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# ELUSIVE SAFETY: THE NEW GEOGRAPHY OF CAPITAL FLOWS AND RISK

Laura Alfaro
Ester Faia
Ruth A. Judson
Tim Schmidt-Eisenlohr

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Elusive Safety: The New Geography of Capital Flows and Risk
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## ABSTRACT

Using a unique confidential data set with industry disaggregation of official U.S. claims and liabilities, we find that dollar-denominated securities are increasingly intermediated by tax havens financial centers (THFC) and by less regulated funds. These securities are risky and respond to tax rates and prudential regulations, suggesting tax avoidance and regulatory arbitrage. Issuers are mostly intangible-intensive multinationals, investors require a high Sharpe ratio, suggesting search for yield. In contrast, safe treasuries are mainly held by the foreign offcial sector and increased with quantitative easing policies. Facts on privately held securities are rationalized through a model where multinationals with heterogeneous default probabilities endogenously choose to shift profits and are funded by global intermediaries with endogenous monitoring intensity. A fall in corporate taxes raises the fraction of entrants and shifts the distribution toward riskier ones. A fall in the costs of global funds or in THFC regulation costs additionally reduces the monitoring intensity at the extensive (fraction of monitored firms) and intensive margin, hence raising ex post risk. Firms appear elusively safe.

Laura Alfaro
Harvard Business School
Morgan Hall 263
Soldiers Field
Boston, MA 02163
and NBER
lalfaro@hbs.edu

Ruth A. Judson
Global Financial Flows Section,
International Finance
Federal Reserve System
20th Street and Constitution Avenue, NW
Washington, DC 20551
ruth.a.judson@frb.gov

Ester Faia
Goethe University Frankfurt
Theodor W. Adorno Platz 3
Frankfurt am Main, 60323
Germany
and CEPR
faia@wiwi.uni-frankfurt.de

Tim Schmidt-Eisenlohr
Federal Reserve System
20th St NW & Constitution Ave NW
Washington, DC 20551
and University of Illinois at Urbana-Champaign
t.schmidteisenlohr@gmail.com

# 1 Introduction

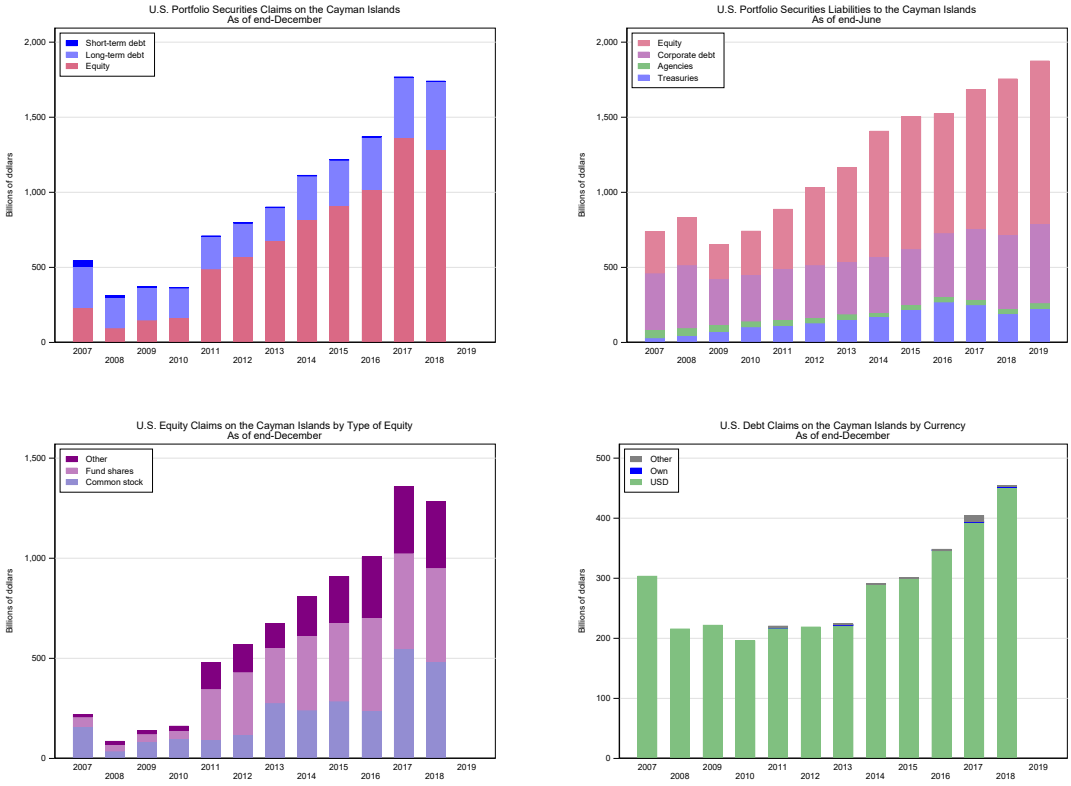
The large and growing international flows of US-denominated securities have long been an important part of theoretical research. Recently some papers (reviewed in the next section) have confirmed and documented the dominance of the dollar in international flows. Yet, no paper has studied the micro origins, especially the motives and incentives, behind these flows due to a lack of reliable data with an exact quantification of the inflows and outflows across years and countries and with granular information on investors, issuers and asset type.

In this paper, we use a unique, granular and confidential data set derived from the Treasury International Capital (TIC) official reporting system (annual survey of US portfolio securities claims on foreigners, and annual survey of US portfolio securities liabilities to foreigners) which collects data on U.S. residents' holdings of foreign securities and on foreign residents' holdings of US securities. We first examine facts and trends at country and sectoral level. The granularity of our data also allows us to match them with sectoral measures of risk and Sharpe ratios.

We find that dollar-denominated capital flows are increasingly intermediated by tax havens financial centers (THFC hereafter) and non-bank financial institutions. These flows reflect mainly holdings of equities in multi-nationals which are riskier and exhibit higher Sharpe ratios. On the contrary safe assets, namely U.S. Treasuries, are mainly held by foreign official investors.[1] Figure 1 presents a first glance of the facts for privately held flows, which we then detail further below. The figure shows the trends for the period 2007-2018 in U.S. claims and liabilities to the Cayman Islands, the THFC that accounts for the largest proportion of the flows. Both claims and liabilities have increased significantly (first two panels on the top of the figure), particularly so for equities (third panel in the bottom) and for US-dollar denominated assets (fourth panel on the bottom). To give a sense of the magnitude and significance of the increase note that Claims in equities to the Cayman have seen a 700 percent increase over the period 2006-2018, liabilities have seen an increase of 483 percent in the form of equities, of 108 in the form of corporate debt and of 674 percent in the form of Treasuries.

[1]The TIC system collects data separately by country for foreign official and private investors, but breakdowns by country for foreign official and private holdings are not published.

Figure 1. U.S. Portfolios Claims and Liabilities To the Cayman Islands– Total, Equities and Dollar-denominated Assets(2007-2018)




Source: TIC data, SHL and SHC Survey.

These trends provide insights on the micro origins of these flows. The increase in private U.S. claims and liabilities channelled through THFC, has been particularly marked around 2010, the year of the Dodd-Frank Act approval.[2] The growth has been larger for equities of multinationals or investment funds with foreign residence. Notably, the majority of U.S. equity shares in the Cayman Islands, the THFC which accounts for the largest portion of U.S. securities abroad, is in less-regulated mutual funds.[3] On the other side, over half ($4.1 trillion out of $6.7 trillion as of December 2019) of safe treasuries are held by the official sector (mostly Japan and China, other emerging markets, but also euro area) and their growth picked up at the time of quantitative easing policies.

[2]An important caveat is that some of the increase from 2011 to 2012 represents an expansion in the reporting universe that accompanied the introduction of the TIC SLT in 2011. See Brandner and Judson (2012) and Bertaut and Judson (2014) for more details.

[3]We note here, and we elaborate more later, that in 2010 no important tax changes or events occurred in the THFC, but the Dodd-Frank Act was approved in the US.

It is important to stress that our data represent the most accurate measurement of U.S. cross-border asset positions. The confidential TIC data are based on official reporting by all significant U.S. custodians and U.S. end-investors holding securities abroad and by all significant U.S. custodians and issuers of U.S. securities held by foreigners.[4] Hence, contrary to data used in previous studies and extracted from industry analysts' reporting, credit agencies' reporting, or other private industry reporting, our data represent an official source with extremely granular coverage.[5]

Following a characterization of broad stylized facts, we then conduct an empirical analysis, both at country and sectoral level, to assess the determinants of the flows. The main finding is that the recent geographical trends of the flows, and of their heightened risk-return characteristics, are driven by tax avoidance and regulatory arbitrage, beyond some of the variables from the financial and dollar cycle literature. Those motives are more pronounced for firms in intangible-intensive sectors.

In particular, we first revisit the empirical evidence, motivated by the above facts, with regard to the global cycle. Using the securities holdings data at our disposal, we run regressions with variables from the financial and dollar cycle literature[6] but also some new ones related to uncertainty measures. The variables include the growth rate of the VIX, dollar exchange rate, Federal Funds Rate or shadow rate, Excess Bond Premium, and the Variance Risk Premium (VRP). First, for the official sector, holdings of equities and corporate bonds are unresponsive, while treasuries respond to risk and uncertainty indices and to the Dollar exchange rate. This confirms the large reliance of the official sector on safe assets.[7] On the contrary, for the private sector, only foreign holdings of equities and debt react and solely to risk and uncertainty indices, but are unresponsive to most other variables. All in all we conclude that while macro variables of the global financial cycles, mostly those related to risk and uncertainty, play an important role in determining the flows, there must be other variables that account for the specific direction toward THFC. And those variables are most likely related to micro incentives.

[4]This was done through a joint effort of the Treasury Department and the Federal Reserve

[5]See Chen et al. (2019) for recent remarks on this issue.

[6]See Rey (2013), Baskayaa et al. (2017), Avdjiev et al. (Forthcoming) or Niepmann and Schmidt-Eisenlohr (2019) for some recent papers in the empirical literature on global financial and dollar cycle

[7]Dollar sensitivity suggests reserve management (Alfaro and Kanczuk (2009); Alfaro et al. (2014))

To verify this conjecture, we run regressions on country level by adding to the list of variables two new candidates, namely indices for corporate taxes[8] and prudential regulation.[9] Private holdings of US equities and debt respond significantly to both variables, confirming tax avoidance and regulatory arbitrage channels. The response to corporate taxes might seem puzzling, given that no significant tax event was recorded for the Caribbean in our sample period. We conjecture that the expansion in the intangible-intensive economy might have allowed firms to benefit from tax avoidance. We confirm this by running industry level regressions, in which we control for an intangible-intensive index.

Tax avoidance, regulatory arbitrage, and the involvement of less regulated funds suggests that private holdings might be risky. This can be verified by exploiting a unique granularity of the micro-TIC data. Our industry level flow data can be matched with industry-level risk metrics and Sharpe ratios. Assets of risky firms with intangible assets are bought mainly in tax havens; also, investors located in there require higher Sharpe ratios, requiring higher returns for a given risk, an indication of search for yield. Interestingly and surprisingly, flows channeled through emerging market economies are the safest.

In the last section of the paper we rationalize our results with a model featuring endogenous entry in tax havens and endogenous risk-taking. The two main facts related to privately held securities, namely the increase in THFC flows and in debt risk, are rationalized through a general equilibrium model with multinationals entering THFC and funded by less-regulated global intermediaries. Firms, heterogeneous in their default probabilities, choose whether to shift profits to the THFC, paying a cost, and to enjoy a tax benefit. Firms fund their activity with risky debt obtained from global intermediaries. The latter have access to a global liquid market and, by enjoying a light regulation, can offer funds at low costs. Loan spreads are chosen based on an incentive-compatible contract and intermediaries choose their monitoring intensity endogenously.

We show that a fall in debt costs, triggered for instance by an exogenous increase in global liquidity, raises firms' profits. This has two contemporaneous effects. On the one side, a higher fraction of firms can afford to enter the THFC and there is a shift in the default

[8]From the KPMG database

[9]From the Cerutti et al. (2017) database

distribution of entrants toward riskier ones. This generates a novel "risk selection" effect. On the other side, more profitable firms appear elusively safer and global intermediaries endogenously reduce their monitoring intensity at both the *extensive* (less firms are monitored) and the *intensive* (each firm is monitored less) margins. This in turn increases each firm default probabilities and the overall aggregate risk in each sector. A fall in the regulatory cost for global intermediaries also raises the fraction of entrants and their risk-profile as well as it increases the intensive and extensive margin of risk. On the other side a fall in the entry costs or in the corporate tax of the THFC only affects the fraction and the risk distribution of entrants, but not the intermediaries' monitoring intensity.

***Relation to Literature*** The increase in foreign direct investment (FDI) in tax havens has been noted in a recent literature measuring the extent of profit shifting. Guvenen et al. (2017) and Tørsløv et al. (2018) both find, using different data sets, that much of the productivity slowdown observed in the U.S. since 2004 can be explained by profit shifting and is larger for R&D intensive industries.[10] Similarly, Liu et al. (Forthcoming) document substantial profit shifting through transfer pricing by U.K. multinationals, also concentrated in the R&D-intensive sectors. Wright and Zucman (2018) examine the evolution of taxes paid by U.S. multinationals on their foreign profits since 1966 and show that an exorbitant tax privilege explains half of the U.S. cross-border return differential.[11] Our works highlights the pursuit of risk in addition to the role of regulation and tax arbitration.

The novelty of our model stems from merging moral hazard contract theory with endogenous monitoring intensity in a setup of heterogeneous firms with a Melitz (2003) style heterogeneous firms set-up. To nest the two, firms are assumed heterogeneous in terms of their default probabilities. This also means that as more firms enter, due to lower costs of global funds or lower entry, regulation or taxes in the THFC, there is a shift in the firms' distribution toward riskier ones. We dub this a novel risk-selection effect. Past work from Froot and Stein (1991) and Klein et al. (2002) related the creation of multinationals and FDI activity to credit imperfections due to informational frictions and bank-firm specific relations in international markets or contracting frictions as in Antràs et al. (2009). We highlight a

[10] See Hines (1996) for early work on this front and also Desai et al. (2004).
[11] See also Curcuru et al. (2008).

novel dimension linking multi-nationals entry and their risk distribution to moral hazard and endogenous monitoring intensity. The paper is also related to the theoretical literature on tax competition literature and profit shifting (see Krautheim and Schmidt-Eisenlohr (2011) or Ottaviano and van Ypersele (2004)). Our model rationalizes the emergence of foreign direct investment flows for the purpose of regulation and tax arbitrage to complement the large literature on the motives of multinational firms.

In the international finance literature, the research by Lane and Milesi-Ferretti (2018) and Obstfeld (2018) began to document the changing landscape of capital flows geography, including the shift toward tax havens or financial centers. More recently, Bertaut et al. (2019) use the TIC data to document an increasing share of U.S. equity and debt claims in firms incorporated in low-tax jurisdictions and intermediated through mutual and hedge funds. Liu and Schmidt-Eisenlohr (2019) also use TIC data to document a rapid growth in the use of CLOs, which, contrary to other safer debt-instruments, facilitate risk-recycling. Compared to the above work, our paper moves step forward in the micro determinants and how those related to the changing nature of the multi-nationals business models toward larger fraction of intangible.

Our paper also relates to the literature documenting the increase of cross-border flows in U.S. dollar-denominated securities and the role of dollar as reserve currency and global provider of liquidity, (see Lane and Milesi-Ferretti (2001), Obstfeld (2004), Gourinchas and Rey (2010), Forbes (2010), Gourinchas and Rey (2014), Caballero et al. (2016) or Gopinath and Stein (2018) among others). Early works attributed the growth in dollar-denominated debt to the safe haven properties of the U.S. dollar and the specialty of Treasuries (Caballero et al. (2008), Mendoza et al. (2009), Gourinchas and Rey (2011), Maggiori (2017) among others). Recent papers (Maggiori et al. (Forthcoming), Lilley et al. (2019) and Coppola et al. (2019)) use private proprietary data to document that the dollar dominance might be even stronger than previously thought while documenting as well the increasing role of tax havens. An advantage of the TIC data is that it provides shares for both inflows and outflows obtained from official reporting to the Fed system which allow to document the two-way risky nature of these flows.[12]

[12]Empirically, our paper relates to the recent literature noting measurements concerns in the Balance of

In terms of highlighting the risky nature of the growth of U.S. securities, our works relates to the research of Bruno et al. (2018) and Avdjiev et al. (Forthcoming) which questions the safe-assets hypothesis for dollar-denominated privately held securities and conjecture that global banks leverage in dollars to cover for the exposure in dollar assets. We also find that cross-border flows in dollar-denominated assets are increasing, and uncover new motives such as tax avoidance and regulatory arbitrage, noting that most of the private flows are actually risky and related more broadly to non-bank financial intermediaries as well. As for the outflows of U.S. Treasuries, very safe assets, we find that they are mainly held within the official sector and their growth coincides with quantitative easing policies.[13]

The paper is organized as follows. Section 2 presents the main facts. Section 3 contain the regression analysis of macro determinants and micro origins. In section 4 we present the model. The last section concludes.

# 2 Facts

We start documenting some facts emerging from the TIC data at the country level and for different types of securities, taken from the Annual survey of US portfolio securities claims on foreigners (SHC) and annual survey of US portfolio securities liabilities to foreigners (SHL). The confidential TIC data, contrary to any other, provide granular information on the breakdown across countries, type of securities (treasuries, debt, equities, ABS, etc.), type of investors (official versus private) and issuers, and on the ultimate destination of the claims (equities of multinationals or of mutual funds). Reporting is required by law. The annual TIC surveys collects data on individual securities since the early 2000s; the TIC-SLT, collecting monthly data starts in 2011.[14] Appendix A describes the data in detail.

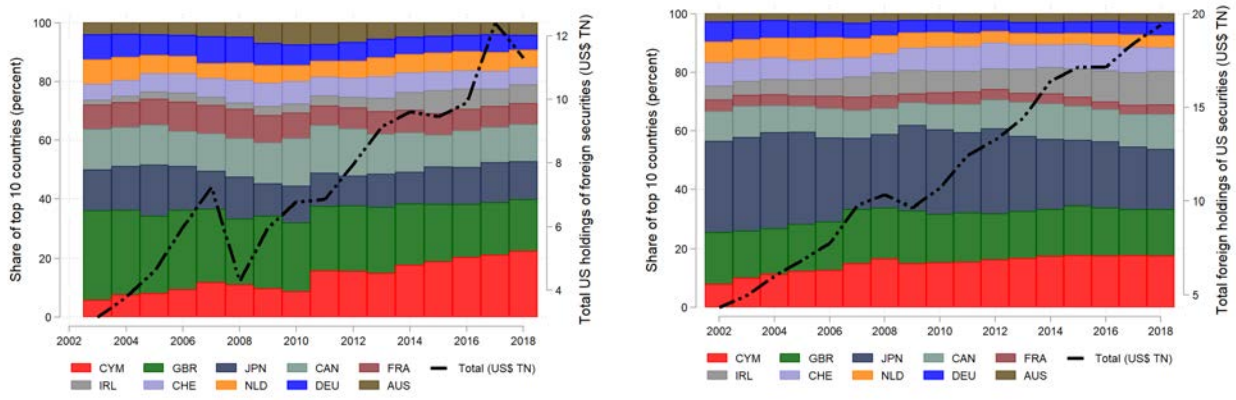
In the data analysis below, we uncover the main trends, such as the change in the size of the flows, their main location and the securities that are most in demand. Facts and empirical

Payments entries due to the more complex structure of multinationals.Avdjiev et al. (2018) and Bertaut et al. (2019), for example, note differences in U.S. cross-border flows based on the nationality, rather than on the residence of the ultimate owner and Coppola et al. (2019) for a broader set of countries.

[13]See Alfaro and Kanczuk (2009) and Alfaro et al. (2014) for the role of reserve accumulation and the role of sovereign flows.

[14]In the analysis, when relevant, we use the longest available sample from the "modern survey" era. Since the surveys are collected at different times, the samples are slightly different.

Figure 2. U.S. Claims and Liabilities of Top 10 Countries (2001-2018)




(a) Claims

(b) Liabilities

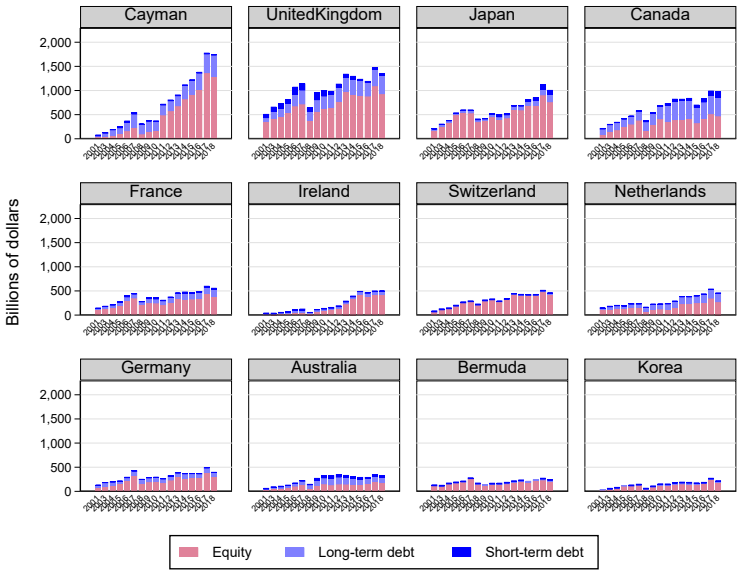
Source: Aggregate TIC Data.

results are reported for both, US holdings of foreign securities (occasionally referred to as claims) and foreign holdings of US securities (occasionally referred to as liabilities). When reporting country level-data break down in the figures below, we choose the 12 counties that account for the largest share and we quantify the percentage change over the sample period and the average percentage change per year for the largest destination of flows. In the next section 3.2, we analyze facts and tends at the more granular sectoral level. The data are based on both the SHL/SHLA (liabilities) and SHC/SHCA (claims) surveys. These collect data on individual cross-border security holdings from custodians, end-investors, and issuers.

First, figure D.1 in Appendix D confirms that both inflows and outflows from and to the United States have been growing over in recent years even further. Figure 2 shows that tax havens, and in particular Cayman Islands, rank in the top 10 destinations for both U.S. claims and liabilities and that their share has increased over time with a jump around 2010.

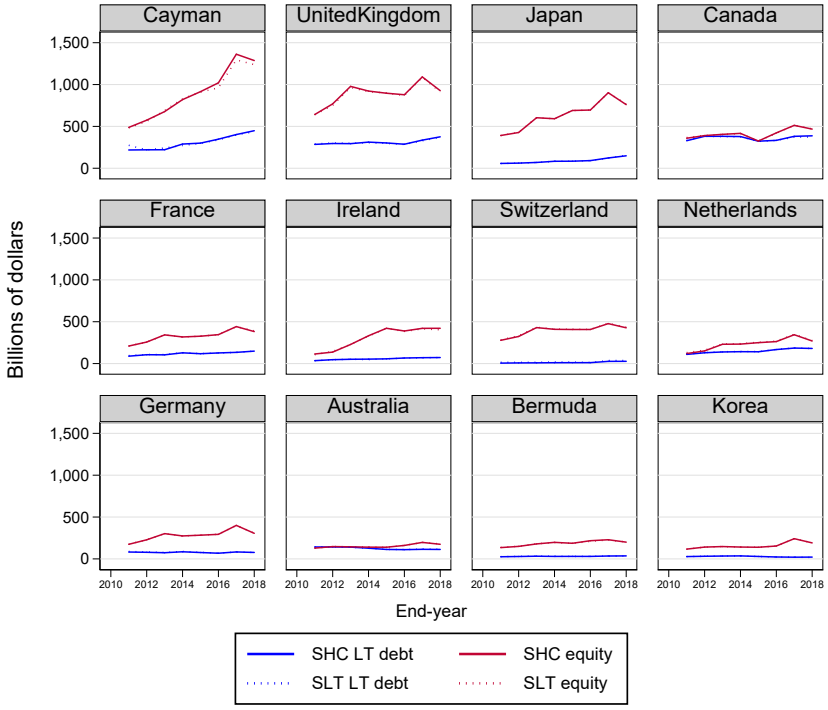
Next we examine the breakdown of the data by country, asset class, currency denomination and other features. We start with U.S. claims. Figure 3 shows the U.S. claims by country and security type (on a common scale), for the set of countries attracting the most U.S. investment. To appreciate the magnitude of the increase note that claims in equities have increased of 700 percent over the sample period 2006-2018, with an average annual percentage change of 18.9 percent. Long term debt claims to the Caymans have increased of 152 percent, with an 8 percent average annual increase. Short term debt claims have instead declined. Most of increase in the flows takes the form of equities.

Figure 3. Market Value of U.S. Holdings of Foreign Securities by Top 12 Countries and Type of Asset (2001-2018)



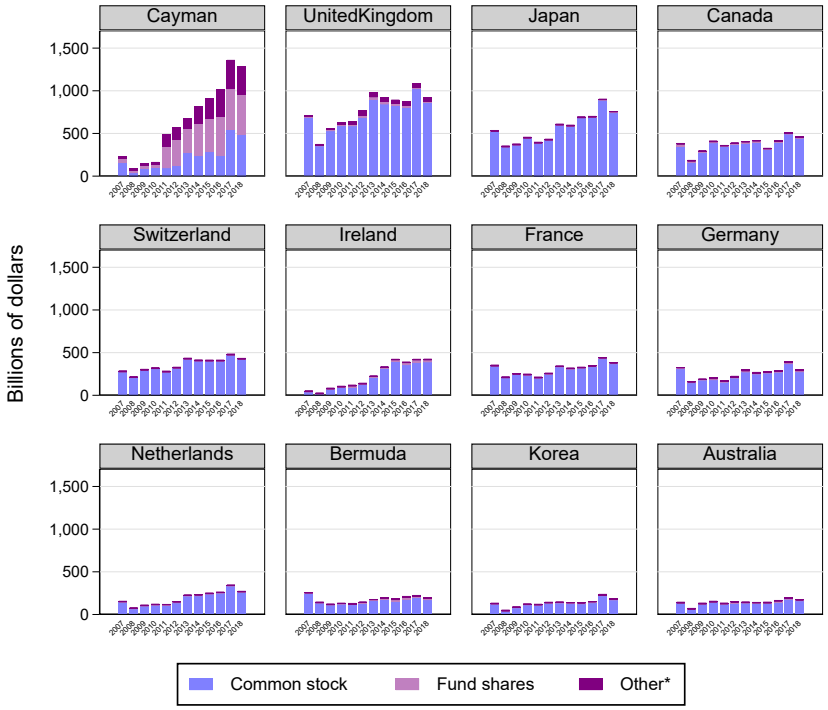

Source: TIC data, SHL and SHC Survey.

Figure 4. U.S. Holdings of Foreign Long-Term Securities by Top 12 Countries–Equities and Debt (2008-2018)




Source: TIC data, SHL and SHC Survey.

Figure 5. U.S. Holdings of Foreign Equities–Common Stocks, Fund Shares and Others–by Top 12 Countries (2007-2018)




Source: TIC data, SHL and SHC Survey.

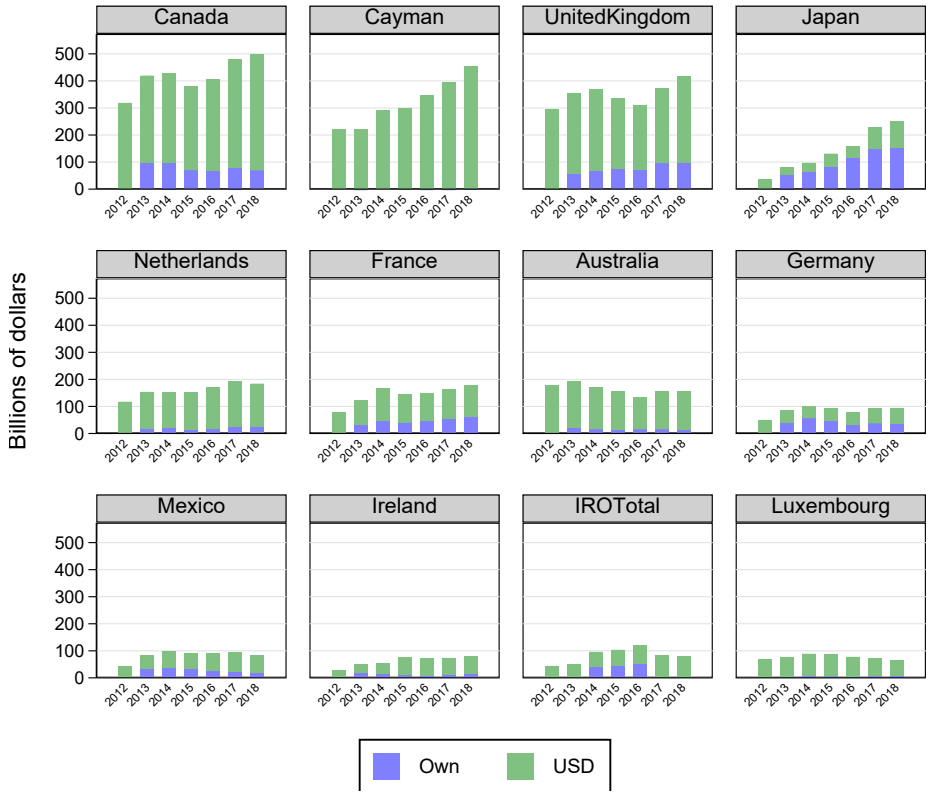
The increasing share of equity in total claims emerges also from Figure 4, which shows the time series evolution of the flows. The unprecedented growth of securities from the Cayman Islands and other offshore centers is evident starting in 2010.Because of this in the next figures we focus on the sample period 2007-2018 (subject to data availability).

Figure 5 breaks down the type of equities in common stocks, fund shares and others. The Cayman Islands stand alone as receiving the vast majority of U.S. inflows the form of fund shares. This reflects ownership by U.S. residents of funds (i.e. non-banks) that intermediate capital in the Cayman Islands. Similarly, figure D.2 in the Appendix shows that the holdings of common stocks and foreign depository receipts are the largest in the Cayman Islands, too. These claims are most likely holdings of equities by affiliates of multinationals.

In summary, recent data show an increase of U.S. claims towards THFC, which mainly the form of equities or corporate debt investments in multinationals or less-regulated funds intermediating from the Caribbean.

In terms of currency denomination, figure 6 shows that asset holdings in THFC are all

Figure 6. U.S. Holdings of Foreign Securities by Top 12 Countries and Currency Denomination (2011-2018)

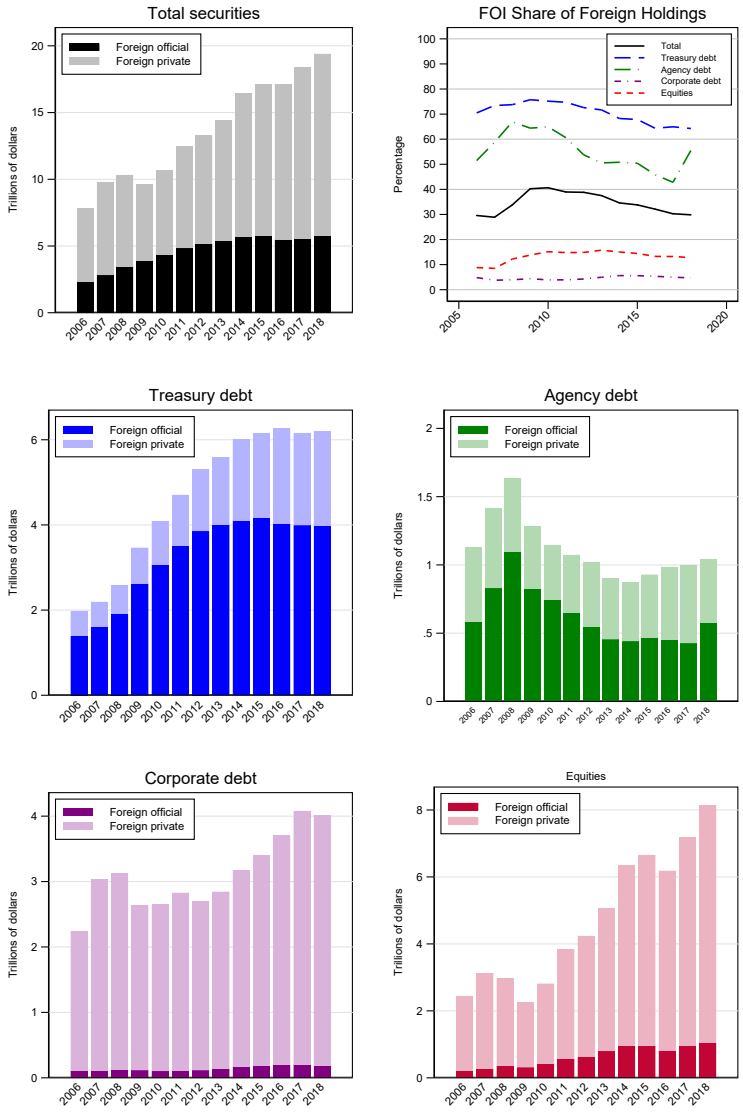



Source: TIC data, SHL and SHC Survey.

in U.S. dollars. Over the sample period 2010-2018 the growth in dollar-denominated debt claims to the Caymans has grown of 129 percent. On the contrary, in other countries (Europe or EMEs) the share of foreign currency-denomination has been increasing starting from 2012. Dollar dominance is predominant in THFC, but not in European countries.

Next we examine U.S. liabilities. This is an essential aspect for a country whose global imbalances have been under the microscope for long. Figure 7 shows the breakdown of foreign holdings of U.S. securities by the official and the private sectors. The most interesting aspect is the dominance of U.S. treasuries in the foreign official sector. Equities and corporate debt are instead held by private investors. The growth of the treasuries within the official sector has increased significantly at the time of quantitative easing policies. Note on the other side that U.S. Claims on foreign Treasuries are basically nil (and not shown for this reason). This confirms the safe asset hypothesis for U.S. Treasuries. At last, likewise for claims, also U.S.

Figure 7. Foreign Holdings of U.S. Securities by the Official and Private Sector (2006-2018)

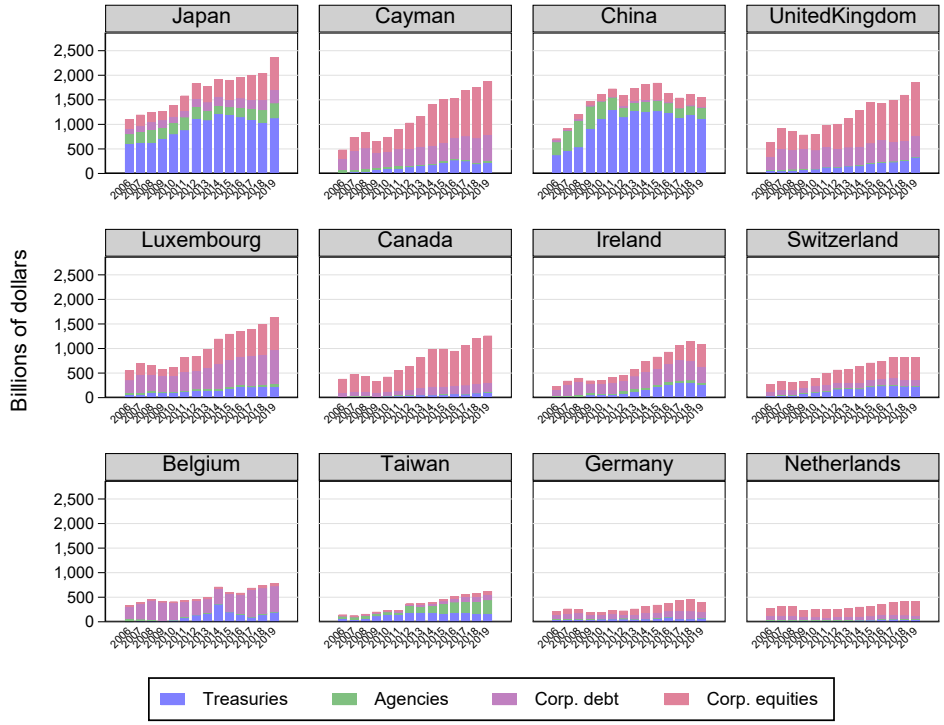



Source: TIC data, SHL and SHC Survey.

liabilities privately held in the Cayman Islands are by and large in the form of equities and corporate bonds and have been growing since 2010.

Figure 8 shows the breakdown of U.S. liabilities by country. Again, most of the equities are held by investors in Cayman Islands and Luxembourg, while most of the treasuries are held by Japan and increased at the time of quantitative easing. Still Cayman Islands have seen an increase in liabilities in U.S. Treasuries of 674 percent over the period 2006-2018, with an average annual increase of 18 percent. The increase in equities and corporate debt

Figure 8. Foreign Holdings of U.S. Securities by Top 12 Countries and Type of Asset (2006-2018)




Source: TIC data, SHL and SHC Survey.

over the same period has been respectively of 108 percent and 483 percent.

Finally, Figure D.3 in Appendix D shows that most of the debt in the Cayman Islands is in the form of asset-backed securities (ABS). ABS are a method to recycle risk onto the market and, as such, they have often been linked to reduced debt monitoring and higher ex post risk. We will examine the risk profile of THFC assets in section 4.

# 3 Empirical Analysis

Two main trends emerge from the previous data analysis, beyond an increase in flows of U.S. securities. First, there is an increase in private U.S. claims and liabilities toward THFC. The flows have trended up mostly around 2010, a year in which most advanced economies had tightened prudential regulations. The fact that most of these flows are intermediated through less-regulated funds suggests a correlation with those events. Second, one can see an increase of U.S. Treasury securities abroad, mostly held by the official sector and mostly around the dates of quantitative easing policies.

These facts together suggest that a combination of macro and micro factors are behind the recent trends in flows. We start by examining the macro determinants, running empirical specifications with variables from the financial and dollar cycle literature[15] but also some new ones related to uncertainty measures[16]. The variables include the growth rate of the VIX, dollar exchange rate, Federal Funds Rate or shadow rate, Excess Bond Premium and the Variance Risk Premium (VRP). In a second step, two additional variables are considered, namely indices for corporate taxes and prudential regulations. This second set of variables captures best the micro origins related to firms' and investors' incentives for international trading.

## 3.1 Macro Determinants of Capital Flows: Global Financial and Dollar Cycle

The empirical specification below revisits the classical analysis featured in the literature on the global financial cycle. Our benchmark regression specification takes the following form:

$$\Delta flow_t^{i,a} = B\ X_t + \epsilon_t, \tag{1}$$

where the dependent variable, $flow_t^{i,a}$, is the ratio of the capital flows in each asset class $a$ (treasuries, equities or corporate bonds for U.S. liabilities; long-term debt and equities

[15] See Rey (2013), Baskayaa et al. (2017) or Avdjiev et al. (Forthcoming) for some recent papers in the empirical literature on global financial and dollar cycle

[16] See also Niepmann and Schmidt-Eisenlohr (2019)

for U.S. claims) for investor type $i$ (foreign official or foreign private for U.S. liabilities) in month $t$ over the previous month's position for that asset class and investor. $X_t$ is a set of macro controls, which include the growth rate of the CBOE Volatility Index (VIX), the change in the excess bond premium (from Gilchrist and Zakrajšek (2012)), the Fed Funds rate (or the Wu-Xia shadow rate during the zero-lower-bound period), the U.S. term spread, the quarterly U.S. unemployment outlook from the Survey of Professional Forecasters, the Federal Reserve Broad Dollar index, the U.S. variance risk premium, VRP (from Londono and Zhou (2017)), the 3-month Treasury basis (from Du et al. (2018)), the emerging markets bond index spread (EMBI), and the oil price. The VIX is taken as a measure of risk and the VRP as a measure of uncertainty. More details on the variables' definitions are in the data Appendix.

The baseline sample for U.S. liabilities is at a monthly frequency for the years 2003 to 2018, while the baseline sample for U.S. claims is from 2002 to 2018.[17] Monthly flows are constructed from survey reports following the procedures developed in Bertaut and Tryon (2007). We present, for each dependent variable, each variable entered one at a time in the regression in the first column and then all variables in the same regression in the next column.

Table 1 shows results for private foreign holdings of U.S. securities. Equities and corporate debt respond to some of the global financial cycle variables, while treasuries are unresponsive. This is well in line with our previous observation that the private sector mainly holds equities and debt, hence it is plausible that these flows are the most responsive. They seem to respond solely to the VIX, the VRP and the EMBI, both for liabilities and claims (shown in Table 3). In other words, the equity and debt demand declines when risk and uncertainty rise. Private flows seem to be unresponsive to numerous other financial cycle and macro variables. This suggest that other, rather micro determinants, might be affecting private flows — a fact that we examine in the next section.

Table 2 shows results for holdings of U.S. securities of the foreign official sector for all asset classes. In this case, it is mostly treasuries which react to some of the global financial cycle variables. During our time period and frequency, in general, they fall when the VIX

[17] As mentioned, we try to use the longest "modern" series which differs slightly in collection dates.

and the VRP rise, or when the unemployment outlook and the EMBI spread worsen. Hence, when US risk and uncertainty raise, the official sector reduces its holdings. U.S. treasuries also respond to changes in the dollar exchange rate. This last result is in line with traditional motives of reserve management.

The effects from the risk and uncertainty measures on flows are economically meaningful. For example, a one standard deviation increase in the VIX (0.18 points) leads to additional sales of U.S. equity by foreign private investors of $3.24 billion or 0.1 percent of total asset holdings. A one standard deviation increase in the dollar (1.4 points) leads to sales of $5.8 billion or 0.18 percent. Looking at foreign official investors, a one standard deviation increase in the dollar would lead to sales of $7.3 billion of Treasuries or 0.32 percent of their total holdings.

All in all, while we find a role for the macro determinants of the global financial cycle, those variables alone cannot explain the shift of capital flows toward THFC. In light of the above findings and of the facts uncovered in section 2, we conjecture that the substantial shift in private flows toward THFC was largely driven by other factors related to issuers' and investors' incentives. The increasing flows in and out of offshore locations suggests that tax avoidance considerations and regulatory arbitrage, following the tighter regulation enacted in most advanced economies after the 2007-2008 financial crisis, are potential explanations. Hence, to the list of variables considered above we add corporate taxes[18] and prudential regulation indices.[19] For those regressions we focus on liabilities and we run them per type of securities, namely treasuries, equities and corporate bonds.

When we add the new variables, we find that equities held by the private sector react significantly to corporate taxes and to prudential regulation (see Table 4), while treasuries do not respond to any. Once more, since the private sector holds mainly equities and debt, it is these asset classes that respond more to taxation and regulation. These results give clear indications that tax avoidance or regulatory arbitrage play an important role. However, for assets held by the official sector the picture is reversed (see Table 5). It is mainly treasuries that respond and primarily to the prudential regime.

[18]From KPMG's corporate tax rate database.

[19]From the Cerutti et al. (2017) and iMaPP (see Alam et al. (2019)) databases.

Again, the size of effects is quantitatively relevant. For example, a one standard deviation increase in Regulation (0.82), implies additional sales of U.S. equity by private foreign investors of $441 million or 0.5 percent of assets held. Similarly, a one standard deviation increase in the corporate tax rate (1.25 points) generates sales of $327 million or 0.4 percent of asset holdings. Turning again to foreign official holdings, a one standard deviation increase in Regulation leads to sales of $197 million or 0.3 percent of holdings.

The significance of the estimates in this new set of regressions is remarkable given the short time span at our disposal and the fact that regulations and tax codes tend to remain relatively constant over time. Still, the responsiveness to tax codes seem puzzling since, while prudential regulation has changed significantly during the sample period considered, the de facto tax code in the Caribbean had not changed much.

We conjecture that the expansions in the intangible-intensive economy makes multinationals more prone to relocate and to benefit from tax avoidance. Most of their capital is made of patents and royalties that are easily movable across locations. To verify whether this hypothesis holds true, we regress the holdings of U.S equities and corporate bonds by private foreign investors on countries' tax rates at the industry level (see Table 6). Now we include an interaction term consisting of the tax rate multiplied by an index of intangible asset intensity in the regression.We find that when tax rates decrease in a country, its residents buy relatively more U.S. equities and corporate bonds in industries with an intangible asset intensity in the top quartile (column 4). Results are robust to including country-year and industry-year fixed effects (columns (5) and (6)).

## 3.2 Micro Origins of Capital Flows: Tax Haven and Risky Firms

The previous empirical analysis highlighted that privately issued and held flows are correlated with risk and uncertainty, more than with other variables capturing the global financial cycle. Tax avoidance and regulatory arbitrage, which are behind an upsurge in THFC flows, are also likely to be conducive to risk-taking behaviour. Motivated by these findings, we move our investigation a step further and examine the risk-return profile of flows. This provides further insights into the nature of micro incentives driving those flows.

We exploit a unique sectorial level granularity of the micro TIC data. For this purpose,

we match our industry-level flow data with industry-level risk metrics and also with the corresponding Sharpe ratios.[20] The first inform us about the origins of asset risk, which indeed seems to be of micro rather than macro or country origin. The second instead allow us to identify the existence of investors' search for yield. Should investors intermediated through THFC require higher excess returns relative to intrinsic risk, this would indicate that appetite for yield, more than for safety, is the driving force behind these investments.

What we find in sum, and describe in detail below, is that securities traded through THFC, in and out, are those of riskier firms that furthermore invest in intangibles and have higher Sharpe ratios. Tax havens are yield-havens more than safe-havens. Intangible-intensive firms are both more easily movable across borders, but also more geared toward a business with more uncertain returns. The collateral that they can offer against debt funding is also of more uncertain valuation compared to firms in more traditional manufacturing sectors.

Interestingly, our results on investors' required returns mirror the ones found in recent studies on inequality, whereby high sophisticated and high net-wealth investors make large use of the tax-dodging industry and seek for high Sharpe ratio securities (see Tørsløv et al. (2018), Wright and Zucman (2018), Piketty (2014) or more recently Piketty and Zucman (2014) and Jordà et al. (2019)). All results are shown in the next section for liabilities, first, and claims, next.

### 3.2.1 Risk and Sharpe Ratios of U.S. Liabilities

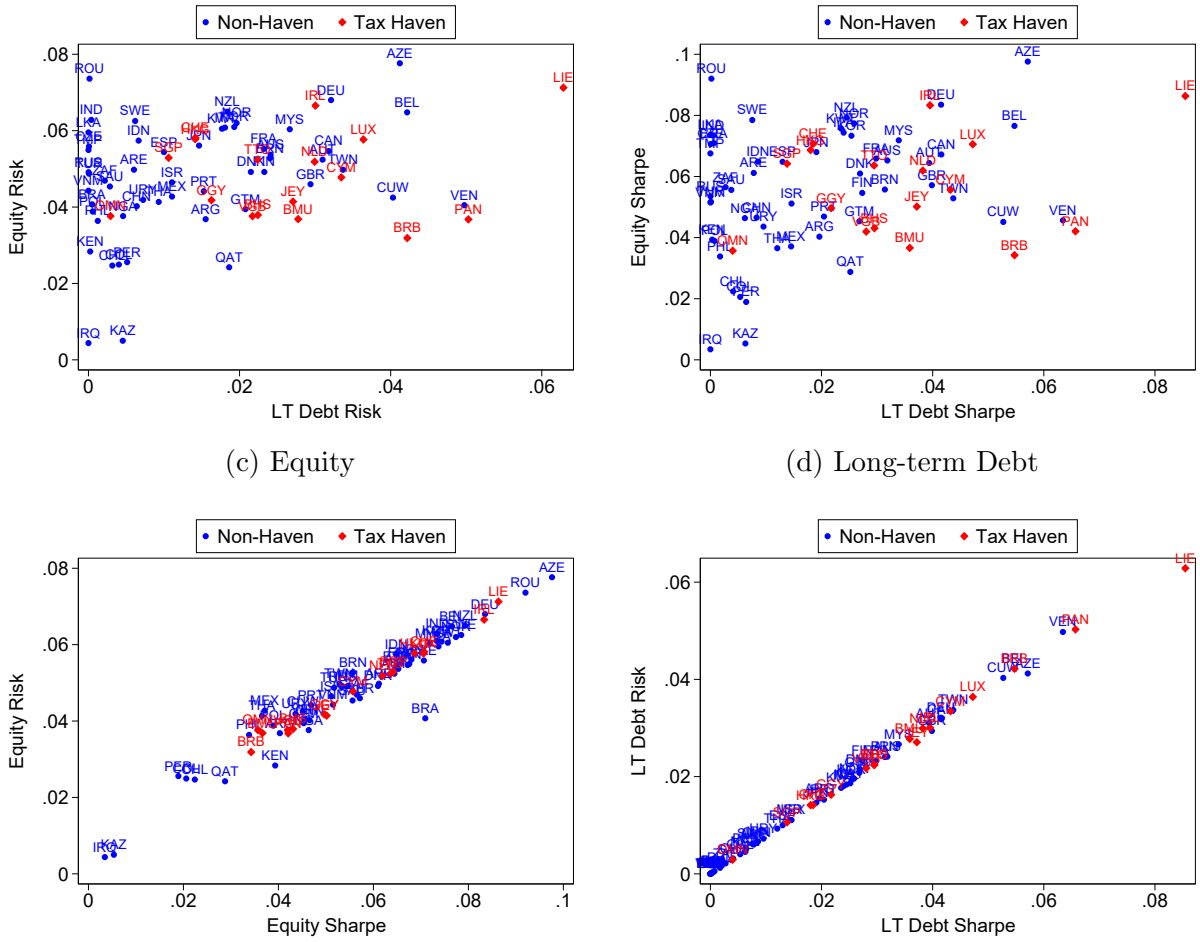
The unique granularity of our flow data allows us to shed light on which investors buy U.S. denominated assets, why they do so and through which countries they channel their investments. Throughout we use realized volatility at the industry level as our main risk metric, but results are robust to alternative risk metrics (for instance those controlling for Fama and French factors).

[20] As a measure of risk we use yearly realized volatility at the firm level which is aggregated by taking means at the industry level based on NAICS codes. Realized volatility is calculated as the square root of the sum of squared daily stock returns in a given year. Yearly Sharpe ratios are also first calculated at the firm level using yearly averages and standard deviations of daily excess stock returns and then aggregated by taking means at the industry level. Both variables are winsorized at the 1% and 99% level before aggregating them to the industry level.

Figure 9. Realized Volatility and Sharpe Ratios for U.S. Liabilities

(a) Realized Volatility

(b) Sharpe ratio




(c) Equity

(d) Long-term Debt

*Notes*: This figure plots the weighted average of industry-level realized volatilities and Sharpe ratios for U.S. liabilities by holding country in 2018. In the top two panels the x-axes show weighted averages for foreign holdings of U.S. long-term debt and the y-axes show weighted averages for foreign holdings of U.S. equity. In the bottom two panels the x-axes show weighted averages of realized volatilities and the y-axes show weighted averages of the Sharpe ratios.

In Figure 9 examines cross-country correlations between risk and Sharpe ratios in 2018. More specifically the top two panels plot the correlation between equity and long term debt risk and between equity and long term debt Sharpe ratios, while the bottom panels plot the correlations between between risk and the Sharpe ratios respectively for equities and long term debt. Panel (a) of Figure 9 shows that tax havens hold riskier U.S. debt liabilities, while no clear pattern emerges for equity. There are several reasons for which riskier firms rely on investors in THFC to buy their debt. Riskier firms find it harder to seek funding

through traditional domestic banking systems, currently subject to tighter regulations. In figure 5 from section 2 we have also seen that Caymans hold a large share of U.S. residents ownership of funds (non-banks) intermediating assets in there. Most likely, riskier firms are those with higher investment in intangibles, which typically have more uncertain valuations. For those firms it is harder to fund their investment through traditional collateral-based intermediation. We will return to this point in section 3.2.3. THFC, which, as shown earlier, are populated by global mutual funds, may offer easier access to liquid investors. The investor side is not less interesting. Panel (b) of Figure 9 shows that investors located in tax havens require higher Sharpe ratios, hence higher returns per intrinsic risk.

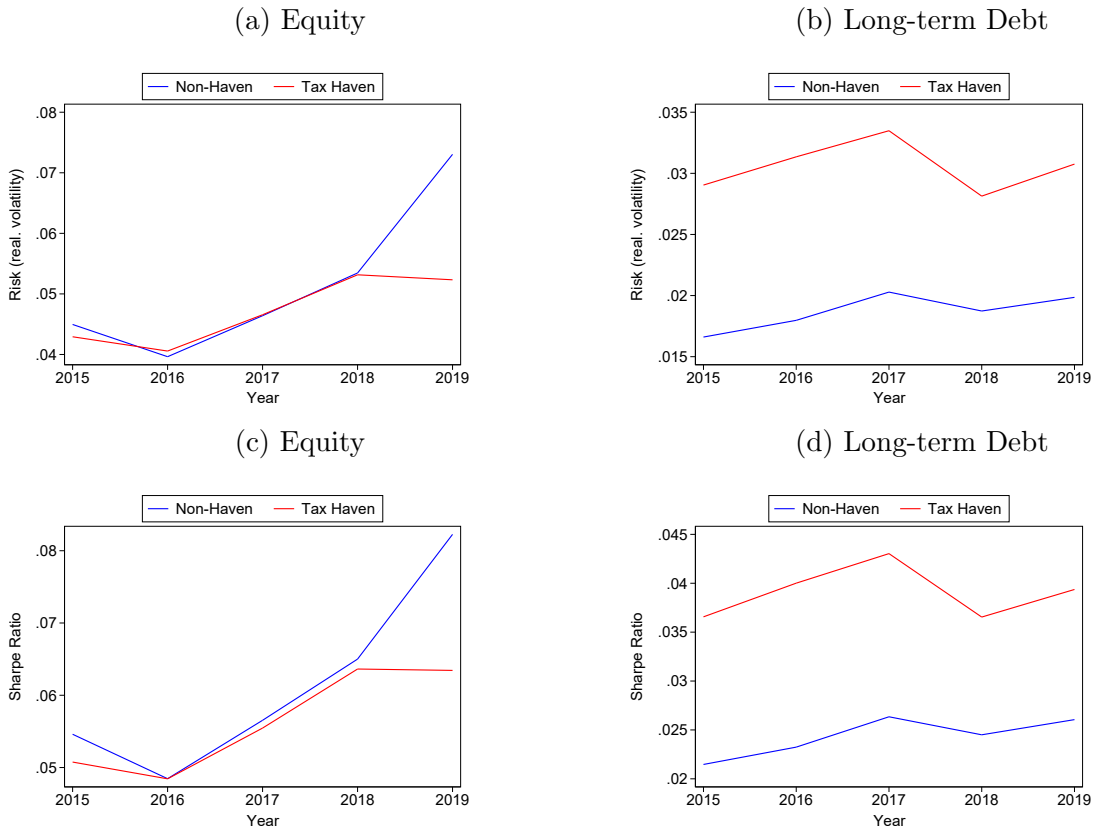
Panels c and d of Figure 9 confirm the positive correlation between risk and Sharpe ratios. This is a clear indication of a search-for-yield behavior. This result parallels the compelling finding of the recent literature examining the origins of wealth inequality (see Tørsløv et al. (2018), Wright and Zucman (2018), Piketty (2014) or more recently Piketty and Zucman (2014) and Jordà et al. (2019)), which finds that rich and sophisticated investors seek high Sharpe ratio securities.

The connection between the shift to tax havens and an increase in risk will be rationalized in the model that we present in section 4. In there, an increase in global saving lowers loan rates and spreads, by increasing the supply of credit. The ensuing raise in profits has two consequences. First, it raises the fraction of firms that can afford the cost to relocate in a tax haven and to benefit from the tax discounts. Second, firms appear more profitable and, because of this, global intermediaries reduce their monitoring incentives. This in turn increases ex post firms' probability of default, hence their debt risk. We will return to this mapping in section 4.

For the figures presented so far we focused on 2018 as a representative year of the most recent trends. We now examine the time series trends in search of the trigger for the sharp increase in investments flows to and from THFC. Panel (b) of Figure 10 shows that the average industry risk of U.S. debt held by tax havens has been significantly and consistently higher than the risk of U.S. debt held by other countries. Similar trends are detectable for Sharpe ratios (Panel (d) of Figure 10). The demand for risky assets is unquestionably located in THFC. Despite a small decline in 2017, risk picked up again in 2018. This is

interesting since it coincides with the approval of the US corporate tax cut. Riskier firms do not seem to have a desire to repatriate. As for equities (Panels (a) and (c) of Figure 10), there is no significant difference in risk and Sharpe ratios between tax havens and other countries. However, both geographical areas experienced an upsurge in average industry risk in recent years. This increase in risk may be driven by a higher growth rate of assets within riskier industries. It could also reflect search-for-yield behavior of foreign investors that may be shifting their portfolios towards riskier assets.

Figure 10. Trends in Average Risk and Sharpe Ratios of U.S. Liabilities



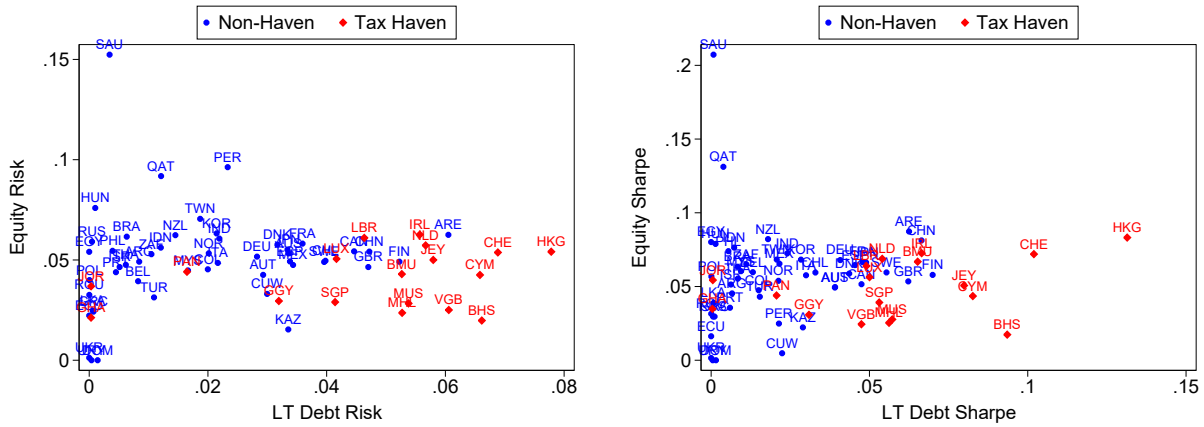

*Notes*: This figure plots the time series of the weighted average of industry-level realized volatilities and Sharpe ratios for U.S. liabilities by country type from 2015 to 2019. Panels (a) and (b) show average weighted realized volatilities. Panels (c) and (d) show average weighted Sharpe ratios.

At last, Table 7 confirms the evidence shown in the preceding figures. Tax havens tend to hold riskier U.S. debt than other investors, with no significant difference for equity holdings. Emerging markets, in contrast, tend to invest in safer U.S. debt and safer U.S. equities.

Figure 11. Realized Volatility and Sharpe Ratios for U.S. Claims

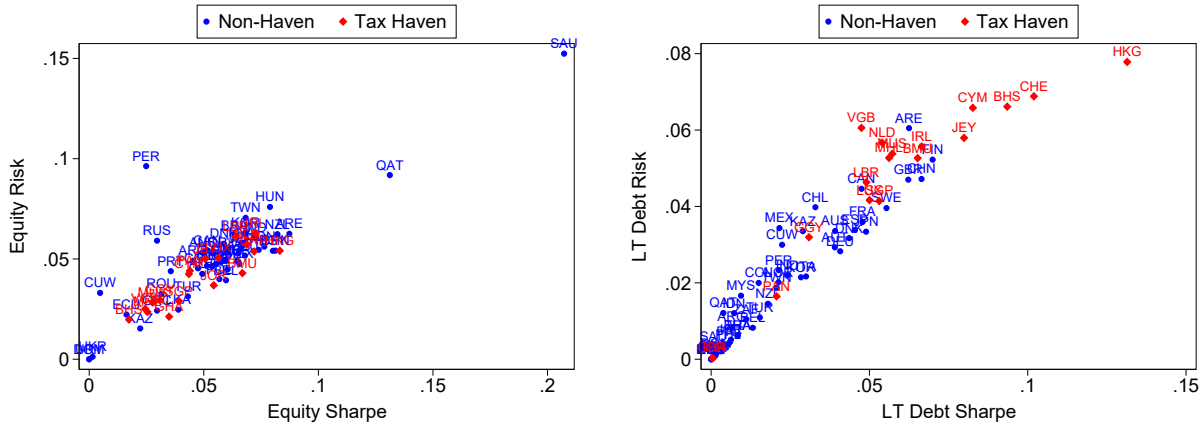
(a) Realized Volatility

(b) Sharpe Ratio




(c) Equity

(d) Long-term Debt



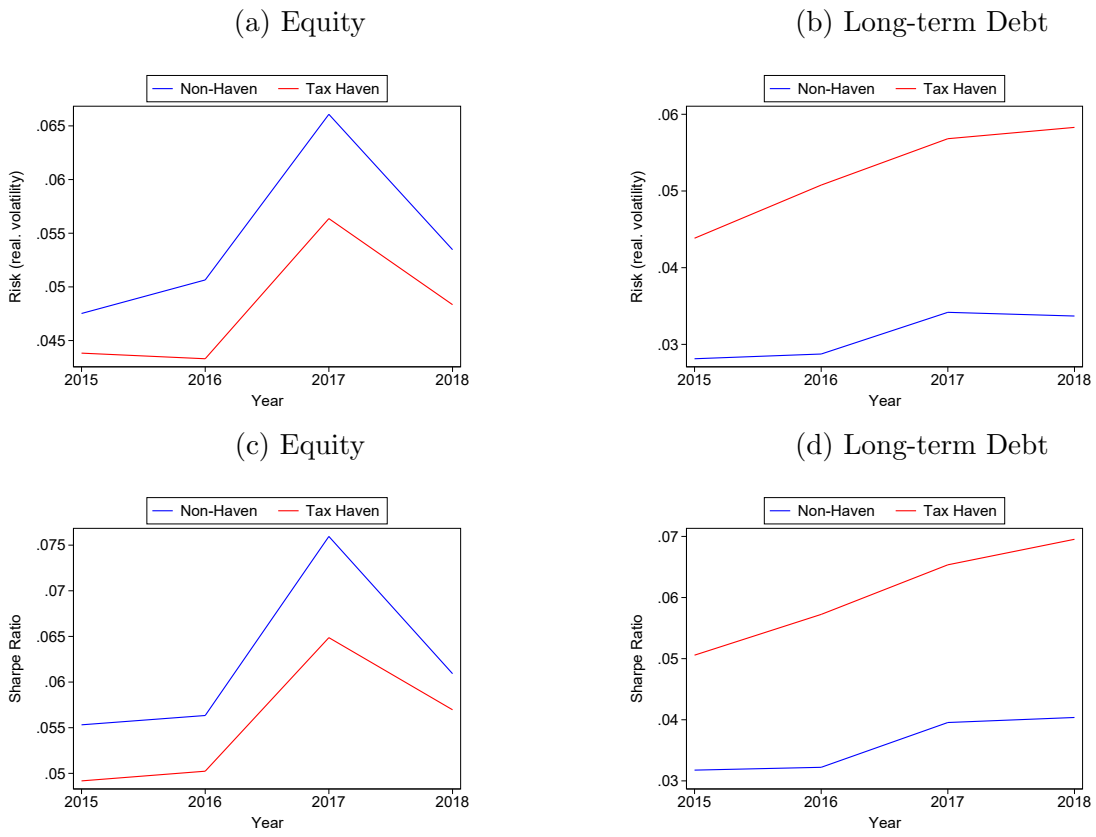

*Notes*: This figure plots the weighted average of industry-level realized volatilities and Sharpe ratios for U.S. claims by holding country in 2018. In Panels (a) and (b), the x-axes show weighted averages for U.S. holdings of foreign long-term debt and the y-axes show weighted averages for U.S. holdings of foreign equity. In Panels (c) and (d), the x-axes show weighted averages of realized volatilities and the y-axes show weighted averages of the Sharpe ratios.

### 3.2.2 Risk and Sharpe Ratios of U.S. Claims

THFC also play a key role in the intermediation of risky assets for U.S. investments abroad. Panels (a) and (b) of Figure 11 show that U.S. residents buy significantly riskier and higher yielding debt securities in THFC than in other countries. In parallel to our previous analysis, there is no significant difference in risk or Sharpe ratios for U.S. equity holdings abroad. These results are also reflected in the time series trends, shown in Figure 12 and Table 8.

Most importantly Figure 12 shows that for long term debt both risk and the Sharpe ratios have increases in the last year and that they are significantly higher in the THFC. Finally Table 8 quantifies the role of THFC in the build up of risk and interestingly shows that THFC are associated with a significant increase in debt risk and Sharpe ratios, while the opposite is true for both Advanced Economies and Emerging Market.

Figure 12. Trends in Average Risk and Sharpe Ratios of U.S. Claims



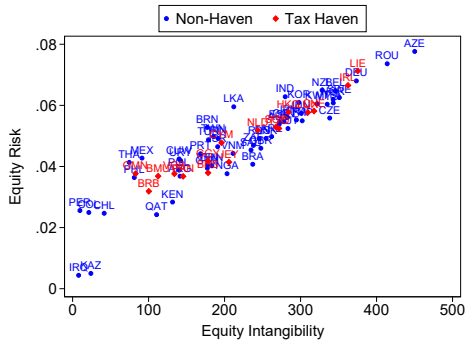

*Notes*: This figure plots the time series of the weighted average of industry-level realized volatilities and Sharpe ratios for U.S. claims by country type from 2015 to 2019. Panels (a) and (b) show average weighted realized volatilities. Panels (c) and (d) show average weighted Sharpe ratio.

### 3.2.3 Intangibles and Risky Firms

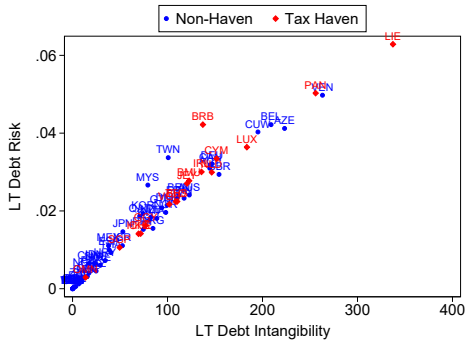
To shed further light on the firms' characteristics that make riskier assets flow through tax havens, we further match our data set with a measure of intangibility. We rely on the measure constructed by Peters and Taylor (2017), which combines both R&D and marketing

Figure 13. Realized Volatility and Intangibility for U.S. liabilities

(a) Equity




(b) Long-term Debt




*Notes*: This figure plots the weighted average of industry-level realized volatilities and asset intangibility for U.S. claims by holding country in 2018. The x-axes show weighted averages of realized volatilities and the y-axes show weighted averages of asset intangibility.

expenditures. See C for more details on the construction of the data. The recent rapid growth of the intangible-intensive economy is well-known. Less known is the strong link between intangible-intensive industries and asset-risk and most importantly between intangible risky assets and tax havens. This is illustrated in Figure 13. Firms with intangible inputs and capital hold very risky collateral, something which can prevent them from obtaining funds in the traditional banking system (see chapter 8 of Haskel and Stan (2017)). In fact current regulation for the U.S. does not allow banks to hold intangible capital as part of capital reserves to be re-deployed during crises [21]. Moreover, intangible-intensive firms find it easier to relocate activities or assets to THFC as there is less need of a proximity between the credit line and the plants. In the model of section 4 we show that lower entry costs, which are typically associated to intangible firms, imply that riskier firms (with higher default probability) afford to enter the THFC. This rationalizes the correlation between risk and intangibility we find in the data.

[21] See https://www.federalreserve.gov/bankinforeg/stress-tests/2014-revised-capital-framework.htm

# 4 A Model of Multinationals and Risky Funding

Our data have highlighted numerous facts, among which two are the most novel and relevant trends for the privately held flows. The first is the increase in flows toward tax havens and the second is a correlation between risk and the share of THFC flows. We have also shown that tax avoidance and regulatory arbitrage are responsible for the joint increase in profit shifting and in asset (firms' equities and corporate debt) risk. We now lay down a simple model which can rationalize these two main trends.

In the model, multinationals, heterogeneous in their default probabilities, endogenously choose, against the payment of an entry cost, to shift profits in a THFC, where they enjoy a tax discount.[22] The entry condition determines the default threshold for the marginal firm which enter the THFC. So for instance any decline in costs of entry or any increase in tax advantage would shift the distribution of entrants toward riskier firms. Firms fund their activity with risky debt obtained from global intermediaries. The latter have access to a global liquid market of risk-neutral investors and, by enjoying a light regulation, can offer funds at low costs. Loan spreads are chosen based on an incentive-compatible contract and intermediaries choose their monitoring intensity endogenously, knowing that firms' default probability depends upon it. The endogenous choice of monitoring intensity determines both the extensive (how many firms are monitored) and the intensive margins (how much each firm is monitored) of risk.

Equipped with this model, we perform several comparative static exercises. We examine the effect of changes in the cost global funds and in taxes and regulation in the THFC on sifts of the default distribution of entrants and on the intensive and extensive margin of risk.

First, a fall in debt costs, triggered for instance by an exogenous increase in global liquidity channeled through the intermediaries, raises firms' profits. This has two contemporaneous effects. On the one side, a higher fraction of firms can afford to enter the THFC. This shifts the distribution of firms that enter the THFC toward those with higher default probability and generates a novel "risk selection" effect. On the other side, more profitable firms appear elusively safer and global intermediaries endogenously reduce their monitoring intensity, both

[22]Beyond our own facts, there is extensive empirical evidence on the relevance of profit shifting, see e.g. Guvenen et al. (2017) or Liu et al. (Forthcoming)).

at the extensive and the intensive margin. This result is consistent with the fact that the increase in U.S. global imbalance, triggered by a global saving glut, went together with an increase of flows and risk in the THFC.

Second, a fall in the corporate tax, entry costs or intermediaries' regulations in the THFC induces a shift in the distribution of firms that enter the THFC toward riskier ones. This is consistent with with tax avoidance and regulatory arbitrage.

## 4.1 Model Structure

There are two countries, a large country, $F$, and a tax haven. We will continue to use the label THFC. For simplicity, we assume that firms can only produce in the large country. In the large country, there are two sectors, one producing a homogeneous good that serves as a numeraire, and one sector with heterogeneous firms producing different varieties. Firms are heterogeneous with respect to their default risk and endogenously decide whether to become multinationals. This requires opening an affiliate in the THFC. Firms have a fixed cost of entering the THFC, where they benefit from tax savings through profit shifting. Given the heterogeneity in default probabilities, only a fraction of them opens an affiliate in the THFC. Production is funded through risky debt, whose rate is determined within an incentive compatible contract with a global intermediary. The latter chooses monitoring intensity endogenously (see Martinez-Miera and Repullo (2017)). Riskier firms pay higher credit spreads, with the latter given by the safe rate plus a premium related to the monitoring intensity. Lenders are global funds located in the THFC, which collect savings worldwide and issue corporate debt to multinationals.[23]

[23]It is possible to include in the model banks operating in the large country. However, to the extent that banks are subject to regulatory requirements, they would be offering less competitive lending conditions compared to unregulated global funds. The latter can also access savings world-wide. In equilibrium, multinationals will only seek funds from the global funds located in off-shore places and banks of the large country would specialize in serving local domestic businesses.

### 4.1.1 Consumers' Preferences

There is a unit mass of identical workers that share the same quasi-linear preferences over consumption of the two goods:

$$U = \alpha \ln Q + q_0 \text{ with } Q = \int_{\Omega} (q(\omega)^{\frac{\sigma-1}{\sigma}})^{\frac{\sigma}{\sigma-1}}, \tag{2}$$

where $q(\omega)$ is the quantity consumed of variety $\omega$. The elasticity of substitution between varieties is given by $\sigma > 1$. $Q$ is aggregate consumption of a preference weighted basket of differentiated goods. The consumption of the numeraire good is given by $q_0$. $\alpha$ is a preference parameter with $0 < \alpha < 1$. The demand for one particular variety is:

$$q(\omega) = \frac{p(\omega)^{-\sigma}}{P^{-\sigma}} Q, \tag{3}$$

where $p(\omega)$ is the price of variety $\omega$. The aggregate price index of the differentiated goods sector is $P = \int_0^{r_h} (p(r)^{1-\sigma} dF(r))^{\frac{1}{1-\sigma}}$, which is the price aggregator over the distribution of firms $F(r)$, whose support is $[0, r_h]$ and $Q = \frac{\alpha}{P}$. Firms are heterogeneous in their level of risk, $r$, which denotes their probability of default and which is distributed according to $F(r) = (\frac{r}{r_h})^{\gamma}$.

### 4.1.2 Production of each Variety

To produce varieties each entrepreneur $r$ has to invest in intermediate inputs. Within the firm, there are several units that assemble the intermediate inputs. The units have a productivity $\theta_p$, which is distributed according to $g(\theta_p) = a\zeta(\theta_p)^{-(\zeta+1)}$ with $a > 0$ and $\zeta > 0$. Each unit of intermediate input has a price $R_p$ and each unit of the firm transforms one unit of intermediate input into $\theta_p$ units of the final good variety. Only units for which $\theta_p > R_p$ will operate. Hence, given an aggregate supply of intermediate inputs, $x_p$, we have that:

$$\int_{R_p}^{\infty} g(\theta_p) = a(R_p)^{-\zeta} = x_p, \tag{4}$$

which implies:

$$R_p = R(x_p) = (\frac{x_p}{a})^{-\frac{1}{\zeta}}. \tag{5}$$

Investment is funded through loans whose returns are derived from the contractual agreement described in the next section. Given the return on debt, $R_b$, the mass of firms that operate is obtained by the condition $R_b = R(x_p)$. To solve the model, we will use the market clearing condition between the aggregate demand for investment and the aggregate supply of savings.

## 4.2 Firms' Pricing Decision

In the homogeneous good sector, firms produce with a constant returns to scale technology and earn zero profits. In the differentiated good sector, firms produce different varieties under monopolistic competition, funding production with debt. Firms are heterogeneous in their riskiness or probability of default, $r$, which determines the loan rate they pay, according to the contractual agreement derived in the next section. The probability of default implies that firms' revenues are stochastic:

$$\widetilde{R} = \begin{cases} R & \text{with probability} \quad 1 - r + m \\ 0 & \text{with probability} \quad r - m \end{cases} \tag{6}$$

where $R > 0$ are firms' revenues, $r \in (0, 1)$ which is distributed according to the density $F(r)$, and $m \in [0, p]$ is the bank's monitoring intensity. Monitoring reduces the default probability, but, as we discuss later, it entails a convex cost for the lender.[24] Firms' costs of loans, $R_b(r)$, are heterogeneous and depend upon the firm's default probability. The exact relation is derived within the contractual agreement solved in the next section.

Under monopolistic competition, firms optimally charge a constant mark-up over marginal cost:

$$p(r) = \frac{\sigma}{\sigma - 1} R_b(r) \tag{7}$$

[24]Results can be easily generalized to convex cost functions.

Firms profits are given by expected revenues, $(1-r+m)p(r)q(r)$, minus the cost of debt:

$$\pi(r) = (1 - r + m)p(r)q(r) - R_b(r) \tag{8}$$

Post-tax profits are given by $\pi^E(r) = (1-t)\pi(r)$. The marginal tax rate will depend upon the location of a firm's profits, which is determined endogenously further below.

### 4.2.1 Debt Rate and Firms' Risk–The Contractual Agreement

Firms are funded by an intermediary that raises funds globally. There is a large set of risk-neutral investors and a representative risk-neutral intermediary. The latter does not necessarily represent traditional banks, but can also be thought of as a mutual fund that sells credit in the market. The intermediary extends debt to firms, but in turn, needs to raise funds from foreign investors, which are characterized by an infinitely elastic supply of funds at an expected safe return equal to $R_S$. Intermediary monitoring entails a convex cost, $c(m)$.

The firms' debt rate, $R_b$, is determined within an optimal contract between the intermediary and the firm on one side and the intermediary and the international investors on the other. For this, we follow Martinez-Miera and Repullo (2017). In the optimal contract, intermediaries choose the monitoring intensity, $m$, as well as the rate to offer to investors to maximize the expected profit, net of returns to investors, $R_I$, given intermediaries' incentive compatibility constraint and the participation constraints of intermediaries and investors. Therefore the optimal contract reads as follows:

$$\max_{\{R_I, m\}} \left[(1 - r + m)(R_b - R_I) - c(m)\right] \tag{9}$$

subject to the intermediaries' incentive compatibility constraint:

$$m^* = \arg\max_m \left\{\left[(1 - r + m)(R_b - R_I) - c(m)\right]\right\}, \tag{10}$$

the intermediaries' participation constraint:

$$(1 - r + m^*)(R_b - R_I) - c(m) \geq 0 \tag{11}$$

and the international investors' participation constraint:

$$(1 - r + m^*)R_I \geq R^S \tag{12}$$

The incentive compatibility constraint (10) characterizes the intermediary's choice of monitoring $m^*$, given the rate on the intermediary's external funds, $R_I$, and the loan rate, $R_b$. The participation constraints (11) and (12) ensure that the intermediary makes profits in excess of the market outside option, and net of the monitoring cost, and that international investors get the required expected return on their investment.

### 4.2.2 Monitoring Intensity - Extensive and Intensive Margin of Risk

The debt contract can be solved sequentially and by backward induction. First, intermediaries choose the monitoring intensity. An interior solution to the contract is given by:

$$(R_b - R_I) - c^{'}(m) = 0 \tag{13}$$

Given the return on outside funds that satisfies investors' participation constraint:

$$R_I = \frac{R^S}{(1 - r + m^*)} \tag{14}$$

we can re-write the intermediaries' first-order condition on the monitoring intensity as follows:

$$R_b = \frac{R^S}{(1 - r + m^*)} + c^{'}(m) \tag{15}$$

The latter allows us to determine the firms' loan rate, which will vary according to their type, $r$. To determine the loan rate we also assume contestability. By the latter, an intermediary lending to entrepreneurs of type $p = 0$ sets a rate equal to the safe return, $R_S$, since at a lower rate it will make negative profits and at a higher rate it will be undercut by another

intermediary. Similarly, for all other firms the loan rate will be set at the minimum given by equation (15). The convexity of the monitoring cost function implies that a corner solution with zero monitoring materializes when $c^{''}(m) - \frac{R_S}{(1-r)^2} \geq 0$. The latter condition also determines a cut-off:

$$\hat{r} = 1 - \sqrt{\frac{R_S}{c^{''}(m)}} \tag{16}$$

below which firms are so safe that the intermediary does not monitor them. Above the cut-off firms are monitored according to their probability of default. The default threshold $\hat{r}$ defines the ***extensive*** margin of risk. The intensive margin of risk is determined by the optimal monitoring intensity, $m^*$. To obtain a closed form solution for that we can assume a cost function, $c(m) = k * m)^2$. In this case an interior solution for the optimal monitoring intensity is:[25]

$$m^* = 1 - r + \sqrt{\frac{R_S}{2k}} \tag{17}$$

Equation 17 provides the ***intensive*** margin of risk.

### 4.2.3 Endogenous Internationalization and Risk Distribution of Entrants

Firms which become a multinational face an entry cost, $\varkappa$. Whether the firm will internationalize depends upon the tax saving and its level of profits. Let us define the 'profit shifting cutoff cost level' as the cost level $r^*$, for which a firm is indifferent between paying taxes at home and paying taxes in the tax haven. The cut-off, $\tilde{r}$, is determined by the following condition:

$$(1 - t_i^F)\left[(1 - r + m)p(r)q(\tilde{r}) - R_b(\tilde{r})q(\tilde{r})\right] = (1 - t_i^H)\left[(1 - r + m)p(\tilde{r})q(\tilde{r}) - R_b(\tilde{r})q(\tilde{r})\right] - \varkappa \tag{18}$$

Using the optimal pricing equation, 7, the above equation leads to:

$$(1 - t_i^F)\left[(1 - r + m)\left(\frac{\sigma}{\sigma - 1} - 1\right)R_b(\tilde{r})\right] + \varkappa = (1 - t_i^H)\left[(1 - r + m)\left(\frac{\sigma}{\sigma - 1} - 1\right)R_b(\tilde{r})\right] \tag{19}$$

[25]This is obtained by taking the first order condition of 15 given the chosen functional form for the cost function

When substituting the expression for $R_b = \frac{R^S}{(1-r+m^*)} + c^{'}(m^*)$, one can recover the default threshold of the firm that is indifferent between opening an affiliate in the THFC or not. The threshold, $\tilde{r}$, identifies the fraction of risky firms that enter the THFC:

$$\pi(r) = \begin{cases} (1-t_i^F)\left[(1-r+m)\left(\frac{\sigma}{\sigma-1}-1\right)R_b(\tilde{r})\right] + \varkappa & \text{when} \quad r < \tilde{r} \\ (1-t_i^H)\left[(1-r+m)\left(\frac{\sigma}{\sigma-1}-1\right)R_b(\tilde{r})\right] & \text{when} \quad r > \tilde{r} \end{cases} \tag{20}$$

Changes in debt rate, taxes or entry costs all change the above threshold, hence the risk distribution of the entrants. We discuss this further below in sections 4.2.5, 4.2.6 and 4.2.7.

### 4.2.4 Global Market Clearing of Debt and Equilibrium

Global demand and supply of debt clears to satisfy the following market clearing condition:

$$F(R_S^*) = \int_0^1 R^{-1}(R_p^*)dr = w, \tag{21}$$

where $w$ is the exogenous amount of worldwide wealth and where $x_p = R^{-1}(R_p^*)$ is the inverse of $R(x_p) = R_p^*$. Given the equilibrium conditions of the model we will now conduct some comparative static exercises, examining how a fall in the corporate tax, in regulation costs of global banks and in entry costs of the THFC or a fall in the debt costs can impact the share of firms endogenously entering the THFC and the extensive and intensive margin of risk.

***Definition 1. Competitive Equilibrium***. A competitive Equilibrium is a an optimal variety, $q(\omega)$, that satisfied 3, an optimal price, $p(r)$, that satisfies 7, an investment schedule, $x_p$, and corresponding loan rate, $R(x_p) = R_p^*$., that satisfies, $R_p^* = min_{m\in[0,p]}(\frac{R^S}{(1-r+m^*)} + c^{'}(m))$ and a market clearing, $\int_0^1 x_p^* dr = w$

### 4.2.5 A Fall in the Tax Haven Corporate Tax or in Firms' Entry Costs

***Lemma 1.*** *A fall in the corporate tax in the THFC raises shifts the distribution of firms that enter the THFC toward riskier ones, but does not affect the monitoring intensity*

***Proof.*** A fall in the corporate tax in the THFC has an effect on equation 19. Upon substituting $R_b = \frac{R^S}{(1-r+m^*)} + c^{'}(m^*)$, in equation 19 the threshold, $\tilde{r}$, is determined as follows:

$$(t_i^H - t_i^F)\left[\left(\frac{\sigma}{\sigma-1} - 1\right)(R^S + (1 - \tilde{r} + m^*))c^{'}(m^*))\right] = -\varkappa \tag{22}$$

Given the above, a fall in $t_i^F$, everything else equal and given the optimal monitoring intensity, shall increase the default probability of the marginal firm entering the THFC. This brings about a shift in the risk distribution of entering firms. On the other side $t_i^F$ does not enter neither the optimal monitoring intensity, 17 nor the threshold for monitored banks, 16.

The intangible firms considered in our empirical analysis are effectively more movable than other firms relying more on physical capital. Hence intangible firms face lower entry costs. As per equation 22 a fall in $\varkappa$ implies an increase in the default threshold of firms that shift profits.

#### 4.2.6 A Fall in Global Banks Regulatory Costs

Global banks operating in THFC face less tighter regulations both in terms of capital requirements and investors protection. Our data has uncovered that the tightening of regulation in the U.S. was among the triggers that shifted a large part of the issuance and investment activity toward tax haven. To fix ideas here we model a relative decline in regulatory costs in the THFC as an increase in the private costs of monitoring. If less compliance is needed this translates, for an incentive compatible contract, in more cost of private monitoring. Given a functional form the monitoring costs given by $c(m) = k(m)^2$, a raise in monitoring can be captured by a raise in, $k$.

***Lemma 2.*** *A fall in global banks regulatory costs: i) shifts the distribution of entrants toward riskier ones; ii) raises the intensive and extensive margin of risk*

***Proof.*** From equation 22 if $k$ raises the threshold $\tilde{r}$ shall increase. This implies a shifts in the distribution of entrants toward riskier ones. This proves part a. The threshold of monitored firms is given by $\overset{\wedge}{r} = 1 - \sqrt{\frac{R_S}{kf^{''}(m)}}$. A raise in $k$ raises the threshold of firms

below which there is no monitoring. Intuitively if the marginal costs are now increasing, global banks will save on costs by reducing the fraction of monitored firms. The result is an increase on the extensive margin of risk. Also from equation 17 the optimal monitoring intensity declines, inducing an increase in the intensive margin of risk. This proves part b.

### 4.2.7 How a Raise in Global Savings Shifts Profits to THFC and Raises the Intensive and Extensive Margins of Risk

The growth in U.S. liabilities is associated with an increase in global saving. Our evidence uncovered that much of those asset flows are channelled through THFC and are associated with higher risk indicators. Our model can shed light on the connection between the shift of the flows to the THFC and the increase in debt risk.

***Proposition 1.*** *In presence of a tax advantage, an increase in global savings, which induces a fal in $R^S$: i) raises the fraction of entrants and shifts its distribution toward riskier firms; ii) it also increases risk at the intensive and extensive margin*

***Proof.*** Since $R'(x_p) < 0$ and since $R_p^*$ is decreasing in $R_S^*$ we have:

$$\frac{dR_S}{dw} = \frac{1}{F'(R_S^*)} < 0 \tag{23}$$

From equation 22 a decline in $R^S$ induces an increase in $\tilde{r}$, hence a larger fraction of firms sifts profits and the distribution of entrants shifts toward riskier ones. This proves part a. Also an increase in the supply of global savings leads to an increase in investment (visible from $x_p = R^{-1}(R_p^*)$) and a fall in the loan rate as per equation:

$$R_b = \frac{R^S}{(1 - r + m^*)} + c^{'}(m) \tag{24}$$

It also leads to an increase in the number of firms that are not monitored, as per equation $\hat{r} = 1 - \sqrt{\frac{R_S}{c''(m)}}$.. This leads to an increase in the extensive margin of risk. Finally, a fall in the safe rate leads to a decrease in the monitoring intensity as per equation $c^{''}(m) - \frac{R_S}{(1-r)^2} \geq 0$.

The joint increase of non-monitored firms and the fall in monitoring intensity leads to an increase in risk. Overall, a saving glut increases the mass of multinationals and contemporaneously increase global risk.

To sum up a reduction in debt costs, due to an increase in global funds, allows us to rationalize why the increasing U.S. global imbalances has been also increasingly associated with shifts of flows and risk toward THFC. Indeed, an increase in global liquidity intermediated through mutual funds resident in tax havens induces firms to create an affiliate in a THFC. The increase in liquidity raises firms' profits for two reasons. First, it directly lowers loan spreads due to increased liquidity supply. Second, it lowers firms' tax bills due to increased profit shifting. The ensuing boost in profits induces global intermediaries to economize on monitoring. This in turn results in an ex post increase of firms' default risk.

# 5 Conclusions

The U.S. global imbalances are still a well-known macro trend in international finance. Their growth is even more puzzling in light of the 2007-2008 financial crisis. A large and influential literature has addressed the macro determinants of the capital flows and of the global financial and dollar cycle. Less is known on the micro determinants that explain the direction of the flows toward specific locations and the riskiness of those assets.

Using confidential and highly granular data from U.S. residents and foreign residents holdings of U.S. dollar-denominated assets, we uncover a set of new facts. Private holdings (inflows and outflows) are mainly intermediated through tax havens/ financial centers, have increased at around 2010, namely the year of the Dodd-Frank Act and the tightening of regulation in the most industrialized countries, and are largely intermediated by unregulated mutual funds. Furthermore, assets intermediated through THFC are riskier and pay higher Sharpe ratios. These assets are mainly linked to firms operating in intangible-intensive sectors. The remaining bulk of the flows is represented by holdings of the official sector. The latter invested mainly in safe assets, such as treasuries, and its holdings grew at around 2012, in correspondence with the world-wide expansion of liquidity associated with quantitative

easing policies.

Motivated by the above facts we conduct an empirical analysis at country and sectoral level. While we confirm that some of the traditional global and dollar cycle variables, such as uncertainty indicators, play a role at country level, we find that much of the flows at sectoral level are explained by corporate tax differentials and prudential regulations.

We rationalize the connection between the growing flows of private holdings toward tax havens and the higher risk of these assets in a model which combines endogenous firms' entry into tax havens and endogenous monitoring intensity by global intermediaries. We introduce firms' heterogeneity at the level of firms' default probabilities, hence their riskiness. In the model, an increase in global savings, by reducing the cost of debt and raising firms profits, induces more of them to enter tax havens. Contemporaneously, more profitable firms appear elusively safe and this induces global intermediaries to reduce their monitoring intensity, a decision which ex post raises firms' default probability.

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# A Tables

Table 1. Aggregate Private Flows into the United States (Liabilities)

| | Equity | | Corporate Bonds | | Treasuries | |
|---|---|---|---|---|---|---|
| | (1) One Variable at a Time | (2) All | (3) One Variable at a Time | (4) All | (5) One Variable at a Time | (6) All |
| D Log Vix | -0.609*** | -0.213 | -1.188*** | -1.064* | 0.710 | 0.679 |
| | (0.208) | (0.320) | (0.297) | (0.597) | (1.384) | (2.062) |
| D Excess BP | -0.302* | 0.0621 | -0.479 | -0.108 | -0.0255 | -0.596 |
| | (0.164) | (0.190) | (0.411) | (0.558) | (1.092) | (1.144) |
| D Fed Funds R. | -0.436* | -0.532** | 0.978** | 1.081** | -2.150 | -2.886* |
| | (0.241) | (0.253) | (0.422) | (0.426) | (1.412) | (1.539) |
| D Term Spread | 0.0393 | -0.0861 | -0.296 | -0.119 | -0.338 | -1.521 |
| | (0.182) | (0.202) | (0.454) | (0.531) | (1.200) | (1.393) |
| D Unempl. Outl. | -0.527 | -0.0791 | 0.449 | 1.187 | 2.291 | 1.753 |
| | (0.436) | (0.591) | (1.208) | (0.864) | (2.291) | (2.140) |
| D Dollar | -0.130*** | -0.112** | -0.134** | -0.149* | 0.0668 | 0.175 |
| | (0.0292) | (0.0440) | (0.0601) | (0.0795) | (0.169) | (0.214) |
| D VRP US | -0.00265** | -0.00178* | -0.00287* | 0.000254 | -0.000959 | -0.00553 |
| | (0.00110) | (0.000906) | (0.00172) | (0.00234) | (0.00553) | (0.00639) |
| D Treas. Basis 3y | -0.00871* | 0.0100 | -0.00931 | 0.0240 | 0.0311 | 0.0203 |
| | (0.00484) | (0.00745) | (0.0182) | (0.0200) | (0.0379) | (0.0485) |
| D EMBI | -0.00403*** | -0.00279 | -0.00599*** | -0.00219 | 0.00486 | -0.000475 |
| | (0.00141) | (0.00237) | (0.00227) | (0.00492) | (0.00695) | (0.00990) |
| D Oil Price | 0.00771 | -0.0134 | 0.0107 | -0.0131 | -0.00148 | 0.0335 |
| | (0.00558) | (0.00836) | (0.0155) | (0.0195) | (0.0426) | (0.0507) |
| $N$ | | 191 | | 191 | | 191 |
| $R^2$ | | 0.173 | | 0.095 | | 0.039 |

*Notes*: This table presents regression results on the aggregate flows into U.S. assets from abroad on monthly changes in a set of macro controls. The dependent variable is the ratio of foreign private purchases of a type of U.S. asset over the previous month's holdings of that asset by foreign private investors. Excess BP is the Excess Bond Premium. Fed Funds R. is the Federal Funds rate or the Wu-Xia shadow rate during the zero lower bound period. VRP US is the variance risk premium as in Londono and Zhou (2017). The treasury basis is from Du et al. (2018). EMBI is the emerging market bond index spread. The sample runs at a monthly frequency from 2002 to 2018. See the data appendix for details. Robust standard errors are shown in parentheses. Key: *** significant at 1%; ** 5%; * 10%.

Table 2. Aggregate Official flows into the United States (Liabilities)

| | Equity | | Corporate Bonds | | Treasuries | |
|---|---|---|---|---|---|---|
| | (1) One Variable at a Time | (2) All | (3) One Variable at a Time | (4) All | (5) One Variable at a Time | (6) All |
| D Log Vix | -0.672 | 0.000555 | -0.710 | -0.854 | -0.961** | -0.512 |
| | (0.474) | (0.736) | (0.582) | (1.178) | (0.387) | (0.649) |
| D Excess BP | -0.418 | -0.0954 | -0.0864 | 0.255 | -0.408 | 0.0860 |
| | (0.328) | (0.378) | (0.547) | (0.742) | (0.292) | (0.363) |
| D Fed Funds R. | -2.076*** | -2.163*** | 1.214* | 1.249 | -0.380 | -0.181 |
| | (0.604) | (0.646) | (0.633) | (0.831) | (0.468) | (0.486) |
| D Term Spread | 0.445 | 0.00748 | -0.832 | -0.755 | 0.323 | 0.337 |
| | (0.483) | (0.478) | (0.737) | (0.924) | (0.404) | (0.502) |
| D Unempl. Outl. | -1.533* | -0.993 | 1.548 | 1.992 | -1.284*** | -0.566 |
| | (0.929) | (1.097) | (1.401) | (1.509) | (0.498) | (0.649) |
| D Dollar | -0.218*** | -0.138 | -0.0959 | -0.123 | -0.230*** | -0.202** |
| | (0.0675) | (0.104) | (0.104) | (0.164) | (0.0606) | (0.0895) |
| D VRP US | -0.00228 | -0.00195 | -0.000975 | 0.00151 | -0.00301** | -0.000600 |
| | (0.00214) | (0.00176) | (0.00221) | (0.00245) | (0.00138) | (0.00202) |
| D Treas. Basis 3y | -0.0183 | -0.00706 | 0.00414 | 0.0388 | -0.0214* | 0.00518 |
| | (0.0158) | (0.0262) | (0.0163) | (0.0294) | (0.0122) | (0.0171) |
| D EMBI | -0.00384 | 0.000419 | -0.00482 | -0.00604 | -0.00624*** | -0.000354 |
| | (0.00247) | (0.00437) | (0.00386) | (0.00896) | (0.00230) | (0.00349) |
| D Oil Price | 0.0280** | 0.00840 | 0.00213 | -0.00767 | 0.0302** | 0.000716 |
| | (0.0142) | (0.0192) | (0.0208) | (0.0345) | (0.0136) | (0.0183) |
| $N$ | | 191 | | 191 | | 191 |
| $R^2$ | | 0.130 | | 0.042 | | 0.087 |

*Notes*: This table presents regression results on the aggregate flows into U.S. assets from abroad on monthly changes in a set of macro controls. The dependent variable is the ratio of foreign official purchases of a type of U.S. asset over the previous month's holdings of that asset by foreign official investors. Excess BP is the Excess Bond Premium. Fed Funds R. is the Federal Funds rate or the Wu-Xia shadow rate during the zero lower bound period. VRP US is the variance risk premium as in Londono and Zhou (2017). The treasury basis is from Du et al. (2018). EMBI is the emerging market bond index spread. The sample runs at a monthly frequency from 2002 to 2018. See the data appendix for details. Robust standard errors are shown in parentheses. Key: *** significant at 1%; ** 5%; * 10%.

## Table 3. Aggregate Flows from the United States (Claims)

| | Equity | | Long Term Debt | |
|---|---|---|---|---|
| | (1) One Variable at a Time | (2) All | (3) One Variable at a Time | (4) All |
| D Log Vix | -0.535*** | -0.0727 | -0.551 | 0.933 |
| | (0.160) | (0.198) | (0.530) | (0.797) |
| D Excess BP | -0.338* | -0.0986 | -0.374 | 0.422 |
| | (0.173) | (0.201) | (0.316) | (0.282) |
| D Fed Funds R. | 0.238 | 0.164 | 0.637 | 0.394 |
| | (0.206) | (0.150) | (0.479) | (0.429) |
| D Term Spread | -0.0178 | -0.0514 | -0.354 | -0.377 |
| | (0.159) | (0.144) | (0.484) | (0.434) |
| D Unempl. Outl. | -0.549 | -0.179 | -1.216* | 0.122 |
| | (0.371) | (0.256) | (0.622) | (0.751) |
| D Dollar | -0.0756*** | -0.0329 | -0.301*** | -0.189*** |
| | (0.0290) | (0.0378) | (0.0510) | (0.0668) |
| D VRP US | -0.00268*** | -0.00175** | -0.00323 | -0.000439 |
| | (0.000580) | (0.000740) | (0.00214) | (0.00175) |
| D Treas. Basis 3y | -0.0109 | 0.00779 | -0.0369*** | 0.00509 |
| | (0.00721) | (0.00686) | (0.0137) | (0.0200) |
| D EMBI | -0.00390*** | -0.00209 | -0.00975*** | -0.00868** |
| | (0.000753) | (0.00165) | (0.00212) | (0.00428) |
| D Oil Price | 0.0102 | -0.0000706 | 0.0585*** | 0.0309* |
| | (0.00686) | (0.00683) | (0.0157) | (0.0182) |
| $N$ | | 191 | | 191 |
| $R^2$ | | 0.147 | | 0.207 |

*Notes*: This table presents regression results on the aggregate investment flows from U.S. residents into foreign assets on monthly changes in a set of macro controls. The dependent variable is the ratio of U.S. residents' purchases of a type of foreign asset over the previous month's holdings of that type of asset by U.S. residents. Excess BP is the Excess Bond Premium. Fed Funds R. is the Federal Funds rate or the Wu-Xia shadow rate during the zero lower bound period. VRP US is the variance risk premium as in Londono and Zhou (2017). The treasury basis is from Du et al. (2018). EMBI is the emerging market bond index spread. The sample runs at a monthly frequency from 2003 to 2018. See the data appendix for details. Robust standard errors are shown in parentheses. Key: *** significant at 1%; ** 5%; * 10%.

## Table 4. Country-level Private Flows into the United States (Liabilities)

| | Equity | | Corporate Bonds | | Treasuries | |
|---|---|---|---|---|---|---|
| | (1) One Variable at a Time | (2) All | (3) One Variable at a Time | (4) All | (5) One Variable at a Time | (6) All |
| Macro Prudential (Cerutti) | -0.778 | 0.316 | 1.638 | 0.516 | -0.883 | -0.730 |
| | (0.881) | (1.020) | (1.036) | (1.329) | (3.857) | (6.386) |
| Regulation (iMaPP) | -0.623*** | -0.719*** | 0.686 | 0.556 | -0.236 | 0.0376 |
| | (0.199) | (0.251) | (0.436) | (0.537) | (0.724) | (1.154) |
| LTV (iMaPP) | 0.00547 | -0.0134 | -0.00543 | 0.0100 | 0.0165 | 0.0273 |
| | (0.0126) | (0.0142) | (0.0137) | (0.0142) | (0.0429) | (0.0571) |
| D Corporate Tax Rate | -0.303** | -0.278** | 0.311* | 0.171 | 0.0986 | 0.500 |
| | (0.132) | (0.122) | (0.180) | (0.197) | (0.286) | (0.504) |
| $N$ | | 219 | | 220 | | 219 |
| $R^2$ | | 0.080 | | 0.025 | | 0.011 |

*Notes*: This table presents regression results on country-level flows into U.S. assets from abroad on a set of variables capturing regulation and taxation. The dependent variable is the ratio of foreign private purchases of a type of U.S. asset over the previous year's holdings of that asset by foreign private investors. Macro Prudential is a variable capturing prudential regulation constructed in Cerutti et al. (2017). Regulation is the cumulative sum of regulation changes and LTV is the average loan-to-value limit, both from iMaPP (Alam et al. (2019)). Corporate tax rate is the statutory corporate tax rate from KPMG. The sample runs at an annual frequency from 2012 to 2019. See the data appendix for details. Robust standard errors are shown in parentheses. Key: *** significant at 1%; ** 5%; * 10%.

Table 5. Country-level Official Flows into the United States (Liabilities)

| | Equity | | Corporate Bonds | | Treasuries | |
|---|---|---|---|---|---|---|
| | (1) One Variable at a Time | (2) All | (3) One Variable at a Time | (4) All | (5) One Variable at a Time | (6) All |
| Macro Prudential (Cerutti) | -2.393* | -3.502 | -1.396 | 1.618 | -0.444 | -1.908 |
| | (1.381) | (2.492) | (1.399) | (2.481) | (1.689) | (1.972) |
| Regulation (iMaPP) | -0.236 | 0.0690 | -0.499* | -0.751 | -0.304*** | 0.0696 |
| | (0.213) | (0.353) | (0.277) | (0.503) | (0.103) | (0.291) |
| LTV (iMaPP) | 0.0117 | 0.0112 | 0.00967 | -0.0240 | 0.0257** | 0.0311 |
| | (0.0170) | (0.0212) | (0.0229) | (0.0325) | (0.0115) | (0.0257) |
| D Corporate Tax Rate | 0.156 | 0.225 | -0.190 | -0.585** | 0.0458 | 0.518*** |
| | (0.269) | (0.237) | (0.349) | (0.288) | (0.147) | (0.198) |
| $N$ | | 185 | | 196 | | 217 |
| $R^2$ | | 0.043 | | 0.033 | | 0.072 |

*Notes*: This table presents regression results on country-level flows into U.S. assets from abroad on a set of variables capturing regulation and taxation. The dependent variable is the ratio of foreign official purchases of a type of U.S. asset over the previous year's holdings of that asset by foreign official investors. Macro Prudential is a variable capturing prudential regulation constructed in Cerutti et al. (2017). Regulation is the cumulative sum of regulation changes and LTV is the average loan-to-value limit, both from iMaPP (Alam et al. (2019)). Corporate tax rate is the statutory corporate tax rate from KPMG. The sample runs at an annual frequency from 2012 to 2019. See the data appendix for details. Robust standard errors are shown in parentheses. Key: *** significant at 1%; ** 5%; * 10%.

Table 6. Tax Rates, Asset Intangibility and U.S. Capital Inflows (U.S. Liabilities)

| | (1) Bonds | (2) Equity | (3) Bonds | (4) Equity | (5) Bonds | (6) Equity |
|---|---|---|---|---|---|---|
| Tax Rate | 0.00850 | 0.00201 | 0.00946 | 0.00350 | | |
| | (0.00942) | (0.00521) | (0.00946) | (0.00581) | | |
| Tax Rate X 1st Quart. Intang. | | | 0.00139 | -0.0151*** | 0.00214 | -0.0155*** |
| | | | (0.00221) | (0.00267) | (0.00218) | (0.00260) |
| Year FE | Yes | Yes | Yes | Yes | No | No |
| Industry FE | Yes | Yes | Yes | Yes | No | No |
| Country FE | Yes | Yes | Yes | Yes | No | No |
| Country-Year FE | No | No | No | No | Yes | Yes |
| Ind.-Year FE | No | No | No | No | Yes | Yes |
| Observations | 9703 | 12352 | 8593 | 11371 | 8568 | 11368 |
| $R^2$ | 0.906 | 0.916 | 0.921 | 0.923 | 0.942 | 0.934 |

*Notes*: This table presents regression results on country-industry level holdings of U.S. assets by foreign private investors on the source country tax rate. The dependent variable is the stock of U.S. corporate bonds and equity held by foreign private investors. Corporate tax rate is the statutory corporate tax rate from KPMG. 1st Quart. Intang. is a dummy variable that takes the value 1 if an industry is in the top quartile in terms of asset intangibility. The sample runs at an annual frequency from 2015 to 2019. Standard errors clustered at the country-year level are shown in parentheses. Key: *** significant at 1%; ** 5%; * 10%.

Table 7. Average Risk of U.S. Liabilities

| | Real. Volatility | | Sharpe Ratio | |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| | Equity | Debt | Equity | Debt |
| Tax Haven | 0.00112 | 0.0120*** | 0.000532 | 0.0152*** |
| | (0.00190) | (0.00215) | (0.00237) | (0.00281) |
| Advanced Economy | -0.0000962 | -0.000250 | -0.00211 | -0.0000362 |
| | (0.00241) | (0.00161) | (0.00302) | (0.00206) |
| Emerging Market | -0.00935*** | -0.0112*** | -0.0164*** | -0.0143*** |
| | (0.00217) | (0.00142) | (0.00262) | (0.00183) |
| Other Countries | -0.00783** | -0.00668** | -0.0132*** | -0.00843** |
| | (0.00308) | (0.00269) | (0.00384) | (0.00347) |
| Observations | 352 | 352 | 352 | 352 |
| $R^2$ | 0.158 | 0.141 | 0.169 | 0.139 |

*Notes*: This table presents regression results on the weighted average risk of U.S. liabilities by country type. The dependent variable in columns (1) and (2) ((3) and (4)) is the weighted average industry-level realized volatility (Sharpe ratio) of U.S. debt and equity liabilities by holder country. The sample runs from 2015 to 2019 for 81 countries. Robust standard errors are shown in parentheses. Key: *** significant at 1%; ** 5%; * 10%.

Table 8. Average Risk of U.S. Claims

| | Real. Volatility | | Sharpe Ratio | |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| | Equity | Debt | Equity | Debt |
| Tax Haven | -0.000155 | 0.0230*** | 0.00293 | 0.0312*** |
| | (0.00262) | (0.00252) | (0.00320) | (0.00323) |
| Advanced Economy | 0.00411 | -0.0116*** | -0.00439 | -0.0110*** |
| | (0.00788) | (0.00203) | (0.00727) | (0.00247) |
| Emerging Market | 0.00454 | -0.0214*** | -0.00206 | -0.0267*** |
| | (0.00761) | (0.00210) | (0.00675) | (0.00266) |
| Other Countries | -0.00970 | -0.0244*** | -0.0256*** | -0.0326*** |
| | (0.00827) | (0.00316) | (0.00794) | (0.00381) |
| Observations | 264 | 264 | 264 | 264 |
| $R^2$ | 0.246 | 0.330 | 0.267 | 0.418 |

*Notes*: This table presents regression results on the weighted average risk of U.S. claims by country type. The dependent variable in columns (1) and (2) ((3) and (4)) is the weighted average industry-level realized volatility (Sharpe ratio) for U.S. residents' claims on foreign debt or equity. The sample runs from 2015 to 2018 for 72 countries. Robust standard errors are shown in parentheses. Key: *** significant at 1%; ** 5%; * 10%.

# B The Treasury International Capital (TIC) Reporting System

## B.1 Overview

The TIC (Treasury International Capital) system collects data on cross-border banking and securities positions and flows. These data form the basis for U.S. official balance of payments and international investment position data on portfolio investment, and are also used in the Federal Reserve's Financial Accounts (Z.1 release) data on rest-of-world portfolio positions and flows. Reporting is legally mandated.

For securities positions and flows, the primary TIC forms are: the TIC S, which has collected data monthly on gross and net long-term securities transactions by instrument and counterparty since the late 1970s; the annual TIC surveys, which have collected data on individual securities since the early 2000s; the TIC-SLT, which has collected monthly aggregate data on long-term securities positions by instrument and counterparty since late 2011; and the TIC BL-2, which has collected—along with custodial banking data—holdings of short-term securities by instrument and counterparty monthly since the late 1970s.

Responsibility for the TIC system is shared by the U.S. Treasury, the Federal Reserve Bank of New York, and the Federal Reserve Board of Governors. The Treasury oversees the TIC system and publishes a wide variety of tables and reports. The Federal Reserve Bank of New York is responsible for the primary collection and review of the data, and the Federal Reserve Board of Governors is responsible for additional data review, data adjustments, and production and dissemination of TIC tables and reports. Board of Governors staff with direct responsibility for TIC production have access to much more detailed breakdowns of the data than are available in the published data, and much of the data used in this paper relies on these unpublished breakdowns.

## B.2 TIC Annual Surveys

TIC annual surveys collect security-level data on U.S. residents' debt and equity claims against foreign residents (that is, foreign securities held by U.S. residents) and on U.S. debt

and equity liabilities to foreign residents (that is, U.S. securities held by foreign residents). Liabilities surveys are conducted each year as of end-June and claims surveys are conducted each year as of end-December. Data are collected from U.S. -resident custodians, issuers, and end-investors, and reporting is mandated by law.

TIC benchmark surveys are conducted every five years (most recently in 2016 for claims and in 2019 for liabilities); in other years, the reporting panels are limited to the largest reporters and typically capture 98% or more of the benchmark reporting. The findings of these surveys are typically published ten months after each reporting date.[26].

## B.3 TIC Monthly Securities Holdings Data

The TIC-SLT, the newest form, was introduced in late 2011 to improve timeliness and frequency of securities holdings data. While in principle it should be possible to estimate positions based on holdings in the prior period, reported transactions from the TIC-S, and estimated price changes, experience had shown that this approach applied to annual TIC survey data rarely produced position information that corresponded to the findings of the following annual TIC survey. As a result, reliable data on securities holdings were available only at a low frequency and with very long lags. In addition to providing much more timely data on securities positions, the TIC-SLT allows for estimation of flows based on the change in TIC-SLT position, estimated valuation change, and any other changes. In the context of this paper, it should be noted that the introduction of the TIC-SLT included a great deal of outreach to managed funds, and resulted in an increase in TIC reporting for these firms, many of which are domiciled in the Cayman Islands. As a result, increases in Cayman Islands positions between the 2011 and 2012 annual surveys include some effects from this increase in reporting.

## B.4 Estimating securities flows from position data

As noted above, combining TIC-S data with annual survey positions and estimated price changes in order to estimate positions for the following survey rarely produce figures that

[26]TIC annual securities reports and the data collection forms are available at the Treasury's TIC website: https://www.treasury.gov/resource-center/data-chart-center/tic/Pages/fpis.aspx

match the following year's survey. As a result, Bertaut and Tryon (2007) developed a method for estimating intra-year positions. Another option for estimating flows is then to calculate flows as [change in estimated position] less price change. We use these flow estimates, and their analogues based on monthly SLT data in this paper.

### B.5 Public and Confidential Data

As noted above, compilers of the TIC data at the Federal Reserve Board have access to more detailed breakdowns of the data than are published, and many of the calculations shown here use these confidential breakdowns. For the aggregate data, most notably we are able to separate securities liabilities (foreign holdings of U.S. securities) by country and also by type of holder—foreign official or foreign private. On the claims side, we are able to break bond positions and flows down by country and also by type of issuer—again foreign official or foreign private (nearly always corporate).

### B.6 Direct Investment

The TIC data do not include direct investment. The Bureau of Economic Analysis, part of the Department of Commerce, conducts a direct investment survey.

## C Other Data Sources

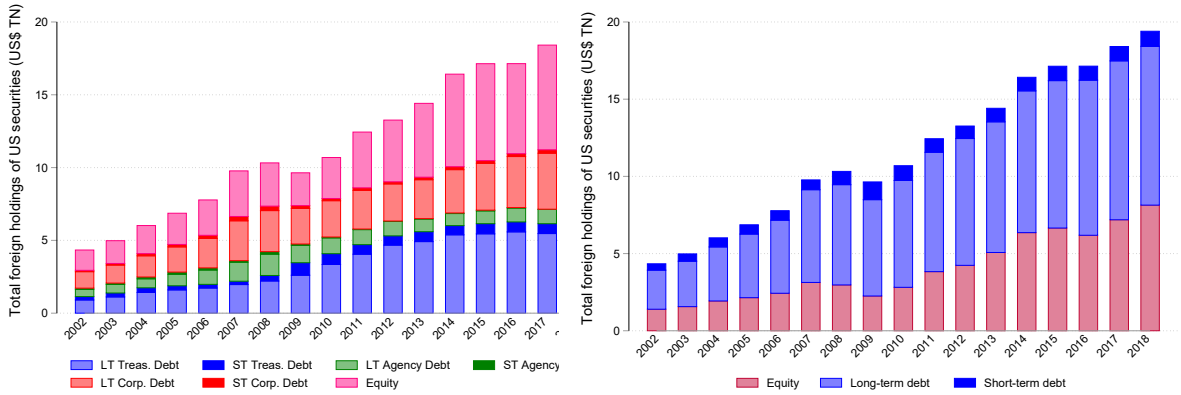
- Survey of Professional Forecasters: Information on expected unemployment rates, real GDP growth, short-term and long-term interest rates as the means of the 4-quarter ahead forecast values.
- Broad dollar index, EME and AFE dollar index: Trade-weighted dollar indices computed and published by the Federal Reserve.
- Standard macro and financial variables: Monthly values from Bloomberg and Haver.
- Excess bond premium: Downloaded from the Federal Reserve's website: https://www.

federalreserve.gov/econresdata/notes/feds-notes/2016/updating-the-recession-risk-and-the-excess-bond-premium-20161006.html.

- Convenience yields provided by Wenxin Du: https://sites.google.com/site/wenxindu/data/govt-cip and Du et al. (2018).
- Variance risk premium provided by Juan-Miguel Londono used in Londono and Zhou (2017).
- World recession probability provided by Pablo-Cuba Borda: https://www.federalreserve.gov/econres/notes/ifdp-notes/monitoring-the-world-economy-a-global-conditions- index-20180615.htm.
- Macro prudential regulation data as constructed in Cerutti et al. (2017).
- Further prudential regulation data are taken from the iMapp database provided by Alam et al. (2019).
- Corporate tax rates are taken from KPMG's corporate tax rates table: https://home.kpmg/xx/en/home/services/tax/tax-tools-and-resources/tax-rates-online/corporate-tax-rates-table.html.
- Firm-level data on intangible assets are taken from Peters and Taylor (2017) (data provided, e.g., via WRDS) and aggregated by taking means at the industry-level based on naics codes after winsorizing at the 1% and 99% level.
- Firm-level data to calculate realized volatility and Sharpe ratios are taken from CRSP. The firm-level measures are aggregated by taking means at the industry-level based on naics codes after winsorizing at the 1% and 99% level.

# D Additional Figures

Figure D.1 shows that flows, in and out, have been growing over time, particularly for equities. Debt liabilities have been growing, too.




(a) Liabilities (b) Claims

Figure D.1. U.S. Liabilities and Claims per Type of Securities

Finally, Figure D.3 shows that most of the debt in the Cayman Islands is in the form of asset-backed securities (ABS).

Figure D.2. U.S. Holdings of Foreign Common Stock Foreign Depository Receipts. Sample Period: 2006-2018. Source: TIC data, SHL and SHC Surveys.

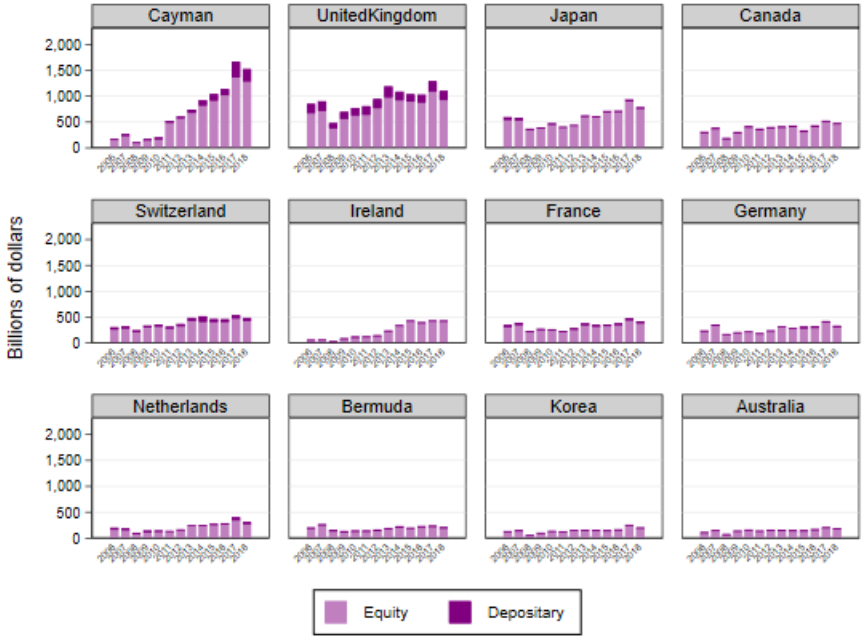



Figure D.3. U.S. Liabilities. Break Down between Asset Backed Securities Debt and Non Asset Backed Securities Debt. Sample Peirod 2006-2018. Source: TIC data, SHL and SHC Surveys.