, Curaçao, the Cayman Islands, the Channel Islands, Luxembourg, Macau, Panama, and the British Virgin Islands. Hong Kong, Ireland, the Netherlands, and Singapore are four exceptions with lower reallocation rates that range from 33% to 72% since these countries are destinations for offshore issuance but also have significant domestic issuance by companies actually operating there. Online Appendix Table A.II 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.

II.D. Reallocation Matrices

The next step in restating bilateral investment positions to account for offshore issuance is to 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. We merge our mapping of affiliates to parents with security-level data on the worldwide holdings of mutual funds and ETFs, obtained from Morningstar and introduced in MNS. As of December 2017, these data include the positions of 61,000 funds reporting over 11 million individual positions worth $32 trillion.

For our purposes, the Morningstar data set provides sufficient coverage of mutual fund and ETF assets under management (AUM) in the United States, the EMU, the United Kingdom, Canada, Switzerland, Australia, Sweden, Denmark, and Norway.[12] Following the approach in MNS, we treat the domicile

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) Morningstar data on the holdings of open-end mutual funds and ETFs. While our core procedure is CUSIP-based, we also aggregate securities that have an ISIN identifier but no corresponding CUSIP.

12. 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. 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

of each fund as reflecting the nationality of its investors with the exception of EMU countries, which we pool together because they heavily invest in funds domiciled in Luxembourg and Ireland.[13] After merging our affiliate-to-parent mapping with these position-level data on fund holdings, we calculate each fund's holdings both under residency and under nationality. We then aggregate across all funds' positions and construct, for each investor country, asset class, and year 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 example, 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. Let $x^{\mathcal{R}\to\mathcal{N}}_{i,k,j}$ denote the dollar value of these same holdings that under 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 1.

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 article. See Maggiori, Neiman, and Schreger (2019) and Lilley et al. (forthcoming) for additional applications using these data.

13. MNS uses TIC data to demonstrate the relatively small scale of U.S. investment in foreign mutual funds and of foreign investment in U.S. mutual funds. By contrast, MNS uses CPIS data to document that 72% of investment in Luxembourg mutual funds comes from other EMU countries. 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. 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.

As an illustration, Table I shows selected entries from the reallocation matrix for U.S. investments in corporate bonds. 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 and under nationality would be allocated to the country listed atop that column. For example, 20.1% of U.S. corporate bond investments in the Cayman Islands are reallocated to Brazil, 33% to China, and 13.3% to the United States.[14] The diagonal elements show the fraction of investments in each destination that are not reallocated elsewhere. Each row's values sum to 100% (for ease of reading, we only list nonzero entries). Table I and the full reallocation matrices (available online) include rows that correspond to countries that are not tax havens and that contain multiple positive values. When computing our baseline results that only reallocate away from tax havens, we replace those rows with a value of 100 on the diagonal and with 0 otherwise.[15]

We compute a separate matrix for each investor country, asset class, and year.[16] For example, in 2012 the Brazilian energy giant Petrobras established a financing subsidiary in the Netherlands called Petrobras Global Finance BV, and U.S. investors bought substantial amounts of the bonds issued by this company. As a result, as plotted in Online Appendix Figure A.III, the cell corresponding to Brazil in our reallocation matrix for U.S. corporate bond investment in the Netherlands increases from 0% in 2011 to over 10% by 2014. We are able, therefore, to recover historical series that reflect changes over time in how firms use tax havens to raise financing.

14. We note that this 13.3% are foreign investment positions in residency-based data that should, under nationality, not be considered foreign investment at all. As discussed in Online Appendix A.IX, we find that 9% of all U.S. holdings of foreign common equities and 11% of all foreign bond holdings in official statistics are better thought of as domestic investments. These investments largely reflect the issuance in the Cayman Islands of collateralized loan obligations (CLOs) backed by U.S. assets as well as tax inversions into Ireland by U.S. firms.

15. We use the unedited matrix when calculating the full nationality version of our results in Section V.

16. Our analyses of TIC separately study common equities, corporate bonds, government bonds, 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.

TABLE I

REALLOCATION MATRIX, U.S. CORPORATE DEBT INVESTMENTS, 2017

	Share reallocated to:															
Destination	BMU	BRA	CAN	CHN	CYM	DEU	GBR	HKG	IND	IRL	JPN	LUX	PAN	RUS	USA	RoW
BMU	1.2	0.5	1.0	1.1		0.4	10.2	1.3		1.7	1.2				64.0	17.4
BRA		100.0														
CAN		0.1	95.2	0.3		0.1	0.3				0.2				2.9	1.0
CHN				99.2			0.8									
CYM		20.1	0.1	33.0	1.4	0.1	3.8	5.6		4.2	0.9				13.3	17.4
DEU						93.4	6.2								0.3	0.2
GBR		0.2	0.1				86.5		1.4		0.2				4.0	7.7
HKG				55.0		3.7	5.8	28.1	0.2							7.2
IND									100.0							
IRL				0.1		0.4	1.8			29.8	21.9			4.7	39.4	1.9
JPN											100.0					
LUX		4.4	1.2	0.1		3.0	1.5			0.4		4.4		10.9	45.2	29.0
PAN		2.3											5.4		82.2	10.1
RUS														100.0		
USA		0.3	0.7	0.1		0.8	1.3		0.1	0.3	1.7				92.3	2.3

Notes. This table shows the share of U.S. investment into selected destination countries (rows) that are distributed to each other country (columns) on a nationality basis. Values are expressed in percentage points. The last column, Rest of World (RoW), shows the sum of the shares allocated to all remaining countries.

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

$$q_j^{\mathcal{N}} = \Omega_j' q_j^{\mathcal{R}}, \tag{3}$$

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.

III. A New Map of Global Capital Allocations

In this section, we discuss how the global map of capital allocation changes when we apply our reallocation matrices to residency-based data on the bilateral investment positions of nine investor countries to restate them on a nationality basis. Tables II and III report key entries in our restatements of TIC for U.S. positions in corporate bonds and common equity for 2017, and Tables IV and V report the same for CPIS data on EMU positions in total bonds and total equities (which includes fund shares).[17] Online Appendix Tables A.III–A.VI report equivalent values for Canada and the United Kingdom, and we have posted these tables online in their entirety for all nine investor countries, asset classes, and years. The first three columns in these tables list the investment destination country, its ISO code, and the value of the corresponding position when stated under residency in TIC and CPIS. Columns (4) and (5) report our calculation of the corresponding nationality-based positions and the implied change relative to the residency-based positions.

17. We obtain corporate bond positions in TIC by starting from private debt and then removing asset-backed securities. While TIC breaks out common equities, CPIS combines common shares, fund shares, and holdings in other types of equity assets such as investment trusts. We only apply our reallocation to common equity positions, so for countries other than the United States, we estimate their magnitude using a methodology detailed in Online Appendix A.IV.

TABLE II

ESTIMATED NATIONALITY-BASED OUTWARD U.S. CORPORATE DEBT PORTFOLIOS, 2017

			With Reallocation	
Destination	ISO code	TIC	Position	Δ
Panel A: Selected non–tax haven countries				
Argentina	ARG	5	5	0
Australia	AUS	144	144	0
Brazil	BRA	8	50	42
Canada	CAN	390	393	4
China	CHN	3	48	45
France	FRA	118	120	2
Germany	DEU	60	80	20
India	IND	6	10	4
Indonesia	IDN	5	9	4
Italy	ITA	16	29	13
Japan	JPN	80	95	15
Mexico	MEX	58	58	0
Russia	RUS	0	12	12
Saudi Arabia	SAU	1	1	0
Spain	ESP	16	19	2
South Africa	ZAF	1	6	5
South Korea	KOR	11	11	0
Turkey	TUR	4	4	0
United Kingdom	GBR	308	326	18
Panel B: Selected tax havens				
Bermuda	BMU	30	0	−30
Cayman Islands	CYM	80	1	−79
Curaçao	CUW	3	0	−3
Guernsey	GGY	13	0	−13
Hong Kong	HKG	8	7	−1
Ireland	IRL	63	25	−39
Jersey	JEY	14	0	−14
Luxembourg	LUX	72	3	−69
Netherlands	NLD	179	95	−84
Panama	PAN	3	0	−3
British Virgin Islands	VGB	14	0	−14
Panel C: Total foreign corporate bond holdings				
Total foreign holdings	—	2,058	1,949	−109
Panel D: Domestic reallocation				
United States	USA	5,247*	5,356	109

Notes. This table presents estimates of restated outward U.S. corporate debt portfolio positions on a nationality basis, which we compare to TIC data. We present our baseline estimates, which only reallocate holdings away from tax havens. Positions in the TIC column with an asterisk (*) are our estimates. Corporate debt is defined in TIC as private debt holdings minus holdings of asset-backed securities.

TABLE III

ESTIMATED NATIONALITY-BASED OUTWARD U.S. EQUITY PORTFOLIOS, 2017

			With Reallocation	
Destination	ISO code	TIC	Position	Δ
Panel A: Selected non–tax haven countries				
Argentina	ARG	9	11	1
Australia	AUS	181	182	1
Brazil	BRA	119	120	1
Canada	CAN	493	501	8
China	CHN	154	696	542
France	FRA	434	447	14
Germany	DEU	375	385	10
India	IND	179	183	4
Indonesia	IDN	40	40	0
Italy	ITA	96	105	10
Japan	JPN	895	911	17
Mexico	MEX	64	64	0
Russia	RUS	55	59	4
Saudi Arabia	SAU	0	0	0
Spain	ESP	123	123	0
South Africa	ZAF	100	100	0
South Korea	KOR	226	226	0
Turkey	TUR	22	22	0
United Kingdom	GBR	1,019	1,146	126
Panel B: Selected tax havens				
Bermuda	BMU	195	1	−194
Cayman Islands	CYM	547	0	−547
Curaçao	CUW	68	0	−68
Guernsey	GGY	14	0	−14
Hong Kong	HKG	147	140	−6
Ireland	IRL	385	71	−315
Jersey	JEY	94	0	−94
Luxembourg	LUX	33	4	−29
Netherlands	NLD	339	276	−63
Panama	PAN	26	0	−26
British Virgin Islands	VGB	15	0	−15
Panel C: Total foreign common equity holdings				
Total foreign holdings	—	7,852	7,152	−700
Panel D: Domestic reallocation				
United States	USA	19,530*	20,230	700

Notes. This table presents estimates of restated outward U.S. equity portfolio positions on a nationality basis, which we compare to TIC data. We present our baseline estimates, which only reallocate holdings away from tax havens. Positions in the TIC column with an asterisk (*) are our estimates.

TABLE IV

ESTIMATED NATIONALITY-BASED OUTWARD EMU TOTAL DEBT PORTFOLIOS, 2017

			With Reallocation	
Destination	ISO code	CPIS	Position	Δ
Panel A: Selected non–tax haven countries				
Argentina	ARG	37	37	0
Australia	AUS	173	178	5
Brazil	BRA	50	120	70
Canada	CAN	191	197	6
China	CHN	19	97	78
India	IND	19	29	10
Indonesia	IDN	44	55	11
Japan	JPN	209	219	11
Mexico	MEX	98	99	2
Russia	RUS	36	107	72
Saudi Arabia	SAU	3	5	2
South Africa	ZAF	28	36	8
South Korea	KOR	25	26	1
Turkey	TUR	39	39	0
United Kingdom	GBR	1,279	1,420	140
United States	USA	1,904	2,111	207
Panel B: Selected tax havens				
Bermuda	BMU	23	2	−21
Cayman Islands	CYM	95	7	−89
Curaçao	CUW	5	0	−5
Guernsey	GGY	17	0	−17
Hong Kong	HKG	21	13	−7
Ireland	IRL	293*	136	−156
Jersey	JEY	47	0	−47
Luxembourg	LUX	535*	23	−512
Netherlands	NLD	984*	522	−462
Panama	PAN	8	5	−4
British Virgin Islands	VGB	32	1	−31
Panel C: Total foreign bond holdings				
Total foreign holdings	—	5,758	6,356	598
Panel D: Domestic reallocation				
European Monetary Union	EMU	8,855*	8,257	−598

Notes. This table presents estimates of restated outward EMU total debt portfolio positions on a nationality basis, which we compare to CPIS data. We present our baseline estimates, which only reallocate holdings away from tax havens. Positions in the *CPIS* column with an asterisk (*) are our estimates.

Compared to the residency-based statistics, we find that advanced economies have significantly larger bilateral bond positions in large emerging markets such as the BRICS and much greater equity exposures to China. We organize our discussion

TABLE V
ESTIMATED NATIONALITY-BASED OUTWARD EMU EQUITY PORTFOLIOS, 2017

			With reallocation	
Destination	ISO code	CPIS	Position	Δ
Panel A: Selected non–tax haven countries				
Argentina	ARG	4	4	0
Australia	AUS	61	62	1
Brazil	BRA	53	54	0
Canada	CAN	92	96	5
China	CHN	96	323	227
India	IND	86	94	9
Indonesia	IDN	18	19	0
Japan	JPN	314	328	14
Mexico	MEX	19	19	0
Russia	RUS	46	51	4
Saudi Arabia	SAU	2	2	0
South Africa	ZAF	33	33	0
South Korea	KOR	95	95	0
Turkey	TUR	11	11	0
United Kingdom	GBR	582	624	42
United States	USA	1,666	1,731	65
Panel B: Selected tax havens				
Bermuda	BMU	38	1	−37
Cayman Islands	CYM	223	11	−212
Curaçao	CUW	7	1	−6
Guernsey	GGY	20	19	−2
Hong Kong	HKG	64	51	−14
Ireland	IRL	707*	678	−30
Jersey	JEY	50	0	−50
Netherlands	NLD	333*	321	−12
Panama	PAN	3	0	−3
British Virgin Islands	VGB	10	7	−3
Panel C: Total foreign equity holdings				
Total foreign holdings	—	4,246	4,300	54
Panel D: Domestic reallocation				
European Monetary Union	EMU	4,791*	4,737	−54

Notes. This table presents estimates of restated outward EMU equity portfolio positions on a nationality basis, which we compare to CPIS data. We present our baseline estimates, which only reallocate holdings away from tax havens. Positions in the CPIS column with an asterisk (*) are our estimates. We drop holdings of the EMU in Luxembourg since the ultimate investments are accounted for by the foreign investments of Luxembourg.

below around these two key patterns, highlighting the key tax havens and firms underlying these changes. Furthermore, we emphasize several implications including the increase in the foreign currency share of these countries' external portfolio liabilities and

our finding that offshore issuance biases China's net foreign asset position upward by more than $1 trillion.

III.A. Much Larger Bond Positions in the BRICS

It has long been puzzling to economists that developed countries like the United States invest so little in large and rapidly growing emerging markets such as the BRICS. For example, the corresponding rows in Table II 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 close to 0 in Russia and South Africa. These positions are tiny compared to the $390 billion invested in Canada, the $308 billion in the United Kingdom, and even the $144 billion allocated to Australia. Overall, the BRICS account for only 1% of all foreign corporate debt investments made by the United States in 2017 on a residency basis. Eurozone holdings of foreign bonds issued by the BRICS are also surprisingly small and account for only 2% of all foreign bond holdings.

Table II shows that our reallocation has a notable impact on these low allocations to emerging economies and increases the level of investment from the United States to the BRICS in corporate bonds from $19 to $126 billion, a 560% increase. The increase in the BRICS is most pronounced in Brazil, China, and Russia. Other large emerging markets also receive capital in the reallocation. For example, U.S. corporate bond investment in Indonesia moves from $5 to $9 billion. The positions in tax havens correspondingly drop by hundreds of billions of dollars.

As shown in Table IV, we also find that bond investment from the EMU to the BRICS countries increases dramatically, from $152 billion under residency to $389 billion under nationality. In fact, major reallocations toward these large emerging markets occur for almost all of our nine investor countries. Figure I plots the share of the BRICS in each investor's external bond portfolio using red (hollow white) bars when measured on a residency basis and using blue (solid gray) bars when measured on a nationality basis. In all cases other than Norway, the blue (solid gray) bars significantly exceed the red (hollow white) ones, reflecting the large and widespread reallocation of corporate bond positions away from tax havens and toward the BRICS countries.

1. Key Tax Havens and Firms with Bonds Reallocated to the BRICS. We turn to examining the sources of the reallocations to

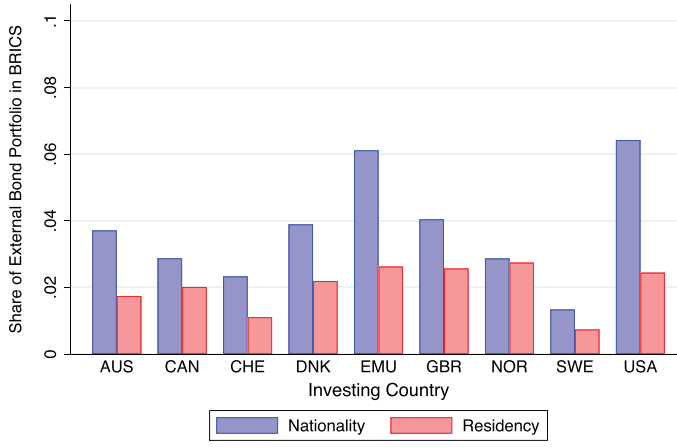


FIGURE I

Portfolio Shares in BRICS Debt, Across Countries: Residency versus Nationality, 2017

Using our restated TIC and CPIS data for each investing country, we show the share of all external bond investments that are attributed to BRICS countries (Brazil, China, India, Russia, and South Africa) on a nationality basis and on a residency basis.

the BRICS. Figure II demonstrates that for U.S. corporate bond investments, most of the reallocation to the BRICS can be attributed to investment in affiliates located in the British Virgin Islands, the Cayman Islands, Ireland, Luxembourg, and the Netherlands. For example, the thick blue lines (color version online) emanating from the British Virgin Islands and the Cayman Islands illustrate how $12 billion and $27 billion of U.S. corporate bond positions associated with those countries under residency in 2017 are restated as investments in China under nationality. The thick red lines emanating from the Cayman Islands and the Netherlands identify them as sources of $16 billion and $22 billion of U.S. corporate bond positions that are reallocated to Brazil. The purple lines show how Russian firms commonly use their affiliates in Luxembourg and Ireland to access U.S. fixed income investors, and the green and orange lines show that bond issuance by tax haven affiliates of Indian and South African firms occurs almost exclusively in the Netherlands.

Figure III offers an equivalent visualization of the key flows underlying the transformation of EMU investment positions from

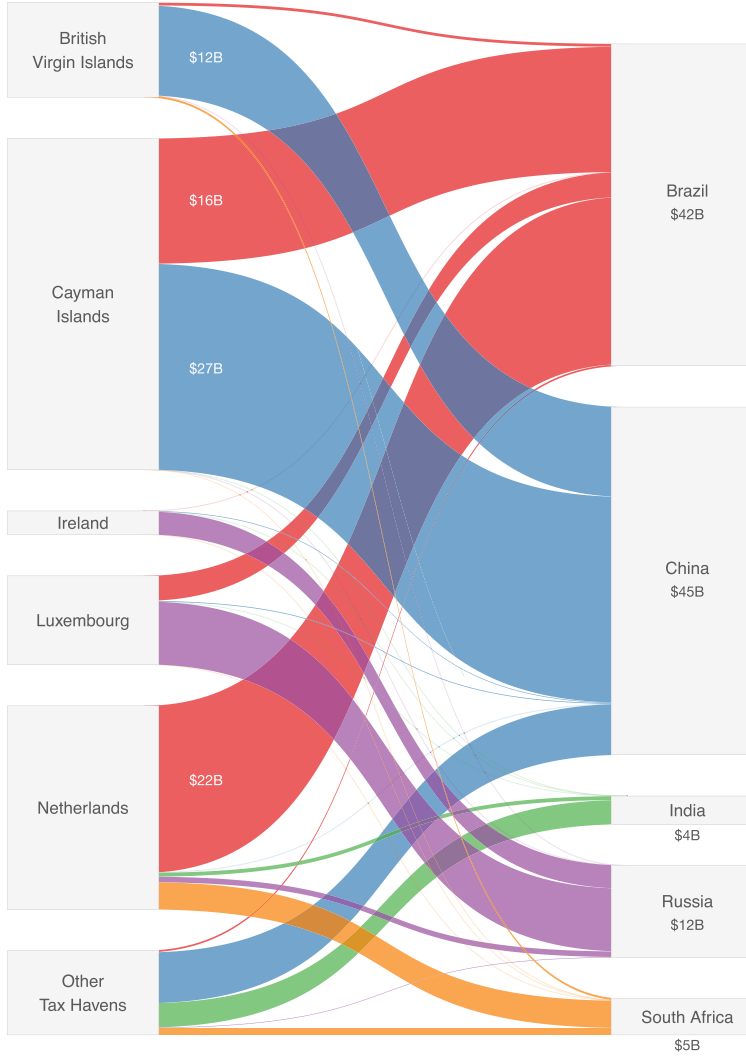


FIGURE II

Patterns of U.S. Corporate Bond Investment in Large Emerging Markets via Tax Havens, 2017

This figure shows the network through which companies in Brazil, China, India, Russia, and South Africa raise bond financing from U.S. investors via affiliates located in tax havens. The amounts on the right show the total amount of investment reallocated to each country from tax havens, and each colored line breaks down these amounts according to their source tax haven.

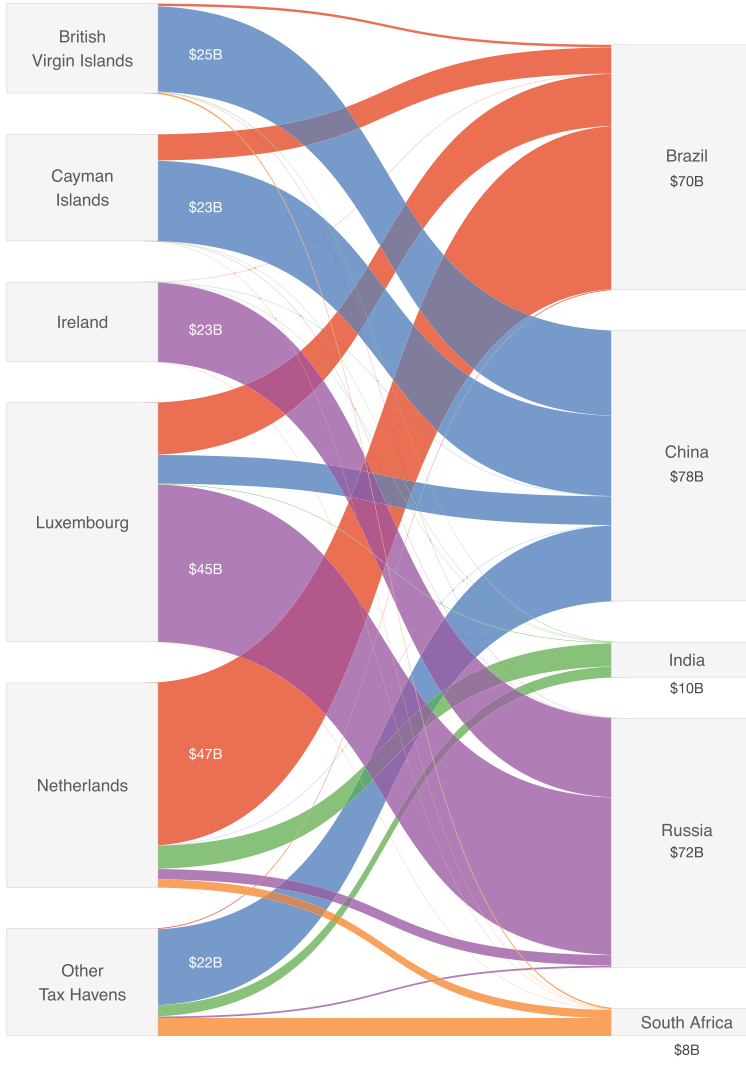


FIGURE III

Patterns of EMU Bond Investment in Large Emerging Markets via Tax Havens, 2017

This figure shows the network through which companies in Brazil, China, India, Russia, and South Africa raise bond financing from EMU investors via affiliates located in tax havens. The amounts on the right show the total amount of investment reallocated to each country from tax havens, and each colored line breaks down these amounts according to their source tax haven.

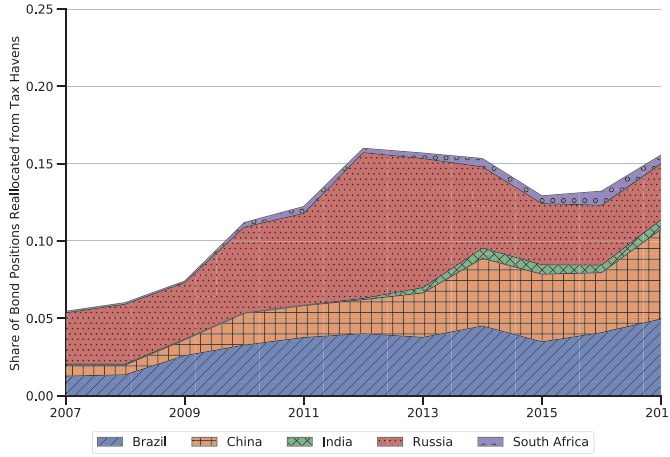


FIGURE IV

The Importance of BRICS Countries in Tax Haven Bond Issuance Over Time

We plot the share of the total reallocated tax haven bond holdings of our nine investor countries that is reallocated under nationality to each of Brazil, China, India, Russia, and South Africa.

a residency to a nationality basis. The patterns are broadly similar, but key differences exist. European investment in Brazilian and Chinese firms, for example, is far less concentrated in their Cayman Islands affiliates than is the case for U.S. investment. Whereas U.S. investors have a nearly $12 billion exposure to Russian firms through bonds issued by their affiliates in Luxembourg and Ireland, our restatement uncovers a $72 billion exposure of European investors to Russian firms through tax havens.

The network of cross-border financing illustrated in Figures II and III does not just vary across issuing and investing countries.[18] As can be seen in the online reallocation matrices for earlier years, the tax havens used to connect issuers to investors also shift significantly over time. Further, Figure IV plots the share of the total tax haven bond holdings of our nine investor countries that is reallocated under nationality to each BRICS country. Combined, the BRICS only accounted for 5% of these tax haven bond positions in 2007, with more than half of that

18. For more detailed and interactive versions of these charts covering all nine of our investor countries, for bonds and equities, see www.globalcapitalallocation.com/reallocation-charts.

attributable to Russian firms and virtually none of it attributable to Indian or South African companies. Largely due to the rapid growth since then in bond issuances by tax haven affiliates of Brazilian and Chinese companies, BRICS issuers in 2017 account for 16% of these tax haven bond positions.

Underlying the reallocations from the British Virgin Islands, Cayman Islands, Ireland, Luxembourg, and Netherlands to the BRICS are bonds issued by a relatively small number of very large firms. To show this, Table VI lists the corporate affiliates whose bonds contribute most to the reallocations away from tax havens and toward each BRICS country. For example, the top row for Brazil captures the fact that Petrobras Global Finance BV, an affiliate of Petrobras that is resident in the Netherlands, issues $28 billion of bonds that we associate under nationality with Brazil. The list of affiliates accounting for the largest reallocations toward Brazil also includes Petrobras International Finance Company, Vale Overseas Limited, and Odebrecht Finance Limited, companies located in the Netherlands and the Cayman Islands. These five issuers represent $58 billion in corporate bonds outstanding, or 82% of the total value of corporate debt that is reallocated to Brazil from tax havens. A small number of large firms are key to understanding the nationality-based investment positions in the other BRICS countries as well. The share of the total reallocated corporate debt that is accounted for by the five affiliates listed in Table VI equals 61% for the case of China, 73% for India, 70% for Russia, and 73% for South Africa. Policy makers and analysts should pay attention to these large firms as even their idiosyncratic behavior can drive sudden stops or rapid changes in total portfolio investment at the country level.

As discussed in Online Appendix A.I, these firms issue through affiliates for a variety of reasons, including minimizing corporate taxes and regulations. Further, by issuing bonds via affiliates in tax havens, firms minimize the burden to their foreign bondholders of withholding taxes on interest payments.[19] For example, some nonresident investors are subject to a 15% withholding tax on holdings of bonds issued domestically by Brazilian firms. The equivalent statutory rate for interest payments to nonresident investors in Russian firms equals 20%. By contrast,

19. See Papke (2000) for a detailed examination of how U.S. firms issued bonds through the Netherlands Antilles to avoid withholding taxes prior to the tax's repeal in 1984.

TABLE VI

LARGEST TAX HAVEN BOND FINANCING SUBSIDIARIES IN BRAZIL, CHINA, INDIA, RUSSIA, AND SOUTH AFRICA, 2017

Name	Issuer CUSIP	Residency	Amount	Parent
Panel A: Brazil				
Petrobras Global Fin. BV	71647N	NLD	27.5	Petroleo Brasileiro SA
Petrobras Intl. Fin. Co.	71645W	CYM	10.8	Petroleo Brasileiro SA
Vale Overseas Ltd	91911T	CYM	8.5	Vale SA
Petrobras Global Fin. BV	N6945A	NLD	7.7	Petroleo Brasileiro SA
Odebrecht Fin. Ltd	G6710E	CYM	3.7	Odebrecht Fin. Ltd
Panel B: China				
Alibaba Group Holding Ltd	01609W	CYM	14.9	Alibaba Group Holding Ltd
Huarong Fin. II Co. Ltd	G463PC	VGB	11.0	China Huarong Asset Management
Huarong Fin. 2017 Co. Ltd	G463PS	VGB	8.7	China Huarong Asset Management
ICBCIL Fin. Co. Ltd	Y3R559	HKG	8.5	Industrial & Commercial Bank of China
Sinopec Group Overseas Dev. 2015 Ltd	G8201J	VGB	8.4	China Petroleum & Chemical Corporation
Panel C: India				
Bharti Airtel Intl. Netherlands BV	N1383S	NLD	2.2	Bharti Airtel Ltd
Bharti Airtel Intl. Netherlands BV	N1384F	NLD	2.0	Bharti Airtel Ltd
Abja Invt. Co. Pte. Ltd	Y202ER	SGP	1.7	Tata Steel Ltd
AE-Rotor Holding BV	N01006	NLD	0.6	Suzlon Energy Ltd
BPRL Intl. Singapore Pte. Ltd	Y0963B	SGP	0.6	Bharat Petroleum Ltd

TABLE VI
CONTINUED

Name	Issuer CUSIP	Residency	Amount	Parent
Panel D: Russia				
Gaz Capital SA Luxembourg	L4191B	LUX	28.6	Gazprom PJSC
Lukoil Intl. Fin. BV	549876	NLD	7.0	Lukoil PJSC
Gaz Capital SA Luxembourg	368266	LUX	7.0	Gazprom PJSC
SB Capital SA Luxembourg	L8084D	LUX	6.8	Sberbank Russia
VTB Capital SA Ln. Partn.	91833E	LUX	6.7	VTB Capital
Panel E: South Africa				
Myriad Intl. Holdings BV	N5946F	NLD	3.7	Naspers Ltd
MTN Mauritius Invts. Ltd	V6143X	MUS	1.8	MTN Group Ltd
Anglogold Ashanti Holdings Plc	03512T	IMN	1.8	Western Deep Levels Ltd
MTN Mauritius Invts. Ltd	55377X	MUS	1.8	MTN Group Ltd
Myriad Intl. Holdings BV	62856R	NLD	1.2	Naspers Ltd

Notes. We show the largest bond financing subsidiaries that are based in tax havens for the BRICS countries. Outstanding bond amounts are in USD billions.

withholding rates on interest income in the British Virgin Islands, the Cayman Islands, Luxembourg, and the Netherlands all equal 0.[20] In some cases, foreign investors can claim back part of the taxes withheld as a domestic tax credit, but even then, the process can be cumbersome.

2. Changes in the Level and Composition of Portfolio Investment. Economists and policy makers view portfolio flows as more volatile than FDI investments. After all, it is much easier for foreigners to sell stocks and bonds than it is for them to sell a wholly owned industrial plant or retail outlet. For this reason, portfolio flows are often the focus of reporting and analysis of the external liabilities of emerging markets. Our work highlights that portfolio investments are larger, more tilted toward the corporate sector, and have a larger share of foreign currency bonds than the official residency-based statistics on portfolio investment reveal.

Imagine an emerging market firm's tax haven affiliate issues a bond and then transfers the funds to the parent. This latter transfer would typically appear in the emerging market's external accounts as an intercompany loan, a type of FDI. By contrast, our nationality-based restatements would add the value of the bond to the emerging market country's portfolio liabilities. Our restatements need not have any implication for a country's total liabilities because the increase in portfolio investment may implicitly come from a decrease in other investment categories. In this sense, our work highlights how the share of portfolio investment in the total external liabilities of large emerging markets may be underappreciated in standard residency-based data because corporate bond financing is often routed through tax havens.

In addition to increasing the relative importance of portfolio liabilities for large emerging markets, our restatement of investment statistics on a nationality basis increases the importance of corporate bonds compared to government bonds in these liabilities. While Table VI details examples of large reallocations of corporate bond positions to the BRICS, Online Appendix Table A.VII shows that reallocations are minimal for government bonds. Governments, after all, 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

20. See, for example, https://www2.deloitte.com/content/dam/Deloitte/global/Documents/Tax/dttl-tax-withholding-tax-rates.pdf.

issues a bond on international capital markets, the immediate issuer is still that sovereign and the residency and nationality approaches coincide. As a result, whereas corporate bonds account for only 25% of all U.S. holdings of Brazilian bonds under residency, we find that they account for 66% of these holdings under nationality.

Finally, our restatements also increase the foreign currency share of external portfolio liabilities because the vast majority of bonds issued by BRICS firms in tax havens are denominated in dollars or euros.[21] For example, under residency, the local currency share of foreign-held bonds in the portfolios of the nine investor countries in our analysis equals 63%, 66%, and 70% for Brazil, India, and Russia. Under nationality, these shares fall to 33%, 57%, and 40%. The local currency shares of foreign-held bonds issued by China and South Africa similarly decline by 5 and 8 percentage points when switching from a residency to a nationality basis.[22]

III.B. Much Larger Equity Positions in China

Table III shows that under residency, 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 methodology reallocates the bulk of these tax haven equity investments to China.[23]

In fact, the reallocation of holdings of Cayman Islands equities to China constitutes the single largest adjustment made to emerging markets in our restated estimates. Under residency,

21. The currency composition of externally held portfolio debt is a commonly referenced statistic in part as it dictates how a country's exchange rate movements generate wealth transfers to foreign creditors. See Eichengreen and Hausmann (1999), Lane and Shambaugh (2010), Du and Schreger (2015), Bénétrix, Lane, and Shambaugh (2015), and Bruno and Shin (2017, 2020) for discussions of the currency composition of debt liabilities across countries.

22. These estimates are discussed in Online Appendix A.VI. As discussed already, our restatements may imply larger portfolio liabilities without any change in the size of a country's overall external liabilities. Similarly, to the extent an offshore affiliate raises financing and then transfers those exact funds (equal in the amount and currency of denomination) to its parent, our restatements may raise the foreign currency share of portfolio liabilities but need not change the currency composition of overall external liabilities.

23. As discussed in Online Appendix A.V, a large share of these U.S. foreign investments are spurious in that they are reallocated back to the United States.

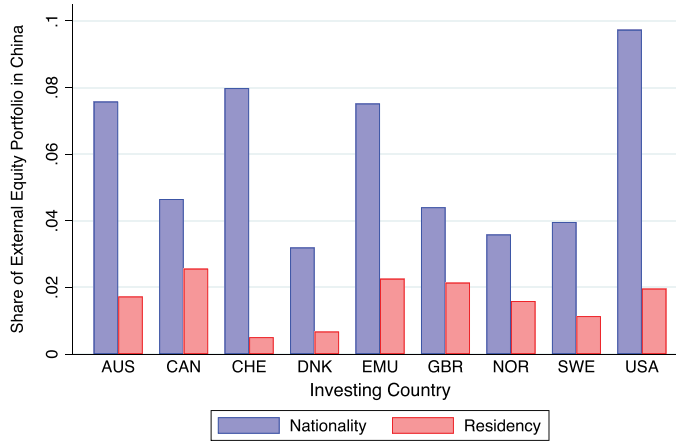


FIGURE V

Portfolio Shares in Chinese Equities, Across Countries: Residency versus Nationality, 2017

Using our restated TIC and CPIS data for each investing country, we show the share of all external equity investments that are attributed to China on a nationality basis and on a residency basis.

as reported in TIC, U.S. investors have about $150 billion in equity exposure to China. Under nationality, that value more than quadruples to almost $700 billion. The EMU's equity exposure to China grows from less than $100 billion under residency to more than $300 billion under nationality. Figure V shows the share of external equity portfolios invested in China for all nine investor countries in our data. The blue (solid gray) bars, which show China's share under nationality, greatly exceed the red (hollow white) bars, which capture the same share under residency.

1. Variable Interest Entities Drive the Equity Reallocation to China. For all nine of the investor countries in our data, the large majority of equity positions that are reallocated to China come from positions that under residency are associated with the Cayman Islands. For instance, of the $542 billion increase in U.S. equity investment in China seen when moving from a residency to nationality basis, $477 billion comes from the Cayman Islands, with the next largest amount ($48 billion) coming from Hong Kong. Similarly, of the $227 billion increase in EMU holdings of Chinese equities, $187 billion comes from the Cayman

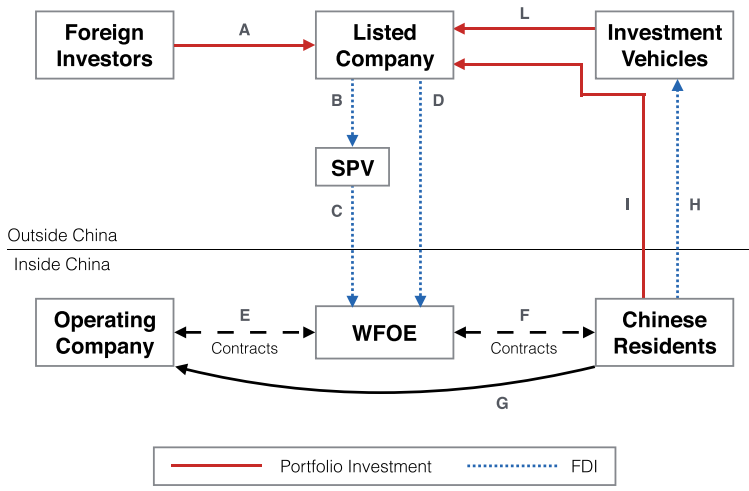


FIGURE VI

VIE Structure

This figure displays a simplified characterization of the variable interest entity (VIE) structure used by Chinese firms to access foreign capital. The Operating Company in China is fully owned by Chinese residents (arrow G). The public Listed Company is located offshore, generally 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), often through a special-purpose vehicle (SPV) located in Hong Kong, the Cayman Islands, or the British Virgin Islands (arrows B and C). The WFOE engages in contracts with the Operating Company and its Chinese owners (arrows E and F) designed to transfer the profits of the Operating Company to the Listed Company. We highlight separately portfolio investment (solid red arrows) and FDI (dashed blue arrows) in the diagram.

Islands, with $30 billion coming from Hong Kong and only about $10 billion from all other countries.

Chinese firms issue equity through affiliates in the Cayman Islands to circumvent Chinese government restrictions on foreign equity investments in a number of strategically important industries. As described in Whitehill (2017), these offshore affiliates are part of what is called a VIE structure that is designed to allow for control of a company "by means other than a majority of voting rights." Figure VI illustrates the relationships involved in a typical VIE structure. 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 or prohibited, its equity is fully owned by Chinese citizens, as indicated by the arrow labeled G. The Listed Company, by contrast, is the entity listed on a global stock exchange and is generally located in the Cayman Islands. As we elaborate in Online Appendix A.VII, the VIE structure then involves a chain of subsidiaries and a set of bilateral contracts such that, for the purposes of international accounting and reporting, the Listed Company can represent to foreign investors that it owns the Operating Company, while at the same time the Operating Company can represent to Chinese regulators that it is wholly owned by Chinese citizens.[24]

To demonstrate how critical these VIEs are for our restated equity positions, Table VII lists the 25 firms that are Chinese on a nationality basis and receive the most equity investment in our positions-level data. Of these 25 firms, only 9 are resident in China; 4 are resident in Hong Kong, and the remaining 12 are VIEs resident in the Cayman Islands. For example, the top row shows that "Tencent Holdings Limited" is an affiliate based in the Cayman Islands of the Chinese firm Tencent. Whereas our restatement considers shares in Tencent to be investments in China, residency-based statistics would treat holders of its nearly $500 billion in outstanding equities as investing in the Cayman Islands.

Chinese restrictions on foreign ownership cover many internet and telecommunications sectors, and as shown in the rightmost column, most prominent VIEs are in this sector, including Alibaba, Baidu, JD.com, and Tencent. Together, these large firms account for a substantial share of the increase in equity positions associated with China on a nationality basis. The stark differences in the industrial composition of the VIEs compared with the companies resident in China that directly raise financing from foreign

24. For example, 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 group needs to be able to report its operations on a consolidated basis under which the Operating Company is consolidated on the balance sheet of the Listed Company. Financial Accounting Standards Board (FASB) Interpretation No. 46R provides that "[a]n 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."

TABLE VII

LARGEST CHINESE FIRMS IN EQUITY HOLDINGS, 2017

Rank	Name	Residency	Market cap	Industry
1	Tencent Holdings Ltd	CYM	493.6	Internet software/services
2	Alibaba Group Holding Ltd	CYM	435.2	Internet retail
3	Baidu Inc	CYM	64.7	Internet software/services
4	China Construction Bank Co.	CHN	221.5	Major banks
5	Ping An Insurance Group	CHN	77.5	Multi-line insurance
6	China Mobile Ltd	HKG	207.6	Wireless telecommunications
7	Industrial & Commercial Bk. of China	CHN	69.8	Major banks
8	Netease Inc	CYM	45.3	Internet software/services
9	JD.com Inc	CYM	49.7	Internet retail
10	Bank of China Ltd	CHN	41.1	Major banks
11	China National Offshore Oil	HKG	64.1	Oil & gas production
12	New Oriental Ed. & Tech. Group	CYM	14.8	Other consumer services
13	AAC Technologies Holdings Inc	CYM	21.8	Electronic components
14	China Petroleum & Chemical Co.	CHN	18.7	Integrated oil
15	China Pacific Insurance Group	CHN	13.3	Multi-line insurance
16	TAL Education Group	CYM	8.3	Other consumer services
17	China State Constr. Engrg. Co. Ltd	HKG	35.3	Real estate development
18	Kweichow Moutai Co. Ltd	CHN	134.6	Beverages: alcoholic
19	China Merchants Bank Co. Ltd	CHN	18.3	Regional banks
20	WH Group Ltd	CYM	16.6	Food: meat/fish/dairy
21	Hangzhou Hikvision Digital Tech.	CHN	55.3	Telecommunications equipment
22	Bank of China (Hong Kong) Ltd	HKG	53.6	Major banks
23	Geely Automobile Holdings Ltd	CYM	31.1	Motor vehicles
24	Shenzhou Intl. Group Holdings	CYM	14.3	Apparel/footwear
25	Sinopharm Group Co. Ltd	CYM	5.2	Pharmaceuticals

Notes. We show the largest firms that are Chinese by nationality, sorted by the value of the equity holdings in each firm in the Morningstar fund data. For each firm, we also show the place of residency, its market capitalization, and its primary industry of operations.

investors corroborates that circumventing ownership restrictions is a key driver of China's use of tax havens to raise equity financing.

VIEs pose risks to investors that may be underappreciated, particularly by retail investors that own VIEs through mutual funds or their pensions. For example, Chinese regulators, who have thus far tolerated these complex offshore structures, might change the tax treatment of VIEs or even recognize them as illegal.[25] Although the legal risks associated with VIEs have been documented, our work demonstrates that the scale of exposure to these risks has been underappreciated due to residency-based reporting and represents a concern for financial stability.[26]

2. Offshore Issuance Causes an Upward Bias in China's NFA Position. Given the common use by Chinese firms of the VIE structure to issue equity through affiliates in tax havens, our nationality-based restatements show that our nine investor countries have far greater bilateral equity exposures to China than what is reported on a residency basis. Beyond this, the use of the VIE structure also affects China's official multilateral external position, its NFA. Offshore issuance, on its own, leads to a $1.1 trillion upward bias in China's officially reported NFA position of $2.1 trillion.

To illustrate the implications of the VIE structure for China's NFA, we return to Figure VI. The only positions in the figure that directly affect China's external liabilities are the investments in the Wholly Foreign Owned Enterprise (WFOE; arrows C and D). Because these investments are made by entities that fully own the WFOE, they are likely classified as FDI or other intercompany positions in China's external liabilities. By contrast, if the VIE structure were not in place, foreign retail investors or mutual funds might directly hold shares issued by the Operating Company, and those holdings would instead be classified as portfolio

25. Alibaba's prospectus for its IPO on NYSE (SEC Form F-1) notes that "[i]f 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."

26. Discussions of tensions between China and the United States and their possible financial repercussions often ignore these exposures or underestimate their size. See, for example, The Economist (2020) and Lardy and Huang (2020).

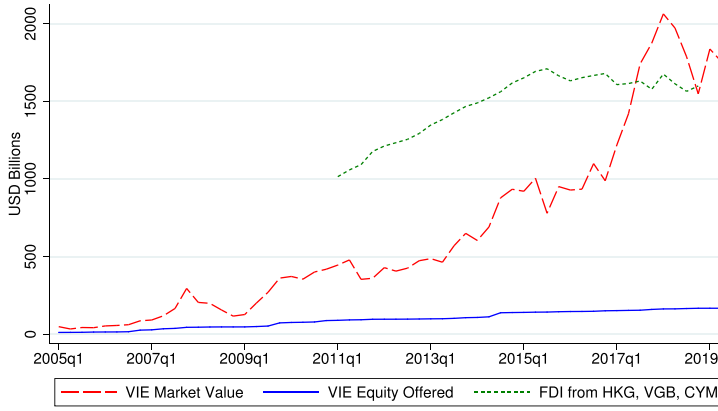
equity investments. In theory, it should not matter whether foreign investments are booked as portfolio or FDI positions since all balance of payments components are supposed to be recorded at market values. In practice, portfolio investment is predominantly in traded securities for which market prices are readily available, whereas FDI tends to be more concentrated in assets for which traded market prices are unavailable and therefore have to be valued in other ways.[27] The VIE structure transforms what would otherwise be portfolio investment into a set of FDI investments for which traded market prices are not available. We have corresponded with China's statisticians and have no reason to believe their treatment of these FDI positions is inconsistent with official guidelines.[28] Nonetheless, we present evidence that however it is done, the value of these foreign positions in China's external liabilities is not connected to the market value of the corresponding publicly listed firms.

The long-dashed red line in Figure VII, Panel A plots the evolution of the market value of all VIEs.[29] Worth only a few billion dollars in 2005, they were worth almost $2 trillion by mid-2019. Most strikingly, the VIEs gained more than $1 trillion in market value during the six quarters from 2016Q4 to 2018Q1. The short-dashed green line in Figure VII, Panel A uses CDIS to plot China's reported stock of inward FDI positions from Hong Kong, the British Virgin Islands, and the Cayman Islands, the three tax havens where the Listed Companies and special-purpose vehicles (SPVs) of VIEs are most commonly located. The positions

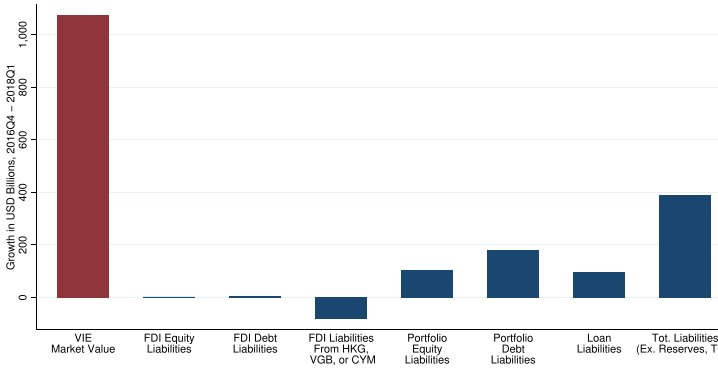
27. In the IMF Balance of Payments and International Position Manual Sixth Edition (BPM6), the IMF suggests six alternative methods to approximate the market value of FDI and then notes: "In cases in which none of the above methods are feasible, less suitable data may need to be used as data inputs. For example, cumulated flows or a previous balance sheet adjusted by subsequent flows may be the only sources available." Further, since Chinese law does not recognize the listed shares as equity claims on the Chinese Operating Company, China's statisticians may reject the notion that the value of owning the WFOE equals the market value of the Listed Company. Finally, as elaborated in Online Appendix A.VII, it would be difficult in practice for China's national statistical office to link the value of FDI positions with the listed share prices in New York or Hong Kong.

28. Given that the underlying BoP transactions are confidential, we do not know exactly how foreign ownership positions in the VIEs are booked in China's accounts.

29. Our analysis defines Chinese companies resident in the Cayman Islands as VIEs. These companies account for more than 99% of the market value of the list of VIEs found in Whitehill (2017).



(A) VIE Market Value, Equity Offered, and Inward FDI



(B) VIE Market Value and External Liabilities

FIGURE VII

China's External Liabilities Do Not Track VIEs' Listed Stock Prices

Panel A plots the total market value of all Chinese companies listed offshore via VIE structures (long-dashed red line), together with a measure of the cumulative value of VIE equity offerings (solid blue line). The graph also shows the total value of all inward FDI positions in China from Hong Kong, the Cayman Islands, and the British Virgin Islands (short-dashed green line). Panel B shows the change in market value for all VIEs between 2016Q4 and 2018Q1, alongside the contemporaneous changes in various categories of China's external liabilities, as reported by China's State Administration of Foreign Exchange.

captured in the green line include all VIE-related investment plus additional FDI unrelated to VIEs, so should be a superset of those captured in the red line. The green line's evolution, however, displays none of the recent surge in the VIEs' market value and toward the end of our sample even lies below the market value of VIEs.[30] It is clear that the VIEs are not captured at their foreign stock market value in China's external FDI liabilities.[31]

Further, Figure VII, Panel B casts doubt on the possibility that the VIE-associated positions track equity market prices but are included in a category of China's external liabilities other than FDI. 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 $180 billion increase in portfolio debt liabilities. This component is highly unlikely to include the VIE equity investments.

We compare China's official NFA with estimates that adjust for the fact that the value of VIEs as recorded in China's external assets and liabilities does not track their market values. To generate this adjustment to China's external liabilities, we assume that the value of each foreign-held VIE position equals the cumulative value of all equity offerings made by that VIE. This would be the case, for example, if the proceeds of each equity offering were immediately transferred as an intercompany loan from the Cayman Islands issuer to the China-resident WFOE, and no other adjustments based on prices in public markets were made. To generate the adjustment to China's external assets, we use data from Bloomberg to estimate the value of the VIEs held by Chinese residents that, as shown in Figure VI, can own shares directly (arrow I) or indirectly via foreign-based investment

30. CDIS also reports an additional $230 billion in FDI to China from unspecified sources in 2018. Even including this amount, the FDI series would fail to track the recent time series behavior and would barely match the level of VIE market capitalization.

31. By contrast, the evolution in VIE market value is easy to see in the external accounts of other countries. For example, Online Appendix Figure A.IVa shows that the value in TIC of U.S. common equity investment in the Cayman Islands comoves almost perfectly with the VIEs' market capitalization. Similarly, Online Appendix Figure A.IVb shows the tight comovement between South Africa's FDI investment in China and Tencent's market capitalization, since Naspers, a South African company, has owned 31% of Tencent since 2009.

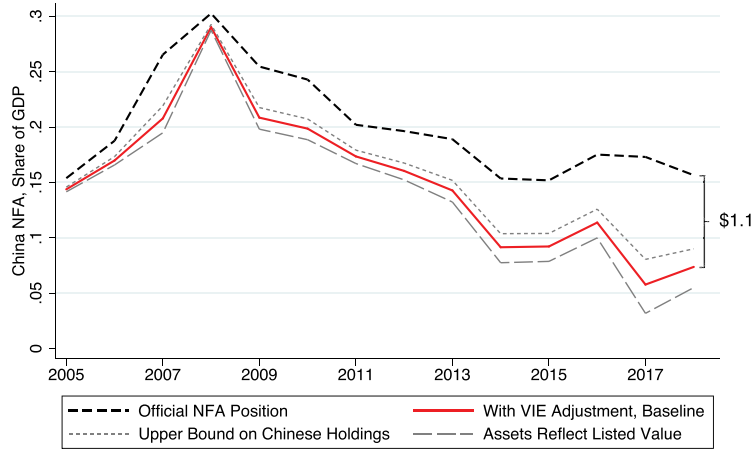


FIGURE VIII

Mismeasurement of China's Net Foreign Asset (NFA) Position due to Offshore Issuance

This graph shows China's official NFA position as a share of GDP (dashed black line), alongside our adjusted NFA position, which accounts for the valuation effects due to the increases in the market values of the VIEs (solid red line). The estimate labeled "Upper Bound on Chinese Holdings" (short-dashed gray line) assigns to China any unattributed positions in the VIEs and any positions held by funds resident in the Cayman Islands or British Virgin Islands. The estimate labeled "Assets Reflect Listed Value" assumes that all recorded Chinese external assets track listed share prices (long-dashed gray line). See Section III and Online Appendix A.VII for details on the construction of these estimates.

vehicles (arrows H and L). Online Appendix A.VII details these and other assumptions underlying our calculation of China's NFA.[32]

We construct an adjusted estimate of China's NFA that takes into account the bias due to offshore issuance. We emphasize that this adjustment does not incorporate other plausible sources of mismeasurement in China's external accounts.[33] Figure VIII plots our estimate with a solid red line alongside China's official

32. As an alternative to using the Bloomberg data, we also estimate Chinese residents' holdings of VIE equities using our nationality-based estimates. The results closely align.

33. For instance, Li, Shen, and Zhang (2020) document significant Chinese investment in the U.S. real estate market that may not be fully captured on the asset side of China's NFA. This would bias the official NFA in the opposite direction from the force we focus on.

NFA position, shown with the dashed black line. China reports a net credit position equalling $2.1 trillion in 2018 (15% of China's GDP), making it one of the world's largest, alongside Germany's similarly sized position and Japan's $3.1 trillion position. We estimate that the overstatement of China's NFA that is due to offshore issuance is close to zero in 2008 and grows rapidly over time, reaching $1.1 trillion by the end of 2018. Absent other adjustments, accounting for missing valuation adjustments due to offshore issuance leads to the conclusion that China is today only half as large a creditor to the rest of the world as official statistics say it is.

The scale of our adjustment to China's NFA is largely insensitive to the key assumptions we make. For example, as discussed in Online Appendix A.VII, the Bloomberg data do not identify 16% of the ownership of the VIEs. If we assume those unidentified owners are all Chinese, this would reduce the magnitude of our adjustment of China's NFA because it would imply a larger revaluation of China's external asset position. Nonetheless, as shown in the short-dashed gray line in Figure VIII, this alternative assumption only modestly reduces the bias in China's NFA in 2018 from $1.1 trillion to $0.9 trillion. If instead we assume that the value of all of China's holdings of the VIEs is linked to their listed market prices, an assumption that China's external assets are not at all biased due to offshore issuance, we increase the scale of the NFA adjustment to $1.4 trillion, as shown in the long-dashed gray line.

Although China has run large current account surpluses since the early 2000s, our analysis suggests that China is a much smaller net creditor today than statisticians, economists, and policy makers believe because its NFA does not reflect massive valuation changes. In fact, China's net credit position may be closer to that of Norway or Switzerland than it is to Japan's. While the common narrative is that of a one-way flow of investments from China to the safe assets of the developed world (U.S. Treasuries), we show that in the past decade there have been important investments made by developed markets into China, and due to offshore issuance, these positions are understated in official statistics. While much attention has been paid to 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.

This modified view of China's NFA has far-reaching consequences. For policy makers, China's large creditor position has long given rise to major concerns about a disruptive resolution of

global imbalances. Our estimates suggest that much of this external adjustment has already happened during 2008–2018 but went unnoticed as it was obscured in the statistics due to offshore issuance. Since foreigners realized very large capital gains on Chinese equities during this period, they retain substantial claims on China. Therefore, significantly less external adjustment will be required in the future than was previously thought. For economic theory, these investments by developed countries in Chinese VIEs, coupled with China's investment in U.S. Treasuries, reinforce the world banker view of global imbalances.

IV. The Role of Micro Data

Micro data on the security-level positions held by mutual funds and ETFs around the world, coupled with a mapping of tax haven affiliates to their corporate parents, form the backbone of our transformation of bilateral investment positions from a residency basis to a nationality basis. In this section, we explain why these micro data are important and sufficiently representative for our purposes. We start by detailing why existing public data reported on residency and nationality bases cannot be used for our analyses. Next, we demonstrate the similarity of our baseline results to those that we obtain using alternative positions-level data from U.S. insurance companies and Norway's SWF. Finally, for countries for which security-level holdings data are unavailable, we use micro data on the total amount of securities outstanding to estimate nationality-based investment positions for the full set of countries available in CPIS. These issuance-based estimates differ from our preferred baseline restatements in part because countries tilt their investments in tax havens toward affiliates of domestic firms, a phenomenon we call "home bias in tax havens."

IV.A. Relationship to BIS Nationality-Based Statistics

The BIS has been a leader in emphasizing the difference between residency- and nationality-based international security issuance. Their International Debt Securities (IDS) statistics include the total value of bonds outstanding for each country of issuance, both on a residency basis and on a nationality basis. The IDS data, though very valuable for both research and policy, cannot be used to generate nationality-based statistics on bilateral investment positions for three reasons.

First, these data only offer the total multilateral value of each issuing country's securities outstanding and do not specify the bilateral composition underlying the differences between residency and nationality. As a result, the data are insufficient to generate nationality-based bilateral investment positions because many possible bilateral configurations are consistent with any given multilateral statistic.[34] Second, the BIS IDS data do not cover equities, a major part of our results, and only include debt securities that are issued on international markets.[35] Third, our approach is flexible and open-source, making it easy to vary key assumptions used in generating our nationality-based investment positions. For example, our baseline results presented above only reallocate the issuances of affiliates in tax havens, whereas in Section V we present an alternative restatement that includes all foreign issuances made anywhere in the world. Building our analyses from the ground up allows us, and users of our algorithm and data, to explore whichever notion of nationality is best tailored to the economic question at hand.

IV.B. Alternative Positions-Level Micro Data

Our benchmark algorithm uses reallocation matrices that are built from micro data on the portfolio holdings of mutual funds and ETFs. A reasonable question is whether our results would look different if we instead based them on holdings of other investors

34. Nevertheless, if one wanted to try to use the IDS data to transform residency-based positions to nationality-based positions, a simple approach might be to scale all bilateral investments in a country under residency by the ratio of bonds outstanding under nationality to bonds outstanding under residency. For example, if one knew from the IDS data that the value of international debt securities issued by Brazil under nationality was twice the value issued under residency, one might simply double U.S. holdings of Brazilian bonds under residency in TIC to estimate the value of U.S. holdings of Brazilian bonds under nationality. We demonstrate in Online Appendix A.VIII that results from this approach have significant shortcomings.

35. A bond is considered an international debt security and included in the BIS IDS data if the registration domain, listing place, or governing law differs from the issuer's residence. As a vivid example of how these data include only a subset of the bonds we study, we note that the local currency share of foreign-held bonds issued by Brazil in IDS data is less than 10% under both residency and nationality, whereas our data shows these values for Brazil to equal about 70% and 34%, respectively. The difference in this case largely owes to foreign holdings of Brazilian government securities that are local currency denominated and excluded from the IDS.

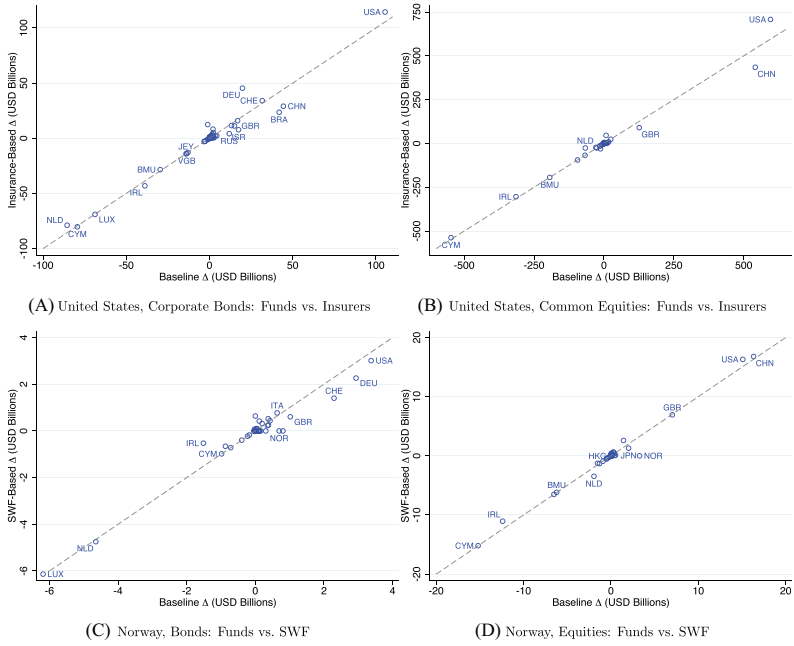
that are not mutual funds or ETFs. To answer this question, we obtain comprehensive security-level data covering the holdings of insurance companies in the United States and the SWF in Norway and demonstrate the similarity of our baseline results with analogous restatements based on these other positions-level data. We conclude that our fund data are sufficiently representative of the broader set of a country's portfolio investments for our exercise.

The details of the portfolios of U.S. insurers are publicly available because insurers are required to disclose their security holdings each quarter to the National Association of Insurance Commissioners. We obtain the universe of these holdings from S&P Global Market Intelligence. At the end of 2017 our micro data from insurance companies account for 20% of total U.S. foreign bond investments and 3% of total U.S. foreign equity investments as reported in TIC, while our micro data on mutual fund and ETF holdings account for 31% and 47% of these totals, respectively. Similarly to the case of U.S. insurers, we obtained details on the portfolio holdings of Norway's SWF, officially known as the Government Pension Fund Global of Norway, from its public investment disclosure reports.[36] Our micro data on the SWF's holdings account for 71% of the total Norwegian foreign bond investments and 88 percent of total Norwegian foreign equity investments as reported in CPIS, while our micro data on mutual fund and ETF holdings account for 4% and 6% of these totals, respectively.[37]

We use the U.S. insurers' and Norwegian SWF's holdings to construct alternative reallocation matrices that are otherwise entirely analogous to our baseline matrices for the United States and Norway, respectively. Using these alternative reallocation

36. The public reports of the Norwegian SWF do not contain CUSIP6 issuer codes but only issuer names, issuer sectors, and the fund's own classification for the residency and country of risk exposure associated with each issuer—the latter corresponding most closely to our notion of nationality. We matched the fund's self-reported fixed income positions to CUSIP codes using name, sector, and residency information. Factset includes an analogous mapping for the equity portion of the Norwegian SWF's portfolio.

37. In the process of conducting this research, we discovered a mistake in Norway's CPIS reporting of the bilateral composition of the SWF's positions. We contacted Statistics Norway and they rectified this mistake for the most recent data. We are in ongoing communication with them as they also update the 2017 data used in this section and the earlier data. In the meantime, for all calculations reported in this section and throughout the article, we use an internally constructed amended version of Norway's CPIS tables that replaces the SWF's holdings using the fund's own self-disclosed positions.



(A) United States, Corporate Bonds: Funds vs. Insurers

(B) United States, Common Equities: Funds vs. Insurers

(C) Norway, Bonds: Funds vs. SWF

(D) Norway, Equities: Funds vs. SWF

FIGURE IX

Representativeness of Fund Data: Comparison with Restatements Based on Holdings of U.S. Insurers and Norwegian Sovereign Wealth Fund, 2017

The blue circles plot the change in holdings relative to residency-based statistics for each investment destination in U.S. external corporate bond holdings (Panel A), U.S. external common equity holdings (Panel B), Norwegian external bond holdings (Panel C), and Norwegian external equity holdings (Panel D). The horizontal axis captures our baseline nationality restatement, while the vertical axis plots the change implied when we apply the matrix based on U.S. insurer holdings or holdings by Norway's SWF. The gray dashes are 45-degree lines.

matrices, we generate estimates of the bilateral investment positions of the United States and Norway on a nationality basis that can be compared to our baseline estimates that use mutual fund data. The blue circles in each subplot of Figure IX capture the changes in holdings relative to residency-based statistics for each investment destination. The horizontal axes correspond to our baseline nationality restatement, and the changes implied when we apply the matrix based on insurer or SWF holdings are plotted on the vertical axis.

For both the United States and Norway, and for both bonds and equities, the blue circles cluster along the gray dashed

45-degree lines. The best-fit line through the origin of Figure IX, Panel A that covers U.S. corporate bond investment has a slope equal to 0.98 and an R^2 of 0.95. The equivalent values in Figure IX, Panel B covering U.S. equity investment are 0.99 and 0.97, respectively. Norway's foreign bond investment reallocations are plotted in Figure IX, Panel C and have a best-fit line with a slope of 0.91 and an R^2 of 0.95. The equivalent values for Norway's foreign equity reallocations, plotted in Figure IX, Panel D, are 1.00 and 0.98, respectively. This analysis corroborates that the data from Morningstar on American and Norwegian fund portfolios are, for our purposes, representative of the portfolios of other investors in these two countries. Changing to nationality using our fund data or using the insurance and SWF data generate what are substantially the same restatements of the two countries' bilateral investment positions.

IV.C. Using Micro Data on Total Securities Outstanding

Our baseline methodology combines a parent-affiliate mapping with micro data on portfolio holdings that are specific to nine investor countries, but for many analyses it is helpful to include the portfolios of a broader set of investor countries. To expand our nationality-based restatement beyond these nine countries, one option is to ignore heterogeneity in how different countries invest in a given destination and instead generate a single global matrix using data on the total securities outstanding that are issued by each country.

In particular, rather than using an investor-specific reallocation matrix Ω_j, this option involves constructing what we call the "issuance distribution matrix" b. The entries $b_{i,k}$ in the issuance distribution matrix capture the share of the outstanding value of total securities issued by i under residency that would instead be considered issued by k under nationality:

$$b = \begin{bmatrix} b_{1,1} & b_{1,2} & b_{1,3} & \dots \\ b_{2,1} & b_{2,2} & b_{2,3} & \dots \\ b_{3,1} & b_{3,2} & b_{3,3} & \dots \\ \vdots & \vdots & \vdots & \ddots \end{bmatrix}. \tag{4}$$

The issuance distribution matrix b can then be used to transform a vector with the value of outstanding securities issued by each country under residency, $B^{\mathcal{R}} = \left[B_1^{\mathcal{R}}, B_2^{\mathcal{R}}, \dots\right]'$, into a vector

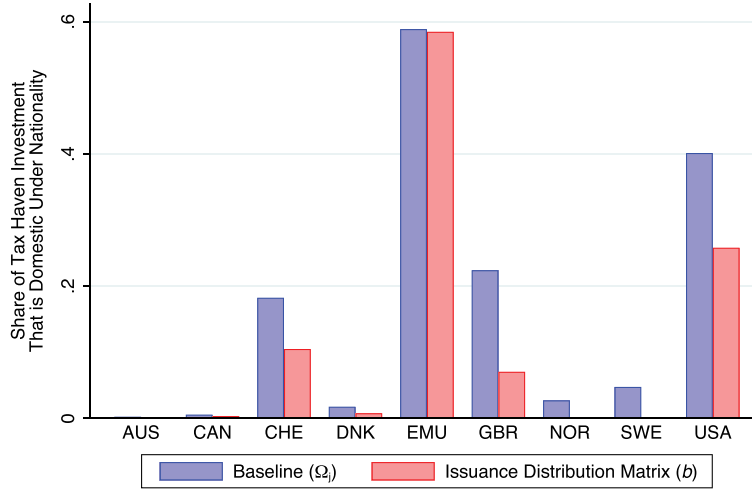
with the value of outstanding securities issued by each country under nationality, $B^{\mathcal{N}} = \left[B_1^{\mathcal{N}}, B_2^{\mathcal{N}}, \ldots\right]'$, as $b'B^{\mathcal{R}} = B^{\mathcal{N}}$. The issuance distribution matrix can also can be used to transform any country j's bilateral investment from a residency to a nationality basis: $b'q_j^{\mathcal{R}} = q_j^{\mathcal{N},I}$. We add the superscript I to distinguish the nationality-based restatement $q_j^{\mathcal{N},I}$, which is constructed with the issuance distribution matrix (b), from $q_j^{\mathcal{N}}$, which is constructed using a reallocation matrix specific to j (Ω_j).

We use data on the value of global securities outstanding from Dealogic, Factset, and Refinitiv's Worldscope, together with our parent-affiliate mapping to construct issuance distribution matrices for debt and equity, to restate the investment positions in CPIS on a nationality basis for all countries. We post on our web page the distribution matrices b and these issuance-based restatements $q_j^{\mathcal{N},I}$ for all countries in CPIS and for each year of our data. For most economic analyses, these issuance-based restatements paint a more useful picture of linkages from bilateral portfolio investment than the residency-based positions found in CPIS. Investors often differ in how they invest in tax havens, however, so we believe our baseline results based on country-specific holding data, when available, are more reliable.

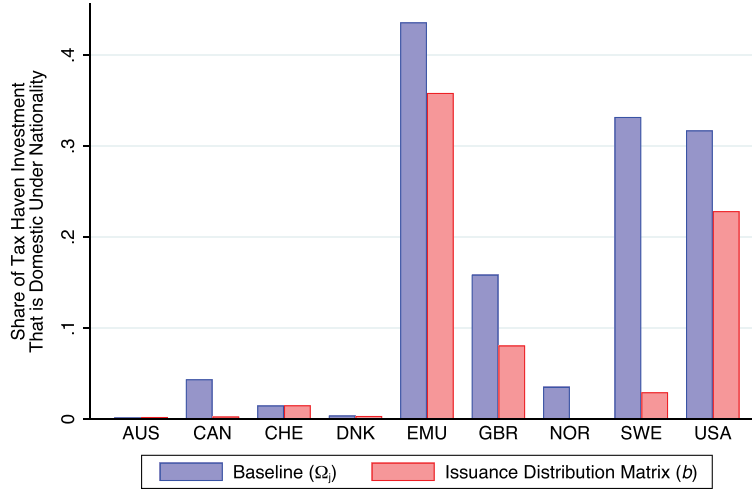
IV.D. Home Bias in Tax Havens

Countries disproportionately buy securities issued by the tax-haven affiliates of domestic firms, a phenomenon we refer to as "home bias in tax havens." For example, British investors allocate more of their Cayman Islands bond portfolio to issuances by the subsidiaries of the U.K. regional water suppliers Thames Water, Southern Water, and Yorkshire Water than do other foreign investors. Similarly, because of this home bias, our baseline restatement of U.S. corporate bond positions reallocates $50 billion more back to the United States than does the restatement using the global issuance distribution matrix.

Figure X plots the share of each country's investment in tax havens that is reallocated back to that investor country under nationality, separately for bonds and for equities. The blue (solid gray) bars plot this share for our baseline restatement that uses investor-specific reallocation matrices (Ω_j) and the red (hollow white) bars plot this share when the restatement uses the global issuance distribution matrix (b). For many of our investor countries, the blue (solid gray) bars significantly exceed the red (hollow



(A) All Bonds



(B) Equities

FIGURE X

Home Bias in Tax Havens, 2017

We plot the share of each country's investment in tax havens that is reallocated back to that investor country under nationality, separately for bonds and for equities. The blue bars plot this share for our baseline restatement that uses investor-specific reallocation matrices (Ω_j), and the red bars plot this share when the restatement uses the global issuance distribution matrix (b).

white) ones, revealing the quantitative importance of home bias in tax havens for our results.[38] Online Appendix A.IX uses regression analyses to demonstrate the statistical significance and robustness of home bias in tax havens.

In summary, our parent-affiliate mapping and micro data on investor portfolio holdings are required inputs to our baseline analyses and allow us to go well beyond what one could do using publicly available alternatives. As a second-best option, we replace the investor-specific reallocation matrices with a single global issuance distribution matrix, which allows us to calculate nationality-based bilateral investment for a much larger set of countries. The presence of a strong home bias in tax havens, however, suggests the importance of using country-specific positions data where available.

V. Beyond Tax Havens

The nationality-based restatement of bilateral investment positions presented above associates holdings of securities issued by affiliates in tax havens with the country of their ultimate parent company. This treatment was used for our baseline results because for most economic questions, the resulting estimates clearly paint a picture of cross-border linkages that is more relevant than existing residency-based data. Some analyses, however, may be better informed by different restatements. In this section, we present the results from several alternative methodologies.

We start by reporting results from two treatments that, like our baseline approach, associate any given security with a single country. The first of these restatements, which we call "full nationality," reallocates all investment positions to the country of the issuer's parent, regardless of whether the issuer is resident in a tax haven. The second of these restatements, which we call "guarantor," associates debt securities with the firm that guarantees the bond. Finally, we present a "sales-based" methodology that associates positions in a security with the full geographic distribution of the issuer's sales, potentially associating a single security with multiple countries.

38. The values are unusually high for the EMU because, due to Ireland, Luxembourg, and the Netherlands, it is the only investor country in our data that is (partly) considered a tax haven.

V.A. *Full Nationality or Guarantor View of Portfolio Investment*

Our baseline analysis does not reallocate any holdings of securities that are issued by companies that do not reside in tax havens. For example, European holdings of bonds issued by Toyota Motors North America are considered to be European investments in U.S. corporate bonds in the raw CPIS data and in our restatements. For some questions, however, one might wish to instead associate those positions with Japan. After all, the parent company that controls how the raised capital is deployed, Toyota, is Japanese. In addition to our baseline treatment, we also offer bilateral investment positions restated under full nationality, a treatment that associates all securities with the issuer's ultimate parent, regardless of whether the issuer is resident in a tax haven.[39] For other questions, researchers might want to focus only on tax haven affiliates but associate their fixed income securities with the country of their credit guarantor, even if the guarantor isn't the ultimate parent.[40] For instance, if considering the vulnerability of a country's fixed income portfolio to destination-country shocks or studying how waves of corporate defaults are transmitted across borders, bilateral investment statistics on a guarantor basis might be most useful. As an example, the South African conglomerate Naspers issued $1.2 billion in bonds via its Dutch-resident subsidiary Prosus NV, which specializes in international technology investing. In our baseline restatements, investments in these bonds are assigned to South Africa. However, Prosus NV explicitly guarantees these bonds with its own capital, so that in our guarantor-based restatements, these positions remain associated with the Netherlands.

Tables VIII and IX present the restated investment positions for the United States and the EMU using the full nationality and the guarantor methodologies (the complete results for all nine investor countries are available online). The large increase in corporate bond holdings in emerging markets is even stronger in our full nationality treatment. This occurs because emerging market

39. As discussed in Online Appendix A.X, the full nationality case includes reallocated domestic positions as well as foreign positions. We are able to do this because the Morningstar data, unlike TIC and CPIS, reports domestic positions.

40. Often issuing vehicles in tax havens have little or no assets and creditors therefore ask for explicit guarantees by group affiliates. To implement a guarantor-based restatement, we use data on credit guarantees from Factset to aggregate securities to the ultimate guarantor rather than the ultimate parent.

TABLE VIII

ESTIMATED OUTWARD U.S. PORTFOLIOS: ALTERNATIVE RESTATEMENTS, 2017

		Corporate bonds				Common equity		
Destination	ISO code	TIC	Full nat.	Sales	Guarantor	TIC	Full nat.	Sales
Panel A: Selected non–tax haven countries								
Argentina	ARG	5	5	27	5	9	18	104
Australia	AUS	144	149	141	144	181	186	327
Brazil	BRA	8	67	122	51	119	107	409
Canada	CAN	390	412	267	393	493	529	697
China	CHN	3	54	235	44	154	698	1,844
France	FRA	118	109	133	120	434	459	455
Germany	DEU	60	119	147	77	375	403	666
India	IND	6	21	68	10	179	173	437
Indonesia	IDN	5	9	35	9	40	36	183
Italy	ITA	16	35	71	29	96	115	355
Japan	JPN	80	188	220	95	895	907	1,170
Mexico	MEX	58	60	105	58	64	61	263
Russia	RUS	0	12	56	11	55	58	281
Saudi Arabia	SAU	1	2	21	1	0	0	80
Spain	ESP	16	52	56	19	123	130	258
South Africa	ZAF	1	7	13	3	100	101	106
South Korea	KOR	11	17	61	11	226	225	388
Turkey	TUR	4	4	24	4	22	22	112
United Kingdom	GBR	308	363	260	326	1,019	1,004	871

TABLE VIII
CONTINUED

Destination	ISO code	Corporate bonds				Common equity		
		TIC	Full nat.	Sales	Guarantor	TIC	Full nat.	Sales
Panel B: Selected tax havens								
Bermuda	BMU	30	0	6	1	195	1	11
Cayman Islands	CYM	80	1	9	5	547	0	5
Curaçao	CUW	3	0	0	0	68	0	2
Guernsey	GGY	13	0	0	0	14	0	2
Hong Kong	HKG	8	9	41	9	147	140	177
Ireland	IRL	63	40	25	26	385	71	74
Jersey	JEY	14	0	2	0	94	0	2
Netherlands	NLD	179	116	88	99	339	376	232
Panama	PAN	3	0	4	1	26	0	13
British Virgin Islands	VGB	14	0	11	0	15	0	8
Panel C: Total foreign holdings								
Total Foreign Holdings	—	2,058	2,326	3,039	1,964	7,852	7,076	12,732
Panel D: Domestic position								
United States	USA	5,247*	4,979	4,266	5,341	19,530*	20,306	14,650

Notes. We present full nationality, sales-based, and guarantor-based restatements. Positions with an asterisk (*) are our estimates.

TABLE IX

ESTIMATED OUTWARD EMU PORTFOLIOS: ALTERNATIVE RESTATEMENTS, 2017

		All bonds				Equity		
Destination	ISO code	CPIS	Full nat.	Sales	Guarantor	CPIS	Full nat.	Sales
Panel A: Selected non–tax haven countries								
Argentina	ARG	37	36	73	37	4	4	41
Australia	AUS	173	191	191	176	61	66	116
Brazil	BRA	50	134	256	119	53	46	174
Canada	CAN	191	205	232	196	92	104	174
China	CHN	19	109	257	94	96	322	634
India	IND	19	48	96	29	86	87	174
Indonesia	IDN	44	55	80	56	18	17	67
Japan	JPN	209	251	318	219	314	331	388
Mexico	MEX	98	110	161	99	19	20	86
Russia	RUS	36	107	185	108	46	50	148
Saudi Arabia	SAU	3	5	53	5	2	2	27
South Africa	ZAF	28	47	22	32	33	34	38
South Korea	KOR	25	27	67	26	95	95	130
Turkey	TUR	39	38	74	39	11	11	48
United Kingdom	GBR	1,279	1,228	1,005	1,425	582	561	439
United States	USA	1,904	2,093	2,429	2,069	1,666	1,754	2,019

TABLE IX
CONTINUED

Destination	ISO code	All bonds				Equity		
		CPIS	Full nat.	Sales	Guarantor	CPIS	Full nat.	Sales
Panel B: Selected tax havens								
Bermuda	BMU	23	2	7	5	38	1	2
Cayman Islands	CYM	95	7	26	10	223	11	13
Curaçao	CUW	5	0	0	0	7	1	1
Guernsey	GGY	17	0	3	1	20	19	21
Hong Kong	HKG	21	16	84	19	64	51	66
Ireland	IRL	293*	143	130	132	707*	678	686
Jersey	JEY	47	0	18	1	50	0	1
Netherlands	NLD	984*	566	400	505	333*	371	340
Panama	PAN	8	5	10	7	3	0	5
British Virgin Islands	VGB	32	1	20	1	10	7	8
Panel C: Total foreign holdings								
Total foreign holdings	—	5,758	6,311	7,542	6,332	4,246	4,254	5,966
Panel D: Domestic position								
European Monetary Union	EMU	8,855*	8,303	7,071	8,291	4,791*	4,783	3,069

Notes. We present full nationality, sales-based, and guarantor-based restatements. Positions with an asterisk (*) are our estimates.

companies also own subsidiaries in developed countries that issue bonds. This dynamic is particularly important for India and South Korea, who receive more funds from U.S. and EMU investors under full nationality than under our baseline treatment. Bilateral investment in Brazil also increases, primarily reflecting large issuances by subsidiaries operating in the United States, such as JBS USA.[41]

Our guarantor-based restatement of bilateral bond investments shows only muted differences relative to our baseline restatement, confirming that corporate control and financial backing typically coincide. Some of the differences shown for our guarantor-based restatements in Tables VIII and IX reflect the fact that a slightly smaller share of tax haven positions are removed, with $5 billion of U.S. positions in the Cayman Islands and $7 billion of EMU holdings in Bermuda remaining, for example.

V.B. A Sales-Based View of Portfolio Investment

Conventional residency-based statistics, as well as our baseline, full nationality, and guarantor restatements all associate investments in a single firm with a single country. However, particularly given the importance of multinational firms in global trade and finance, another useful description of exposures and global linkages comes from associating some firms with multiple geographies. Our sales-based restatement associates investments in a company with multiple countries based on the share of the firm's revenues that each country accounts for.

As detailed in Online Appendix A.XI, we use Factset GeoRev data to measure revenue exposures for each company across countries.[42] Online Appendix Table A.XIV illustrates the resulting differences between standard residency data, our baseline

41. JBS S.A. earns a majority of its revenue in the United States, with "Beef USA" its most important business segment. It raises significant funds via its operating affiliate JBS USA. While our baseline estimates treat these bonds as issued by a U.S. firm, our full nationality estimates associate them with Brazil.

42. As part of both GAAP and IFSR accounting, firms are required to report the geographic segments where they earn their revenues, though these segments are not standardized and typically do not separately list exports and affiliates' sales. If the sales shares of an issuing firm are unavailable from Factset, we use the sales data for the ultimate parent firm. If data is unavailable for both the issuer and ultimate parent, we leave unchanged the association of a security with the country of its issuer's residency. We treat governments as earning all of their

nationality methodology, and this sales-based approach for a number of prominent firms. For example, lines 1 and 2 show that Tencent and Alibaba are Cayman Islands firms by residency, Chinese firms by nationality, and have 97% and 89% of their respective values associated with China in our sales-based methodology. Medtronic is considered Irish under residency, but is a prominent case of a tax inversion by a U.S. firm. It is therefore American under nationality and has 56% associated with the United States under the sales-based treatment. In all these cases, listed in Panel A, the nationality notion coincides with the country where the firm earns most of its sales. Online Appendix Table A.XIV, Panel B includes a number of cases in which the country accounting for the largest share of sales coincides with the residency rather than nationality basis. T-Mobile US, an operating subsidiary of Deutsche Telecom, is German by nationality but American by residency and earns 99% of its sales in the United States. Compared to residency-based or nationality-based data, our sales-based restatement may better connect wealth effects in one country to demand shocks around the world and can be usefully incorporated in multicountry general equilibrium models.[43]

The results of our sales-based restatement of TIC and CPIS for the United States and the EMU are included in Tables VIII and IX and show significantly larger exposures to China. For example, the TIC data show that China accounts on a residency basis for 2% of the U.S. external stock portfolio, and our baseline results show that under nationality the share increases to 10%, largely because they include the VIEs based in the Cayman Islands. Our sales-based measure captures most of the VIE reallocations but additionally associates with China substantial shares of investment in countries that are not tax havens. Some share of U.S. investment in Japan, for example, is reallocated to China using this method because Japanese firms earn some of their revenues from selling to China. As a result, using this sales-based measure, we find that China accounts for 15% of the U.S. portfolio of foreign equities and 10% of the Eurozone portfolio.

revenues domestically. For 2017, we match 99% of equities and 93% of corporate bonds in Morningstar by market value to sales data from Factset GeoRev.

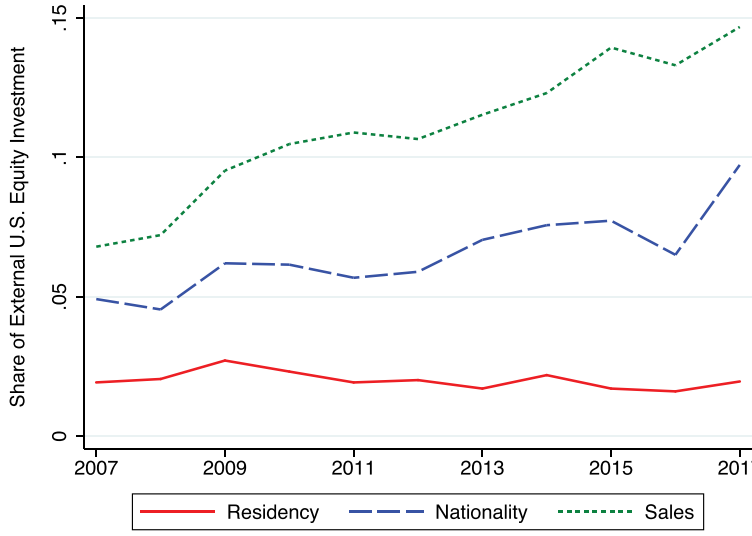
43. For example, a growing literature in international trade offers quantitative dynamic general equilibrium models where countries' foreign asset positions are key state variables. See Eaton et al. (2016), Reyes-Heroles (2016), and Ravikumar, Santacreu, and Sposi (2019).

These three different methodologies not only tell a different story about the level of equity exposure to China, but they also imply three different time trends in this exposure. The solid red line in Figure XI, Panel A shows that, by residency, there's been essentially no growth from 2007 to 2017 in China's share of the U.S. external equity portfolio. The long-dashed blue line shows how, by nationality, that share has grown by about 5 percentage points (i.e., almost doubling) over the same period, largely reflecting the increasing value of investment in China's VIEs. Finally, the short-dashed green line shows an even greater growth in China's sales-based share of the U.S. external stock portfolio of almost 10 percentage points. Figure XI, Panel B plots China's share in the EMU's external stock portfolio and reveals a similar pattern.

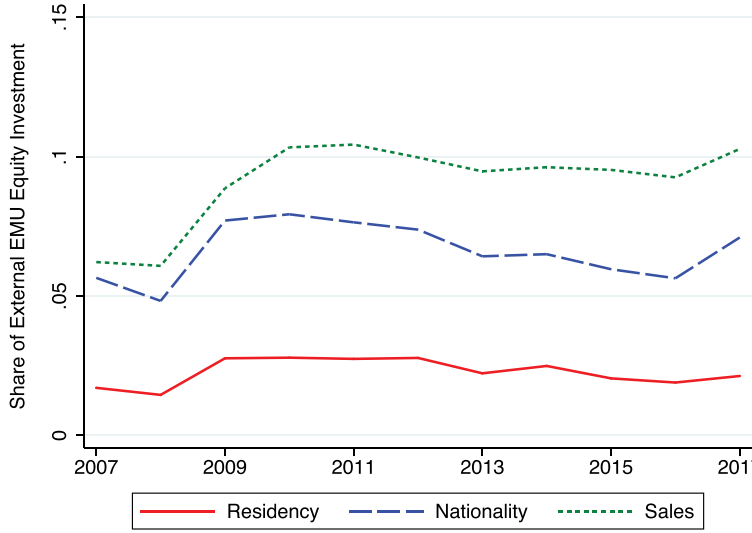
These results demonstrate how, depending on the economic question at hand, researchers and policy makers may wish to consider different restatements of bilateral investment statistics. Our article offers a baseline treatment emphasizing tax havens, a broader full-nationality approach useful for thinking about corporate control, results focused on financial guarantors, and a sales-based methodology. Our approach allows users to choose among any of these options, or in fact develop their own, using the set of results and tools we provide. Ultimately, a deeper understanding of how capital is allocated globally can only be achieved by considering alternative measures and understanding the underlying economics that they reveal. An approach solely based on residency, like the one most commonly used so far by academics and policy makers, is far more limited.

VI. Conclusion

We redraw the map of global capital flows by unwinding corporate ownership chains and accounting for offshore issuance in tax havens around the world. This new map reveals that official bilateral investment statistics significantly understate the magnitude of financing provided by developed market investors to firms in large emerging markets. The offshore structures that we uncover often mask investment in securities under the cover of foreign direct investment, which causes an understatement of the share of corporate and foreign currency bonds in the portfolio liabilities of these countries and can also lead to the omission of valuation effects in external accounts, leading to a large upward bias in China's net creditor position to the rest of the world. In



(A) U.S. External Equity Holdings



(B) EMU External Equity Holdings

FIGURE XI

Exposure to China in External Equity Portfolios, Under Residency, Nationality, and Sales-Based Measures

We show the exposure to China in the external equity portfolios of the United States and of the EMU under different methodologies.

addition to our main results, we offer a restatement of bilateral investment positions that associates all subsidiaries—even those not in tax havens—with their ultimate parents, another restatement that associates bond issuers with their guarantor firms, and a final restatement that associates investment in a firm with multiple countries based on the geographic distribution of the firm's sales. We think that our results and procedure improve the characterization of global capital allocation and allow researchers and policy makers to use the data best suited to answer the international macroeconomic question at hand.

Supplementary Material

An Online Appendix for this article can be found at *The Quarterly Journal of Economics* online.

Data Availability

Code replicating the tables and figures in this article can be found in Coppola et al. (2021) in the Harvard Dataverse, https://doi.org/10.7910/DVN/1SCTXG.

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