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Research Article

Corporate Taxation and International Financial Integration: U.S. evidence from a consolidated perspective

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Abstract

We document a robust relation between corporate tax differentials and US international financial integration (IFI). While this is the case for traditional IFI based on cross-border positions, the positive link also emerges for its larger consolidated-by-nationality version. The gap between these IFI measures, the key outcome variable in our analysis, exhibits a strong positive correlation with tax differentials too. This is in part due to consolidated assets of multinational enterprises being more strongly correlated with tax differentials than their cross-border counterpart. We interpret this as indirect evidence of US multinationals taking advantage of tax differentials in ways that go beyond what is captured by traditional Balance of Payments procedures.
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INTRODUCTION

Multinational enterprises (MNEs) make decisions on how to geographically distribute assets and liabilities taking into account international differences in tax codes. They shift the location of intangible assets (Dischinger & Riedel, 2011) and book increasing amounts of profits in low-tax jurisdictions (Tørsløv *et al.*, 2018). Most of these re-allocation decisions are captured in the Balance of Payments statistics that track cross-border transactions using the residence principle.

The well-known acceleration in international financial integration (IFI), identified in Lane & Milesi-Ferretti [2001], goes hand in hand with a surge in the complexity of global financial links. This motivated a new line of research jointly taking a residence- and a nationality-based perspective to study financial globalization.[1] The differences in IFI emerging from these two complementary approaches can shed light on central questions in international macroeconomics/finance[2].

How MNEs take advantage of differences in tax codes across countries is key for estimating missed revenue by home tax authorities. How much of their taxable activity is not known due international transactions being recorded only if they are cross-border is central too.

While most asset re-allocations or profit booking decisions are captured by residence-based statistics, the nationality approach shows that potentially large volumes of financial transactions may go unnoticed. Consider a US multinational that decides to increase its asset holdings in a low-tax country. It chooses to do so through a group affiliate resident in that country. If this investment is funded by local counterparts, no link to the USA would appear in the Balance of Payments. Yet these assets are a US investment in a foreign country with the potential of generating revenue to US tax authorities.

An alternative approach that correctly accounts for these international investments is to apportion assets and liabilities according to the nationality of ultimate owners. This is equivalent to consolidating local assets and liabilities of affiliates to the parent company. The consolidated-by-nationality approach implies recording assets held by an affiliate as US foreign assets, regardless of how they were financed. These can be cross-border or local positions.

This paper studies the link between corporate income tax differentials and measures of IFI. It delivers three main contributions: (i) the construction of time-series estimates of US consolidated-by-nationality foreign holdings; (ii) the description of stylized facts around these new nationality-based data and (iii) an analysis of the relationship between the difference in nationality- and residence-based measures of IFI and corporate income tax differentials.

The construction of a time series data set with estimates for the US foreign balance sheet consolidated by nationality is done for the period between 1999 and 2019 using a methodology similar

[1] Avdjiev *et al.* (2018a) pointed to the tension between concept of residence and the global activities of MNEs. Avdjiev *et al.* (2016) describe shortcomings of treating the economic area defined by the GDP boundary to be the same defining decision-making units.

[2] Lane (2021) notes that the consolidated framework may be useful in identifying the ultimate financial exposures of countries. Avdjiev *et al.* (2020) shows that the nationality of global banks is an important element in assessing cross-country policy spillovers. Exposure to such spillovers would be better visualized with consolidated statistics.

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to Bank for International Settlements (2015).[3] To the best of our knowledge, this is the first paper to elaborate time series estimates for the consolidated foreign balance sheet of any country. This consolidated approach offers advantages relative to the existing residence-based data. First, it sorts assets and liabilities according to nationality the ultimate owner. Second, this approach takes into account all foreign holdings and not only those funded by cross-border transactions. These two features indicate that the consolidated approach provides a clearer picture on the ultimate international exposure of countries. Relative to Coppola *et al.* (2021), our approach looks at the entire nationality-based foreign balance sheet of the USA, whereas their approach focuses only on portfolio investments.

Two key stylized facts emerge from these novel data. First, the US consolidated foreign balance sheet is on average two times larger than its residence-based analogue.[4] Second, US non-bank MNEs were responsible for around half of the IFI expansion over this period.

Using existing cross-border data and this new time series data set consolidating US foreign assets and liabilities, we document a robust link between tax differentials and IFI. Such positive relation also emerges for the difference between IFI consolidated by nationality and residence-based. This aggregate result is driven by consolidated assets of MNEs. We find that these are more strongly correlated with tax differentials than their cross-border counterpart. We interpret this as indirect evidence of multinationals taking advantage of tax codes in ways that go beyond what is captured by traditional residence-based statistics. An approach relying on the latter as the sole input would fall short in capturing the extent to which tax codes and international investments are associated.

This paper relates to two main strands of the literature. The first one is on nationality-based statistics. It adds a time series dimension to the initial contribution of Bank for International Settlements (2015) on constructing consolidated-by-nationality estimates of foreign holdings for the USA, as such it complements the existing residence-based data as suggested by Lane (2021). The second one is on the link between foreign investment and corporate taxation. Djankov *et al.* (2010) documents some macroeconomic effects of changes in corporate taxation. Using firm-level data for Germany, Hebous & Johannessen (2021) provides evidence of profit shifting activities to low-tax countries. This paper shows indirect evidence that profit shifting activities may extend beyond what is recorded in residence-based statistics.

The remainder of the paper is structured as follows: Section 2 provides additional reasons for analysing international exposures using consolidated-based statistics. Section 3 describes key stylized facts that emerge from our analysis by comparing estimates based on the US consolidated balance sheet to those based on cross-border positions. Section 4 details our analysis on the relation between corporate income tax differential and IFI. Section 5 provides an estimate of how much is missed by relying solely on cross-border statistics when assessing the link between the tax differential and foreign assets held by multinationals. Section 6 concludes.

REASONS TO CONSOLIDATE

Residence-based estimates of foreign holdings have proven useful across several applications in international finance and macroeconomics. Relying on such approach, Catao & Milesi-Ferretti (2014) show that measures such as net foreign liabilities are particularly useful when estimating the probability of an external crisis. Gourinchas & Obstfeld (2012) show that a larger current account balance reduces the likelihood of a currency crises. These papers provide tools for policymakers focused on constructing more informative early warning systems using residence-based metrics.

In recent decades, the increase in complexity of global firms have generated challenges to the existing residence-based framework as noted by Avdjiev *et al.* (2018a) and Di Nino *et al.* (2020). These MNEs have a vast presence outside of their home country where the decision are made. This mismatch between the decision-making unit and the geographical footprint of these companies implies that measures based on residence may not fully capture the degree of interconnectedness between different entities within the same group. Under the residence-based approach, foreign assets and liabilities held by an affiliate of a US MNE based in Ireland are foreign assets and liabilities of Ireland even though this entity belongs to a US corporate group.

Given this challenge related to MNEs, Borio (2013) and Lane (2021) pointed to the renewed need for collecting data on a consolidated basis to provide a more accurate picture of the decision-making units. Lane (2021) notes that such consolidated approach should complement rather than replace the existing residence-based approach. When choosing which approach to use, this decision should depend on the question at hand as both approaches offer specific advantages.[5]

The consolidated approach sort assets and liabilities according to the nationality of their ultimate owners. Relative to the residence-based approach, this procedure has the advantage of providing a clearer view around the cross-country financial exposures. Avdjiev *et al.* (2016) show that relying solely on residence-based metrics could pose a challenge when studying financial risks. Specifically, it is difficult to identify which agents would face balance sheet losses in case a particular set of assets falls in value. For example, hedge funds in Brazil frequently use investment vehicles in the Cayman Islands to hold offshore positions. In case these international positions fall sharply in value, relying solely on the residence-based metrics may lead one to conclude that investors in the Cayman Islands would face balance sheet losses, while in reality Brazilian investors would be the ones facing such hit. This example illustrates how properly identifying the ultimate owner of an international investment is needed to determine who would bear the losses if this asset plunges in value, as it is frequently the case in financial crises.

Another key advantage is that the consolidated approach takes into consideration all assets and liabilities when compiling estimates of foreign holdings. Meanwhile, only cross-border transactions are taken into consideration under the residence-based

[3] This is part of the larger 'Consolidated Foreign Wealth of Nations' project aimed at constructing a data set with estimates of consolidated-by-nationality assets and liabilities for a large country sample. This project complements the seminal work by Lane and Milesi-Ferretti's *External Wealth of Nations*.

[4] It is not necessarily the case that the cross-border approach will lead to an underestimation of the true degree of IFI of countries as in this example. Countries that host a significant amount of pass-through companies can observe a decrease in their IFI when analysed through the consolidated approach. Ireland is one such example as noted by Sanchez Pacheco (2022). See also Damgaard & Elkjaer (2017).

[5] The first two studies pointing to the importance of compiling economic accounts based on ultimate ownership are Baldwin *et al.* (1998) and Baldwin & Kimura (1998). Their key contribution is to show that adopting a consolidated approach for the US trade balance yields a USD 46.4bn surplus instead of a USD 39.7bn deficit in 1992. Such difference underscores the need to evaluate international accounts not only using the traditional cross-border approach but also considering the ultimate ownership of international investments.

approach. In the case of the Global Financial Crisis, McCauley (2018) shows that US affiliates of European banks produced and held a quarter of a trillion dollars in mortgage-backed securities in mid-2007. While this large exposure would be captured by consolidated-based statistics, relying exclusively on residence-based statistics would have meant failing to account for a substantial exposure the European countries had to the US housing market at a period in which housing prices fell sharply.

These two features of the consolidated approach are also relevant in the evaluation of policy spillovers. Global banks operating in multiple countries react not only to policy decisions made in the host countries but also to those made in its home country. McCauley *et al.* (2019) point to the importance of analysing bank positions based on the nationality of its parent company rather than on their location to identify the factors driving their decisions on a global scale. An affiliate operating in a foreign country could be more responsive to decisions made in its home country than those made in the country it operates. Avdjiev *et al.* (2020) show that macro-prudential decisions taken in the home country affects cross-border lending in foreign affiliates more so than those taken by the host country. Similarly, Avdjiev *et al.* (2018a) shows that global banks' cross-border lending is affected by the monetary policy decisions taken at their home countries.

Once positions are allocated to their ultimate owners, significant differences appear relative to the conventional residence-based data. Damgaard & Elkjaer (2017) show that the global network of foreign direct investments changes significantly when the FDI positions are allocated on a ultimate beneficiary basis rather than on a locational basis. In the case of Ireland, Galstyan (2019) reports that the country's external liabilities fall by three-quarters when pass-through companies are excluded from the calculations.[6] Such finding implies that Irish IFI as conventionally measured using cross-border external assets and liabilities overstates the true degree of financial globalization of the country as noted by Lane (2019) and Sanchez Pacheco (2022). Globally, Damgaard *et al.* (2019) show that cross-border FDI statistics are distorted by offshore financial centres with enormous FDI positions.

Similarly, Coppola *et al.* (2021) show that the map of international portfolio investments also changes drastically when the positions are allocated on a ultimate beneficiary basis. The authors show that China's net foreign asset position is USD 1.1tr smaller when compared with the official cross-border statistics. More broadly, they also show that important findings in empirical international macroeconomics are put into question when analysed from a consolidated perspective. Among such findings, analysing holdings based on nationality reveals that north-to-south capital flows are more significant than previously thought as in the famous Lucas (1990) paradox.

In contrast, a disadvantage of the consolidated approach is that it currently does not have a universally adopted and well-established methodology like the residence approach.[7] As a result, residence-based statistics also have the advantage of providing longer time-series that are available for a large set of countries as pioneered by Lane & Milesi-Ferretti (2001). These existing data gaps serve as limiting factors in the usage of consolidated-by-nationality approach to answer policy relevant questions.

A third disadvantage of the consolidated approach relates to the difficulties associated with determining the ultimate owners of assets and liabilities. One example of such challenge are the opaque corporate structures Chinese multinationals use to circumvent capital controls as described by Coppola *et al.* (2021). Another example are corporate groups that change their domicile to foreign countries as noted by Sanchez Pacheco (2022). In the latter case, searches in multiple repositories are needed to determine ultimate ownership. This challenge does not emerge in the residence-based approach as this approach does not require the ultimate ownership of companies to be established.

The focus of this paper on the link between taxation and multinationals calls for the broadest measure of foreign assets to be used. Relying on residence-based data would limit the scope of our analysis to assets funded only via cross-border transactions. Alternatively, consolidated-by-nationality estimates include all foreign asset holdings by US multinationals regardless of how these were financed. Our empirical analysis considers consolidated-based data and compares it to traditional residence-based data.

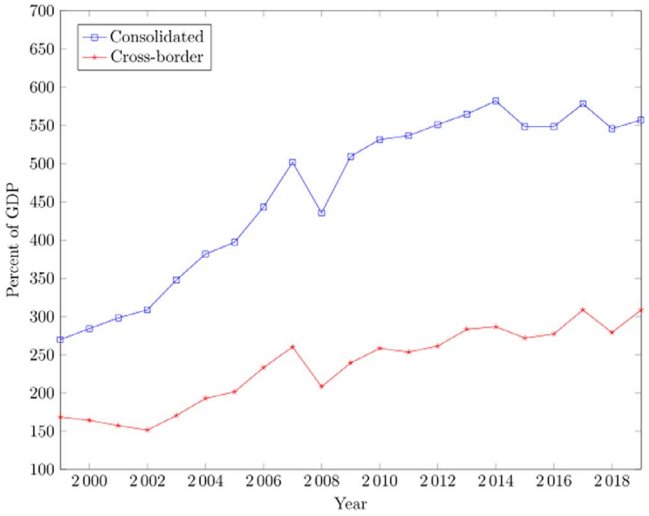

Figure 1. US IFI. Note: This figure shows the evolution of consolidated-based and cross-border based measures of US International Financial Integration. US IFI is computed as the sum of foreign assets and liabilities divided by GDP. Our calculations do not include financial derivatives given the existing challenges to determine the nationality of their ultimate owners.

STYLIZED FACTS

Main aggregates

Figure 1 shows the evolution of US IFI based on the consolidated approach and compares it to the same measure calculated using the cross-border approach from the US international investment position database. The estimate of IFI is calculated as the sum of US foreign assets and foreign liabilities divided by US GDP as in Lane & Milesi-Ferretti (2003). Due to challenges in properly identifying the ultimate beneficiary of financial derivatives, we exclude them from all the calculations presented in this paper. Figure 2 shows the sum of US assets and liabilities reported in trillions of US dollars.

[6] Pass-through companies are companies whose sole purpose is to engage in international financial intermediation. One such example discussed in Sanchez Pacheco (2022) is Rusal Capital DAC. This Irish-resident entity is owned by the EN+ group from Russia. As of 2019, this company had approximately USD 1.6 billion in total assets, which were entirely made of loans made out to Rusal and JSC Russian Aluminium. It had USD 1.6 billion in total liabilities, which were made of bonds sold to foreign investors. This company had shareholders' equity of one thousand dollars and no reported employees in Ireland. These data indicate that Rusal Capital DAC is intermediating the financing of EN+ group companies by international investors and has no economic ties to Irish nationals. Yet its residence in Ireland raises Irish residence-based measures of foreign holdings.

[7] See IMF's Balance of Payments and International Investment Position Manual.

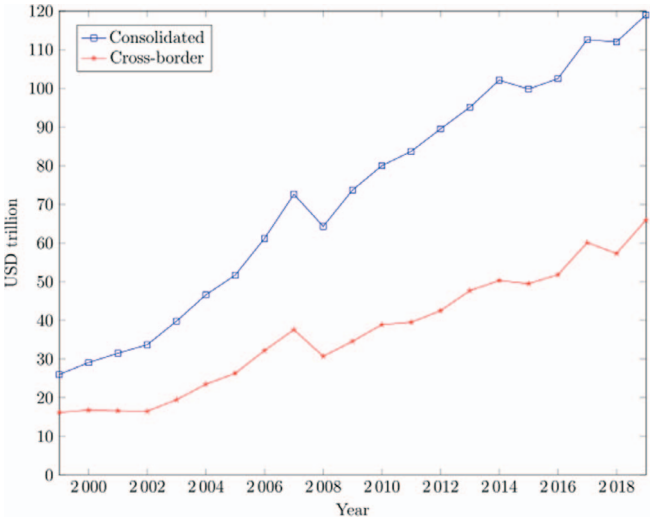

Figure 2. US foreign assets plus liabilities. Note: This figure shows the evolution of consolidated-based and cross-border based sum of US assets and liabilities. Our calculations do not include financial derivatives given the existing challenges to determine the nationality of their ultimate owners.

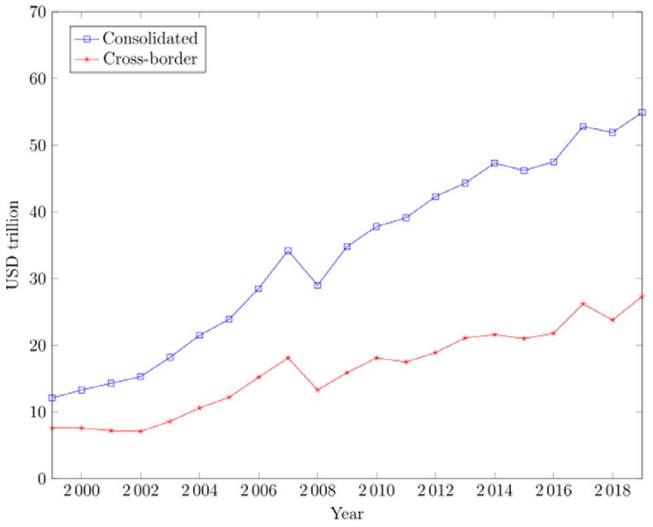

Figure 3. US assets. Note: This figure shows the evolution of consolidated-based and cross-border based US assets. Our calculations do not include financial derivatives given the existing challenges to determine the nationality of their ultimate owners.

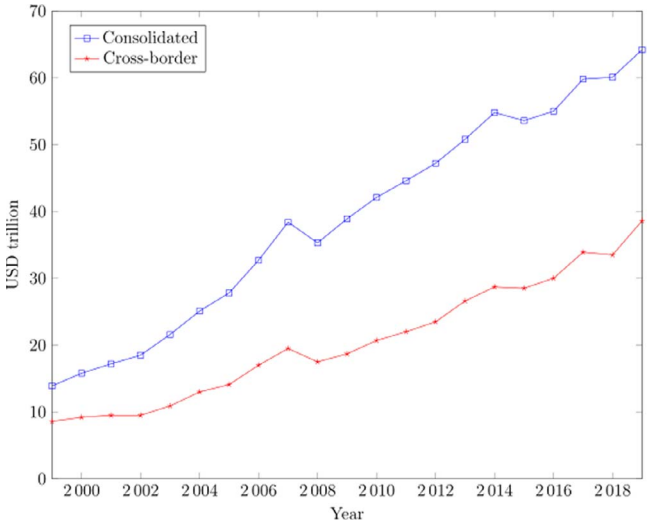

Figure 4. US liabilities. Note: This figure shows the evolution of consolidated-based and cross-border based US liabilities. Our calculations do not include financial derivatives given the existing challenges to determine the nationality of their ultimate owners.

These two figures indicate that US IFI is on average two times larger when calculated using the consolidated approach relative to the cross-border approach. Such finding is consistent with a similar order of magnitude found by the Bank for International Settlements (2015). It indicates that US nationals hold sizeable amounts of assets and liabilities relative to foreigners that are not captured by cross-border statistics. This includes local assets and liabilities held by affiliates of US MNEs operating abroad. The stark difference between the two measures of financial globalization provides a relevant reason for statistical offices to produce consolidated-based estimates of external accounts.

Another important finding that stands out is that US IFI based on the consolidated approach continued to increase after the Global Financial Crisis following a contraction during the crisis. This result is not fully consistent with the stability seen in the years following the crisis when measured using the cross-border estimate as documented by Lane & Milesi-Ferretti (2007).

Figures 3 and 4 show the evolution of U.S assets and liabilities separately. Our estimates suggest that both increased from 2007 to 2019. Consolidated assets increased from USD 34.2tn in 2007 to USD 54.9tn in 2019. Similarly, consolidated liabilities increased from USD 38.4tn in 2007 to USD 64.2tn in 2019. Both US consolidated assets and liabilities fell in the years of 2008 and 2015 while only the former fell in 2018.

Despite the significantly larger balance sheet, the US net international investment position (IIP) when calculated using the consolidated approach is relatively close to that computed using cross-border estimates. Figure 5 shows the evolution of the US net IIP calculated as the difference between assets and liabilities using the two approaches. The consolidated-based net IIP stood at USD -9.3 trillion in 2019, which compares to a USD -11.3 trillion net IIP when calculated through the cross-border approach. While the consolidated net IIP does not meaningfully change relative to the cross-border estimate, the sizeable difference in gross positions is an important reason to also take into account the findings emerging from consolidated-based statistics. As Avdjiev *et al.* (2016) indicate, gross positions matter when analysing the international exposure of countries.

Balance sheet decomposition

Table 1 shows the US consolidated balance sheet for 2019, the last year in our sample. This table reveals that US non-financial MNEs operating abroad represent the single largest source of US IFI. Relying on data from the US Bureau of Economic Analysis (BEA), we estimate that US non-financial MNEs operating abroad have total assets worth USD 20.3tn in 2019 and total liabilities worth USD 15.4tn.

In order to evaluate the components driving the growth of the consolidated balance sheet, we decompose the contribution to growth generated by each item. As is standard, we can decompose the cumulative growth rate of foreign assets and liabilities between periods t and T according to the formula:

$$R_{t,T}^{type} = \sum_{i=1}^{N} w_{i,t}^{type} R_{t,T}^{i}, \quad (1)$$

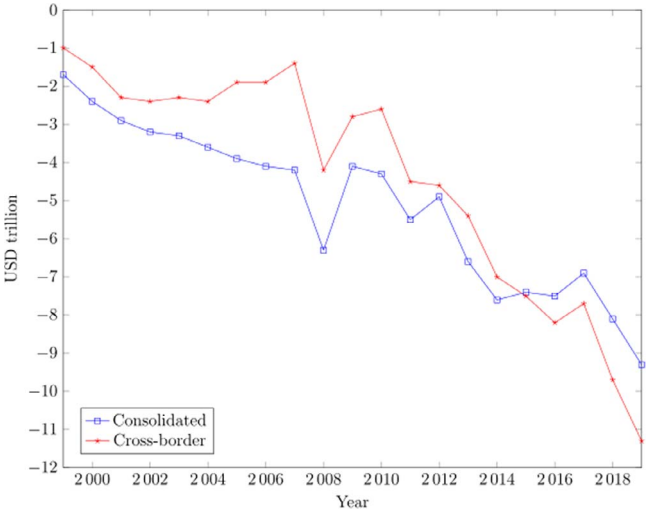

Figure 5. US NIIP. Note: This figure shows the evolution of US NIIP using both the consolidated and cross-border approach. The NIIP is defined as the difference between US assets and liabilities. Our calculations do not include financial derivatives given the existing challenges to determine the nationality of their ultimate owners.

Table 1. US consolidated foreign balance sheet, 2019 (USD bn)

Item	Assets	Liabilities
Bank-reported		
Consolidated US banks	3045	3247
Foreign banks	2349	3248
Financial non-banks		
US multinationals	7920	6901
Affiliates of foreign multinationals	4315	4830
Non-financial companies		
US multinationals	20 265	15 376
Affiliates of foreign multinationals	3885	7578
Private portfolio investments	12 493	15 302
Official assets and liabilities	514	6,765
Other non-financial reported	74	97
US currency		825
Total	**54 860**	**64 170**

Note: This table shows the US consolidated foreign balance sheet for the year of 2019. The consolidated balance sheet is constructed using a methodology similar that used in BIS (2015). It relies on publicly available data from the US BEA, the US TIC, the Bank for International Settlements (BIS) and the Federal Reserve Board. The procedure used here to estimate the US consolidated balance sheet is similar to that used in BIS (2015).

where *type* can be foreign assets, liabilities or the sum of both and can be applied both to the consolidated approach as well as to the cross-border approach. Note that the number of components N will vary according to the type selected. $R^{i}_{t,T}$ represents the cumulative growth rate of component $i \in N$ between periods t and T. $w^{type}_{i,t}$ represents the share of component i relative to *type* at time t. We call $w^{type}_{i,t}R^{i}_{t,T}$ the contribution of component i to the growth rate of *type* between t and T. In order to avoid breaks in the time series due to the methodological changes described in the Appendix, we group non-bank financial enterprises with non-financial enterprises into a single non-bank enterprises group when decomposing the consolidated external balance sheet.[8]

[8] All components are perfectly matched besides 'other non-financial reported' pre-2013 and 'other non-bank reported' post-2013, which are pooled into a 'other reported' subgroup. This is due to the fact that Treasury International Capital (TIC) reporting changed the breakdown from banking/non-banking to financial/non-financial in 2013. The pre-2013 'other non-bank reported' and post-2013 'other non-financial reported' are two tiny components in the US consolidated balance sheet. This new subgroup is irrelevant when decomposing the growth of the external balance sheet.

Table 2. Consolidated foreign balance sheet growth

Item	Assets	Liabilities	Total
Bank-reported			
Consolidated US banks	349%	164%	253%
Foreign banks	256%	229%	240%
Non-bank Enterprises			
US multinationals	509%	521%	524%
Affiliates of foreign multinationals	150%	197%	176%
Private portfolio investments	371%	431%	402%
Official assets and liabilities	277%	606%	565%
Other reported	-3%	26%	12%
US currency	-	295%	295%
Total	**353%**	**363%**	**358%**

Note: This table shows the cumulative growth rate of each item to the overall growth in US foreign assets, liabilities and the sum of the two components over the sample period. For each item, the cumulative growth rate is calculated by dividing the stock value of each item at the end of our sample by its initial value and subtracting one.

We can normalize the contribution of each item $w_{i,t}R^{i}_{t,T}$ by the growth rate of each *type*. Doing so provides a clearer visualization around the relative contribution delivered by them as the sum of the individual contributions adds up to one for each *type*. As such, the relative contribution $Contrib^{type}_{i,t,T}$ of item i on the cumulative growth *type* is given by:

$$Contrib^{type}_{i,t,T} = \frac{w^{type}_{i,t}R^{i}_{t,T}}{R^{type}_{t,T}}. \quad (2)$$

Table 2 shows the cumulative growth rate for each item. The last column shows the growth rate of the sum of the assets and liabilities of that item. Official assets and liabilities and US non-bank MNEs experienced the two highest growth rates over this period. While the growth in official assets and liabilities has been widely discussed by policymakers since at least Bernanke (2005), the latter has received far less public attention until recently.

Table 3 describes the relative contribution of each of the components to consolidated foreign assets, liabilities and the sum of both items between 1999 and 2019. The table reveals that almost half of the cumulative growth rate observed in the sum of consolidated assets and liabilities during this period can be attributed to US non-bank MNEs. In order of relevance, this component is followed by private portfolio investments and the activities of non-bank affiliates of foreign multinationals.

Figures 6 and 7 illustrate the decomposition of consolidated foreign assets and liabilities respectively over the sample period. As it can be seen, the share of US non-bank MNE assets grew between 1999 and 2019. US non-bank MNE assets represented 38.2% of US foreign assets in 1999 and 51.4% in 2019. Similarly, the share of US non-bank MNE liabilities increased from 25.0% of US foreign liabilities in 1999 to 34.7% 2019.

The increasing importance of US non-bank MNEs over our sample period overlaps with the significant increase in the share of profits made abroad among US corporates documented by Zucman (2014). It is possible that tax-motivated profit shifting activities by MNEs have led to both an increase in the share of profits and in asset holdings abroad. The following session empirically explores the link between the US foreign balance sheet and the corporate income tax differential.

Table 3. Relative contribution to consolidated foreign balance sheet growth

Item	Assets	Liabilities	Total
Bank-reported			
Consolidated US banks	6%	4%	5%
Foreign banks	4%	4%	4%
Non-bank enterprises			
US multinationals	55%	37%	46%
Affiliates of foreign multinationals	12%	16%	14%
Private portfolio investments	23%	25%	24%
Official assets and liabilities	1%	12%	7%
Other reported	0%	0%	0%
US currency	-	1%	1%
Total	**100%**	**100%**	**100%**

Note: This table shows the relative contribution of each item to the overall growth in US foreign assets, liabilities and the sum of the two components over the sample period. The relative contribution of each item is calculated as its relative weight in 1999 times its cumulative growth rate between 1999 and 2019.

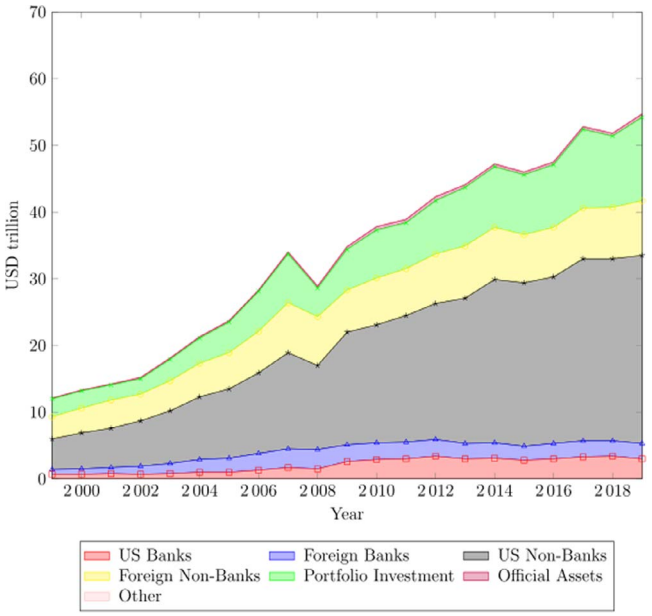

Figure 6. US consolidated foreign assets. Note: This figure shows the time-varying composition of US consolidated foreign assets over the sample period. The 'other non-financial reported assets' pre-2013 category and the 'other non-bank reported assets' post-2013 category are pooled into a 'other reported assets' subgroup that is quantitatively irrelevant.

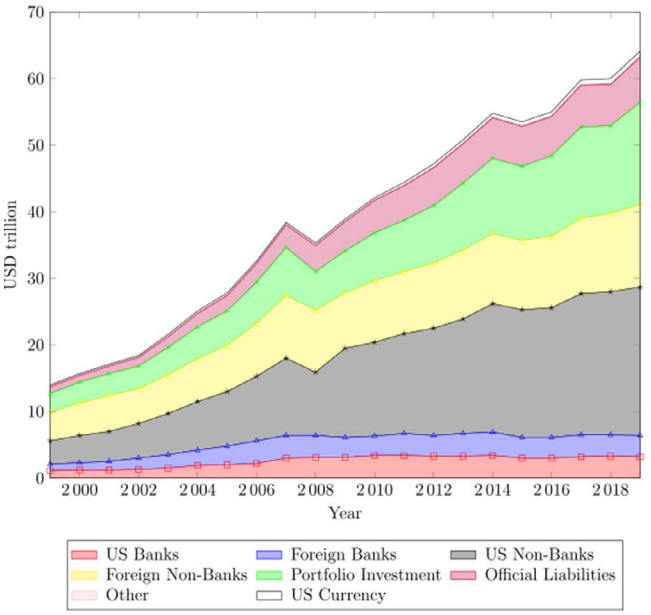

Figure 7. US consolidated foreign liabilities. Note: This figure shows the time-varying composition of US consolidated foreign liabilities over the sample period. The 'other non-financial reported liabilities' pre-2013 category and the 'other non-bank reported liabilities' post-2013 category are pooled into a 'other reported liabilities' subgroup that is relatively tiny.

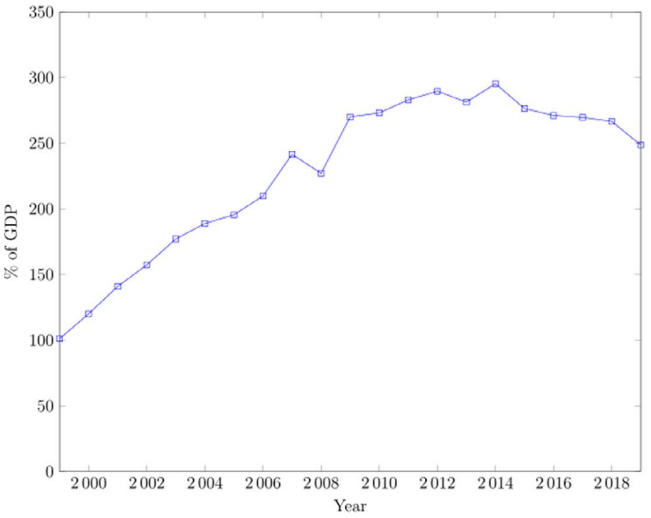

Figure 8. Difference between consolidated and cross-border IFI. Note: This figure the time-varying difference between the consolidated- and cross-border measures of US IFI.

The share of bank-related foreign assets had grown prior to the Global Financial Crisis. Since then, it has fallen back to the level registered in the first year of our sample. Such dynamics was largely driven by foreign banks as its share went from 5.5% in 1999 to a peak of 10% in 2008 and has since then declined to 4.3% in 2019. This is in line with McCauley *et al.* (2019) that showed that the decline in bank positions following the Global Financial Crisis has been driven by European banks rather than US banks.

EMPIRICAL ANALYSIS

The prominent role played by US non-bank multinationals suggests that factors associated with firm-wide decision-making on the geographic allocation of assets and liabilities can also be associated with the increase in US consolidated-based IFI (IFI^{CO}) over the sample period. In this section, we investigate whether the corporate tax differential between the US and the rest of the world is associated with the consolidated measure of international financial integration (IFI_t^{CO}), the cross-border measure of IFI (IFI_t^{XB}) and the time-varying difference between the two series.

Karninsky & Riedel (2012) argue that MNEs have an incentive to locate patents at low-tax affiliates to minimize the corporate tax burden. Dischinger & Riedel (2011) show that MNEs shift the location of their intangible assets towards low-tax affiliates within the group. Hájková *et al.* (2007) also provide evidence that differences in corporate taxation has a significant impact on choices around FDI location.

The decisions by multinationals to hold assets in low-tax countries is closely associated with profit shifting activities. MNEs can

lower their overall tax bill by transferring assets to subsidiaries located in low-tax countries. Zucman (2014) calculates that the share of profits made abroad by US companies has increased significantly since the start of this century. Tørsløv *et al.* (2018) provide estimates around the scale of profit shifting among MNEs and find that close to 40% of multinational profits are shifted to low-tax countries globally.

While some of these geographical decisions by MNEs can be correctly captured by cross-border statistics, this may not always be the case. In our example, suppose the US MNE transfers one asset worth $100 to its Dutch affiliate. If this purchase is funded via an inter-company loan of the same amount, the US cross-border balance sheet will register a $100 increase in assets due to this outward FDI activity by the parent company. For a different reason, the US consolidated balance sheet will also increase by $100 not because of the inter-company funding but rather due to the fact that the transferred asset is no longer an US domestic asset. As a result, the cross-border and consolidated IFI indicators will increase by $100.

However, if the purchase made by the affiliate is funded by borrowing $100 from a Dutch bank, this transaction would no longer lead to an increase in US foreign assets using the cross-border methodology. This is because there is no cross-border financing from the home country involved. However, this transaction would still produce a $100 increase in US consolidated foreign assets for the reason exposed above. In addition, US consolidated foreign liabilities would also increase by $100 as this loan represents a liability of a US company with respect to a Dutch agent. In this sense, the US consolidated-based IFI would increase by $200 while no change would be recorded in its cross-border analogue. The difference between the two measures would widen.

As a first step, we empirically test whether the two measures of IFI are associated with the corporate income tax differential between the US and the rest of the world. We compute the tax differential between the US and the rest of the world as the difference between the US statutory corporate income tax rate and a weighted average of the statutory corporate tax rate of other countries. In our baseline specification, this average is calculated by weighting the statutory corporate tax rate of 26 countries based on the sum of bilateral FDI positions vis-à-vis the US for each year.[9] Data on statutory corporate income tax rates come from the OECD and is available for the period between 2000 and 2019. Data on bilateral FDI positions to compute the time-varying weights come from the US BEA.

The two measures of IFI present a positive time trend. We proceed by detrending the two variables IFI_t^{CO} and IFI_t^{XB} by running two separate regressions of each variable on a constant and a linear trend. Throughout our analysis, we focus on the resulting residuals $IFIC_t^{CO}$ and $IFIC_t^{XB}$. We focus on the cycle as the two measures of IFI move slowly and we want to study the dynamics of the two variables with respect to the tax differential. As the corporate income tax rate differential also presents a time trend, we detrend it by applying the same procedure generating the variable $CorpTax_t$.

Then we run the following linear regression of $IFIC_t^i$ where $i = XB$ or CO on the corporate income tax differential $CorpTax_t$ and a set of control variables $\mathbf{X}$.

$$IFIC_t^i = \alpha + \beta CorpTax_t + \mathbf{X}_t\mathbf{B} + \epsilon_t \quad (1)$$

We include trade openness as a control variable given the linkages between international trade and financial integration. The stock market capitalization as a percentage of GDP is also included as a control variable to proxy for the degree of financial deepening of the US economy. Data on both variables come from the World Bank.

Table 4 shows the results of the regressions of both dependent variables. We find positive coefficient estimates associated with $CorpTax_t$ in both univariate and multivariate regressions of the two measures of IFI. These results indicate that there is a positive relation between corporate income tax differential and IFI both when measured using cross-border statistics as well as when computed using our consolidated estimate of international exposure. Such finding is in line with what one would expect given the well-documented increase in profit shifting activities and its effects on international accounts.

The *CorpTax* coefficient estimates associated with the consolidated-based measures are larger and significant at a higher confidence level relative to the estimates found when using the cross-border measure of IFI. These results also suggest that the corporate income tax differential is more strongly correlated with the consolidated-based measure IFI_t^{CO} than to its cross-border analogue IFI_t^{XB}. Given the faster growth registered by the consolidated measure of IFI, we investigate whether the corporate income tax differential is also positively associated with the time-varying difference between the two measures. If so, it would be an indication that the corporate income tax differential leads agents to expand their global financial footprint beyond what is captured by cross-border statistics.

As the US consolidated-based IFI grew more rapidly than its cross-border analogue, the difference between the two series also present a positive time trend. In order to remove this trend, we first run a regression of the difference $(IFI_t^{CO} - IFI_t^{XB})$ on a constant and a linear trend. We use the resulting residuals ($DIFI_t$) as the detrended difference between the two series.[10] Once again, we focus on the cycle as the difference moves slowly and we want to study the dynamics of this difference with respect to the tax differential.

We run the following linear regression of $DIFI_t$ on the corporate income tax differential $CorpTax_t$ and the same set of control variables $\mathbf{X}$ as in the separate regressions.

$$DIFI_t = \alpha + \beta CorpTax_t + \mathbf{X}_t\mathbf{B} + \epsilon_t \quad (2)$$

Results are shown in columns (1) and (2) in Table 5. We find positive and statistically significant coefficient estimates associated with the corporate income tax rate differential in both univariate and multivariate regressions. In the simple linear regression shown in column (1), a one percentage point increase in the corporate income tax differential is associated with a 5.32% of GDP increase in the difference between IFI^{CO} and IFI^{XB}. The positive coefficient is statistically significant at the 1% level. Column (2) displays the results of the multivariate linear regression with control variables. The coefficient estimate associated with *CorpTax* is positive and statistically significant at the 1% level. It indicates

[9] The countries include Austria, Belgium, Bermuda, Brazil, Canada, Chile, China, Denmark, France, Germany, Hong Kong, India, Ireland, Italy, Japan, Luxembourg, Mexico, Netherlands, Norway, Portugal, Singapore, South Korea, Spain, Sweden, Switzerland and the United Kingdom.

[10] $DIFI_t = (IFI_t^{CO} - IFI_t^{XB}) - \widehat{(IFI_t^{CO} - IFI_t^{XB})}$ where $\widehat{(IFI_t^{CO} - IFI_t^{XB})}$ are the fitted values of the difference on a constant and a time trend.

Table 4. Regression results of measures of IFI

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Dependent Variable	$IFIC_t^{XB}$	$IFIC_t^{XB}$	$IFIC_t^{XB}$	$IFIC_t^{XB}$	$IFIC_t^{CO}$	$IFIC_t^{CO}$	$IFIC_t^{CO}$	$IFIC_t^{CO}$
Constant	-59.53	-29.86	-0.60	−91.60**	−200.14**	71.01	1.53	-86.59
	(36.02)	(22.74)	(3.63)	(40.85)	(77.60)	(53.19)	(6.66)	(82.54)
Trade Openness	2.23			1.84	7.51**			4.02
	(1.34)			(1.36)	(2.90)			(2.75)
Stock market capitalization		0.23		0.32*		-0.54		-0.15
		(0.17)		(0.16)		(0.40)		(0.33)
CorpTax			1.75*	1.81*			7.07***	5.78***
			(0.94)	(0.96)			(1.72)	(1.94)
R^2	0.13	0.09	0.17	0.40	0.26	0.09	0.49	0.55

Note: * $P < 0.1$; ** $P < 0.05$; *** $P < 0.01$ Columns (1)–(4) show the results of linear regressions of $IFIC_t^{XB}$ on control variables and on $CorpTax_t$ defined as the detrended statutory corporate income tax differential between the US and the rest of the world using FDI-based time-varying weights. All regressions estimated using yearly data from 2000 to 2019. $IFIC_t^{XB} = (IFI_t^{XB}) - (\widehat{IFIC_t^{XB}})$ where $(\widehat{IFI_t^{XB}})$ are the fitted values of IFI_t^{XB} on a constant and a time trend. Columns (5)–(8) show the results of linear regressions of $IFIC_t^{CO}$ on the same variables. $IFIC_t^{CO} = (IFI_t^{CO}) - (\widehat{IFIC_t^{CO}})$ where $(\widehat{IFI_t^{CO}})$ are the fitted values of IFI_t^{CO} on a constant and a time trend.

Table 5. Regression results of the difference between consolidated and cross-border

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent Variable	$DIFI_t$	$DIFI_t$	$DMNE_t$	$DMNE_t$	$DXME_t$	$DXME_t$
Constant	2.14	5.02	1.87	4.86	0.27	0.16
	(4.49)	(49.44)	(3.82)	(41.33)	(0.87)	(10.93)
Trade Openness		2.18		1.92		0.26
		(1.65)		(1.38)		(0.36)
Stock market cap.		−0.47**		−0.42*		-0.05
		(0.20)		(0.16)		(0.04)
CorpTax	5.32***	3.97***	4.34***	3.14**	0.98***	0.83**
	(1.16)	(1.16)	(0.99)	(0.97)	(0.23)	(0.26)
R^2	0.54	0.68	0.52	0.68	0.51	0.56

Note: * $P < 0.1$; ** $P < 0.05$; *** $P < 0.01$ Columns (1) and (2) show the results of linear regressions of $DIFI_t$ on control variables and on $CorpTax_t$ defined as the detrended statutory corporate income tax differential between the US and the rest of the world using FDI-based time-varying weights. All regressions estimated using yearly data from 2000 to 2019. $DIFI_t = (IFI_t^{CO} - IFI_t^{XB}) - (\widehat{IFI_t^{CO} - IFI_t^{XB}})$ where $(\widehat{IFI_t^{CO} - IFI_t^{XB}})$ are the fitted values of the difference on a constant and a time trend. We decompose the difference in IFI into two parts: one that is related to the $DMNE_t$ and another that is associated with all else but MNEs ($DXME_t$). Columns (3) and (4) show the results of linear regressions of $DMNE_t$ on the control variables and $CorpTax_t$. Columns (5) and (6) show the results of linear regressions of $DXME_t$ on the control variables and $CorpTax_t$.

that a one percentage point increase in the corporate income tax differential is associated with a 3.97% of GDP increase in *DIFI*.

These results suggest that the difference between the US consolidated and cross-border IFI is positively associated with the corporate income tax differential. We interpret this as an indication that there is a systematic link between the corporate income tax differential and the part of the US international balance sheet that is not captured by cross-border statistics. The main implication of this finding is that IFI is more closely associated with the corporate tax differential than when considering only cross-border measures.

Despite the prominent role played by MNEs in expanding US IFI, it is possible that this positive link between $DIFI_t$ and $CorpTax_t$ is driven by components of the external balance sheet that are unrelated to these companies. To test this hypothesis, we decompose both the consolidated and cross-border measures of IFI into one part that is related to activities of MNEs and one that is not.[11]

We follow the same procedure implemented to compute *DIFI*: we calculate the difference between the consolidated and cross-border measures for each of the two components and separately detrend the two time-varying differences. This procedure generates the detrended difference in part of IFI related to multinationals $DMNE_t$ and the detrended difference in the part of IFI that is not related to multinationals $DXME_t$. We then separately regress these two variables on the set of controls and $CorpTax_t$ to investigate the link between the tax differential and MNEs.

Columns (3) and (4) in Table 5 show the regression results for $DMNE_t$. The coefficient estimates associated with the corporate income tax differential are positive and statistically significant in both specifications. This indicates that the difference between the two measures of multinationals-related IFI is positively associated with the corporate income tax differential. As such, it is evidence that the part of the US balance sheet not captured by cross-border statistics that is related to MNEs is positively related to the corporate income tax differential.

Similarly, columns (5) and (6) in Table 5 show the regression results for $DXME_t$. The coefficient estimates associated with the corporate income tax differential are also positive and statistically significant in both specifications albeit smaller in magnitude compared with the results from the regression on $DMNE_t$. We see this as evidence that the part of the US balance sheet not captured by cross-border statistics and not related to MNEs is also positively correlated with the corporate income tax differential.

[11] For the consolidated balance sheet, the multinationals-related measure of IFI is computed as the sum of US assets and liabilities with respect to US MNEs and foreign MNEs operating in the US divided by GDP. The part that is not related to MNEs is simply the difference between total IFI and this measure related to multinationals. For the cross-border balance sheet, the measure related to multinationals is imperfectly approximated by the sum of US FDI assets and liabilities divided by GDP. Similarly, the part not related to MNEs is the difference between total IFI and this FDI-related measure.

Taken together, the regression results shown in columns (4) and (6) approximately decompose the coefficient estimates of the regression (2) of $DIFI_t$ into a part associated with $DMNE_t$ and another associated with $DXME_t$. Such decomposition shows that around 79% of the coefficient estimate associated with $CorpTax_t$ comes from the part related to MNEs, whereas only 21% is attributed to the part that is not related to MNEs.[12] This indicates that the positive relation between $CorpTax_t$ and $DIFI_t$ is largely driven by the difference associated with multinational enterprises $DMNE_t$.

In sum, the results shown in Table 5 indicate that the difference between the two measures of IFI, which represents the part of the US balance sheet not captured by cross-border statistics, is positively associated with the corporate income tax differential. This positive link emerges both when analysing only the part of the balance sheet related to MNEs as well as to the part not related to these companies. When quantitatively decomposing the link between $CorpTax_t$ and $DIFI_t$, we estimate that around 79% of the coefficient estimate of the regression can be attributed to the difference in the part related to MNEs.

Robustness

As a first robustness check, we run the same analysis on $DIFI_t$ using alternative definitions of the corporate income tax rate differential between the US and the rest of the world. Besides the baseline specification using FDI-based weights, we calculate it as the difference between the US corporate tax rate and (i) the average corporate tax rate from the OECD database, (ii) the median corporate tax rate, (iii) the trade-weighted average corporate tax rate and (iv) the portfolio-weighted average corporate tax rate.

The trade-weighted average corporate tax rate is constructed based on the relative sum of exports and imports of goods and services for the main US trading partners. Table 6 lists the countries included in the construction of this index. We use yearly data from the US Federal Reserve Board to compute the time-varying weights and apply these weights on the statutory corporate income tax rate of the trading partners.[13]

Similarly, the portfolio-weighted average corporate tax rate is constructed using IMF Coordinated Portfolio Investment Survey data to compute time-varying weights. After selecting a group of 31 countries shown in Table 6, we compute the weights as the relative sum of inward and outward portfolio between country i and the USA in any given year. Once again, we apply these weights on the statutory corporate income tax rate of these countries to calculate portfolio-weighted average corporate tax rate.

Table 7 shows the results for both the univariate and multivariate regressions on each alternative definition of *CorpTax*. We find positive and statistically significant at the 5% level estimates for all four alternative specifications. In particular, we find the coefficient estimate associated with the tax differential to be positive and statistically significant at the 1% level when we compute the tax differential using the average corporate tax rate and the trade-weighted average corporate tax rate. When the tax differential is measured using the median statutory corporate income tax rate from the OECD database, the coefficient estimate associated with *CorpTax* is still positive but statistically significant at the 5% level. The coefficient estimate associated with the portfolio-weighted average corporate tax rate is also positive and statistically significant at the 5% level.[14]

Then we conduct a similar exercise using these five alternative measures of *CorpTax* but replacing the stock market capitalization by the natural logarithm of the Financial Development Index ($ln(FIX)$) as a different proxy for the degree of financial deepening. The FIX is elaborated by the IMF and includes nine different measures of financial development as described in Svirydzenka (2016).

Results are shown in Table 8. We find that the coefficient estimate on *CorpTax* is positive and statistically significant at the 1% level when calculated using four out of the five different specifications. That is the case of when *CorpTax* is computed using FDI-based, trade-based weights as well as when using the average and median corporate tax rates. We find a positive and statistically significant at the 5% level coefficient estimate when using the portfolio-based weights.

Another robustness check we conduct is including real GDP growth-related variables in our baseline regression using FDI-based *CorpTax*. The main reason behind this check is that agents could direct their international investments to regions presenting higher growth rates when compared to alternatives. In such case, one would expect US IFI to be correlated with the growth differential between the US and the rest of the world. We proceed by computing the weighted-average annual real GDP growth rate of counterpart economies using FDI-based weights described above. Data on real GDP growth rates come from the World Bank. Then we calculate the differential between the US annual real GDP growth rate and this weighted-average series. We include both the real GDP growth differential and the weighted-average real GDP growth rate of counterpart economies separately in our baseline model to test if our findings stand.

Table 9 shows that the coefficient estimate associated with *CorpTax* does not materially change in the regressions including growth-related variables. It remains statistically significant at the 5% level across specifications. Neither the coefficient associated with growth differential nor that associated with the real GDP growth rate of counterpart economies are statistically significant at the 10% level.

A final robustness check we conduct focuses on the non-detrended versions of IFI and the difference between the two measures of IFI. It is motivated by the fact that corporate income tax differentials and other factors can be not only related to the cyclical variation in IFI and DIFI but also to their time trends. For these specifications, we use *TaxDiff* which is the non-detrended version of *CorpTax* which uses FDI-based weights.

In order to capture the existing positive time trend in IFI and DIFI, we first construct a time-varying average global IFI measure excluding the USA. That is done using residence-based data from Lane and Milesi-Ferretti's *External Wealth of Nations* data set. For a particular year, we sum the external assets and liabilities for all countries but the US and divide that by the sum of their gross domestic product. The resulting variable IFI^{ROW} is used as an explanatory variable across specifications.

[12] Calculated as the coefficient estimate associated with $CorpTax_t$ in the regression of $DMNE_t$ (3.14) divided by the coefficient estimate in the regression of $DIFI_t$ (3.97). The latter can be approximated by the sum of the coefficient estimate that comes from the regression of $DMNE_t$ (3.14) plus the coefficient estimate that comes from the regression of $DXME_t$ (0.83).

[13] In a separate exercise, we estimated the trade-weighted average corporate income tax rate using the relative sum of exports and imports of goods only for all US trading partners. The results were similar to those shown in Table 6. Importantly, we find that the coefficient associated with $CorpTax_t$ remains positive and statistically significant.

[14] We also estimated these regressions using a common set of counterpart countries. The results were similar to those shown in Table 7 using the different set of countries described in Table 6.

Table 6. Countries included in the construction of alternative *CorpTax* measures

	Countries				
	Austria	Belgium	Bermuda	Brazil	Canada
	Chile	China	Denmark	France	Germany
FDI-based	Hong Kong	India	Ireland	Italy	Japan
	Luxembourg	Mexico	Netherlands	Norway	Portugal
	Singapore	South Korea	Spain	Sweden	Switzerland
	United Kingdom				
	Brazil	Canada	China	France	Germany
Trade-based	Hong Kong	India	Italy	Japan	South Korea
	Mexico	Saudi Arabia	Singapore	Taiwan	United Kingdom
	Australia	Austria	Bermuda	Brazil	Canada
	Cayman Islands	Chile	China	Colombia	Denmark
	France	Germany	Hong Kong	India	Ireland
Portfolio-based	Italy	Japan	Mexico	Netherlands	Norway
	Portugal	Saudi Arabia	Singapore	South Africa	South Korea
	Spain	Sweden	Switzerland	Thailand	Turkey
	United Kingdom				

This table shows the counter-party countries included when computing each of the alternative measures of corporate income tax differential. The time-varying weight for country i in a given year is determined as the sum of bilateral positions between the US and country i that year divided by the sum of the bilateral positions with respect to the US for all countries in the group. The average and median-based corporate income tax rate differential are calculated using a list of 107 countries from the OECD database. The portfolio-based corporate income tax weights for the year of 2000 are set equal to those in 2001 due to data availability issues.

Table 7. Regressions using alternative definitions of corporate tax differential

	FDI		Trade		Portfolio		Average		Median	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Dependent Variable: DIFI$_t$										
Constant	2.14	5.02	2.14	6.97	2.14	-3.65	2.14	12.52	2.14	6.49
	(4.49)	(49.44)	(4.43)	(49.87)	(5.36)	(54.97)	(4.36)	(48.86)	(4.79)	(52.99)
Trade Openness		2.18		2.03		3.05		1.87		2.29
		(1.65)		(1.68)		(1.78)		(1.65)		(1.77)
Stock market capitalization		−0.47**		−0.45**		−0.58**		−0.46**		−0.50**
		(0.20)		(0.20)		(0.21)		(0.19)		(0.21)
CorpTax	5.32***	3.97***	5.29***	3.95***	4.78***	3.41**	5.51***	4.20***	5.47***	3.93**
	(1.16)	(1.16)	(1.31)	(1.17)	(1.56)	(1.37)	(1.14)	(1.17)	(1.36)	(1.36)
R^2	0.54	0.68	0.55	0.68	0.34	0.60	0.56	0.69	0.48	0.64

Note: * $P < 0.1$; ** $P < 0.05$; *** $P < 0.01$ This table shows the results of linear regressions of $DIFI_t$ on control variables and on $CorpTax_t$. We use five alternative definitions of $CorpTax_t$. The first three are constructed using FDI-based, trade-based and portfolio-based time-varying weights, respectively. The last two alternatives, respectively, use the average and median statutory corporate tax from the OECD database. Regressions estimated using yearly data from 2000 to 2019. $DIFI_t = (IFI_t^{CO} - IFI_t^{XB}) - (\widehat{IFI_t^{CO} - IFI_t^{XB}})$ where $(\widehat{IFI_t^{CO} - IFI_t^{XB}})$ are the fitted values of the difference on a constant and a time trend. Point estimates are not directly comparable across specifications as each $CorpTax_t$ alternative was constructed using a different set of countries due to data availability. When using the same set of countries in the construction of $CorpTax_t$, the coefficient estimates do not change significantly. The regressions displayed here capture heterogeneity both in the weighting scheme as well as in the set of countries used in the construction of each $CorpTax_t$.

Table 8. Regressions using alternative definitions of corporate tax differential

	FDI	Trade	Portfolio	Average	Median
Dependent Variable: DIFI$_t$					
Constant	-56.76	-46.27	-98.71	-44.85	-56.69
	(66.67)	(67.50)	(74.22)	(66.66)	(72.71)
Trade Openness	1.84	1.65	2.89	1.49	1.95
	(1.92)	(1.93)	(2.16)	(1.92)	(2.07)
ln(Financial Development)	-82.72	-35.92	-199.96	-60.67	-55.92
	(399.08)	(399.76)	(457.86)	(393.05)	(431.21)
CorpTax	4.78***	4.82***	3.97**	5.04***	4.84***
	(1.32)	(1.31)	(1.65)	(1.34)	(1.58)
R^2	0.57	0.57	0.42	0.58	0.50

Note: * $P < 0.1$; ** $P < 0.05$; *** $P < 0.01$ This table shows the results of linear regressions of $DIFI_t$ on control variables and on $CorpTax_t$. We use five alternative definitions of $CorpTax_t$. The first three are constructed using FDI-based, trade-based and portfolio-based time-varying weights respectively. The last two alternatives respectively use the average and median statutory corporate tax from the OECD database. Regression estimated using yearly data from 2000 to 2019. $DIFI_t = (IFI_t^{CO} - IFI_t^{XB}) - (\widehat{IFI_t^{CO} - IFI_t^{XB}})$ where $(\widehat{IFI_t^{CO} - IFI_t^{XB}})$ are the fitted values of the difference on a constant and a time trend.

Table 9. Regression results including growth-related controls

	(1)	(2)	(3)
Dependent Variable: $DIFI_t$			
Constant	5.02	1.68	-0.82
	(49.44)	(50.13)	(51.99)
Trade Openness	2.18	2.11	2.21
	(1.65)	(1.67)	(1.69)
Stock market capitalization	−0.47**	−0.42*	-0.40
	(0.20)	(0.21)	(0.24)
CorpTax	3.97**	4.20**	3.94**
	(1.16)	(1.21)	(1.19)
Growth Differential		3.80	
		(4.65)	
RoW Growth			-1.42
			(2.87)
R^2	0.68	0.69	0.69

Note: * $P < 0.1$; ** $P < 0.05$; *** $P < 0.01$ This table shows the results of linear regressions of $DIFI_t$ on control variables and on $CorpTax_t$ defined as the detrended statutory corporate income tax differential between the US and the rest of the world using FDI-based time-varying weights. Relative to our baseline model, we separately add two explanatory variables. RoW Growth is the annual real GDP growth rate of the counterpart economies using FDI-based weighted. Growth Differential is the difference between the US annual GDP growth rate and RoW Growth. Regression estimated using yearly data from 2000 to 2019. $DIFI_t = (IFI_t^{CO} - IFI_t^{XB}) - \widehat{(IFI_t^{CO} - IFI_t^{XB})}$ where $\widehat{(IFI_t^{CO} - IFI_t^{XB})}$ are the fitted values of the difference on a constant and a time trend.

We then add a set of control variables frequently employed in the literature on the determinants of foreign direct investment as in Djankov *et al.* (2010). These include the VIX as a measure of risk aversion, the MNE (EFI) from the Fraser Institute and the number of start-up procedures to register a business from the World Bank's Ease of Doing Business data set. For the VIX, we compute the annual average value of this daily series. In the case of the EFI, the time series used includes the average value for all countries for any given year. In the case of the number of procedures, we take the time series related to the World as reported by the World Bank.

Table 10 shows the regression results. Columns (1)–(4) and (5)–(8), respectively, show the regression results of the non-detrended consolidated and residence-based IFI. The coefficient estimate associated with IFI^{ROW} is positive and statistically significant across specifications in both the consolidated and residence-based IFI regressions. The estimates associated with *TaxDiff* are positive in the consolidated IFI regressions but display weak statistical significance. The analogous estimates are statistically indistinguishable from zero in the residence-based IFI regressions.

These results reflect the fact that US residence-based external assets and liabilities are implicitly considered when constructing IFI^{ROW}. While direct US holdings are excluded from IFI^{ROW}, external assets and liabilities held by other countries vis-à-vis the US are included in the computation. The assets held by these countries are booked as US liabilities and vice versa. This produces a strong link between IFI and IFI^{ROW} that captures most of the variation in IFI. It leaves out relatively little variation for other factors such as tax differentials to capture.

Columns (9)–(12) in Table 10 show the regression results of the non-detrended version of the difference between the two measures of IFI. The coefficient estimates associated with the corporate income tax differential are positive and statistically significant across specifications. These results indicate that the positive and significant correlation between tax differentials and the difference between the two measures of IFI also emerges in the non-detrended regressions.

Overall, we conclude that there is supportive evidence that the corporate income tax differential is positively associated with the difference between the consolidated and cross-border measures of US IFI. This indicates that IFI is more closely associated with the corporate tax differential than when considering only cross-border measures.

US MULTINATIONALS AND MISSING FOREIGN ASSETS

Profit shifting activities often involve transferring a domestic asset to an affiliate located in a low-tax country. As discussed in the introduction, such inter-company sale leads to an increase in consolidated assets. This can also produce an increase in cross-border assets if the sale is financed by the parent company via cross-border funding from the home country. Motivated by the result that both IFI measures are positively correlated with tax differentials and by the leading role played by MNEs, we turn our focus to the association between tax differentials and their assets.

We proceed by decomposing consolidated and cross-border assets into MNE-related and MNE-unrelated. Using our methodology, the part associated with non-bank MNEs is computed as foreign assets related to US MNEs abroad. This produces an estimate of MNEs consolidated foreign assets ($AMNE_t^{CO}$). The part unrelated to MNE activities ($AXME_t^{CO}$) is computed as the difference between total (A_t^{CO}) and MNEs consolidated assets ($AXME_t^{CO} = A_t^{CO} - AMNE_t^{CO}$). Regarding cross-border measures, the estimate of US external assets (A_t^{XB}) comes directly from the US IIP database. For cross-border assets related to multinationals, ($AMNE_t^{XB}$) we take FDI assets.[15] Lastly, cross-border assets not related to multinationals ($AXME_t^{XB}$) is computed as the difference between total cross-border assets and FDI assets. After decomposing foreign assets, we divide all six by GDP and detrend them using the same procedure in Section 4.[16]

For each cycle variable $z \in Z = \{AC_t^{CO}, ACMNE_t^{CO}, ACXME_t^{CO}, AC_t^{XB}, ACMNE_t^{XB}, ACXME_t^{XB}\}$, we estimate the following regression on the same set of control variables $\mathbf{X}$ as in the baseline regression and FDI-weighted $CorpTax_t$:

$$z_t = \alpha + \beta CorpTax_t + \mathbf{X}_t\mathbf{B} + \epsilon_t \quad (1)$$

Table 11 displays the regression results for all six dependent variables. Columns (2) and (5) show that the coefficient estimate associated with $CorpTax_t$ (1.69) for MNEs when using the consolidated approach is substantially larger than the that of its cross-border analogue (0.56). We see this as further evidence that tax-related reasons lead US MNEs to expand their global footprint beyond what is captured by cross-border statistics.

Using the coefficient estimates from Table 11 on 2018 values, we estimate that a 1% increase in $CorpTax_t$ is associated with a USD 361bn increase in consolidated assets related to MNEs. The same increase is associated with a mere USD 120bn increase in

[15] This is an imperfect estimate of multinationals-related assets as it includes bank-related positions. Other potential issues with the usage of FDI positions are described by Blanchard & Acalin [2016].

[16] We separately estimate regressions of each variable on a constant and a time trend and store the resulting residuals as the detrended variables. In terms of notation, we add a capital letter C at the end of each variable name to denote cycle variables. For example, we label AC_t^{CO} the detrended consolidated foreign assets as a percentage of GDP.

Table 10. Regression results of non-detrended IFI

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Dep.Var.		IFI_t^{CO}			IFI_t^{XB}				$DIFI_t$			
Constant	−85.8**	-83.6	−4253**	475.1**	-25.2	7.9	-894.7	109.1	−60.6**	−91.5**	−3358***	366.0**
	(41.0)	(59.9)	(1659)	(177.4)	(20.8)	(28.1)	(970)	(91.0)	(28.3)	(39.9)	(1070)	(126.6)
TaxDiff	2.28	2.29	2.80*	3.92**	-0.75	-0.54	-0.64	0.07	3.03**	2.82**	3.44***	3.85***
	(1.71)	(1.78)	(1.51)	(1.46)	(0.87)	(0.83)	(0.88)	(0.75)	(1.18)	(1.19)	(0.97)	(1.04)
IFI^{ROW}	1.40***	1.40***	0.66**	0.70**	0.71***	0.67***	0.56***	0.58***	0.69***	0.73***	0.10	0.12
	(0.10)	(0.12)	(0.31)	(0.25)	(0.05)	(0.05)	(0.18)	(0.13)	(0.07)	(0.08)	(0.20)	(0.18)
VIX		-0.06				-0.99				0.93		
		(1.27)				(0.59)				(0.84)		
EFI			652.9**				136.3				516.7***	
			(259.9)				(151.9)				(168)	
EDB				−35.8***				−11.0*				−24.8***
				(10.27)				(5.26)				(7.33)
R^2	0.96	0.92	0.94	0.91	0.92	0.93	0.92	0.92	0.87	0.88	0.92	0.83

Note: * $P < 0.1$; ** $P < 0.05$; *** $P < 0.01$ This table shows the results of regressions using the non-detrended IFI and the difference between the two measures of IFI. *TaxDiff* is the non-detrended version of the corporate income tax rate differential used in our baseline specification. IFI^{ROW} is the GDP-weighted global residence-based IFI excluding the US *VIX* is the Chicago Board Options Exchange's Volatility Index. *EFI* is the average EFI from the Fraser Institute. *EDB* is the number of start-up procedures to register a business for World. These data come from the World Bank Ease of Doing Business data set. Regressions estimated using yearly data from 2000 to 2019 except for (4), (8) and (12), which are estimated using data from 2003 to 2019.

Table 11. Regression results of cross-border and consolidated-based assets

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent Variable	AC_t^{XB}	$ACMNE_t^{XB}$	$ACXME_t^{XB}$	AC_t^{CO}	$ACMNE_t^{CO}$	$ACXME_t^{CO}$
Constant	−51.94*	−22.33***	-29.62	-44.84	-8.03	-36.81
	(28.08)	(7.54)	(20.88)	(43.99)	(18.38)	(30.20)
Trade Openness	1.16	0.14	1.02	1.94	0.26	1.69
	(0.94)	(0.25)	(0.70)	(1.47)	(0.61)	(1.01)
Stock market capitalization	0.16	0.14***	0.02	-0.05	0.01	-0.06
	(0.11)	(0.03)	(0.08)	(0.17)	(0.07)	(0.12)
CorpTax	1.20*	0.56***	0.64	2.97**	1.69***	1.27*
	(0.66)	(0.18)	(0.49)	(1.04)	(0.43)	(0.71)
R^2	0.34	0.64	0.28	0.52	0.57	0.42

Note: * $P < 0.1$; ** $P < 0.05$; *** $P < 0.01$ This table shows the results of detrended consolidated- and cross-border assets on a set of control variables and the FDI-weighted $CorpTax_t$. We split assets into two parts: one that is related to activities by US multinational enterprises (*ACMNE*) and one that is not (*ACXME*) and run the same regression on these two components for the two methodologies. Regressions estimated using yearly data from 2000 to 2019.

cross-border assets.[17] Ultimately, these estimates indicate that a 1% increase in the tax differential is associated with a USD 241bn increase in the difference between consolidated and cross-border assets related to US MNEs, a dimension not captured by traditional Balance of Payments procedures.

These results are also in line with our previous findings showing that the an increase in $CorpTax_t$ is associated with a larger gap between the two IFI measures. Focusing on cross-border statistics potentially misses out a key dimension related to how MNEs expand their global financial footprint.

Conclusion

MNEs make decisions on how to geographically distribute assets and liabilities considering the tax codes of the countries they operate in. Since these generate holdings that constitute part of countries foreign balance sheets, they directly impact de-facto measures of IFI.

The industry-standard IFI measure relies on publicly available cross-border statistics. While this is a useful approach for studying financial globalization, it presents limitations related with the complexity of international investments and ownership structure. In addition, this approach leaves out international investments such as local positions of national affiliates in foreign countries and leaves in intra-group positions.

An alternative approach that correctly accounts for these international investments is to apportion assets and liabilities according to the nationality of the ultimate owner. By employing such methodology, assets and liabilities would not be recorded focusing on cross-border transactions only, but considering all international investments based on the nationality of the ultimate counterparts.

We construct the US consolidated balance sheet for the period between 1999 and 2019. Adopting such consolidated approach reveals that US IFI is on average two times larger than when computed using the traditional cross-border approach, as reported by Bank for International Settlements (2015) for 2012.

In line with that finding, our exercise confirms that US non-bank MNEs represent the largest source of US IFI. In addition, they deliver the most relevant contribution to the expansion of IFI over our sample period. Around half of the expansion in

[17] The two dollar amounts are estimated by multiplying the coefficient estimates associated with $CorpTax_t$ on the respective consolidated and cross-border assets related to MNEs by the US 2019 GDP. These values represent 0.66% of US consolidated assets and 0.44% of cross-border assets, respectively.

consolidated-based IFI can be attributed to these firms. Given the well-documented link between the geographical decisions by MNEs and tax planning, we investigate whether tax differentials are associated with the consolidated- and cross-border based measures of IFI for the US

Using these novel data, we document that both IFI measures and their difference are positively correlated with tax differentials. Such finding is robust with respect to alternative specifications, control variables and tax differential definitions. Furthermore, we find that an increase in tax differentials is associated with a larger increase in consolidated than in cross-border assets of MNEs. We interpret this as an indication that MNEs expand their global financial footprint beyond what is captured by cross-border statistics and that corporate tax differentials may be one of its reasons. Thus, we provide further evidence on the importance of elaborating consolidated-based measures of international financial positions as indicated by Lane (2021).

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Conflict of Interest

André Sanchez Pacheco and Agustń Bénétrix do not have conflict of interest to report.

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A Methodology

We construct estimates of consolidated foreign assets and liabilities using data from the US BEA, the US TIC, the BIS and the Federal Reserve Board. The procedure used here to estimate the US consolidated balance sheet is similar to that used in BIS (2015). As such, it also does not include financial derivatives due to challenges in determining the ultimate beneficiaries of contracts. Table A12 summarizes the estimation procedure for the components of the consolidated balance sheet for the period between 2013 to 2019. Prior to that, we do not discriminate between financial non-banks and non-financial enterprises due to the available data reporting until then. As such, Table A13 summarizes the estimation procedure for the components of the consolidated external balance sheet for the period between 1999 and 2012.

US banks and foreign banks

Consolidated US bank assets are equal to the total claims of US banks on all counterparts except US counterparts. This data series is available on the BIS consolidated banking statistics database on a quarterly frequency. Consolidated US bank liabilities are estimated as the local liabilities of US banks abroad plus US banks cross-border liabilities excluding those to related offices and central banks. The BIS banking data can be downloaded from the BIS Statistics Warehouse at https://stats.bis.org/.

The local liabilities of foreign banks operating in the US relative to US counterparts are booked as US foreign assets. Similarly, the total claims of foreign banks on US counterparts are booked as US foreign liabilities. These data series also come from the BIS consolidated banking statistics database and are reported on a quarterly basis.

Non-bank US multinational enterprises

The total assets of US-owned non-bank MNEs operating outside the US are booked as US foreign assets.[18] The BEA provides yearly data on the total assets of US-owned MNEs operating abroad on a sectoral basis. From 1999 up to 2012, we make no distinction between financial non-banks and non-financial firms. From 2013 onward, we separate the two groups to reflect the change in TIC reporting that occurred that year as the US Treasury started to be reporting TIC data using a financial/non-financial firms breakdown as opposed to the previous banks/non-banks breakdown.

The estimated liabilities of these firms are calculated as the difference between their total assets and the US foreign direct investment made in each specific sector. This difference provides an estimate of the portion of their total assets that are funded with resources other than those provided by the US parent company. The FDI data also come from the BEA and is available on a quarterly frequency.

As these data are available on a sectoral basis, policymakers can use them to assess the risks related to specific sectors and possible policy changes in other countries affecting these sectors. Given the aggregate focus of this paper, we use a bank/non-bank and financial/non-financial breakdown while acknowledging that further research can be done related to specific sectors.

Non-bank foreign MNEs

The total assets of foreign-owned MNEs operating in the US are booked as US foreign liabilities. We compute the US foreign assets as the difference between the total assets of foreign-owned MNEs operating in the US on a sectoral basis and the FDI received by the US in each sector. This procedure is analogous to that used when booking US external liabilities arising from US-owned MNEs operating abroad. The difference between the total assets of foreign-owned MNEs operating in the US and the FDI received by the US in the same sector represents the amount of assets in that sector that were acquired by foreign-owned MNEs with resources other than those funded by the foreign parent.

As it is also the case for non-bank US multinationals, we make no distinction between financial non-banks and non-financial firms between 1999 and 2012. From 2013 onward, we separate the two groups to reflect the change in TIC reporting that occurred that year. For the sectoral breakdown, where banking/financial firms data were not disclosed for all US affiliates of foreign MNEs, we estimated it by applying the proportion observed for majority-owned US affiliates as they represent more than 90% of the universe of all US affiliates of foreign MNEs.[19]

[18] We use total assets as a proxy for local assets owned by these companies in foreign countries due to data availability issues. Similarly, we assume that the total assets of US affiliates of foreign multinationals are all local assets. This also limits the netting out of intra-group positions. As a result, the estimates of foreign assets and liabilities of both US MNEs and US affiliates of foreign MNEs can be seen as upper bounds.

[19] For the year of 2017, the total assets of all US affiliates of foreign MNEs was equal to USD 15.8tn while the total assets of majority-owned US affiliates of foreign MNEs was equal to USD 14.5tn. Of the latter, financial affiliates accounted for USD 8.3tn and non-financial affiliates accounted for USD 6.2tn. As such, we estimate the total assets of all non-financial US affiliates of foreign MNEs as USD 6.8tn ($= 15.8 \cdot \frac{6.2}{14.5}$), which is booked as an US foreign liability.

Table A12. US Consolidated foreign balance sheet (2013–19)

Item	Assets	Liabilities
Bank-reported		
Consolidated US banks	Total claims of US banks (consolidated) on all counterparts except US counterparts.	Local liabilities of US banks operating abroad plus US banks cross-border liabilities excluding those to related offices and central banks.
Foreign banks	Local liabilities of foreign banks operating in the US relative to US counterparts.	Total claims of Foreign banks (consolidated) on US counterparts.
Financial non-banks		
US multinationals	Total assets of financial non-bank US MNEs operating abroad.	Total assets of financial non-bank US multinationals operating abroad minus the FDI made by the US in the financial non-banking sector.
Affiliates of foreign multinationals	Total assets of financial non-bank US affiliates of foreign multinationals minus the FDI received by the US in the financial non-banking sector.	Total assets of financial non-bank US affiliates of foreign multinationals.
Non-financial Enterprises		
US multinationals	Total assets of non-financial US MNEs operating abroad.	Total assets of non-financial US multinationals operating abroad minus the FDI made by the US in the non-financial sector.
Affiliates of foreign multinationals	Total assets of non-financial US affiliates of foreign multinationals minus the FDI received by the US in the non-financial sector.	Total assets of non-financial US affiliates of foreign multinationals.
Private portfolio investments	Foreign equity and bond securities holdings by US residents.	US equity and bond securities holding by foreigners excluding official agencies.
Official assets and liabilities	US official reserve assets.	US portfolio and other investments holding by foreign official agencies.
Other non-financial reported	Claims on unaffiliated foreigners reported by US non-financial companies.	Liabilities to unaffiliated foreigners reported by non-financial firms.
US currency	-	US currency held by the rest of the world

Table A13. US consolidated foreign balance sheet (1999–2012)

Item	Assets	Liabilities
Bank-reported		
Consolidated US banks	Total claims of US banks (consolidated) on all counterparts except US counterparts.	Local liabilities of US banks operating abroad plus US banks cross-border liabilities excluding those to related offices and central banks.
Foreign banks	Local liabilities of foreign banks operating in the US relative to US counterparts.	Total claims of Foreign banks (consolidated) on US counterparts.
Non-bank Enterprises		
US multinationals	Total assets of non-bank US MNEs operating abroad.	Total assets of non-bank US multinationals operating abroad minus the FDI made by the US in the non-banking sector.
Affiliates of foreign multinationals	Total assets of non-bank US affiliates of foreign multinationals minus the FDI received by the US in the non-banking sector.	Total assets of non-bank US affiliates of foreign multinationals.
Private portfolio investments	Foreign equity and bond securities holdings by US residents.	US equity and bond securities holding by foreigners excluding official agencies.
Official assets and liabilities	US official reserve assets.	US portfolio and other investments holding by foreign official agencies.
Other non-bank reported	Claims on unaffiliated foreigners reported by US non-bank companies.	Liabilities to unaffiliated foreigners reported by non-bank firms.
US currency	-	US currency held by the rest of the world

Private portfolio investments

US private portfolio assets are equal to the total holdings of foreign securities by US residents. This data series is available on the TIC database on a monthly frequency and starts in September 2011. Prior to that date, we use portfolio investment data from the US IIP database from the BEA on a quarterly frequency.

US private portfolio liabilities are the total holdings of US securities by non-residents, excluding foreign official agencies. This data series is available on the TIC database on a quarterly frequency and starts in December 2011. Prior to that date, US private portfolio liabilities are calculated as the difference between US total portfolio liabilities and the portfolio liabilities to foreign official agencies. Both series come from the BEA IIP database.

Official assets and liabilities

US official assets are equal to the US reserve assets as reported in the IIP. This data series is available on the BEA IIP database on a quarterly frequency. Similarly, US official liabilities are equal to the US liabilities to foreign official agencies. This includes US equity and, most importantly, debt securities held by foreign official agencies as well as other investments. This data series also comes from the BEA and is available on a yearly frequency.

Other non-financial reported

Other non-financial reported US foreign assets are claims on unaffiliated foreigners reported by US non-financial companies. Other non-financial reported US foreign liabilities are liabilities to unaffiliated foreigners reported by US non-financial companies. Both data series come from the US TIC and start in 2013. Prior to that year, our balance sheet decomposition does not discriminate between financial non-banks and non-financial companies as US Treasury reported claims and liabilities reported by non-banks instead of by non-financial companies.

US currency

US currency held by the rest of the world are booked as an US foreign liability. This data series comes from the Federal Reserve Board Financial Accounts of the United States and is available on a quarterly frequency.

Cross-border estimates

The cross-border estimate of total assets used in this paper is the US total assets excluding financial derivatives that comes from the IIP database from the BEA. Similarly, the cross-border estimate of total liabilities used is the US total liabilities excluding financial derivatives. These two time series are similar to the estimates produced by Lane and Milesi-Ferretti (2018) when also excluding financial derivative positions.