



Trinity College Dublin

Coláiste na Tríonóide, Baile Átha Cliath

The University of Dublin

Consolidated Foreign Wealth of Nations: Initial Steps and Novel Estimates

A THESIS SUBMITTED TO THE UNIVERSITY OF DUBLIN, TRINITY

COLLEGE IN APPLICATION FOR THE DEGREE OF DOCTOR OF

PHILOSOPHY BY

André Sanchez Pacheco

Supervised by

Agustín S. Bénétrix

2023

Declaration

I declare that this thesis, submitted to Trinity College Dublin for the degree of Doctor in Philosophy (Ph.D.), has not been submitted for a degree at this or any other university. I declare I was the lead author for the co-authored chapter in the thesis. All research contained herein is entirely my and my co-author's work and all errors are our own.

I agree to deposit this thesis in the University's open access institutional repository or allow the Library to do so on my behalf, subject to Irish Copyright Legislation and Trinity College Library conditions of use and acknowledgement.

I consent to the examiners retaining a copy of the thesis beyond the examining period, should they wish so (EU GDPR May 2018).

André Sanchez Pacheco

Abstract

This thesis is made of three essays in International Macroeconomics. The central question these essays focus on is how to assess the international exposure of countries. The conventional approach uses the residence of the immediate counterparts as the key criterion in sorting these balance sheet exposures. However, this approach presents shortcomings that make it difficult for policymakers and researchers to sort the ultimate exposure countries have to financial risks. In this thesis, I construct novel estimates on the international exposure of countries based on a consolidated-by-nationality approach. These estimates are used to analyse global profit shifting activities and the spillovers of U.S. monetary policy shocks on multinational enterprises.

The first essay studies the link between U.S. international financial integration and tax differentials. In particular, we document a robust relation between corporate tax differentials and U.S. 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 U.S. multinationals taking advantage of tax differentials in ways that go beyond what is captured by traditional Balance of Payments procedures.

The second essay seeks to assess how exposed Ireland is to foreign shocks. Relying on residence-based measures of foreign holdings to answer this question can be challenging. These statistics are obscured by the vast presence of Special Purpose Entities in the country. Alternatively, I construct an estimate of the Irish consolidated-by-nationality foreign balance sheet for the period between 2011 and 2019 based on a novel methodology that builds on firm-level data. I find that Ireland's consolidated foreign balance sheet is on average 46.7% smaller relative to its residence-based analogue. I interpret this result as an indication that Ireland is significantly less exposed to foreign shocks than what is suggested by residence-based statistics.

Lastly, the third essay presents novel estimates of foreign holdings from a consolidated-by-nationality perspective for a sample of fourteen developed countries over multiple years. It describes the stylized facts that emerge from this new data-set on the international exposure of countries. It shows that aggregate international financial integration is larger from a nationality-based approach relative to the conventional residence-based data. These novel data are used to analyze (1) profit shifting activities and (2) spillovers from U.S. monetary policy shocks. I find evidence suggesting that nationals of relatively high-tax countries may shift assets to low-tax countries in ways not fully captured in residence-based statistics. I also find that a tightening in U.S. monetary policy is associated with a decline in consolidated-by-nationality foreign asset holdings by non-financial multinational enterprises. Such findings highlight the usefulness of this new data-set in international macroeconomics.

Acknowledgements

First and foremost, I would like to thank my supervisor and co-author Agustín S. Bénétrix for the valuable learnings during this journey. His guidance was paramount for my intellectual development and for the successful conclusion of this thesis.

I would like to thank Stefan Avdjiev and Davide Romelli for the insightful discussion during the Ph.D. Viva Voce examination and for their important comments. I would also like to thank Simone Arrigoni, Luís Catão, Vu Thanh Chau, Beren Demirölmez, Joseph Kopecki, Barra McCarthy, Valerie Mignon, Francesco Pappadà, Martin Schmitz and Michael Wycherley for their comments. Similarly, I am grateful to anonymous referees for their valuable suggestions. I would like to thank the participants at the CEBRA Annual Meeting, Irish Economic Association Annual Meeting and RIEF Network Meeting for their questions, comments and suggestions.

My journey would not have been possible without the continuous and relentless support from my family. I am thankful to my wife Juliana Wei for standing by me through ups and downs along this journey. I would also like to thank my parents André and Vania for their patience and affection. Capitu and Mafalda were the best companions a person can have.

This research was funded by an Irish Research Council Government of Ireland Postgraduate Scholarship.

Contents

1	General Introduction	1
2	Corporate Taxation and International Financial Integration: U.S. evidence from a consolidated perspective	5
2.1	Introduction	5
2.2	Reasons to consolidate	8
2.3	Methodology	11
2.4	Stylized facts	12
2.4.1	Main aggregates	12
2.4.2	Balance sheet decomposition	13
2.5	Empirical Analysis	15
2.5.1	Robustness	20
2.6	U.S. Multinationals and missing foreign assets	23
2.7	Conclusion	24
2.A	Appendix	45
2.A.1	U.S. banks and foreign banks	45
2.A.2	Non-bank U.S. Multinational Enterprises	45
2.A.3	Non-bank Foreign Multinational Enterprises	46
2.A.4	Private portfolio investments	47
2.A.5	Official assets and liabilities	47
2.A.6	Other non-financial reported	47
2.A.7	U.S. Currency	47
2.A.8	Cross-Border Estimates	48
3	A consolidated-by-nationality approach to Irish foreign exposure	51
3.1	Introduction	51
3.2	Foreign exposure and consolidated statistics	53
3.3	Methodology	55
3.3.1	Non-financial foreign multinational enterprises	55
3.3.2	Non-financial Irish MNEs operating abroad	58

3.3.3	Irish and foreign banks	62
3.3.4	Financial non-bank foreign MNEs	62
3.3.5	Irish financial non-banks	64
3.3.6	Portfolio Investments	66
3.3.7	Official assets and liabilities	66
3.4	Stylized Facts	66
3.5	Conclusion	69
3.A	Appendix	76
4	Consolidated Foreign Wealth of Nations: Nationality-based measures of international exposure	99
4.1	Introduction	99
4.2	Nationality- and residence-based statistics	102
4.3	Data	104
4.3.1	Bank-related holdings	105
4.3.2	Non-financial MNEs	106
4.3.3	Financial non-bank holdings	108
4.3.4	Portfolio Investment	110
4.3.5	Official Assets	110
4.4	Stylized Facts	110
4.4.1	Aggregate dynamics	110
4.4.2	Country-level analysis	111
4.5	Tax differentials and foreign holdings	112
4.6	U.S. monetary policy spillovers and non-financial MNEs	116
4.6.1	Robustness	118
4.7	Conclusion	118
4.A	Appendix	130
5	General Conclusion	137
	Bibliography	139

List of Figures

2.1 U.S. International Financial Integration	26
2.2 U.S. Foreign Assets plus Liabilities	27
2.3 U.S. Assets	28
2.4 U.S. Liabilities	29
2.5 U.S. Net International Investment Position	30
2.6 U.S. Consolidated Foreign Assets	31
2.7 U.S. Consolidated Foreign Liabilities	32
2.8 Difference between Consolidated and Cross-Border IFI	33
3.1 Irish Consolidated Foreign Holdings related to foreign non-banks	73
3.2 Sum of foreign assets and liabilities	74
3.3 Irish Consolidated Foreign Assets and Liabilities	75
3.A.4 Irish consolidated foreign assets	77
3.A.5 Irish consolidated foreign liabilities	78
3.A.6 Irish net foreign assets	79
3.A.7 Irish consolidated net foreign assets	80
3.A.8 Number of foreign MNEs per size group based on total assets	81
3.A.9 Sum of total assets of foreign MNEs per size group	82
3.A.10 Number of non-financial foreign affiliates in Ireland by country	84
3.A.11 Sum of total assets of non-financial foreign MNEs per country	85
3.A.12 Sum of employment of non-financial foreign MNEs per country	86
3.A.13 Foreign assets and liabilities related to non-financial foreign MNEs	87
3.A.14 Share of Irish outbound FDI position in covered countries relative to total	89
3.A.15 Foreign assets and liabilities related to Irish non-financial MNEs in the U.S.	90
3.A.16 Foreign assets and liabilities related to Irish non-financial MNEs in Europe	91
3.A.17 Consolidated foreign assets related to banks	92
3.A.18 Consolidated foreign liabilities related to banks	93
3.A.19 Consolidated foreign assets and liabilities related to banks	94

3.A.20 Foreign assets and liabilities related to foreign financial non-banks . .	95
3.A.21 Foreign assets and liabilities related to Irish financial non-banks in the U.S.	96
3.A.22 Foreign assets and liabilities related to Irish financial non-banks in the Europe	97
4.7.1 Aggregate international financial integration - % of GDP	121
4.7.2 Difference between the aggregate nationality- and residence-based IFI .	122
4.7.3 Consolidated-by-nationality and residence-based IFI - 2019	123
4.7.4 Nationality-based and residence-based IFI	124
4.7.5 Consolidated-by-nationality foreign assets and liabilities - % of GDP . .	125
4.A.6 Consolidated-by-nationality foreign holdings related to national banks .	130
4.A.7 Consolidated-by-nationality foreign holdings related to foreign banks .	131
4.A.8 Consolidated foreign holdings related to foreign non-financial MNEs . .	132
4.A.9 Share of outbound FDI position to covered countries relative to total .	133
4.A.10 Consolidated foreign holdings related to national non-financial MNEs	134
4.A.11 Consolidated foreign holdings related to foreign financial non-banks .	135
4.A.12 Consolidated foreign holdings related to national financial non-banks .	136

List of Tables

2.1 U.S. Consolidated Foreign Balance Sheet - 2019 (USD bn)	34
2.2 Consolidated Foreign Balance Sheet Growth	35
2.3 Relative Contribution to Consolidated Foreign Balance Sheet Growth . .	36
2.4 Regression results of measures of IFI	37
2.5 Regression results of the difference between consolidated and cross-border	38
2.6 Countries included in the construction of alternative <i>CorpTax</i> measures .	39
2.7 Regressions using alternative definitions of corporate tax differential . . .	40
2.8 Regressions using alternative definitions of corporate tax differential . . .	41
2.9 Regression results including growth-related controls	42
2.10 Regression results of non-detrended IFI	43
2.11 Regression results of cross-border and consolidated-based assets	44
2.12 U.S. Consolidated Foreign Balance Sheet (2013-2019)	49
2.13 U.S. Consolidated Foreign Balance Sheet (1999-2012)	50
3.1 Ireland Consolidated Foreign Balance Sheet	72
3.2 Ireland Consolidated Foreign Balance Sheet: Sources	76
3.3 SIC 2007 sub-classes excluded from the sample of non-financial MNEs .	83
3.4 Countries included in estimating assets and liabilities related to Irish MNEs	88
4.1 Regression Results using full sample of countries	126
4.2 Regression Results of the difference between nationality- and residence- based measures	127
4.3 Regression Results of the first difference in foreign assets related to national non-financial MNEs (% of GDP)	128
4.4 Regression Results of the first difference in foreign assets related to MNEs using alternative measures of policy shocks	129

1 General Introduction

This thesis is made of three essays in International Macroeconomics. The central question these essays focus on is how to assess the international exposure of countries. The conventional approach uses residence of the immediate counterparts as the key criterion in sorting these exposures. This approach presents two important shortcomings. First, it focuses solely on cross-border exposure as only transactions between agents residing in different countries are recorded. Local exposures in country A a foreign agent from country B residing in country A have may not enter the international investment position of neither country A nor B.

Second, the residence-based approach treats affiliates of multinational enterprises (MNEs) operating abroad largely as separate entities. Consider a foreign affiliate of an MNE from country B operating in host country A. The assets held by this affiliate represent investments made by that MNE from country B in foreign country A. Yet these investments may not enter the foreign balance sheet of neither the host country A nor home country B. This international exposure a company from country B has in this foreign country might not be captured in the conventional approach. More specifically, this exposure would only be recorded if these assets are funded by cross-border transactions arising from the home country. If these assets are financed by raising resources locally in country B, no exposure would be recorded.

These two shortcomings generate a range of issues in international finance. One such issue is that the ultimate exposure to international financial risks may not be properly identified in the residence-based approach. In our example, if the assets held by the affiliate in country B falls in value, it would represent a financial loss for an MNE from country A. Yet this risk is not readily observable with residence-based statistics as such exposure may not enter the external balance sheet of country A. Another issue relates to the identification of decision-making and production units. Decisions made by the MNE in country B may affect production and employment in its affiliate operating in country A. Treating each entity as separate firms according to their residence may not accurately represent complex decision-making and production structures.

Alternatively, one could adopt a consolidated-by-nationality approach when sorting the

international exposure of countries. Under such approach, foreign assets and liabilities are sorted according to the nationality of the ultimate counterparts. Assets and liabilities held by affiliates operating abroad are consolidated to their parent companies. These holdings are then sorted according to the nationality of these economic agents. This approach has the benefit of taking both cross-border and local positions into account rather than just the former. It also traces back assets and liabilities held by affiliates operating abroad to their parent countries. These features imply that the consolidated-by-nationality approach provides a more nuanced view on the international exposure of countries.

Despite these relative advantages of the consolidated-by-nationality approach, one important disadvantage is that there is no data-set containing consolidated estimates for multiple countries over time. Similarly, there is no unified methodology on how consolidated-by-nationality estimates of foreign holdings can be constructed. These two shortcomings reduces the usage of this approach by policymakers and researchers.

This thesis seeks to address these two important shortcomings by constructing a data-set containing consolidated-by-nationality estimates of foreign holdings for multiple countries over time. This data-set complements the existing residence-based estimates from Lane and Milesi-Ferretti's seminal *External Wealth of Nations*. A novel methodology that relies on firm-level financial and ownership data is used to construct these estimates for all but one country. The essays also point to applications of these novel data in research.

In the first essay (Chapter 2, co-authored with Agustín S. Bénétrix), we estimate the entire U.S. foreign balance sheet from a consolidated-by-nationality perspective for the period between 1999 and 2019. This is the first paper to do so for multiple years for any country. Then we compare the consolidated-by-nationality foreign balance sheet with the conventional residence-based one. A key variable in our analysis is the index of international financial integration (IFI), calculated as the sum of foreign assets and liabilities divided by GDP.

We find that the U.S. consolidated-based IFI is on average around two times larger than the residence-based one. This result reveals that the U.S. economy is substantially more financially integrated with world than previously thought. The difference between the two measures of IFI is positively correlated with corporate income tax differentials between the U.S. and the rest of the world. A detailed analysis indicates that such positive correlation is mostly driven by the part of the U.S. foreign balance sheet related to multinational enterprises. We interpret this as indirect evidence that U.S. multinational enterprises are taking advantage of tax differences in ways not fully captured in conventional residence-based statistics.

These findings underscore the need for developing consolidated-by-nationality estimates of foreign holdings. They can provide a more nuanced description related to the international exposure of countries. Furthermore, they can reveal dynamics arising from economic decisions not entirely captured by the residence-based approach.

In the second essay (Chapter 3), I construct consolidated-by-nationality estimates of foreign holdings for Ireland. This is the first study to construct such nationality-based estimates for the entire Irish foreign balance sheet. The country presents an interesting case study given the significant presence of foreign-owned special purpose entities. These Irish-resident foreign companies are often involved in international financial intermediation and have little economic ties to Irish agents. Yet these intermediation activities mean they hold cross-border assets and liabilities. Such holdings significantly increase the size of Ireland's residence-based foreign balance sheet. This poses a challenge for policymakers and researchers when assessing the international exposure Irish agents have. Under the consolidated-by-nationality approach, the holdings owned by these foreign companies operating in Ireland would be attributed to their parent companies. Therefore, the consolidated-by-nationality foreign balance sheet would provide a clearer description on the exposures held by Irish agents.

The second essay reveals that Ireland's consolidated-by-nationality foreign balance sheet is on average 46.7% smaller relative to its residence-based analogue over the period between 2011 and 2019. This result indicates the Irish economy is substantially less exposed to foreign shocks than what the conventional residence-based measures suggest.

There are multiple methodological challenges associated with the estimation of the Irish consolidated-by-nationality foreign balance sheet. First, there's not enough publicly-available data on the activities of foreign multinationals operating in Ireland. Similarly, there's also a lack of enough publicly-available data on Irish multinationals operating abroad. In addition, the presence of Special Purpose Entities and of companies that have redomiciled to Ireland pose additional challenges to the estimation of consolidated foreign assets and liabilities.

This second essay presents a novel methodology to estimate the consolidated-by-nationality foreign balance sheet and overcome these challenges. It uses company-level financial and ownership data obtained from Bureau van Dijk's Orbis Europe and FAME data-sets. These data-sets complement publicly available data from multiple sources. This methodology estimates foreign holdings related to non-bank multinational enterprises based on firm-level data. It has the benefit that it can easily applied to different countries.

In the third essay (Chapter 4), I construct consolidated-by-nationality estimates of for-

eign holdings for a set of developed countries over multiple years. This represents the first data-set on consolidated-by-nationality foreign assets and liabilities for any group of countries. It complements the seminal residence-based *External Wealth of Nations* data-set by Lane and Milesi-Ferretti. The methodological innovation introduced in chapter 3 is used to construct these estimates for multiple countries.

These novel estimates reveal that this group of countries is on aggregate more internationally financially integrated when compared to the conventional residence-based view. Individually, most countries also present a larger consolidated-by-nationality IFI relative to their residence-based analogue. Such result comes from the fact that the consolidated approach takes into account all local and cross-border positions while the residence-based approach focuses only on the latter. However, countries who have a relevant industry focused on international financial intermediation present can have a larger residence-based IFI at times.

This data-set is used to analyze two separate international macroeconomic issues. The first one is on the profit shifting while the second is on the spillovers from U.S. monetary policy shocks on non-financial multinational enterprises. I find indirect evidence that is consistent with the notion that agents in high-tax countries have an incentive to shift assets and profits to low-tax countries. A policy implication that emerges from this analysis is that profit shifting activities might extend beyond what is captured by residence-based statistics.

The second application is on the analysis of spillovers of U.S. monetary policy shocks on foreign asset holdings by non-financial multinational enterprises. I find a negative and robust correlation between a tightening U.S. monetary policy shock and the change in consolidated-by-nationality foreign assets by these companies. This result suggests that U.S. monetary policy shocks might generate spillovers that are associated with changes in foreign assets by non-financial multinationals. Taken together, these two sets of results indicate that consolidated-by-nationality estimates of foreign holdings can be useful in tackling important questions across different topics in international macroeconomics.

Lastly, Chapter 5 summarizes the key findings of these essays and provides a general conclusion.

2 Corporate Taxation and International Financial Integration: U.S. evidence from a consolidated perspective¹

2.1 Introduction

Multinational enterprises 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 and Riedel, 2011) and book increasing amounts of profits in low-tax jurisdictions (Zucman, 2014). 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, identified in Lane and 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 globalisation.² The differences in international financial integration emerging from these two complementary approaches can shed light on central questions in international macroeconomics/finance.³

How multinational enterprises take advantage of differences in tax codes across countries is key for estimating missed revenue by home tax authorities. How much of their taxable

¹This is a joint work with my supervisor Agustín S. Bénétrix. A slightly modified version of this paper was published in *Oxford Open Economics*, Volume 2, 2023, odac011.

²Avdjiev et al. (2018) pointed to the tension between concept of residence and the global activities of multinational enterprises. Avdjiev et al. (2016) describe shortcomings of treating the economic area defined by the GDP boundary to be the same defining decision-making units.

³Lane (2021) notes that the consolidated framework may be useful in identifying the ultimate financial exposures of countries. Avdjiev et al. (2021) shows that the nationality of global banks is an important element in assessing cross-country policy spillovers. Exposure to such spillovers would be better visualised with consolidated statistics.

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 U.S. 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 U.S. would appear in the Balance of Payments. Yet these assets are a U.S. investment in a foreign country with the potential of generating revenue to U.S. 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 U.S. 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 international financial integration (IFI). It delivers three main contributions: (1) the construction of time-series estimates of U.S. consolidated-by-nationality foreign holdings; (2) the description of stylized facts around these new nationality-based data and; (3) 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 U.S. foreign balance sheet consolidated by nationality is done for the period between 1999 and 2019 using a methodology similar to BIS (2015). 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 United States while their approach focuses only on portfolio investments.

Two key stylized facts emerge from these novel data. First, the U.S. consolidated foreign balance sheet is on average two times larger than its residence-based analogue.⁴

⁴It is not necessarily the case that the cross-border approach will lead to an underestimation of the

Second, U.S. non-bank multinational enterprises 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 U.S. 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 multinational enterprises. 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 BIS (2015) on constructing consolidated-by-nationality estimates of foreign holdings for the U.S. 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 and Johannesen (2021) provide 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 2.2 provides additional reasons for analysing international exposures using consolidated-based statistics. Section 2.3 provides a summary of the methodology used to construct the U.S. consolidated-by-nationality foreign balance sheet. Section 2.4 describes key stylized facts that emerge from our analysis by comparing estimates based on the U.S. consolidated balance sheet to those based on cross-border positions. Section 2.5 details our analysis on the relation between corporate income tax differential and international financial integration. Section 2.6 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 2.7 concludes.

true degree of international financial integration of countries as in this example. Countries that host a significant amount of pass-through companies can observe a decrease in their international financial integration when analysed through the consolidated approach. Ireland is one such example as noted by Sanchez Pacheco (2021). See also Damgaard and Elkjaers (2017).

2.2 Reasons to consolidate

Residence-based estimates of foreign holdings have proven useful across several applications in international finance and macroeconomics. Relying on such approach, Catão and Milesi-Ferretti (2014) show that measures such as net foreign liabilities are particularly useful when estimating the probability of an external crisis. Gourinchas and 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. (2018) and Di Nino et al. (2020). These multinational enterprises 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 U.S. MNE based in Ireland are foreign assets and liabilities of Ireland even though this entity belongs to a U.S. corporate group.

Given this challenge related to multinational enterprises, 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

⁵The first two studies pointing to the importance of compiling economic accounts based on ultimate ownership are Baldwin et al. (1998) and Baldwin and Kimura (1998). Their key contribution is to show that adopting a consolidated approach for the U.S. 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.

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 approach. In the case of the Global Financial Crisis, McCauley (2018) shows that U.S. 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 U.S. 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. (2021) 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. (2018) 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 and 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

⁶Pass-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

finding implies that Irish international financial integration as conventionally measured using cross-border external assets and liabilities overstates the true degree of financial globalisation 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 centers 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 to 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 and 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 U.S. multinationals regardless of how these were financed. Our empirical analysis considers consolidated-based data and compares it to traditional residence-based data.

Ireland raises Irish residence-based measures of foreign holdings.

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

2.3 Methodology

The U.S. consolidated-by-nationality foreign balance sheet is constructed using publicly available data from the U.S. Bureau of Economic Analysis (BEA), the U.S. Treasury International Capital System (TIC), the Bank for International Settlements (BIS) and the Federal Reserve Board. The procedure adopted to construct the U.S. consolidated balance sheet follows that in BIS (2015).

The methodology is explained in detail in the Appendix. For non-bank multinational enterprises, U.S. foreign assets and liabilities are constructed using aggregate financial data by sector as well as foreign direct investment data. Both data-sets are published by the U.S. Bureau of Economic Analysis. U.S. foreign assets related to U.S. non-bank companies are equal to the assets held by affiliates of these companies operating abroad. U.S. foreign liabilities related to these companies are calculated as the difference between their total asset holdings minus the U.S. foreign direct investment in this sector. Similarly, U.S. foreign liabilities related to foreign non-banks operating in the U.S. are equal to their total asset holdings. U.S. foreign assets related to these companies are equal to their total asset holdings minus the foreign direct investment received by the United States in this sector.

Such methodology implies that the estimates of U.S. consolidated-by-nationality foreign holdings related to both U.S. and foreign non-banks are upper bound values. For U.S. MNEs operating abroad, it assumes that the difference between their total asset holdings and U.S. FDI is entirely funded by non-U.S. agents. However, it is possible that U.S. economic agents such as banks might be financing part of this difference. In this case, U.S. consolidated-by-nationality foreign liabilities would be smaller than the estimates constructed in this paper. Likewise, it is possible that a portion of the total assets these U.S. MNEs hold abroad have U.S. nationals as ultimate counterparts. In such case, U.S. consolidated-by-nationality foreign assets would be smaller than the estimates presented in this paper.

For foreign MNEs operating in the U.S., the methodology assumes that their total asset holdings have U.S. nationals as ultimate counterparts. However, it is possible that a portion of these assets have non-U.S. nationals as their ultimate counterparts. In such case, U.S. foreign liabilities related to foreign MNEs operating in the U.S. would be smaller than our estimates. Similarly, the methodology assumes that the difference between these foreign companies' assets and FDI received are entirely funded by U.S. agents. However, it is possible that part of this difference is funded non-U.S. agents. This would imply that U.S. foreign assets related to foreign non-banks would be overstated in our methodology.

One would require transaction-level information for all U.S. MNEs operating abroad and all foreign MNEs operating in the U.S. to accurately estimate U.S. foreign assets and liabilities related to these groups of non-bank entities. Such information is not available at this moment. As a result, the methodology provides upper bound estimates of these foreign assets and liabilities using the publicly available data.

2.4 Stylized facts

2.4.1 Main aggregates

Figure 2.1 shows the evolution of U.S. international financial integration based on the consolidated approach and compares it to the same measure calculated using the cross-border approach from the U.S. international investment position database. The estimate of international financial integration is calculated as the sum of U.S. foreign assets and foreign liabilities divided by U.S. GDP as in Lane and 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 2.2 shows the sum of U.S. assets and liabilities reported in trillions of U.S. dollars.

These two figures indicate that U.S. 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 BIS (2015). It indicates that U.S. 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 U.S. multinational enterprises operating abroad. The stark difference between the two measures of financial globalisation provides a relevant reason for statistical offices to produce consolidated-based estimates of external accounts.

Another important finding that stands out is that U.S. 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 and Milesi-Ferretti (2018).

Figures 2.3 and 2.4 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 U.S. 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 U.S. net international investment position (IIP) when calculated using the consolidated approach is relatively close to that computed using cross-border estimates. Figure 2.5 shows the evolution of the U.S. 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 analyzing the international exposure of countries.

2.4.2 Balance sheet decomposition

Table 2.1 shows the U.S. consolidated balance sheet for 2019, the last year in our sample. This table reveals that U.S. non-financial multinational enterprises (MNEs) operating abroad represent the single largest source of U.S. international financial integration. Relying on data from the U.S. BEA, we estimate that U.S. 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:

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

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. $R_{t,T}^i$ represents the cumulative growth rate of component $i \in N$ between periods t and T . $w_{i,t}^{type}$ represents the share of component i relative to *type* at time t . We call $w_{i,t}^{type} R_{t,T}^i$ 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

⁸All 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

We can normalise the contribution of each item $w_{i,t}R_{t,T}^i$ by the growth rate of each *type*. Doing so provides a clearer visualisation 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 $Contrib_{i,t,T}^{type}$ of item i on the cumulative growth *type* is given by:

$$Contrib_{i,t,T}^{type} = \frac{w_{i,t}R_{t,T}^i}{R_{t,T}^{type}} \quad (2)$$

Table 2.2 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 U.S. 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 2.3 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 U.S. 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 2.6 and 2.7 illustrate the decomposition of consolidated foreign assets and liabilities respectively over the sample period. As it can be seen, the share of U.S. non-bank MNE assets grew between 1999 and 2019. U.S. non-bank MNE assets represented 38.2% of U.S. foreign assets in 1999 and 51.4% in 2019. Similarly, the share of U.S. non-bank MNE liabilities increased from 25.0% of U.S. foreign liabilities in 1999 to 34.7% 2019.

The increasing importance of U.S. non-bank MNEs over our sample period overlaps with the significant increase in the share of profits made abroad among U.S. 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 U.S. foreign balance sheet and the corporate income tax differential.

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

fact that 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 U.S. consolidated balance sheet. This new subgroup is irrelevant when decomposing the growth of the external balance sheet.

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 U.S. banks.

2.5 Empirical Analysis

The prominent role played by U.S. 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 U.S. consolidated-based IFI (IFI^{CO}) over the sample period. In this section, we investigate whether the corporate tax differential between the U.S. 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 and Riedel (2012) argue that multinational enterprises have an incentive to locate patents at low-tax affiliates to minimize the corporate tax burden. Dischinger and Riedel (2011) show that multinational enterprises 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. Multinational enterprises 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 U.S. companies has increased significantly since the start of this century. Tørsløv et al. (2022) 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 U.S. 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 U.S. 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 U.S. 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 U.S. 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 U.S. 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 U.S. consolidated foreign assets for the reason exposed above. In addition, U.S. consolidated foreign liabilities would also increase by \$100 as this loan represents a liability of a U.S. company with respect to a Dutch agent. In this sense, the U.S. 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.

The empirical analysis focuses on U.S. consolidated-by-nationality and residence-based time series data. Ideally, panel data analysis using the bilateral positions between the U.S. and foreign countries as well as their respective bilateral tax differentials would provide greater variation in our econometric specification. However, data limitations do not allow for the construction of entire bilateral consolidated foreign balance sheets. In particular, the U.S. BEA data currently cannot be used for the construction of bilateral positions for non-bank companies. As a result, this paper focuses on time series analysis instead.

As a first step, we empirically test whether the two measures of international financial integration are associated with the corporate income tax differential between the U.S. and the rest of the world. We compute the tax differential between the U.S. and the rest of the world as the difference between the U.S. 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 twenty-six countries based on the sum of bilateral FDI positions vis-à-vis the U.S. 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 U.S. 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

⁹The 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.

corporate income tax differential $CorpTax_t$ and a set of control variables $\mathbf{X}$.

$$IFIC_t^i = \alpha + \beta CorpTax_t + \mathbf{X}_t \mathbf{B} + \epsilon_t \quad (3)$$

We include trade openness as a control variable given the linkages between international trade and financial integration. We also include a variable to capture the linkages between financial deepening and international financial integration. In our baseline specification, the stock market capitalisation as a percentage of GDP is used to proxy for the degree of U.S. financial deepening. Alternative measures such as the index of financial development or credit to GDP could also be used as financial deepening measures. In the robustness subsection, such proxy is replaced by the Financial Development Index. This index is computed by the IMF and includes nine different measures of financial development as described in Svirydzhenka (2016). Data on U.S. trade openness and stock market capitalization come from the World Bank.

Table 2.4 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 U.S. 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

¹⁰ $DIFI_t = (IFI_t^{CO} - IFI_t^{XB}) - (\widehat{IFI_t^{CO}} - \widehat{IFI_t^{XB}})$ where $(\widehat{IFI_t^{CO}} - \widehat{IFI_t^{XB}})$ are the fitted values of the

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.

$$DIFI_t = \alpha + \beta CorpTax_t + \mathbf{X}_t \mathbf{B} + \epsilon_t \quad (4)$$

Results are shown in columns (1) and (2) in Table 2.5. We find positive and statistically significant coefficient estimates associated with the corporate income tax rate differential in both uni-variate 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 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 U.S. 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 U.S. international balance sheet that is not captured by cross-border statistics. The main implication of this finding is that international financial integration is more closely associated with the corporate tax differential than when considering only cross-border measures.

Despite the prominent role played by multinational enterprises in expanding U.S. 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 multinational enterprises 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 gener-

difference on a constant and a time trend.

¹¹For the consolidated balance sheet, the multinationals-related measure of IFI is computed as the sum of U.S. assets and liabilities with respect to U.S. MNEs and foreign MNEs operating in the U.S. 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 U.S. 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.

ates 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 2.5 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 U.S. 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 2.5 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 to the results from the regression on $DMNE_t$. We see this as evidence that the part of the U.S. balance sheet not captured by cross-border statistics and not related to multinational enterprises is also positively correlated with the corporate income tax differential.

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 multinational enterprises while 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 2.5 indicate that the difference between the two measures of IFI, which represents the part of the U.S. 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 multinational enterprises 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.

¹²Calculated 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).

2.5.1 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 U.S. and the rest of the world. Besides the baseline specification using FDI-based weights, we calculate it as the difference between the U.S. corporate tax rate and (1) the average corporate tax rate from the OECD database, (2) the median corporate tax rate, (3) the trade-weighted average corporate tax rate and (4) 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 U.S. trading partners. Table 2.6 lists the countries included in the construction of this index. We use yearly data from the U.S. 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 (CPIS) data to compute time-varying weights. After selecting a group of 31 countries shown in Table 2.6, we compute the weights as the relative sum of inward and outward portfolio between country i and the United States 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 2.7 shows the results for both the uni-variate 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 $CorpTax$

¹³In 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 U.S. trading partners. The results were similar to those shown in Table 2.6. Importantly, we find that the coefficient associated with $CorpTax_t$ remains positive and statistically significant.

¹⁴We also estimated these regressions using a common set of counterpart countries. The results were similar to those shown in Table 2.7 using the different set of countries described in Table 2.6.

but replacing the stock market capitalisation 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 Svirydzienka (2016).

Results are shown in Table 2.8. 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 U.S. IFI to be correlated with the growth differential between the U.S. 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 U.S. 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 2.9 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 United States. That is done using residence-based data from Lane and Milesi-Ferretti's *External Wealth of Nations* dataset. For a particular year, we sum the external assets and liabilities for all countries but the U.S. and divide that by the sum of their gross domestic product. The resulting

variable IFI^{ROW} is used as an explanatory variable across specifications.

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 Economic Freedom Index (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 dataset. 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 2.10 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 U.S. residence-based external assets and liabilities are implicitly considered when constructing IFI^{ROW} . While direct U.S. holdings are excluded from IFI^{ROW} , external assets and liabilities held by other countries vis-à-vis the U.S. are included in the computation. The assets held by these countries are booked as U.S. 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 2.10 shows 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 U.S. IFI. This indicates that international financial integration is more closely associated with the corporate tax differential than when considering only cross-border measures.

2.6 U.S. 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 multinational enterprises, 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 U.S. multinational enterprises 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 U.S. external assets (A_t^{XB}) comes directly from the U.S. 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 2.5.¹⁶

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 $CorpTax_t$:

$$z_t = \alpha + \beta CorpTax_t + \mathbf{X}_t \mathbf{B} + \epsilon_t \quad (5)$$

Table 2.11 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 U.S. MNEs to expand their global footprint beyond what is captured by cross-border

¹⁵This 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 and Acalin (2016).

¹⁶We 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.

statistics.

Using the coefficient estimates from Table 2.11 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 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 U.S. MNEs, a dimension not captured by traditional Balance of Payments procedures.

These results are also in line with our previous findings showing that 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 multinational enterprises expand their global financial footprint.

2.7 Conclusion

Multinational enterprises 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 international financial integration (IFI).

The industry-standard IFI measure relies on publicly available cross-border statistics. While this is a useful approach for studying financial globalisation, 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.

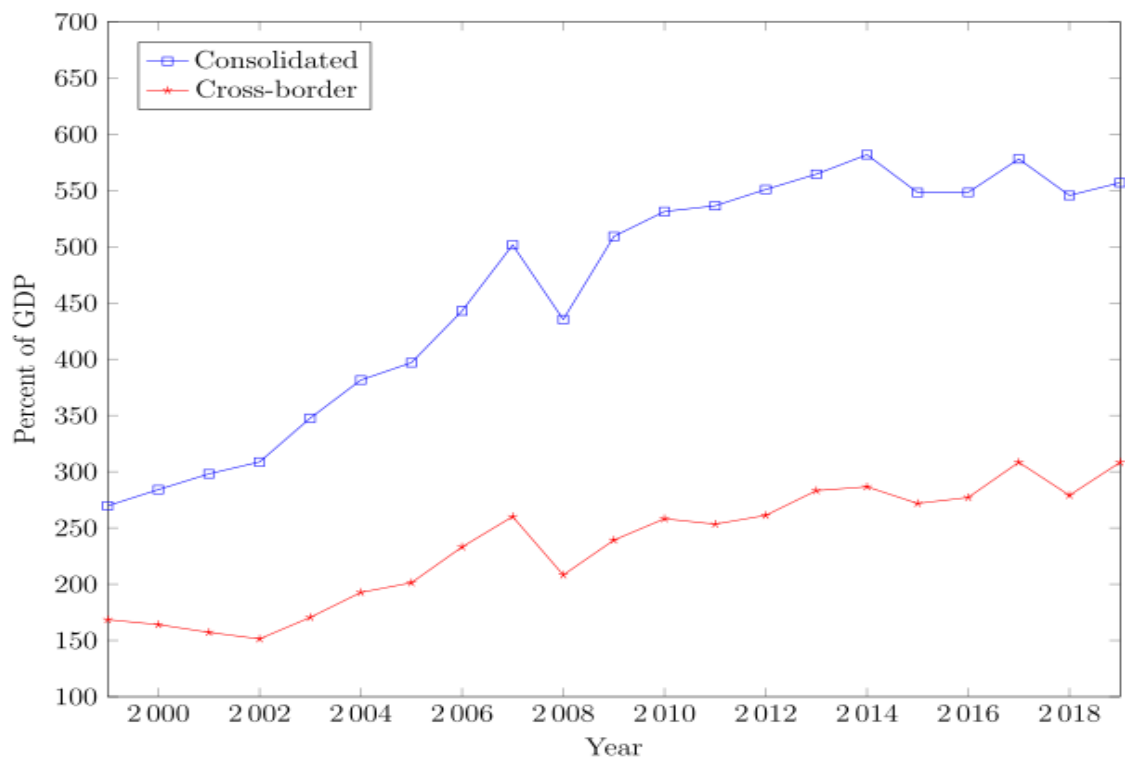
We construct the U.S. consolidated balance sheet for the period between 1999 and 2019. Adopting such consolidated approach reveals that U.S. international financial integration is on average two times larger than when computed using the traditional cross-border approach, as reported by BIS (2015) for 2012.

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

In line with that finding, our exercise confirms that U.S. non-bank multinational enterprises represent the largest source of U.S. international financial integration. In addition, they deliver the most relevant contribution to the expansion of IFI over our sample period. Around half of the expansion in consolidated-based IFI can be attributed to these firms. Given the well-documented link between the geographical decisions by multinational enterprises and tax planning, we investigate whether tax differentials are associated with the consolidated- and cross-border based measures of IFI for the U.S.

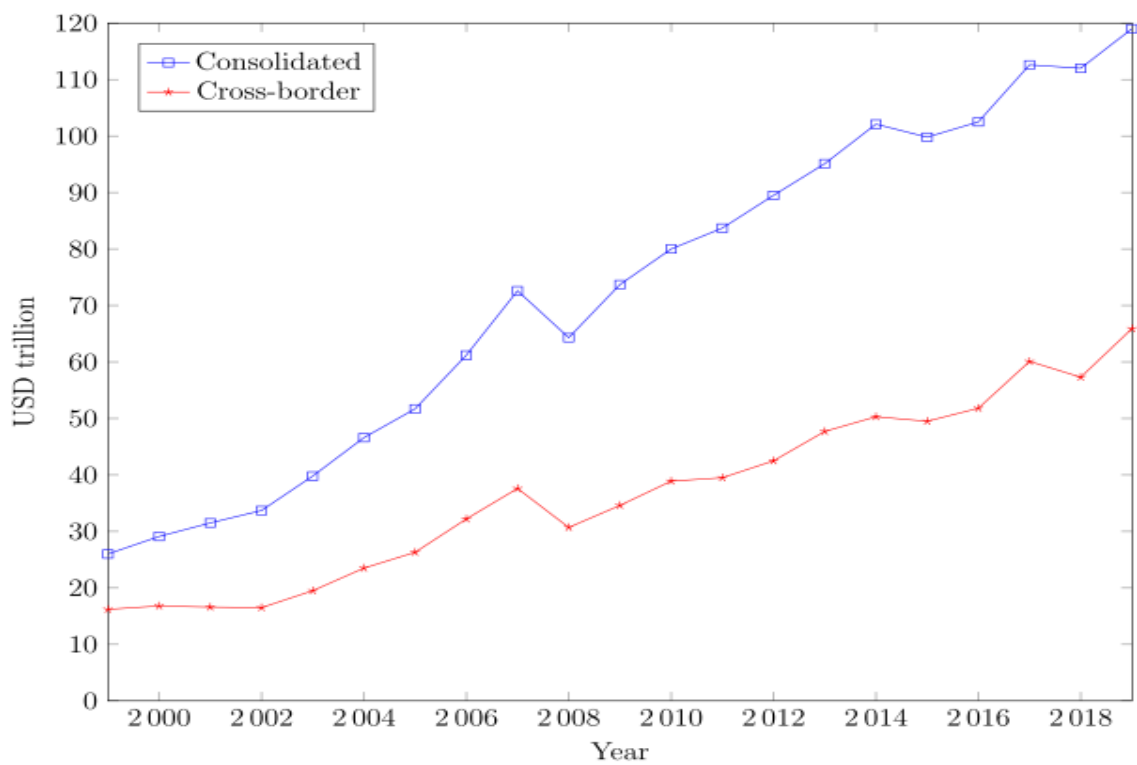
Using these novel data, we document that both IFI measures and their difference are positively correlated with tax differentials. Such finding is robust with respect to alternative specifications, control variables and tax differential definitions. Furthermore, we find that an increase in tax differentials is associated with a larger increase in consolidated than in cross-border assets of multinational enterprises. 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).

Figure 2.1: U.S. International Financial Integration



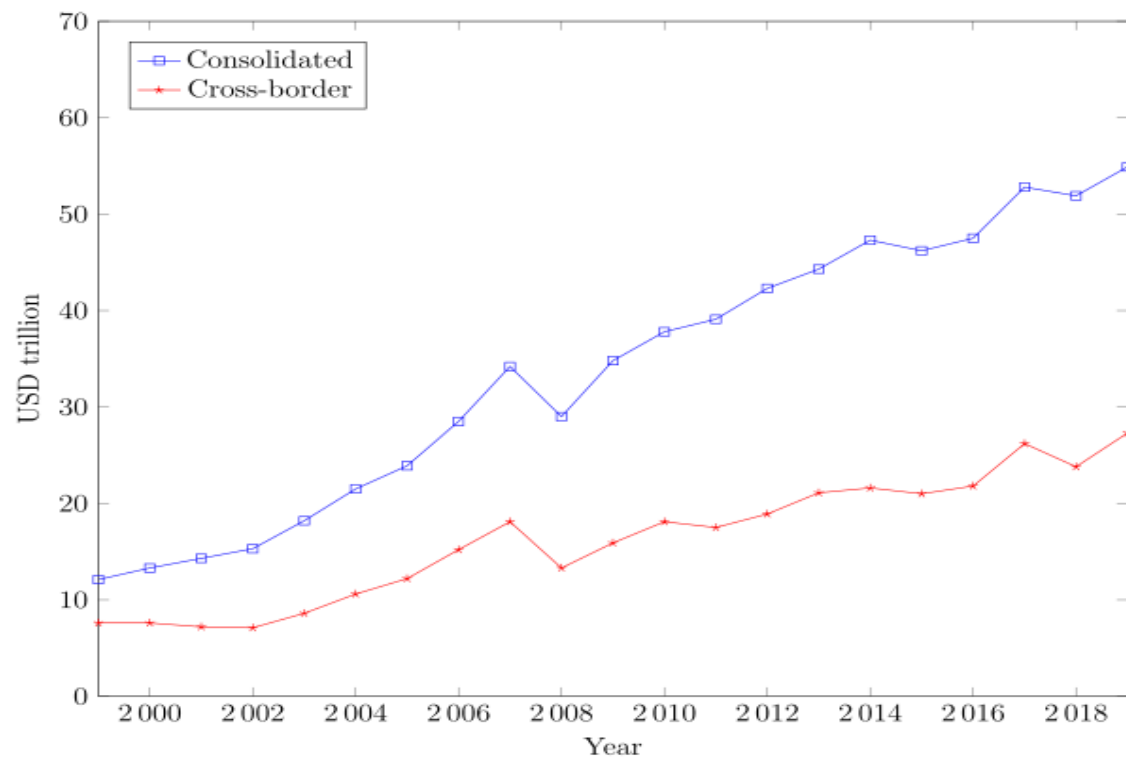
Note: This figure shows the evolution of consolidated-based and cross-border based measures of U.S. International Financial Integration. U.S. IFI is computed as the sum of foreign assets and liabilities divided by GDP. Our calculations do not include financial derivatives given the existing challenges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

Figure 2.2: U.S. Foreign Assets plus Liabilities



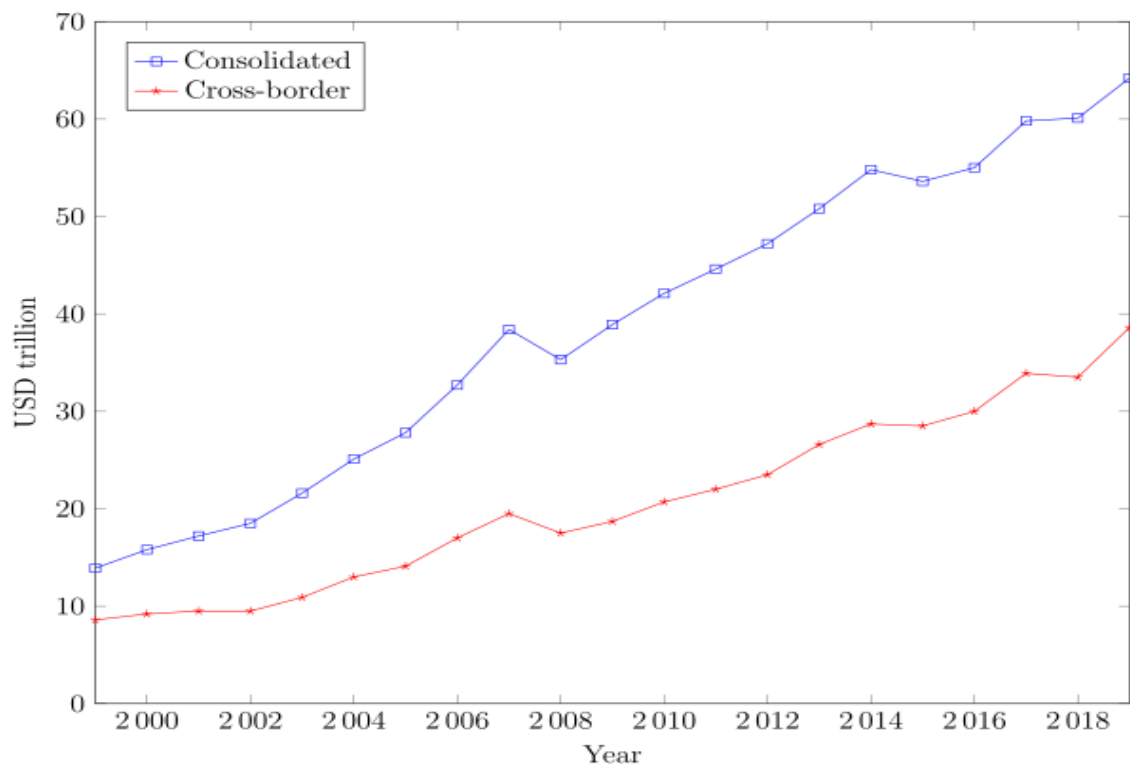
Note: This figure shows the evolution of consolidated-based and cross-border based sum of U.S. assets and liabilities. Our calculations do not include financial derivatives given the existing challenges to determine the nationality of their ultimate owners.

Figure 2.3: U.S. Assets



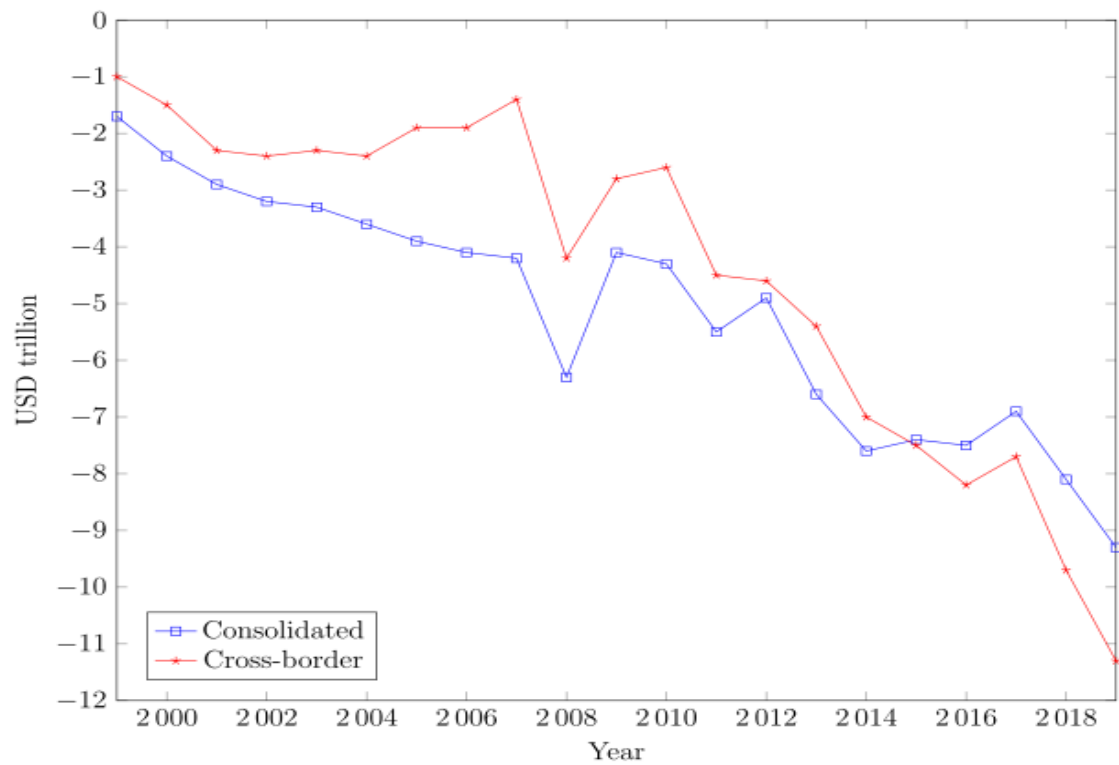
Note: This figure shows the evolution of consolidated-based and cross-border based U.S. assets. Our calculations do not include financial derivatives given the existing challenges to determine the nationality of their ultimate owners.

Figure 2.4: U.S. Liabilities



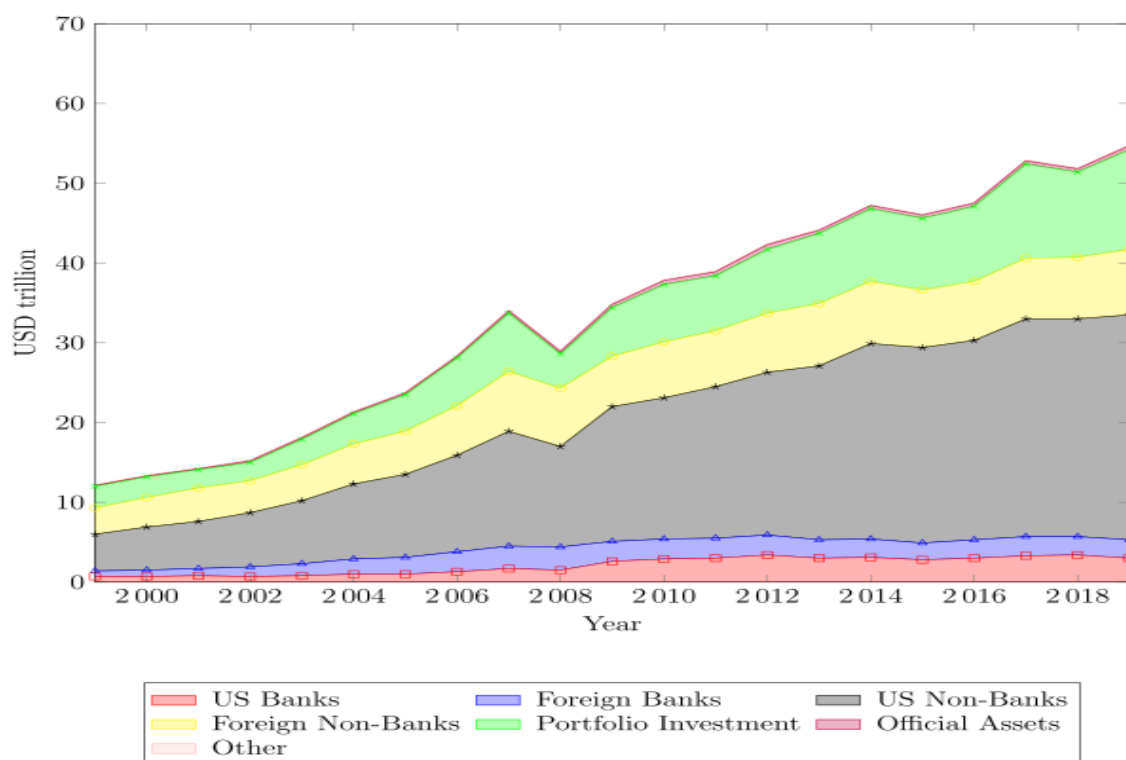
Note: This figure shows the evolution of consolidated-based and cross-border based U.S. liabilities. Our calculations do not include financial derivatives given the existing challenges to determine the nationality of their ultimate owners.

Figure 2.5: U.S. Net International Investment Position



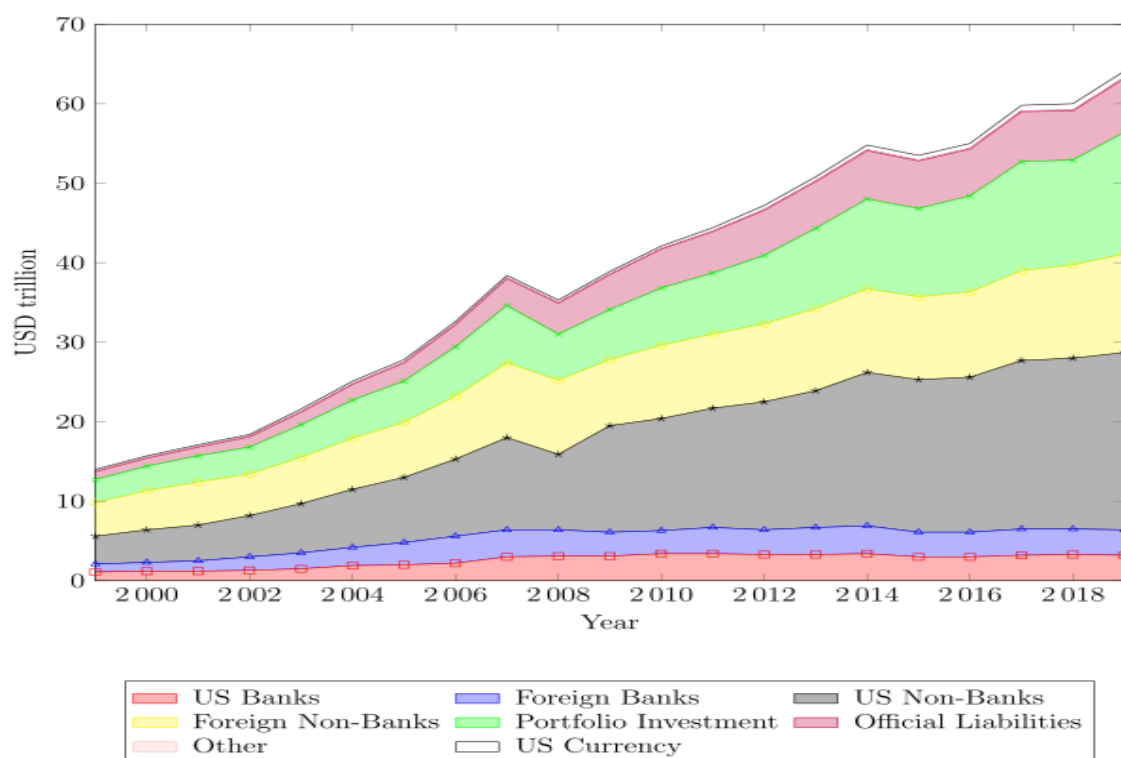
Note: This figure shows the evolution of U.S. Net International Investment Position (NIIP) using both the consolidated and cross-border approach. The NIIP is defined as the difference between U.S. assets and liabilities. Our calculations do not include financial derivatives given the existing challenges to determine the nationality of their ultimate owners.

Figure 2.6: U.S. Consolidated Foreign Assets



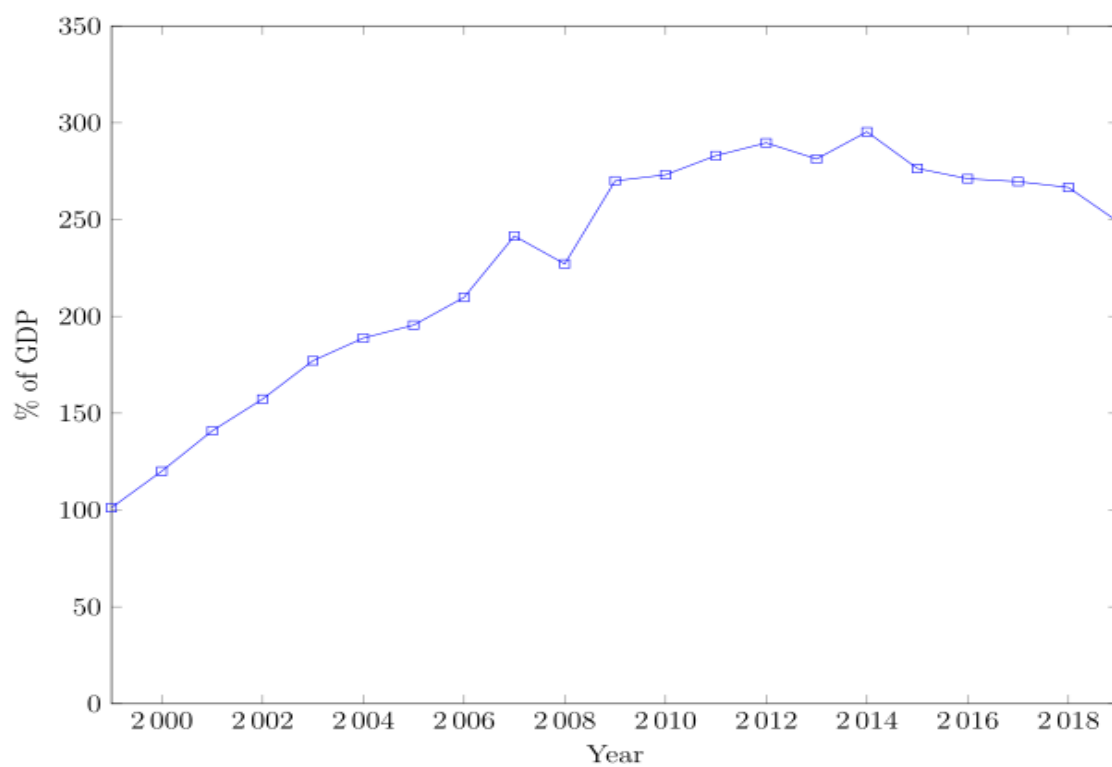
Note: This figure shows the time-varying composition of U.S. consolidated foreign assets over the sample period. The 'other non-financial reported assets' pre-2013 category and the 'other non-bank reported assets' post-2013 category are pooled into a 'other reported assets' subgroup that is quantitatively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

Figure 2.7: U.S. Consolidated Foreign Liabilities



Note: This figure shows the time-varying composition of U.S. 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 2.8: Difference between Consolidated and Cross-Border IFI



Note: This figure the time-varying difference between the consolidated- and cross-border measures of U.S. International Financial Integration.

Table 2.1: U.S. Consolidated Foreign Balance Sheet - 2019 (USD bn)

Item	Assets	Liabilities
Bank-reported		
Consolidated US banks	3,045	3,247
Foreign banks	2,349	3,248
Financial non-banks		
U.S. multinationals	7,920	6,901
Affiliates of foreign multinationals	4,315	4,830
Non-financial companies		
U.S. multinationals	20,265	15,376
Affiliates of foreign multinationals	3,885	7,578
Private portfolio investments	12,493	15,302
Official assets and liabilities	514	6,765
Other non-financial reported	74	97
U.S. currency	-	825
Total	54,860	64,170

Note: This table shows the U.S. 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 U.S. Bureau of Economic Analysis (BEA), the U.S. Treasury International Capital System (TIC), the Bank for International Settlements (BIS) and the Federal Reserve Board. The procedure used here to estimate the U.S. consolidated balance sheet is similar to that used in BIS (2015).

Table 2.2: 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			
U.S. 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%
U.S. currency	-	295%	295%
Total	353%	363%	358%

Note: This table shows the cumulative growth rate of each item to the overall growth in U.S. 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.

Table 2.3: 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			
U.S. 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%
U.S. currency	-	1%	1%
Total	100%	100%	100%

Note: This table shows the relative contribution of each item to the overall growth in U.S. 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.

Table 2.4: Regression results of measures of IFI

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
<i>Dependent Variable</i>	$IFIC_t^{XB}$	$IFIC_t^{XB}$	$IFIC_t^{XB}$	$IFIC_t^{XB}$	$IFIC_t^{CO}$	$IFIC_t^{CO}$	$IFIC_t^{CO}$	$IFIC_t^{CO}$
Constant	-59.53 (36.02)	-29.86 (22.74)	-0.60 (3.63)	-91.60** (40.85)	-200.14** (77.60)	71.01 (53.19)	1.53 (6.66)	-86.59 (82.54)
Trade Openness	2.23 (1.34)			1.84 (1.36)	7.51** (2.90)			4.02 (2.75)
Stock market capitalisation		0.23 (0.17)		0.32* (0.16)		-0.54 (0.40)		-0.15 (0.33)
<i>CorpTax</i>			1.75* (0.94)	1.81* (0.96)			7.07*** (1.72)	5.78*** (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) to (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 U.S. and the rest of the world using FDI-based time-varying weights. All regressions estimated using yearly data from 2000 to 2019. $IFIC_t^{XB} = (IFI_t^{XB}) - (\widehat{IFI_t^{XB}})$ where $(\widehat{IFI_t^{XB}})$ are the fitted values of IFI_t^{XB} on a constant and a time trend. Columns (5) to (8) show the results of linear regressions of $IFIC_t^{CO}$ on the same variables. $IFIC_t^{CO} = (IFI_t^{CO}) - (\widehat{IFI_t^{CO}})$ where $(\widehat{IFI_t^{CO}})$ are the fitted values of IFI_t^{CO} on a constant and a time trend.

Table 2.5: Regression results of the difference between consolidated and cross-border

	(1)	(2)	(3)	(4)	(5)	(6)
<i>Dependent Variable</i>	$DIFI_t$	$DIFI_t$	$DMNE_t$	$DMNE_t$	$DXME_t$	$DXME_t$
Constant	2.14 (4.49)	5.02 (49.44)	1.87 (3.82)	4.86 (41.33)	0.27 (0.87)	0.16 (10.93)
Trade Openness		2.18 (1.65)		1.92 (1.38)		0.26 (0.36)
Stock market cap.		-0.47** (0.20)		-0.42* (0.16)		-0.05 (0.04)
<i>CorpTax</i>	5.32*** (1.16)	3.97*** (1.16)	4.34*** (0.99)	3.14** (0.97)	0.98*** (0.23)	0.83** (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 U.S. and the rest of the world using FDI-based time-varying weights. All regressions estimated using yearly data from 2000 to 2019. $DIFI_t = (IFI_t^{CO} - IFI_t^{XB}) - (\widehat{IFI_t^{CO}} - \widehat{IFI_t^{XB}})$ where $(\widehat{IFI_t^{CO}} - \widehat{IFI_t^{XB}})$ 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 difference associated with multinational enterprises ($DMNE_t$) and another that is associated with all else but multinational enterprises ($DXME_t$). 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 $CorpTax_t$.

Table 2.6: Countries included in the construction of alternative *CorpTax* measures

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

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 U.S. and country i that year divided by the sum of the bilateral positions with respect to the U.S. 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 2.7: Regressions using alternative definitions of corporate tax differential

	FDI		Trade		Portfolio		Average		Median	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
<i>Dependent Variable: $DIFI_t$</i>										
Constant	2.14 (4.49)	5.02 (49.44)	2.14 (4.43)	6.97 (49.87)	2.14 (5.36)	-3.65 (54.97)	2.14 (4.36)	12.52 (48.86)	2.14 (4.79)	6.49 (52.99)
Trade Openness		2.18 (1.65)		2.03 (1.68)		3.05 (1.78)		1.87 (1.65)		2.29 (1.77)
Stock market capitalisation		-0.47** (0.20)		-0.45** (0.20)		-0.58** (0.21)		-0.46** (0.19)		-0.50** (0.21)
<i>CorpTax</i>	5.32*** (1.16)	3.97*** (1.16)	5.29*** (1.31)	3.95*** (1.17)	4.78*** (1.56)	3.41** (1.37)	5.51*** (1.14)	4.20*** (1.17)	5.47*** (1.36)	3.93** (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. $DIFI_t = (IFI_t^{CO} - IFI_t^{XB}) - (\widehat{IFI_t^{CO}} - \widehat{IFI_t^{XB}})$ where $(\widehat{IFI_t^{CO}} - \widehat{IFI_t^{XB}})$ 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 2.8: Regressions using alternative definitions of corporate tax differential

	FDI	Trade	Portfolio	Average	Median
<i>Dependent Variable: $DIFI_t$</i>					
Constant	-56.76 (66.67)	-46.27 (67.50)	-98.71 (74.22)	-44.85 (66.66)	-56.69 (72.71)
Trade Openness	1.84 (1.92)	1.65 (1.93)	2.89 (2.16)	1.49 (1.92)	1.95 (2.07)
ln(Financial Development)	-82.72 (399.08)	-35.92 (399.76)	-199.96 (457.86)	-60.67 (393.05)	-55.92 (431.21)
<i>CorpTax</i>	4.78*** (1.32)	4.82*** (1.31)	3.97** (1.65)	5.04*** (1.34)	4.84*** (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. $DIFI_t = (IFI_t^{CO} - IFI_t^{XB}) - (\widehat{IFI_t^{CO}} - \widehat{IFI_t^{XB}})$ where $(\widehat{IFI_t^{CO}} - \widehat{IFI_t^{XB}})$ are the fitted values of the difference on a constant and a time trend.

Table 2.9: Regression results including growth-related controls

	(1)	(2)	(3)
<i>Dependent Variable: $DIFI_t$</i>			
Constant	5.02 (49.44)	1.68 (50.13)	-0.82 (51.99)
Trade Openness	2.18 (1.65)	2.11 (1.67)	2.21 (1.69)
Stock market capitalisation	-0.47** (0.20)	-0.42* (0.21)	-0.40 (0.24)
<i>CorpTax</i>	3.97** (1.16)	4.20** (1.21)	3.94** (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 U.S. 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 U.S. annual GDP growth rate and RoW Growth. Regression estimated using yearly data from 2000 to 2019. $DIFI_t = (IFI_t^{CO} - IFI_t^{XB}) - (\widehat{IFI_t^{CO}} - \widehat{IFI_t^{XB}})$ where $(\widehat{IFI_t^{CO}} - \widehat{IFI_t^{XB}})$ are the fitted values of the difference on a constant and a time trend.

Table 2.10: 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** (41.0)	-83.6 (59.9)	-4253** (1659)	475.1** (177.4)	-25.2 (20.8)	7.9 (28.1)	-894.7 (970)	109.1 (91.0)	-60.6** (28.3)	-91.5** (39.9)	-3358*** (1070)	366.0** (126.6)
<i>TaxDiff</i>	2.28 (1.71)	2.29 (1.78)	2.80* (1.51)	3.92** (1.46)	-0.75 (0.87)	-0.54 (0.83)	-0.64 (0.88)	0.07 (0.75)	3.03** (1.18)	2.82** (1.19)	3.44*** (0.97)	3.85*** (1.04)
IFI ^{ROW}	1.40*** (0.10)	1.40*** (0.12)	0.66** (0.31)	0.70** (0.25)	0.71*** (0.05)	0.67*** (0.05)	0.56*** (0.18)	0.58*** (0.13)	0.69*** (0.07)	0.73*** (0.08)	0.10 (0.20)	0.12 (0.18)
VIX		-0.06 (1.27)				-0.99 (0.59)				0.93 (0.84)		
EFI			652.9** (259.9)				136.3 (151.9)				516.7*** (168)	
EDB				-35.8*** (10.27)				-11.0* (5.26)				-24.8*** (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 U.S. *VIX* is the Chicago Board Options Exchange's Volatility Index. *EFI* is the average Economic Freedom Index from the Fraser Institute. *EDB* is the number of start-up procedures to register a business for World. These data comes from the World Bank Ease of Doing Business dataset. 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 2.11: Regression results of cross-border and consolidated-based assets

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

2.A Appendix

We construct estimates of consolidated foreign assets and liabilities using data from the U.S. Bureau of Economic Analysis (BEA), the U.S. Treasury International Capital System (TIC), the Bank for International Settlements (BIS) and the Federal Reserve Board. The procedure used here to estimate the U.S. 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 2.12 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 2.13 summarizes the estimation procedure for the components of the consolidated external balance sheet for the period between 1999 to 2012.

2.A.1 U.S. banks and foreign banks

Consolidated U.S. bank assets are equal to the total claims of U.S. banks on all counterparts except U.S. counterparts. This data series is available on the BIS consolidated banking statistics database on a quarterly frequency. Consolidated U.S. bank liabilities are estimated as the local liabilities of U.S. banks abroad plus U.S. 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 U.S. relative to U.S. counterparts are booked as U.S. foreign assets. Similarly, the total claims of foreign banks on US counterparts are booked as U.S. foreign liabilities. These data series also come from the BIS consolidated banking statistics database and are reported on a quarterly basis.

2.A.2 Non-bank U.S. Multinational Enterprises

The total assets of U.S.-owned non-bank Multinational Enterprises (MNEs) operating outside the U.S. are booked as U.S. foreign assets.¹⁸ The BEA provides yearly data on the total assets of U.S.-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 U.S. Treasury started to be reporting TIC data using

¹⁸We 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 U.S. 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 U.S. MNEs and U.S. affiliates of foreign MNEs can be seen as upper bounds.

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 U.S. 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 U.S. parent company. The FDI data also comes 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.

2.A.3 Non-bank Foreign Multinational Enterprises

The total assets of foreign-owned MNEs operating in the U.S. are booked as U.S. foreign liabilities. We compute the U.S. foreign assets as the difference between the total assets of foreign-owned MNEs operating in the U.S. on a sectoral basis and the FDI received by the U.S. in each sector. This procedure is analogous to that used when booking U.S. external liabilities arising from U.S.-owned MNEs operating abroad. The difference between the total assets of foreign-owned MNEs operating in the U.S. and the FDI received by the U.S. 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 U.S. 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 U.S. affiliates of foreign MNEs, we estimated it by applying the proportion observed for majority-owned U.S. affiliates as they represent more than 90 percent of the universe of all U.S. affiliates of foreign MNEs.¹⁹

¹⁹For the year of 2017, the total assets of all U.S. affiliates of foreign MNEs was equal to USD 15.8tn while the total assets of majority-owned U.S. 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 U.S. affiliates of foreign MNEs as USD 6.8tn ($= 15.8 \cdot \frac{6.2}{14.5}$), which is booked as an U.S. foreign liability.

2.A.4 Private portfolio investments

U.S. private portfolio assets are equal to the total holdings of foreign securities by U.S. 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 U.S. International Investment Position database from the BEA on a quarterly frequency.

U.S. private portfolio liabilities are the total holdings of U.S. 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, U.S. private portfolio liabilities are calculated as the difference between U.S. total portfolio liabilities and the portfolio liabilities to foreign official agencies. Both series come from the BEA International Investment Position database.

2.A.5 Official assets and liabilities

U.S. official assets are equal to the U.S. reserve assets as reported in the IIP. This data series is available on the BEA International Investment Position database on a quarterly frequency. Similarly, U.S. official liabilities are equal to the U.S. liabilities to foreign official agencies. This includes U.S. 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.

2.A.6 Other non-financial reported

Other non-financial reported U.S. foreign assets are claims on unaffiliated foreigners reported by U.S. non-financial companies. Other non-financial reported U.S. foreign liabilities are liabilities to unaffiliated foreigners reported by U.S. non-financial companies. Both data series come from the U.S. 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 U.S. Treasury reported claims and liabilities reported by non-banks instead of by non-financial companies.

2.A.7 U.S. Currency

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

2.A.8 Cross-Border Estimates

The cross-border estimate of total assets used in this paper is the U.S. total assets excluding financial derivatives that comes from the international investment position database from the BEA. Similarly, the cross-border estimate of total liabilities used is the U.S. 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.

Table 2.12: U.S. Consolidated Foreign Balance Sheet (2013-2019)

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

Table 2.13: U.S. 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 U.S. banks operating abroad plus U.S. 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		
U.S. multinationals	Total assets of non-bank U.S. multinational enterprises operating abroad.	Total assets of non-bank U.S. multinationals operating abroad minus the FDI made by the U.S. in the non-banking sector.
Affiliates of foreign multinationals	Total assets of non-bank U.S. affiliates of foreign multinationals minus the FDI received by the U.S. in the non-banking sector.	Total assets of non-bank U.S. affiliates of foreign multinationals.
Private portfolio investments	Foreign equity and bond securities holdings by U.S. residents.	U.S. equity and bond securities holding by foreigners excluding official agencies.
Official assets and liabilities	U.S. official reserve assets.	U.S. portfolio and other investments holding by foreign official agencies.
Other non-bank reported	Claims on unaffiliated foreigners reported by U.S. non-bank companies.	Liabilities to unaffiliated foreigners reported by non-bank firms.
U.S. currency	-	U.S. currency held by the rest of the world

3 A consolidated-by-nationality approach to Irish foreign exposure¹

3.1 Introduction

How exposed is Ireland to foreign shocks? Relying on residence-based measures of foreign holdings to answer this question can be challenging. These statistics are obscured by the vast presence of Special Purpose Entities (SPEs) in the country. In residence-based statistics, foreign assets and liabilities are sorted according to the residence of the immediate counterparts. Consequently, the cross-border positions held by these Irish-resident financial intermediaries appear in Ireland's external balance sheet. However, these entities frequently have no economic ties to Irish agents. Lane (2019) notes that the large size of these holdings imply that the positions of Irish agents are not visible in the headline data. Such opaqueness poses an obstacle for policymakers when assessing the exposure of the Irish economy to foreign shocks.

Consider a foreign-owned SPE resident in Ireland whose sole purpose is to raise capital from international investors and transfer these resources to the company's headquarters located abroad. Suppose this Irish-resident company sells one billion Euros in bonds and lends one billion Euros to its parent company. Under the residence-based approach, the bonds issued by this entity and purchased by international investors will be recorded as Irish foreign liabilities. Similarly, the loans sent to its home country will be booked as Irish foreign assets. As a result, the presence of this SPE in Ireland will increase the sum of Irish external assets and liabilities by two billion Euros. However, the activities conducted by this company have virtually no relation to Irish agents. In line with this example, Galstyan et al. (2021) provide evidence of cross-country financing happening through Irish-resident SPEs.

Alternatively, one could rely on consolidated-by-nationality statistics to provide a more accurate description of Irish foreign exposure. Its key principle is to sort foreign assets

¹A slightly modified version of this paper was published in *International Economics*, Volume 170, August 2022, Pages 235-247.

and liabilities according to the nationality of the ultimate counterparts. In this example, such approach would imply leaving the holdings of the SPE out of Ireland's consolidated foreign balance sheet as these holdings do not have Irish agents as their ultimate counterparts. By not incorporating such holdings, the consolidated-by-nationality balance sheet would provide a more accurate description of the foreign exposure related to Irish agents.

More generally, Avdjiev et al. (2016) and McCauley (2018) show that assessing the exposure of any country to international financial risks is particularly difficult when relying on residence-based statistics. In our example, the bonds issued by the SPE and sold to foreign investors represent Irish external liabilities under the residence-based approach. However, these bonds represent a financial exposure of the ultimate foreign owner of that SPE and not of Irish nationals. Under the consolidated approach, these bonds would be recorded as liabilities of the country of the foreign owner of that SPE. Therefore, the consolidated-by-nationality approach can be particularly useful in identifying ultimate financial exposures as noted by Lane (2021).

Furthermore, Lane (2021) notes that the consolidated framework also provides a useful perspective on multinational enterprises (MNEs). Di Nino et al. (2020) describe the challenges posed by the activities of MNEs in residence-based statistics. One such challenge is that the activities of foreign affiliates of an MNE are not recorded in the external accounts of the country of the parent MNE but rather in the accounts of the countries hosting such affiliates. In contrast, the consolidated-by-nationality approach consolidates the holdings of such affiliates and attributes them according to the nationality of their ultimate owner. As a result, the consolidated-by-nationality approach provides a complementary view on the activities of MNEs operating abroad.²

In this paper, I construct the Irish consolidated-by-nationality foreign balance sheet for the period between 2011 and 2019. The balance sheet is constructed using a novel methodology that builds on firm-level data. This methodology relies on both publicly available data as well as data from Bureau van Dijk's Orbis Europe and FAME. I adopt a similar categorization as that used in BIS (2015) when constructing the consolidated-by-nationality foreign balance sheet.

The key stylized fact that emerges from this analysis is that Ireland's consolidated-by-nationality foreign balance sheet is smaller when compared to its residence-based analogue. A measure of the size of the foreign balance sheet is the index of international financial integration as in Lane and Milesi-Ferretti (2003). The index is computed as the sum of a country's foreign assets and liabilities divided by its GDP. Using data from

²Daamgard and Elkjaer (2019) provides evidence that the global FDI network changes in important dimensions relative to the conventional residence-based approach once positions are allocated according to their ultimate owners.

Lane and Milesi-Ferretti (2021), the residence-based index of international financial integration for Ireland stood at 2,944% of GDP in 2019 as the sum of its external assets and liabilities was equal to EUR 10.5 trillion. In contrast, the sum of Irish consolidated-by-nationality foreign assets and liabilities was equal to EUR 5.61 trillion (1,572% of GDP) in that year.

Over the sample period, I find that Ireland's consolidated-by-nationality foreign balance sheet is on average 46.7% smaller relative to the residence-based one. Devereux and Yu (2020) show that international financial integration increases the degree of cross-country contagion. Therefore, I interpret this finding as indicating that Ireland is less exposed to foreign shocks than what is captured by residence-based statistics.

Affiliates of foreign non-bank MNEs represent the main source of Irish international financial integration. In 2019, their activities are associated with EUR 923.2 billion in Irish foreign assets and EUR 2,172.1 billion in foreign liabilities. Of that amount, U.S. MNEs are the most relevant ones as their activities account for over half of the Irish foreign liabilities related to foreign non-banks. This result suggests that Ireland is particularly exposed to shocks in the U.S. that affect the decision-making of these MNEs. U.S. firms are followed by German and U.K. firms in terms of the size of Irish foreign holdings associated with their activities.

The contribution of this paper is twofold. First, this paper proposes a novel methodology to estimate consolidated-by-nationality foreign holdings of countries using firm-level data. This approach is motivated by the seminal work of Kalemli-Ozcan et al. (2015). In particular, I use company-level financial and ownership data to compute consolidated holdings related to Irish MNEs operating abroad as well as to foreign MNEs operating in Ireland. The second contribution of this paper is that it is the first to produce estimates of consolidated foreign assets and liabilities for Ireland.

The remainder of the paper is organized as follows. Section 3.2 provides further context on why consolidated-by-nationality statistics are useful in assessing foreign exposure. Section 3.3 presents the methodology used to estimate each category of the Irish consolidated balance sheet as well as the different data sources used. Section 3.4 presents the main stylized facts that emerge from the consolidated balance sheet. Section 3.5 concludes.

3.2 Foreign exposure and consolidated statistics

Affiliates of foreign MNEs operating in Ireland can react to shocks happening there as well as in their home country. However, the Irish exposure to these multinationals might not be entirely captured in residence-based statistics.

Consider the risk that a U.S. MNE decides to shut down its operations in Ireland in case it gets hit by a negative shock at home. This group-level decision to a shock happening in the home country would produce a spillover effect in the host country. One measure to quantify the exposure the Irish economy has relative to this risk would be to look at the assets held by this MNE in the country.

However, the assets held by this MNE in Ireland will only enter the residence-based balance sheet of both countries if they were financed by U.S. residents. The portion of assets funded locally won't appear in neither Ireland's nor in the U.S. balance sheet. Despite that, the U.S. parent may still decide to dispose these assets not captured in traditional Balance of Payments statistics.

In consolidated statistics, all positions held by this MNE would be taken into account. The assets this U.S. MNE holds in Ireland would be booked as U.S. consolidated foreign assets and Irish liabilities. Similarly, the funding provided by Irish agents to this corporation would be booked as Irish consolidated foreign assets and U.S. liabilities. Therefore, the consolidated approach would provide a more comprehensive view on the exposure the Irish economy has relative to U.S. MNEs.

As in this example, the recent literature has pointed to the role MNEs play in transmitting shocks from their home country into host countries. Avdjiev et al. (2018) show that cross-border lending by global banks is influenced by monetary policy decisions taken in their home country. Similarly, Avdjiev et al. (2021) show that cross-border lending in foreign affiliates is more influenced by decision taken in the home country than those taken in the host country.

McCauley et al. (2019) pointed to the importance nationality plays in determining global decision-making in banking. Their study showed that the global retrenchment in cross-border lending seen in cross-border data following the Great Financial Crisis was not a worldwide phenomenon. Rather, their nationality-based analysis showed that this decline in cross-border lending was driven by European banks that shredded assets to restore capital ratios.

Regarding non-banks, Bénétrix and Sanchez Pacheco (2021) provide evidence that tax-related factors are associated with U.S. MNEs expanding their global footprint beyond what is captured by residence-based statistics.

Finally, Lane (2021) notes that the consolidated framework could be particularly useful in identifying ultimate financial exposures. He argues that consolidated-by-nationality approach should complement the existing residence-based statistics. This paper is the first to estimate Ireland's consolidated-by-nationality foreign holdings.

3.3 Methodology

The Irish consolidated foreign balance sheet is constructed using both publicly available data as well as firm-level data from Bureau van Dijk's Orbis Europe and FAME datasets. Given data availability limitations, this paper provides estimates of the consolidated balance sheet for the period between 2011 and 2019. When sorting foreign assets and liabilities, this paper follows a categorization similar to BIS (2015) and Bénétrix and Sanchez Pacheco (2021).

Foreign assets and liabilities related to the activities of multinational enterprises are divided into three categories depending on the main activity such enterprises conduct. Assets and liabilities related to the banking sector are calculated using the Bank for International Settlements data. Those related to financial non-banks and non-financial MNEs are calculated using FAME and Orbis Europe as well as U.S. Bureau of Economic Analysis data. Table 3.2 in the Appendix summarizes the data sources used to estimate foreign holdings for each category of the Irish balance sheet.

The estimates of foreign assets and liabilities presented in this paper are denominated in Euros. Positions reported in US dollars by the BIS, IMF and U.S. BEA are converted to Euros using the end of year Euro-dollar exchange rate. Therefore, currency fluctuations generate changes in the Euro value of foreign holdings from one period to the next.

3.3.1 Non-financial foreign multinational enterprises

Estimates of Irish consolidated foreign assets and liabilities that are related to activities of non-financial foreign multinational enterprises (MNEs) are constructed using a procedure similar to that used by BIS (2015) and Bénétrix and Sanchez Pacheco (2021) for the United States. However, unlike in the U.S., there is currently no existing public estimate of asset holdings by foreign MNEs operating in Ireland nor of Irish MNEs operating in foreign countries.

In order to overcome such challenge, this paper uses company-level data to construct estimates of Irish consolidated foreign assets and liabilities. The data used comes from the FAME database which contains financial and ownership information from 687 thousand companies operating in Ireland, among which 256 thousand that are currently active. As a first step, companies that have never reported total assets are removed from the sample regardless of their status. This procedure shrinks the sample down to 301.5 thousand companies.

Given the current focus on foreign MNEs operating in Ireland, all companies whose ultimate owner is identified by FAME as an Irish national or whose ultimate owner

cannot be determined are excluded from the sample.³ Such step produces a total of twelve thousand companies operating in Ireland whose ultimate owner can be identified as non-Irish. Of this total, Figure 3.A.8 in the Appendix shows that 45.7% of the firms have reported total asset holdings below EUR 5mn in its last available period. However, Figure 3.A.9 in the Appendix reveals that these companies hold only 0.15% of the overall sum of total assets of all foreign companies operating in Ireland.

As the focus of this paper is to estimate consolidated foreign holdings, foreign companies that have last reported total asset holdings below EUR 5 million are also excluded from the sample. This procedure produces a sample of 6,899 foreign enterprises whose ultimate owner are identified as non-Irish.

Identifying financial companies

The sample of foreign MNEs that last reported total assets greater than EUR 5 million contains both financial and non-financial companies. Given the current focus on determining Irish foreign assets and liabilities related to foreign non-financial MNEs, the sample must be split according to the primary activity conducted by each company. Industry activity classification information according to the UK Standard Industrial Classification (SIC) 2007 is available for 6,598 foreign companies operating in Ireland out of the 6,899 in the sample. These industry codes are equivalent to the European NACE codes.

Companies whose primary activity code is in section K ('Finance and Insurance') are removed from the sample of non-financial foreign MNEs. Similarly, companies whose code is in group 77 ('Rental and Leasing') are also excluded from the sample in question. Such decision is motivated by the substantial presence of aircraft leasing companies in Ireland as documented by Osbourne-Kinch et al (2017). A few other finance-related codes not covered by these two categories are also used to identify firms as financial companies. Table 3.3 contains all the five digit SIC codes used to identify financial firms. Out of the 6,899 companies in the sample, this procedure identifies 3,164 companies as non-financial and 3,735 as financial companies.

These non-financial companies jointly hold EUR 1.94 trillion in total assets and employ 355.9 thousand people according to the last available data. Figure 3.A.10 shows the number of foreign companies by the country of the group ultimate owner. The U.S. and the U.K. represent the two countries with the largest number of companies operating in the Republic of Ireland. Within the European Union, Germany and France are the countries with the largest number of affiliates in Ireland.

³The identification of the ultimate owners follows the standard classification adopted by Bureau van Dijk. More specifically, an entity is identified as the ultimate owner of any given subsidiary it owns at least 50.01% of that subsidiary.

Figure 3.A.11 displays the sum of total asset holdings of these non-financial foreign MNEs according to the country of their ultimate owner. Around 65% of these holdings can be attributed to U.S.-owned companies while 6% can be apportioned to U.K.-owned companies. Figure 3.A.12 shows the number of employees of these non-financial foreign MNEs according to the country of their ultimate owner when available.

Addressing reporting gaps

Many companies in the sample present gaps in their financial data. For an example, Dell Products is an U.S.-owned non-financial company operating in Ireland whose status in FAME is listed as active. Data on the total assets of this company is available for 2003-2009 and for 2011-2020 but not for 2010. In order to avoid jumps in the sample, the total asset holdings of Dell Products for the year of 2010 is assumed to be the same as in 2009.

Whenever there is missing data on an active company's total assets and/or shareholders' equity, data from the last available period prior to that one is inputted instead. That is, if a company is listed as active but has no available data for period T , data from period $T - z$ such that $z > 0$ is the smallest possible is inputted.

In case a company is not listed as active, the next step after identifying a reporting gap for a certain period T depends on whether there is financial data available for at least one period $T + k$, $k > 0$, that succeeded T . If that is the case, the data from the last available period prior to that one T is inputted.

If there is no financial data available for future periods $T + k$ for a company not listed as active, this is an indicative that the company became inactive at period T . Therefore, total assets and shareholders' equity are set to zero from that period T onward.

This algorithm is used to generate inputted firm-year financial data whenever there is a reporting gap. Inputted data on total assets and shareholders' equity represent 8.7% of the observations later used to compute Irish consolidated foreign assets and liabilities related to foreign-owned non-bank multinationals.

Besides data on total assets and shareholders' equity, data on same-group inter-company loans is used to estimate Irish foreign assets and liabilities. Inter-company loan data can be substantially more volatile than shareholders' equity and total assets and include frequent sign changes (e.g. from net creditor to net debtor) from one period to the other. Unlike equity and total assets, it is also entirely possible that companies do not report inter-company loans for a given year because there were no such claims in that period. Given these differences, inter-company loans are only included as reported.

Consolidated liabilities are estimated as the sum of the total assets of non-financial

foreign MNEs operating in Ireland minus any same-group inter-company loans (assets) held by these companies. The latter represents an asset the Irish affiliate of a foreign MNE owns with respect to another company owned by the same group. As the ultimate owner of such multinational enterprise is the same, these same-group transactions are excluded when looking at consolidated-by-nationality international statistics.⁴

The result is an estimate of assets owned by foreign companies operating in Ireland with respect to Irish nationals, which is accordingly booked as Irish consolidated foreign liabilities. As it is possible that part of these assets refers to holdings owned by these Irish affiliates with respect to non-Irish nationals, the estimates presented in this paper represent an upper bound.

Consolidated assets are estimated as the sum of the total liabilities of non-financial foreign MNEs operating in Ireland minus their shareholders' equity and any same-group inter-company loans (liabilities) received by these companies. The equity and inter-company loans represent liabilities the affiliates have with respect to their ultimate owner and/or to companies in the same group. Therefore, these same-group transactions are also excluded when consolidated-by-nationality international statistics.

This procedure generates an estimate of liabilities held by foreign companies operating in Ireland with respect to Irish nationals, which is booked as Irish consolidated foreign assets. It is possible that part of the remaining liabilities held by these Irish affiliates is in fact associated with non-Irish counterparts. As a result, the estimate presented in this paper also represent an upper bound.

Figure 3.A.13 in the Appendix show the evolution of Irish foreign assets and liabilities related to non-financial MNEs. The increasing difference between foreign liabilities and assets is a result of foreign MNEs increasing their asset holdings in Ireland through equity and/or intra-group loans.

3.3.2 Non-financial Irish MNEs operating abroad

Data from Bureau van Dijk's Orbis Europe and the U.S. Bureau of Economic Analysis are used to estimate Irish consolidated foreign assets and liabilities related to non-financial Irish MNEs operating abroad. Taken together, these two sources contains data related to European countries and the United States shown in Table 3.4.

While relying solely on these sources excludes the activities of Irish MNEs in other countries, data from the IMF Coordinated Direct Investment Survey indicate that almost all activities from Irish companies happen in the covered countries. In particular, the

⁴Loans between two entities within the same group would not enter the consolidated foreign balance sheet of any country as their ultimate owner (and nationality) are the same for both.

sum of Irish outbound direct investment positions relative the countries listed in Table 3.4 represent on average 96% of all Irish direct investment positions whose recipients are (1) identified and (2) non-haven countries, for the period between 2009 and 2019.⁵ Figure 3.A.14 reveals that this ratio remained above 90% throughout the entire sample. Such elevated ratio indicates that just a tiny part is potentially missed when focusing on European countries and the U.S. to construct estimates of Irish foreign assets and liabilities related to non-financial Irish MNEs.

The following subsections describe the methodology used to estimate Irish consolidated foreign assets and liabilities related to non-financial Irish MNEs. The procedure adopted relative to U.S. affiliates of Irish MNEs is akin to that used in BIS (2015). In contrast, the methodology for companies located in European countries is similar to that used for non-financial foreign MNEs operating in Ireland.

Companies operating in the United States

The U.S. Bureau of Economic Analysis (BEA) provides detailed data on activities of U.S. affiliates of foreign MNEs. I use data from the BEA to estimate Irish consolidated foreign assets and liabilities related to non-financial Irish MNEs operating in the U.S. The procedure is similar to that used in BIS (2015) and Bénétrix and Sanchez Pacheco (2021).

For the period between 2007 and 2019, the BEA reports total asset holdings of all majority-owned U.S. affiliates of foreign MNEs at a country- and industry-level data. I proceed by subtracting the total asset holdings of financial majority-owned U.S. affiliates of Irish MNEs from the total asset holdings of all majority-owned U.S. affiliates of Irish MNEs. The resulting series is then divided by 98.5% which is the average ratio of the total asset holdings of all majority-owned U.S. affiliates of Irish MNEs and all U.S. affiliates of Irish MNEs during this period.

This procedure generates estimates of the total asset holdings of non-financial Irish MNEs operating in the United States. Such estimates are accordingly booked as Irish consolidated foreign assets related to non-financial Irish MNEs operating abroad. Irish consolidated foreign liabilities are estimated as the difference between the estimated total asset holdings of non-financial Irish MNEs operating in the U.S. and the FDI made by Ireland in the U.S. As both series are estimated in USD terms, these values are then converted to Euro using end-of-period exchange rate data from the International

⁵Haven countries include Bermuda, Cayman Islands and Jersey. These countries are excluded as the Irish direct investment position in these countries does not appropriately measure the activities of Irish MNEs in them. As such, the ratio used is given by the sum of Irish outbound FDI position relative to countries in Table 3.4 divided by the total Irish outbound FDI position excluding the positions whose recipients are not identified and positions relative to the three haven countries.

Monetary Fund.

For the period between 2003 and 2006, there is less detailed data available. As such, Irish consolidated foreign assets are computed as the total assets of majority-owned non-bank Irish MNEs operating in the U.S. once again divided by 98.5%.⁶ Irish consolidated foreign liabilities are computed as the difference between the estimated total asset holding minus the FDI made by Ireland in the U.S. Figure 3.A.15 shows the evolution of Irish foreign assets and liabilities related to its non-financial MNEs operating in the United States.

Companies operating in Europe

Irish consolidated foreign assets and liabilities related to non-financial Irish MNEs operating in Europe are estimated using Bureau van Dijk's Orbis Europe. The first step involves selecting all companies located outside of Ireland whose ultimate owners are identified in Orbis Europe as Irish.⁷ As in the case of foreign MNEs in Ireland, companies that have reported total assets below EUR 5 million are removed from the sample. This procedure generates a sample of 3,239 companies operating outside of Ireland whose ultimate owners are at first identified as Irish. Furthermore, Orbis Europe provides the NAICS 2007 industry code for 96.7% of the companies. Given the current focus on non-financial companies, companies whose NAICS 2007 code is 52 (Finance and Insurance) are removed from the sample which reduces it to 3,110 companies.

Addressing redomiciliation

Several large corporations have decided to change their legal domicile to Ireland in the past decades as noted by Avdjiev et al (2018). Once a multinational enterprise redomiciles to Ireland, all the group's affiliates will be identified as having an Irish ultimate owner in Orbis Europe. However, this change in the domicile does not affect the nationality-based ultimate ownership of assets and liabilities. Therefore, one must account for the fact that these Irish-domiciled corporations are not owned by Irish nationals and remove them from this sample accordingly.⁸

There are 772 unique ultimate owners of the companies in the sample under consideration. These ultimate owners are classified on whether there is available evidence of redomiciliation through web searches. The repositories used to find evidence of redomi-

⁶This data availability limitation implies that financial non-bank Irish MNEs operating in the U.S. albeit small are also included for this period.

⁷Orbis Europe provides data on companies operating in countries listed in Table 3.4 excluding the United States.

⁸In an ideal setting, one would apportion foreign assets and liabilities of multinational enterprises according to the nationality of their shareholders. Unfortunately, no such detailed data-set is available at this time.

ciliation are (1) the Bloomberg Tax Inversion Tracker described in Mider (2017), (2) company websites whenever available and (3) article searches on Google based on the company name and the words "redomiciliation" and "inversion".

These searches identified 54 out of these 772 ultimate owners as either foreign multinational enterprises that re-domiciled to Ireland and/or companies that are not Irish-owned. All the global affiliates of these 54 multinational enterprises are removed from the sample under consideration as their ultimate owners cannot be best described as Irish nationals.

For an example, Medtronic is a Minnesota-based medical device multinational enterprise that owns 62 affiliates in countries covered by Orbis Europe. Information from both the Bloomberg Tax Inversion Tracker as well as the company's website provide enough evidence that Medtronic has changed its domicile to Ireland in 2015. As such, all these affiliates are listed as having an Irish ultimate owner. Once it is determined that their ultimate owner cannot be best described as an Irish national, these companies are excluded from the sample that is used to compute Irish foreign assets and liabilities related to Irish non-financial multinational enterprises operating abroad.

These 54 identified foreign multinational enterprises collectively own 722 affiliates located in countries covered by Orbis Europe. They have a reported cumulative EUR 734.1 billion in total assets as of 2019. Given the relevant size of these holdings, failing to identify redomiciled companies as such could produce overstated estimates of Irish foreign assets. Once these foreign-owned companies are excluded from the sample, financial data from the remaining Irish-owned non-financial companies are used to compute Irish foreign assets. Orbis Europe provides data on total asset holdings and shareholders' funds for these companies for the period between 2011 and 2019.⁹ Reporting gaps are addressed using the same procedure for non-financial foreign MNEs operating in Ireland as described in subsection 3.3.1.

Irish consolidated foreign assets related to non-financial Irish MNEs operating abroad are estimated as the sum of the total asset holdings of these companies. Similarly, Irish consolidated foreign liabilities related to these companies are computed as the difference between the sum of total asset holdings and the sum of total shareholders' funds. Figure 3.A.16 show the evolution of Irish foreign holdings related to non-financial MNEs in Europe.

Due to the lack of a publicly available and frequently updated dataset on redomiciliation, it is possible that the searches conducted failed to identify all companies that have redomiciled to Ireland. In such case, the estimates of Irish consolidated foreign holdings

⁹Unlike in the FAME database, Orbis Europe does not provide data on same group inter-company loans.

to non-financial Irish MNEs presented here would potentially be upward biased.

3.3.3 Irish and foreign banks

I use data from the Bank for International Settlements (BIS) to estimate Irish consolidated foreign assets and liabilities related to activities from both Irish and foreign banks. The methodology used in this paper is similar to that used in BIS (2015) and Bénétrix and Sanchez Pacheco (2021). All original data series are expressed in U.S. dollar terms. These values are converted to Euro using end-of-period exchange rate data from the International Monetary Fund. Data from the BIS Consolidated Banking Statistics is used on an immediate counterparty basis. Such reporting basis provides a longer time series than the guarantor basis one, with quantitatively small differences between the two.

The claims held by Irish banks on all counterparts except Irish counterparts are booked as Irish consolidated foreign assets. This data series is available on the BIS consolidated banking statistics database on a quarterly frequency. The local liabilities of foreign banks operating in the Ireland relative to Irish counterparts are also booked as Irish foreign assets. These data series also come from the BIS database and are reported on a quarterly basis. Figure 3.A.17 shows the evolution of Irish consolidated foreign assets related to banks. It points to a sharp reduction in foreign assets led by Irish banks reducing their foreign holdings after the Global Financial Crisis.

The liabilities related to the operations of Irish banks is estimated as the local liabilities of Irish banks abroad plus Irish banks cross-border liabilities excluding those to related offices.¹⁰ Meanwhile, the total claims of foreign banks on Irish counterparts are booked as Irish foreign liabilities. Figure 3.A.18 shows the evolution of Irish consolidated foreign liabilities related to banks. It shows that Irish banks also reduced their foreign liabilities over this period. Figure 3.A.19 show the significant decline in Irish foreign exposure related to banks in the aftermath of the Global Financial Crisis.

3.3.4 Financial non-bank foreign MNEs

Irish consolidated foreign assets and liabilities related to financial non-bank foreign MNEs are estimated using data from FAME. We proceed with the sample of 3,735 financial companies located in Ireland whose ultimate owner are identified as non-Irish and have reported last reported total assets of at least EUR 5 million. This sample contains all

¹⁰There is a reporting gap related to local liabilities of Irish banks abroad between 4Q2005 and 4Q2013. In this gap period between the two reported values, these local liabilities shrank by a percentage close to that observed in cross-border liabilities. As such, I assume that these two variables experienced the same quarterly growth rates over this period. Therefore, I use the quarterly change rates from cross-border liabilities to estimate time path of local liabilities over this period.

the companies that were excluded in subsection 3.3.1 when computing foreign assets and liabilities related to non-financial foreign MNEs operating in Ireland.

This sample includes banks and special purpose entities that have very little or no presence at all in Ireland. Galstyan et al (2021) identify cross-country debt financing links that happen through part of these companies. These activities increase the size of Ireland's residence-based foreign balance sheet but have no little to no relation to Irish nationals or firms. Therefore, these companies must be identified and removed from the sample when estimating the consolidated-by-nationality foreign assets and liabilities related to financial non-banks.

In the case of banks, I remove from this sample companies whose SIC codes are banks as the assets and liabilities related to these companies were already estimated in subsection 3.3.3. This procedure reduces the sample of foreign financial non-banks down to 3,728.¹¹

Identifying and removing SPEs is a particularly challenging task that involves adopting a set of assumptions. In such sample, there are companies that have a physical presence in Ireland and do business locally. However, there are also companies whose sole purpose often is to provide financial intermediation between two non-Irish nationals. While the activities of the latter group are included in residence-based international accounts, these activities should generate little to no implication in nationality-based accounts. As such, a procedure to identify and eliminate these pass-through companies is needed.

Albeit imperfect, the criterion used is that a company must have last reported at least one employee for it to remain in the sample. As a result, all foreign financial non-banks that have never reported the number of employees or that have last reported zero employees in Ireland are removed from the sample. This step reduces the number of companies down to 602.¹²

One example of a special purpose entity captured by this criterion and excluded from the sample is Rusal Capital DAC. Its ultimate owner is the EN+ Group from Russia that controls Rusal. Rusal Capital's main activity is best described as 'other credit granting activity' which is characterized as a financial activity. It has never reported the number of employees in Ireland. Rusal Capital owned USD 1.6 billion in total assets in 2019. This entire amount was consisted of loans to Russian companies Rusal and JSC Russian

¹¹That is, I exclude from this sample companies whose SIC code are subgroups 64110 ('Central banks') and 64191 ('Banks').

¹²While the majority of companies are excluded when applying such criterion, the lack of detailed enough data constraints the choices that can be made to identify and remove pass-through companies from the sample. If such criterion was not applied, Irish consolidated foreign assets and liabilities related to foreign financial non-banks would be equal to EUR 1238.4 billion and EUR 703.3 billion, respectively in 2018. This compares to EUR 244.2 billion and EUR 428.6 billion when applying the criterion.

Aluminium. However, Rusal Capital DAC had a bit more than one thousand dollars in shareholders' equity. The loans given to the two Russian aluminium companies were funded by bond issuance by Rusal Capital totaling USD 1.6 billion.

In essence, Rusal Capital DAC is an Irish-resident financial corporation whose purpose is to intermediate financing from foreign investors to the two aluminium companies in Russia. While Rusal Capital has little-to-none economic ties to Irish nationals, its presence in Ireland increases the country's residence-based foreign balance sheet by approximately USD 3.2 billion.

Using this sample, Irish consolidated foreign liabilities are computed as the sum of the total asset holdings of the foreign financial non-banks minus any same-group inter-company loans (assets) held by these companies. Irish consolidated foreign assets are computed as the sum of the total liabilities of non-financial foreign MNEs operating in Ireland minus their shareholders' equity and any same-group inter-company loans (liabilities) received by these companies. Figure 3.A.20 shows the evolution of Irish foreign assets and liabilities related to foreign financial non-banks in the country.

3.3.5 Irish financial non-banks

As before, I use data from Orbis Europe and the U.S. BEA to estimate the Irish consolidated foreign assets and liabilities related to the activities of Irish financial non-banks abroad.

Companies operating in the United States

Irish consolidated foreign assets and liabilities related to Irish financial non-banks operating in the U.S. are estimated using data from the U.S. Bureau of Economic Analysis. The estimation procedure is similar to that employed in subsection 3.3.2.

The BEA does not provide a detailed breakdown on the total asset holdings of Irish financial non-banks operating in the U.S. However, it does provide such data for majority-owned financial non-bank companies whose ultimate beneficiary owner is European excluding France, Germany, the Netherlands, Switzerland and the United Kingdom. For this 'Other Europe' group, I compute the share of total asset holdings of non-bank institutions relative to the total assets recorded under 'Finance and Insurance'. Such ratio can be calculated for the period between 2012 and 2019. For the period between 2007 and 2011, I input the value from the first observation (2012).

I then assume that the ratio of total assets holdings of majority-owned Irish financial non-banks relative to all majority-owned Irish financial companies operating in the U.S. is the same as that of the 'Other Europe' group. Using such ratio, I produce produce an

estimate of the total asset holdings of majority-owned Irish financial non-banks operating in the U.S.

The second key assumption I make is that the total asset holdings of Irish majority-owned financial non-banks represent 98.5% of the total asset holdings of all Irish financial non-bank companies operating in the U.S., which is the same ratio observed for all Irish companies irrespective of their activities. Put together, these two assumptions applied to the available data generates estimates of total asset holdings of Irish financial non-banks operating in the U.S. for the period between 2007 and 2019.

A final step is needed to compute the Irish consolidated foreign liabilities related to the operation of these financial non-banks operating in the U.S. As before, these liabilities are estimated as the difference between the total asset holdings minus the FDI made by Ireland in this sector of the U.S. economy. Unfortunately, there are several data gaps in the series of Irish FDI stock in the U.S. finance and insurance ex-banking sector. Whenever there is a gap between two actual observations, the missing values are estimated by interpolation. The missing values that preceded the first actual observation (2009) and succeeded the last observation (2016) are assumed to be equal to the nearest actual observation. This procedure generates a series of Irish FDI in the U.S. finance and insurance ex-banking sector for the period between 2007 and 2019.

Irish consolidated foreign assets are equal to the estimated total asset holdings of Irish financial non-banks operating in the U.S. Meanwhile, Irish consolidated foreign liabilities are calculated as the difference between the estimated total asset holdings of these companies and the estimated series of Irish FDI in the finance and insurance ex-banking sector. Figure 3.A.21 show the evolution of Irish foreign holdings related to Irish financial non-banks in the U.S. These estimates are very small compared to other items of the consolidated balance sheet.

Companies operating in Europe

In the case of Europe, the same sample of 3,261 companies taken from Orbis Europe described in subsection 3.3.2 is used. Financial non-banks are identified as those whose NAICS 2007 code belongs in the 52 group (Finance and Insurance) but are not monetary authorities (5211) nor depository institutions (5221). Data on total asset holdings and shareholders' funds are available from 2011 to 2019. Reporting gaps are addressed using the same procedure described in subsection 3.3.1.

Irish consolidated foreign assets related to financial non-bank Irish MNEs operating abroad are estimated as the sum of the total asset holdings of these companies. Similarly, Irish consolidated foreign liabilities related to these companies are computed as the difference between the sum of total asset holdings and the sum of total shareholders'

funds. Figure 3.A.22 show the evolution of Irish foreign holdings related to Irish financial non-banks in the Europe. As in the case of companies operating U.S., these estimates are also tiny compared to other items of the Irish consolidated balance sheet.

3.3.6 Portfolio Investments

Consolidated foreign assets and liabilities related to portfolio investments would ideally be calculated by sorting these investments according to the nationality of the ultimate owner of each debt and equity securities worldwide. Coppola et al (2021) construct estimates of portfolio investment holdings according to the nationality of their ultimate owners. However, the fact that Ireland is one important financial hub for the European Monetary Union makes it particularly challenging to identify which assets and liabilities are ultimately held by Irish nationals.

In the absence of such nationality-based data, I use data from the Central Statistics Office (CSO) to estimate Irish consolidated foreign assets and liabilities related to portfolio investments. The CSO provides a breakdown of Ireland's residence-based international investment position according to whether they are related to activities conducted by financial intermediaries or not. The key assumption I make is that the external assets and liabilities held by these financial intermediaries are not associated with Irish nationals. As such, Irish foreign assets and liabilities are estimated as Ireland's external assets and liabilities that unrelated to financial intermediaries, respectively.

3.3.7 Official assets and liabilities

Irish consolidated foreign assets related to the official sector is equal to Ireland's official external assets. Data on official assets comes from the Irish Central Statistical Office (CSO) on a monthly frequency.

3.4 Stylized Facts

Table 3.1 shows Ireland's consolidated foreign balance sheet for the year of 2019. It reveals that Irish foreign assets are estimated at EUR 2.16 trillion while its foreign liabilities totaled EUR 3.44 trillion. In terms of their contribution to Irish international financial integration, non-financial foreign multinationals represent the most relevant category as the sum of foreign assets and liabilities related to them is EUR 2.21 trillion. This group is followed by non-financial Irish multinationals operating abroad with EUR 1.3 trillion and financial non-bank foreign multinationals in Ireland with EUR 0.9 trillion.

The micro-level data allows one to estimate the Irish consolidated-by-nationality foreign assets and liabilities related to non-bank foreign multinational enterprises according to

the country of their ultimate owners. Figure 3.1 shows Irish foreign holdings related to these entities in 2019. U.S. non-bank MNEs represent the largest source of Irish foreign assets and liabilities. Collectively, activities conducted by these U.S. companies increased the sum of Ireland's foreign assets and liabilities by EUR 1,413.2 billion in that year. German and U.K. firms come in distant second and third places with a sum of foreign assets and liabilities associated to them of EUR 297.1 billion and EUR 275.1 billion respectively.

One important stylized fact that emerges from the data is that Ireland's consolidated-by-nationality foreign balance sheet is substantially smaller than its cross-border analogue. Figure 3.2 shows the sum of foreign assets and liabilities using both the consolidated and well as the cross-border methodologies. Data on cross-border foreign assets and liabilities comes from Lane and Milesi-Ferretti (2021). This figure shows that the consolidated balance sheet is substantially smaller throughout the entire sample period. In 2019, the sum of Irish foreign assets and liabilities stood at EUR 10.5 trillion from a cross-border perspective which compares to EUR 5.61 trillion from a consolidated-by-nationality perspective. These estimates indicate that the consolidated-by-nationality foreign balance was 46.6% smaller than its residence-based counterpart in 2019. Between 2011 and 2019, the consolidated-by-nationality balance sheet is estimated to be on average 46.7% smaller than the cross-border one.

The gross exposure estimates are shown in trillions of Euros rather than as a percentage of GDP as Lane and Milesi-Ferretti (2003). Such decision is motivated by the fact that the activities of foreign multinational enterprises operating in Ireland inflate its GDP. A smaller and more appropriate measure of the size of the Irish economy is the GNI* published by Ireland's Central Statistics Office. GNI* removes from the Gross National Income factor income of re-domiciled companies as well as depreciation on aircraft leasing as well as on imported intellectual property. Honohan (2021) shows how the Irish economy compares to foreign countries when such adjustment is done.

The Irish consolidated-by-nationality foreign balance sheet is smaller than its residence-based counterpart for two reasons. First, the consolidated-by-nationality approach does not include assets and liabilities held by Irish-resident foreign SPEs. In contrast, the cross-border holdings of these foreign-owned entities are included in the Irish residence-based external balance sheet. Such inclusion happens despite the fact that these entities have virtually no economic ties to Irish nationals.

Second, the consolidated-by-nationality approach seeks to identify and remove holdings related to foreign companies that changed their legal domicile to Ireland. While the cross-border holdings of these Irish-resident entities are included the Irish residence-based external balance sheet, they do not enter its consolidated-by-nationality analogue.

As a result of not including the holdings of foreign-owned SPEs and redomiciled entities, the Irish consolidated-by-nationality foreign balance sheet becomes smaller than its residence-based analogue.

This important finding regarding the difference between the Irish consolidated-by-nationality and residence-based foreign balance sheets contrasts with recent studies focused on the United States. BIS (2015) and Bénétrix and Sanchez Pacheco (2021) find that the U.S. consolidated-by-nationality foreign balance sheet is larger than its residence-based analogue. Unlike Ireland, the U.S. does not have a vast presence of foreign-owned pass-through entities nor of redomiciled entities that inflate the size of its residence-based external balance sheet.

Meanwhile, U.S. MNEs hold sizable asset positions through their subsidiaries abroad. Whenever these positions are funded with resources other than coming from the United States, they will not enter the U.S. residence-based external balance sheet despite the fact that these positions represent investments from U.S. firms abroad. The consolidated approach includes these holdings in the U.S. foreign balance sheet regardless of how they were financed. These differences help explain why the U.S. consolidated-by-nationality foreign balance sheet is larger than its residence-based analogue while the opposite is true for Ireland.

Figure 3.3 shows the evolution of Ireland's consolidated foreign assets and liabilities respectively. Both assets and liabilities expanded during the sample period both in absolute terms as well as a percentage of GDP. However, foreign assets and liabilities relative to GDP have peaked in 2016. Figure 3.A.4 reveals that Irish non-financial multinational enterprises are responsible for most of the expansion in Ireland's consolidated foreign assets over the sample period.

Similarly, figure 3.A.5 reveals that the increase in Ireland's foreign liabilities over the past ten years were mostly related to foreign non-financial multinational enterprises. This expansion can be attributed to an increase in asset holdings in Ireland by these conglomerates that were mostly funded with equity and/or intra-group loans. Besides this expansion, Ireland's foreign liabilities also increased due to a build-up in portfolio liabilities.

The sum of Irish consolidated foreign assets and liabilities grew by 128.6% between 2011 and 2019. Of that total, 55.6% can be attributed to the expansion of the footprint of foreign non-financial multinationals in Ireland.¹³ In terms of relevance, that is followed

¹³The sum of Irish foreign assets and liabilities related to these companies grew by 161.9% over the sample period. As the foreign asset and liability holdings related to the companies represented 34.3% of the total in 2011, the contribution to the overall expansion in Ireland's foreign balance sheet is given by the product of the two. Therefore, the sum of the contributions across groups should be equal to the growth seen in the sum of Irish foreign assets and liabilities.

by non-financial Irish multinationals which generated a 35.6% growth contribution to the expansion of Ireland's consolidated foreign balance sheet. Foreign holdings related to the activities of foreign financial non-banks and portfolio investment have produced a contribution of around 20% each to overall balance sheet growth.

Interestingly, the banking sector generated a negative contribution of -5.2% to the expansion of Irish foreign exposure between 2011 and 2019. During the sample period, Irish banks have reduced their exposure to foreign agents. Similarly, foreign banks have also reduced their exposure to Irish agents during the same period. Figure 3.A.19 reveals that the Irish foreign exposure attributed to banking activities peaked in 2007. Banks significantly reduced their foreign exposure in the aftermath of the Global Financial Crisis. Irish consolidated-by-nationality foreign assets related to banking companies decreased from EUR 561.6 billion in 2007 to EUR 138.3 billion in 2019. Such reduction is in line with the deleveraging of European banks that followed the financial crisis as noted by McCauley et al (2019).

While Ireland's gross exposure is smaller from a cross-border perspective, its net foreign liabilities are larger from a consolidated perspective. In 2019, Ireland's net foreign liabilities stood at EUR 1.28 trillion when analysed through the consolidated approach. This compares to a EUR 486.3 billion figure when computed using the cross-border approach. Figure 3.A.6 shows the evolution of Ireland's net foreign assets using both methodologies. It reveals that the difference between the two measures of net foreign liabilities has increased over recent years. More specifically, this figure shows that Irish consolidated net foreign liabilities have grown from EUR 315.6 billion in 2011 to EUR 1.28 trillion in 2019.

The detailed categorization used in the construction of the consolidated-by-nationality foreign balance sheet can be used to determine the drivers of this aggregate trend. Figure 3.A.7 shows the evolution of Irish net foreign assets related to each balance sheet category. This figure indicates that most of the increase in Irish net foreign liabilities is related to activities of non-financial foreign multinationals operating in Ireland. The Irish net foreign indebtedness related to such firms increased from EUR 243.5 billion in 2011 to EUR 1.03 trillion in 2019. Irish non-financial multinational enterprises have partially offset such increase as their net foreign assets position improved from EUR 119.9 billion in 2011 to EUR 502.8 billion in 2019.

3.5 Conclusion

Residence-based measures of Irish foreign holdings are obscured by the vast presence of financial intermediaries in the country. These companies engage in activities that

substantially increase the size of Ireland's external balance sheet but have virtually no economic ties with the Irish households and firms. As a result, measures of gross foreign exposure such as the index of international financial integration overstate the degree to which the Irish economy is exposed to foreign shocks.

Alternatively, I construct an estimate of the Irish consolidated-by-nationality foreign balance sheet for the period between 2011 and 2019. This is done by employing a novel methodology that relies on company-level financial and ownership data to estimate consolidated foreign holdings. This procedure excludes holdings related to Irish-resident foreign-owned special purpose entities.

I find that Ireland's consolidated-by-nationality foreign balance sheet is on average 46.7% smaller than its residence-based analogue over the sample period. In the sense of Lane and Milesi-Ferretti (2003), this result indicates that the Irish economy is less financially integrated with the rest of the world when analysed through the consolidated-by-nationality approach.

Devereux and Yu (2020) show that greater financial integration increases contagion across countries. Therefore, a key policy implication of this empirical finding is that Ireland's gross exposure to foreign shocks might be less significant than when analysed through the conventional residence-based approach.

The difference between the two measures of Irish gross foreign exposure is associated with a pair of factors. First, holdings related to Irish-resident foreign-owned SPEs are not included when computing Ireland's exposure from a consolidated-by-nationality perspective. Second, holdings related to foreign companies that have redomiciled to Ireland are also not incorporated under the consolidated approach. In contrast, the cross-border holdings of these two sets of companies are included in residence-based statistics despite the fact that they have virtually no economic ties to Irish nationals. Such difference is also in line with Galstyan (2019) that shows that Ireland's external balance sheet becomes smaller once foreign holdings related to SPEs are removed from the calculation.

The estimates of Irish consolidated foreign holdings presented in this article represent upper bound estimates. This is due to the possibility that not all redomiciled foreign MNEs have been identified and removed. In addition, it is possible that not all local assets and liabilities held by Irish affiliates of foreign MNEs have Irish nationals as their ultimate counterparts. In both cases, the consolidated estimates presented here would likely overstate the true size of Ireland's consolidated-by-nationality foreign balance sheet.

In terms of relevance, foreign non-financial multinational enterprises operating in Ireland

represent the most important source of Irish international financial integration. Similarly, these companies were the largest contributors to the increase in Ireland's consolidated-based international financial integration over the past ten years.

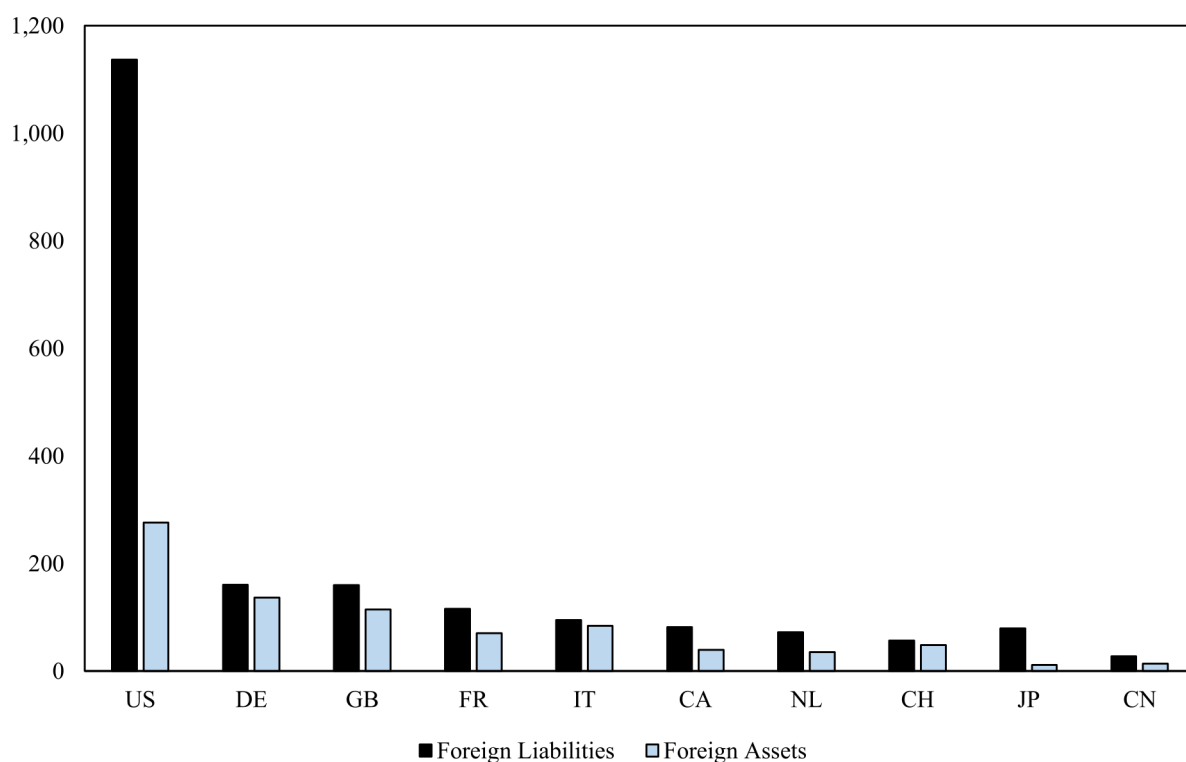
More generally, the differences between the consolidated and residence-based foreign balance sheets highlight the importance of developing consolidated-by-nationality statistics of foreign holdings.

Table 3.1: Ireland Consolidated Foreign Balance Sheet

Item	Assets	Liabilities
Bank-reported		
Irish banks	87.4	58.5
Foreign banks	50.9	69.0
Financial non-banks		
Irish multinationals	47.6	32.6
Affiliates of foreign multinationals	335.5	553.5
Non-financial companies		
Irish multinationals	890.8	389.0
Affiliates of foreign multinationals	587.7	1,618.6
Portfolio investments	158.5	721.6
Official assets	5.1	-
Total	2,163.5	3,442.7

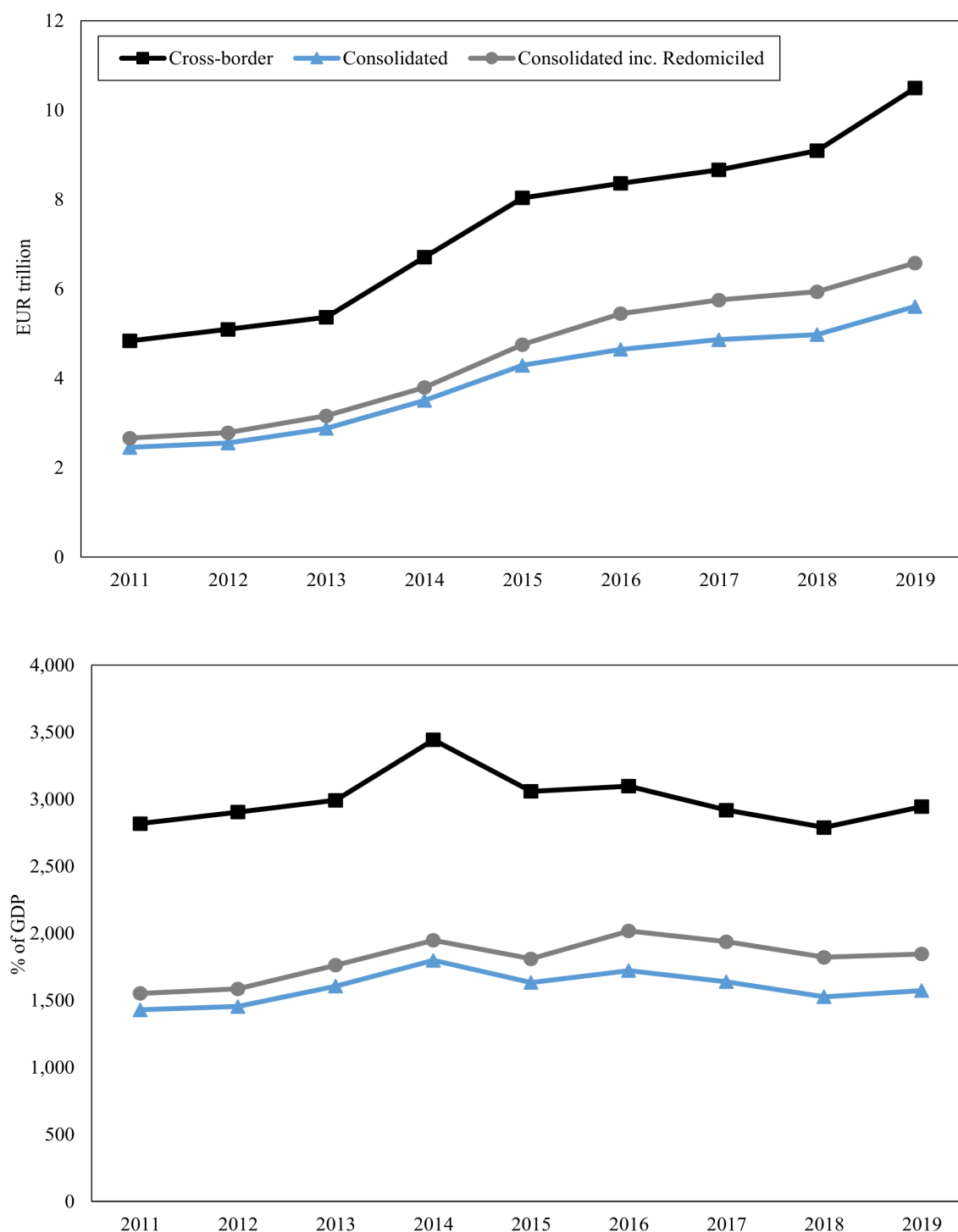
Note: This table shows the Irish consolidated foreign balance sheet for the year of 2019. The consolidated balance sheet is constructed using a methodology similar that used in BIS (2015) and Bénétrix and Sanchez Pacheco (2021). It relies on data from the U.S. Bureau of Economic Analysis, Bureau van Dijk's Orbis Europe and FAME databases, the Bank for International Settlements, Ireland's Central Statistics Office and the Central Bank of Ireland. Foreign companies that have changed their domicile to Ireland are excluded from the sample. Data reported in billions of Euros.

Figure 3.1: Irish Consolidated Foreign Holdings related to foreign non-banks



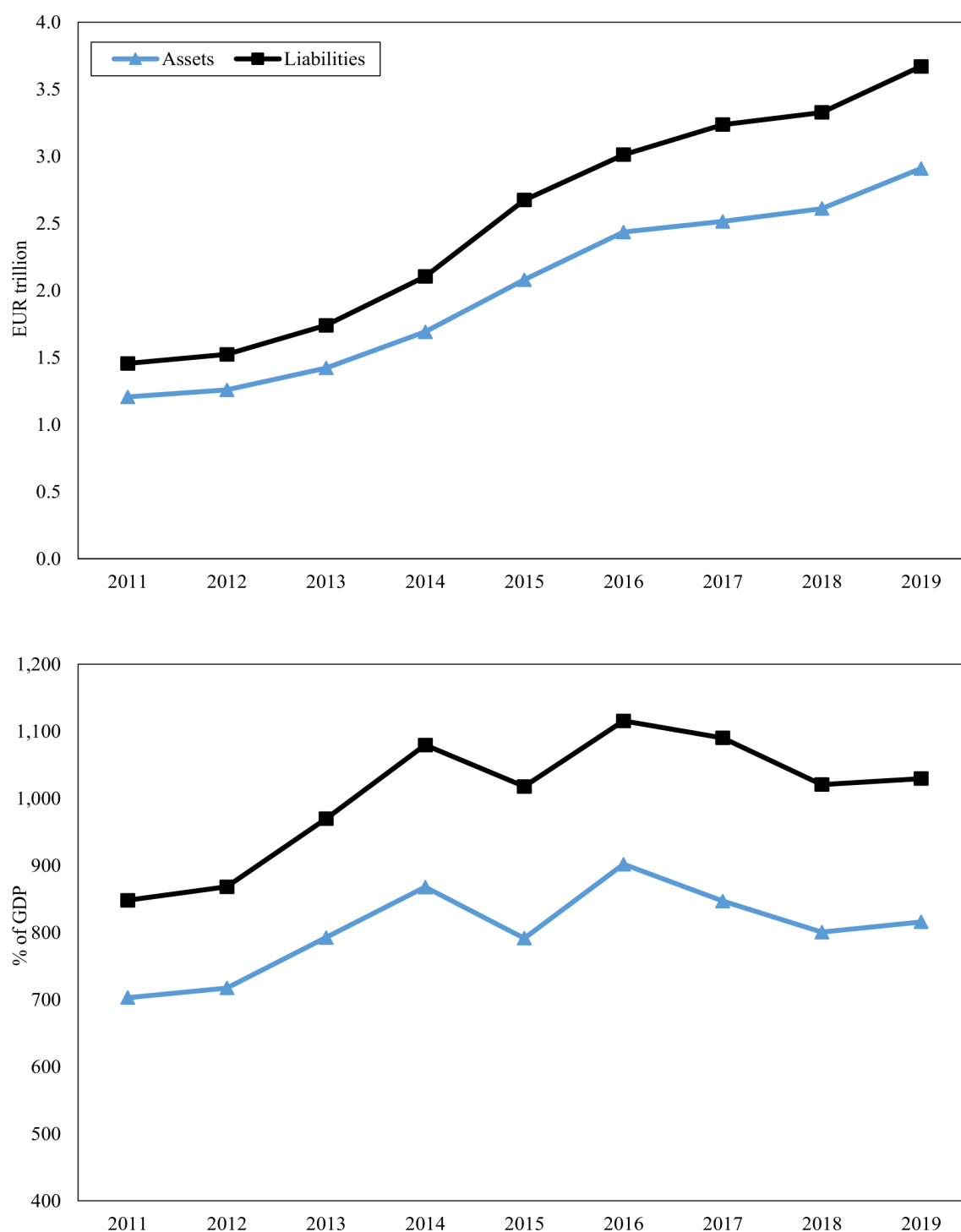
Note: This figure shows Irish consolidated foreign assets and liabilities related to foreign non-banks operating in Ireland for 2019. Foreign holdings are sorted according to the ultimate counterpart countries that own these companies operating in Ireland. These holdings are estimated using data from Bureau van Dijk's FAME data-set. Data reported in billions of Euros.

Figure 3.2: Sum of foreign assets and liabilities



Note: This figure shows the evolution of the sum of Irish foreign assets and liabilities. The blue line shows such sum when calculated using the consolidated-by-nationality approach proposed in this paper. The black line comes from Lane and Milesi-Ferretti's *External Wealth of Nations* database and shows the sum when calculated using a residence-based approach. The grey line shows the sum from a consolidated perspective when the foreign assets and liabilities related to companies that have redomiciled to Ireland are still included in the sample.

Figure 3.3: Irish Consolidated Foreign Assets and Liabilities



Note: This figure shows Irish consolidated foreign assets and liabilities. The top panel presents values in trillions of Euros while the bottom panel expresses the values as a percentage of GDP. While some of its components present a longer time series, the figure only shows data for the years in which estimates of all categories were available.

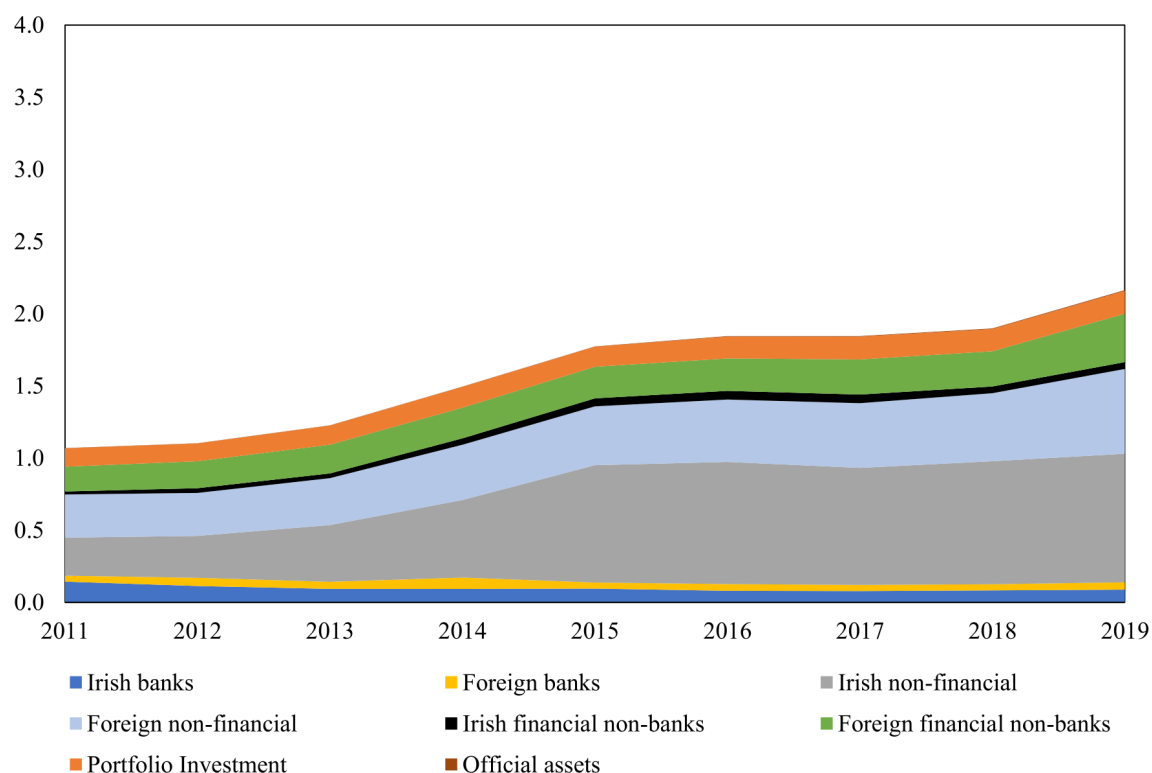
3.A Appendix

Table 3.2: Ireland Consolidated Foreign Balance Sheet: Sources

Item	Sources used
Bank-reported	
Irish banks	Bank for International Settlements
Foreign banks	Bank for International Settlements
Financial non-banks	
Irish multinationals	BvD's Orbis Europe and U.S. BEA
Affiliates of foreign multinationals	BvD's FAME
Non-financial companies	
Irish multinationals	BvD's Orbis Europe and U.S. BEA
Affiliates of foreign multinationals	BvD's FAME
Portfolio investments	Central Statistics Office
Official assets	Central Bank of Ireland

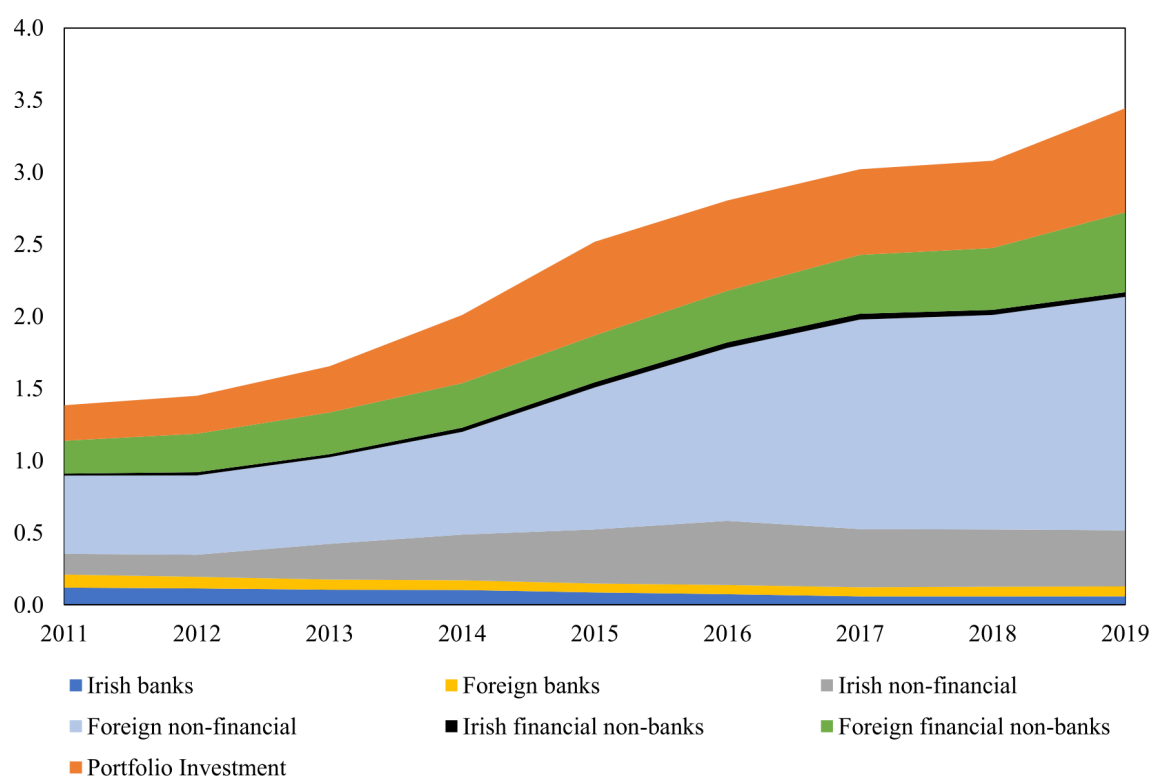
Note: This table summarizes the data sources used to the estimation of Irish consolidated foreign assets and liabilities for each category of the balance sheet. Foreign companies that have changed their domicile to Ireland are excluded from the sample.

Figure 3.A.4: Irish consolidated foreign assets



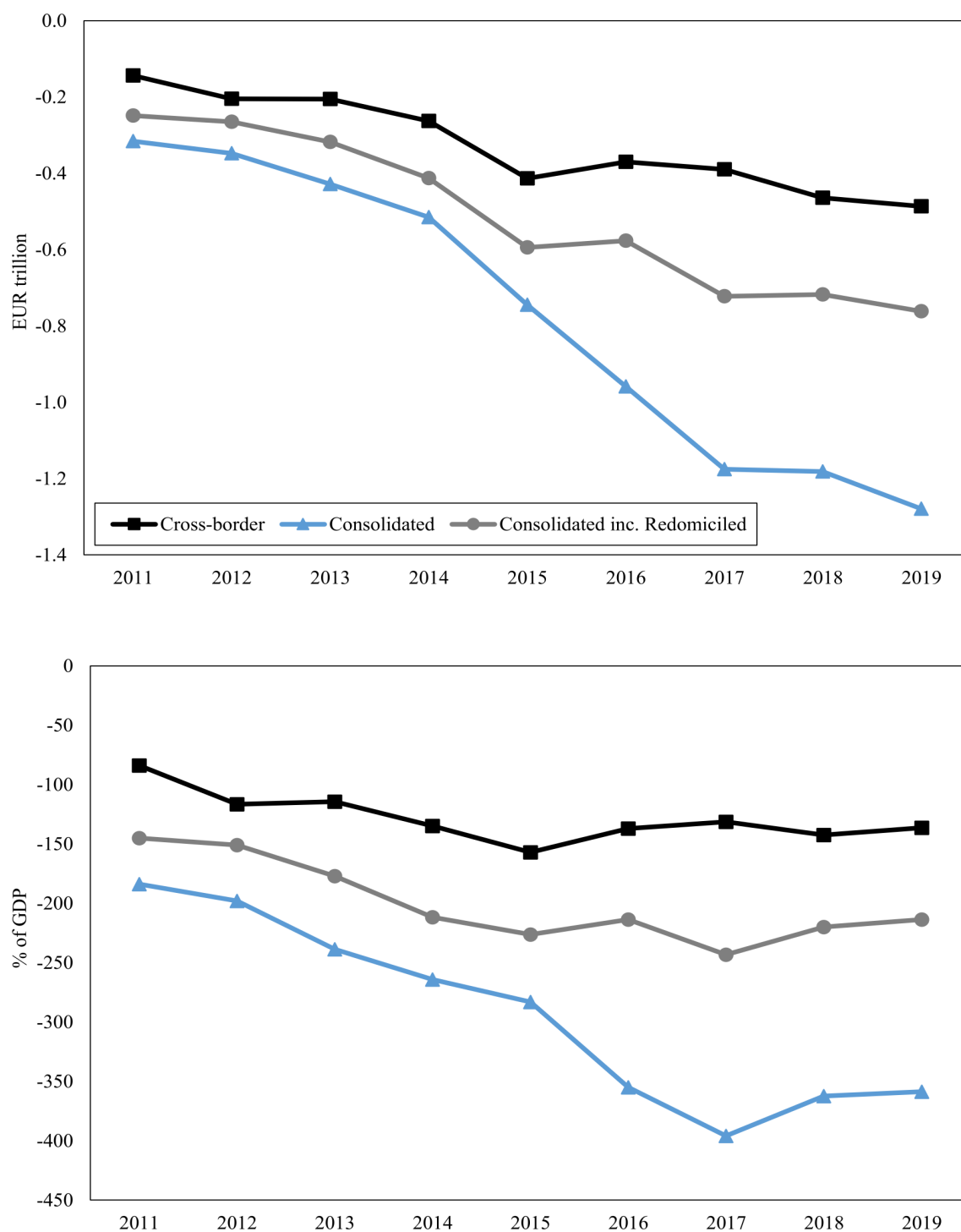
Note: This figure shows the evolution of Irish consolidated-by-nationality foreign assets related to each category. The categorization used in this paper to construct the consolidated foreign balance sheet is similar to that used in BIS (2015) and Bénétrix and Sanchez Pacheco (2021). Foreign companies that have changed their domicile to Ireland are excluded from the sample.

Figure 3.A.5: Irish consolidated foreign liabilities



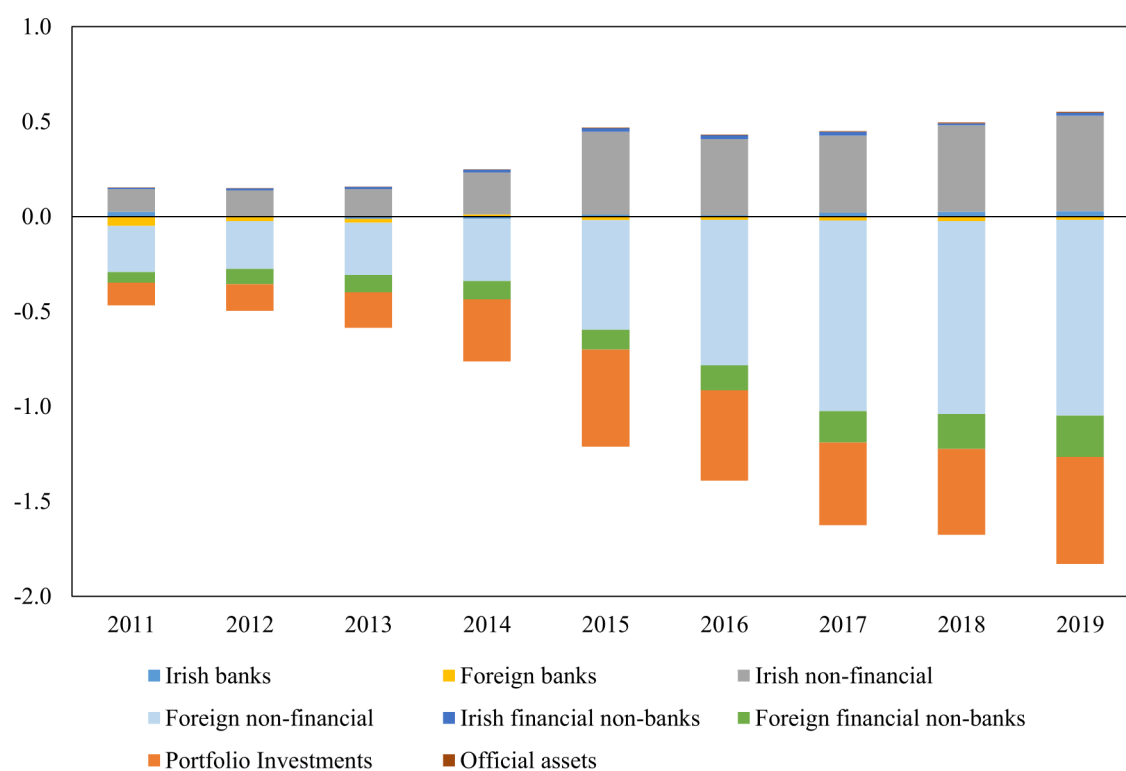
Note: This figure shows the evolution of Irish consolidated-by-nationality foreign liabilities related to each category. The categorization used in this paper to construct the consolidated foreign balance sheet is similar to that used in BIS (2015) and Bénétrix and Sanchez Pacheco (2021). Foreign companies that have changed their domicile to Ireland are excluded from the sample.

Figure 3.A.6: Irish net foreign assets



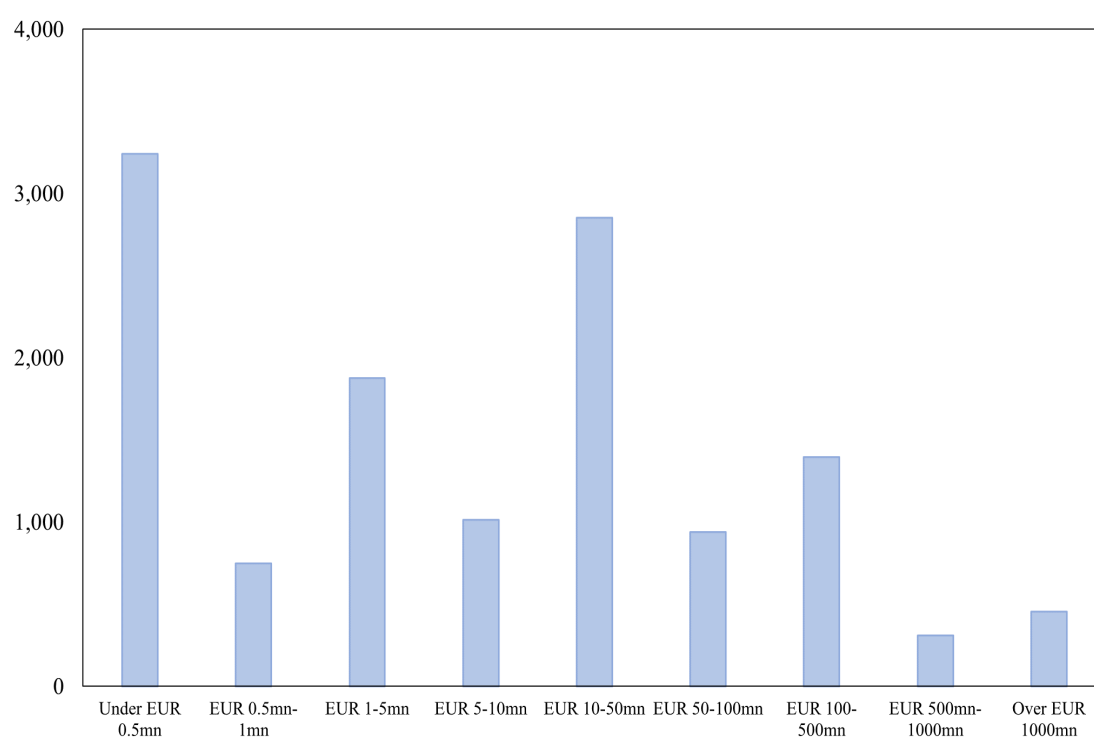
Note: This figure shows the evolution of Irish net foreign assets. The blue line shows net foreign assets when calculated using the consolidated-by-nationality approach proposed in this paper. The black line comes from Lane and Milesi-Ferretti (2018) and shows net foreign assets when calculated using a residence-based approach. The grey line shows net foreign assets from a consolidated perspective when the foreign assets and liabilities related to companies that have redomiciled to Ireland are still included in the sample.

Figure 3.A.7: Irish consolidated net foreign assets



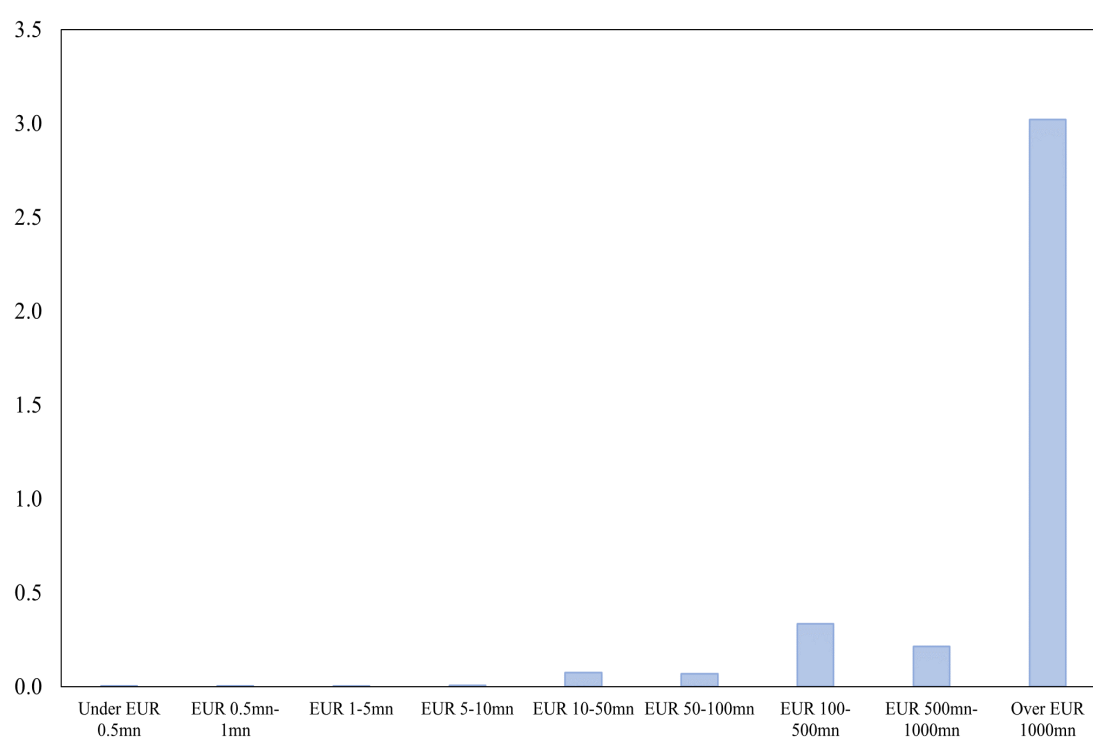
Note: This figure shows the evolution of Irish consolidated-by-nationality net foreign assets related to each category. The categorization used in this paper to construct the consolidated foreign balance sheet is similar to that used in BIS (2015) and Bénétrix and Sanchez Pacheco (2021). Foreign companies that have changed their domicile to Ireland are excluded from the sample.

Figure 3.A.8: Number of foreign MNEs per size group based on total assets



Note: This figure shows the number of companies operating in Ireland whose ultimate owner can be identified as non-Irish. Companies are grouped according to their total asset holdings in the last available period. This figure excludes companies that have never reported total assets and includes firms that are no longer active.

Figure 3.A.9: Sum of total assets of foreign MNEs per size group



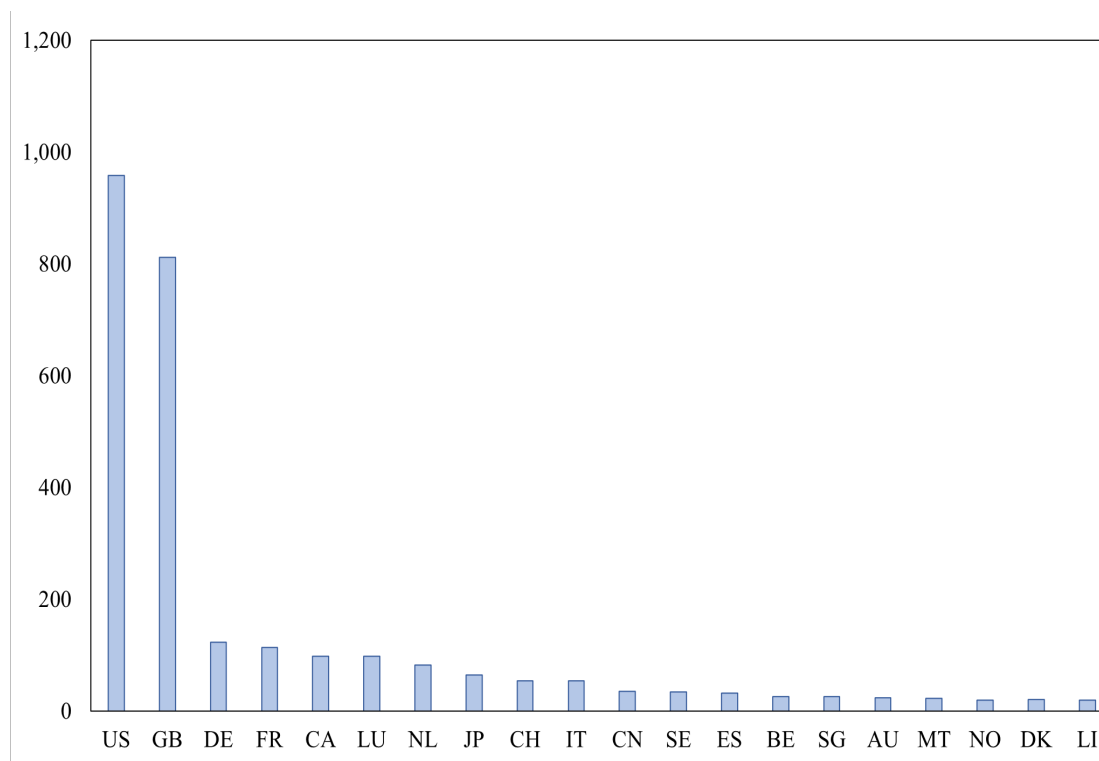
Note: This figure shows the sum of the total assets held by the companies located in each group. Only companies operating in Ireland whose ultimate owner can be identified as non-Irish are included. Companies are grouped according to their total asset holdings in the last available period. This figure excludes companies that have never reported total assets and includes firms that are no longer active. Data reported in trillions of Euros.

Table 3.3: SIC 2007 sub-classes excluded from the sample of non-financial MNEs

51210	64302	64999	66290	77320
64110	64303	65110	66300	77330
64191	64304	65120	69109	77341
64192	64305	65201	70221	77342
64201	64306	65202	77110	77351
64202	64910	65300	77120	77352
64203	64921	66110	77210	77390
64204	64922	66120	77220	77400
64205	64929	66190	77291	
64209	64991	66210	77299	
64301	64992	66220	77310	

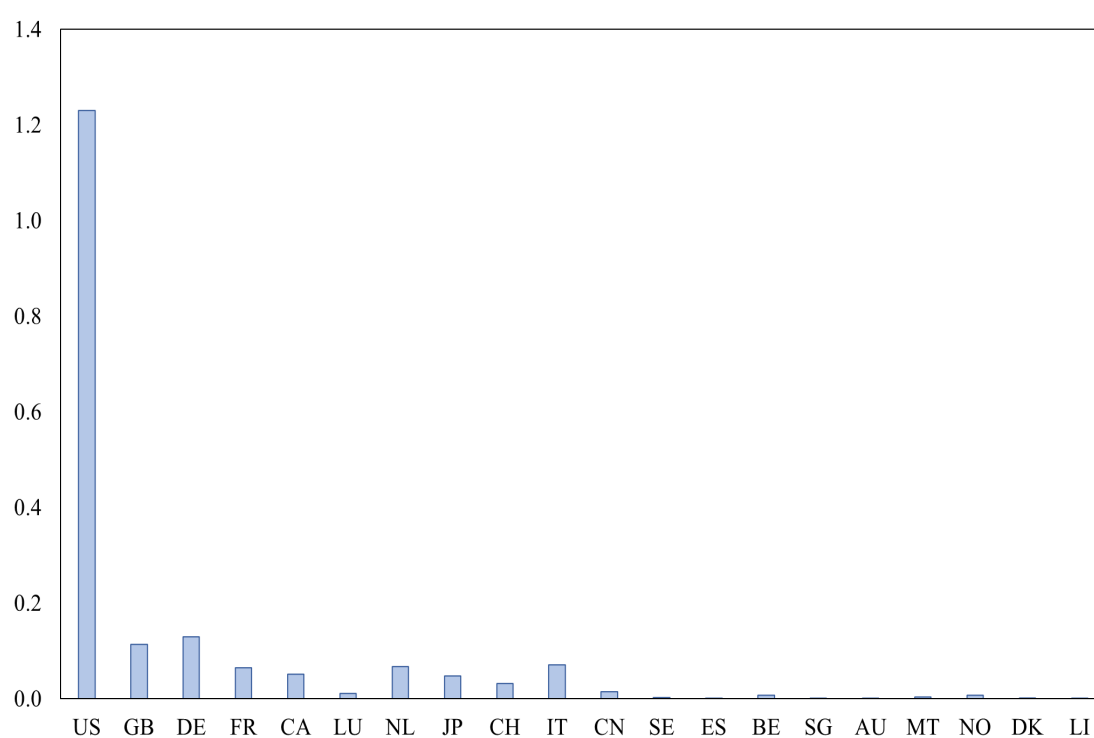
Note: This table shows the UK SIC 2007 sub-classes that are used in an attempt to identify SPEs and financial companies. These codes are equivalent to the European NACE classification. Companies whose primary activity are identified by one of these SIC codes are excluded from the sample used to estimate Irish consolidated foreign assets and liabilities.

Figure 3.A.10: Number of non-financial foreign affiliates in Ireland by country



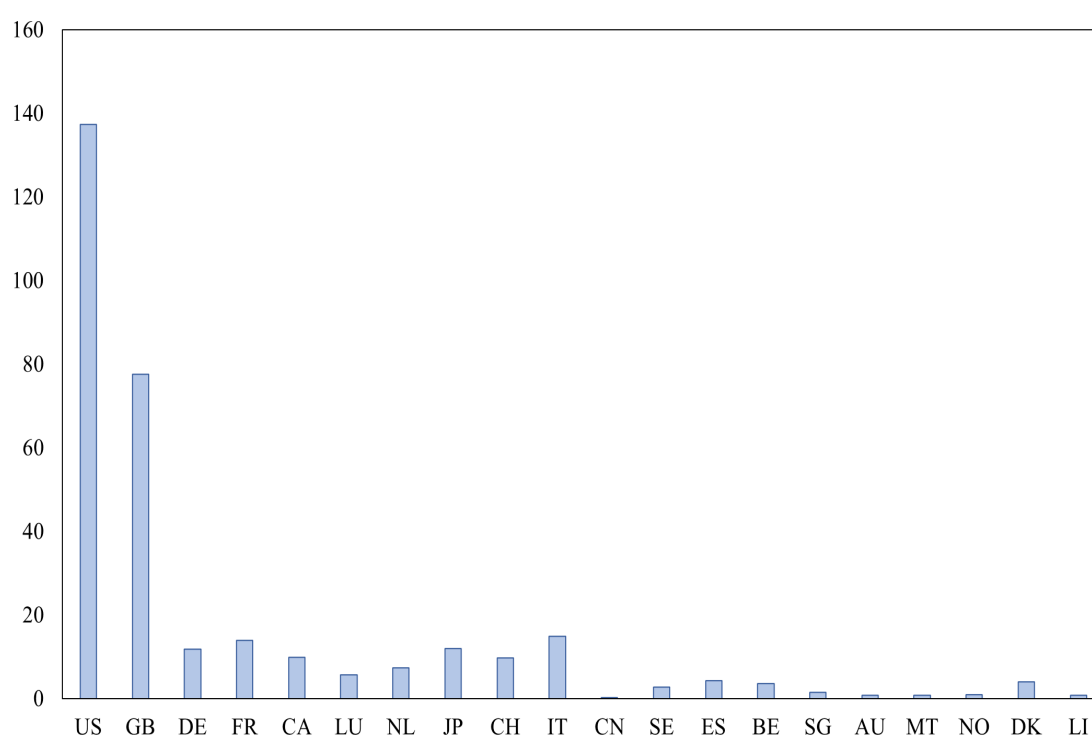
Note: This figure shows the number of companies operating in Ireland whose ultimate owner can be identified as non-Irish. Firms are sorted according to the country of their ultimate owner. Data is only displayed for the twenty countries with the largest number of companies operating in Ireland. This figure includes firms that are no longer active.

Figure 3.A.11: Sum of total assets of non-financial foreign MNEs per country



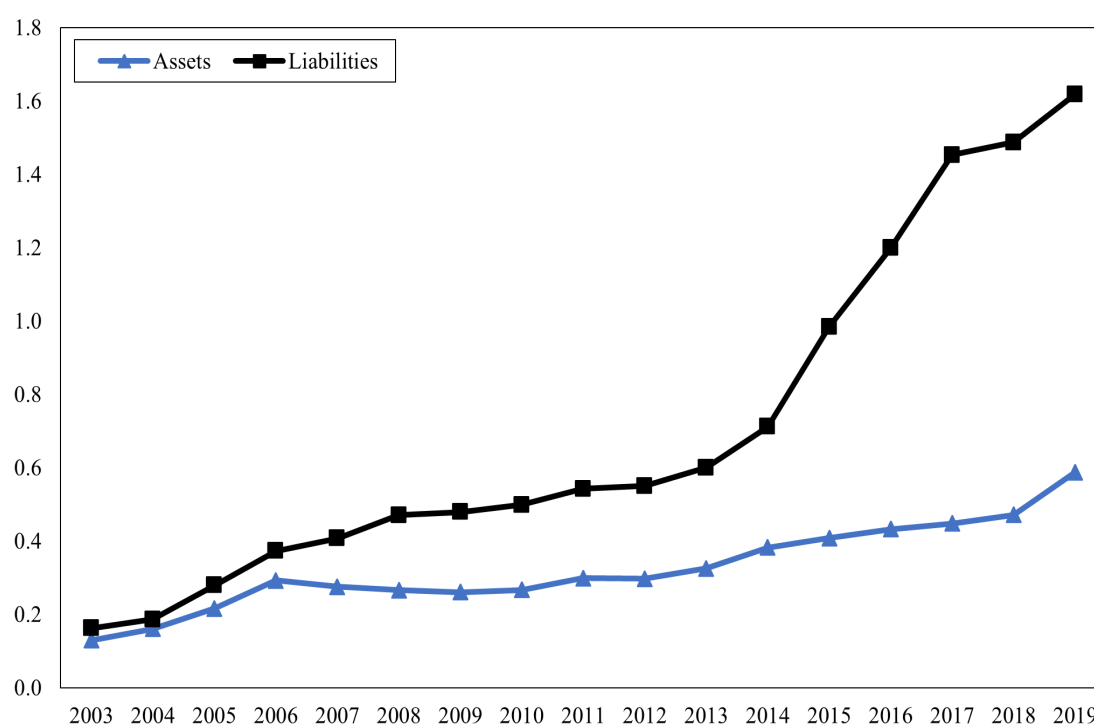
Note: This figure shows the sum of total asset holdings of companies operating in Ireland whose ultimate owner can be identified as non-Irish. Firms are sorted according to the country of their ultimate owner. Data is only displayed for the twenty countries with the largest number of companies operating in Ireland. This figure includes firms that are no longer active. Data reported in trillions of Euros.

Figure 3.A.12: Sum of employment of non-financial foreign MNEs per country



Note: This figure shows the sum of people employed by non-financial foreign companies operating in Ireland whose ultimate owner can be identified as non-Irish. Firms are sorted according to the country of their ultimate owner. Data is only displayed for the twenty countries with the largest number of companies operating in Ireland. This figure includes firms that are no longer active. Data reported in thousands.

Figure 3.A.13: Foreign assets and liabilities related to non-financial foreign MNEs



Note: This figure shows estimates of Irish consolidated foreign assets and liabilities related to the activities of non-financial foreign multinational enterprises operating in the country. Foreign liabilities are estimated as the difference between total assets and same-group inter-company loan assets of non-financial foreign multinationals. Foreign assets are estimated as the total assets of non-financial foreign MNEs minus their shareholders' equity and same-group inter-company loan liabilities. Data reported in trillions of Euros.

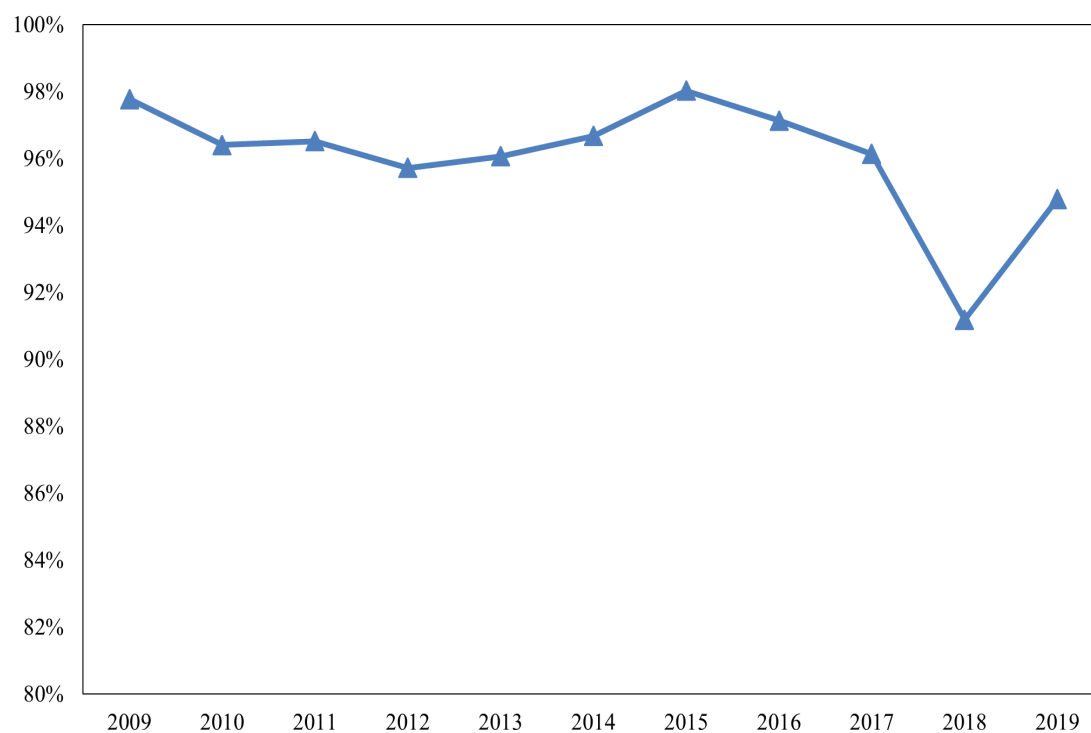
Table 3.4: Countries included in estimating assets and liabilities related to Irish MNEs

Albania	Denmark	Kosovo	North Macedonia	Sweden
Andorra	Estonia	Latvia	Norway	Switzerland
Austria	Finland	Liechtenstein	Poland	Turkey
Belarus	France	Lithuania	Portugal	Ukraine
Belgium	Germany	Luxembourg	Romania	United Kingdom
Bosnia and Herzegovina	Greece	Malta	Russia	United States
Bulgaria	Greenland	Moldova	Serbia	
Croatia	Hungary	Monaco	Slovak Republic	
Cyprus	Iceland	Montenegro	Slovenia	
Czech Republic	Italy	Netherlands	Spain	

Note: This table shows the countries listed in the Orbis Europe database plus the United States.

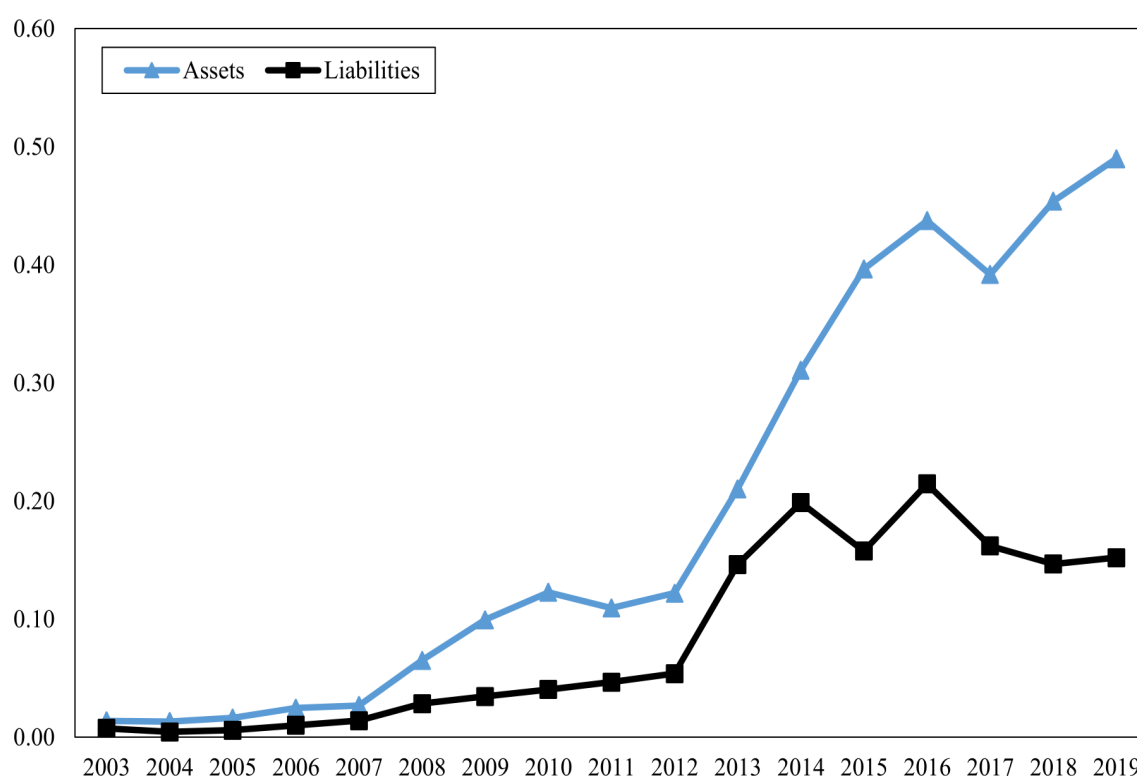
Estimates of Irish consolidated foreign assets and liabilities related to non-financial Irish MNEs are based on the positions held by such companies in these listed countries.

Figure 3.A.14: Share of Irish outbound FDI position in covered countries relative to total



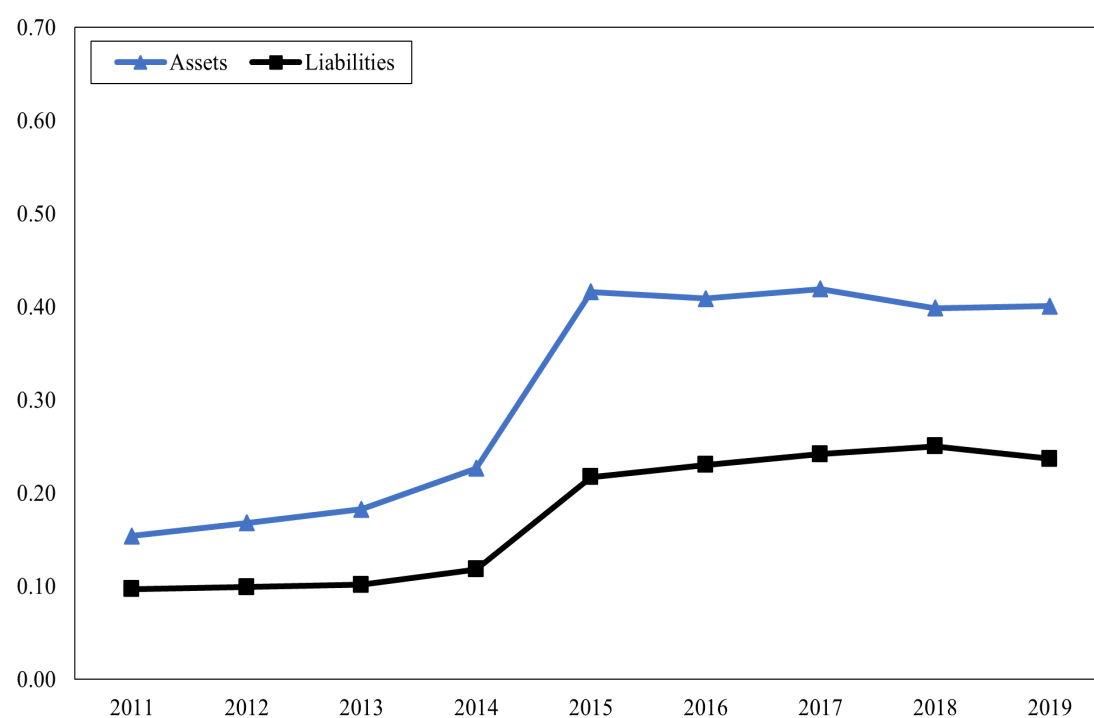
Note: This figure shows the sum of Irish outbound foreign direct investment positions in countries listed in Table 3.4 as a percentage of total Irish outbound FDI positions with respect to recipient countries that are possible to identify and that are non-haven countries. This is calculated as the total Irish outbound FDI position minus the position associated to unidentified recipients and the positions with respect to Bermuda, Cayman Islands and Jersey.

Figure 3.A.15: Foreign assets and liabilities related to Irish non-financial MNEs in the U.S.



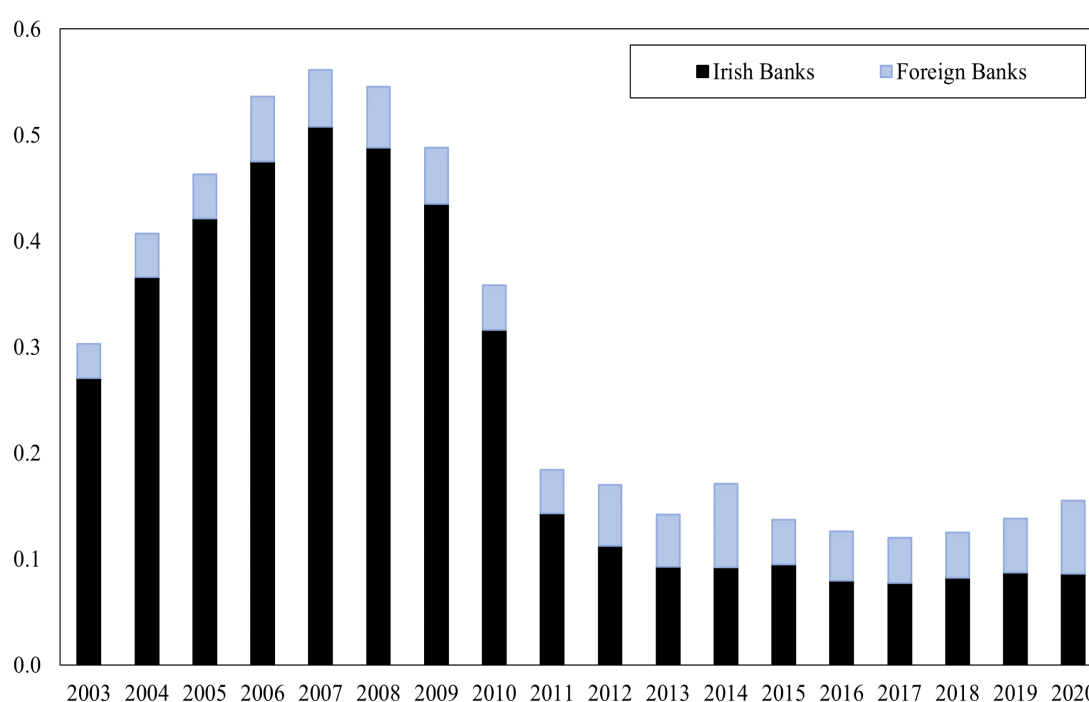
Note: This figure shows estimates of Irish consolidated foreign assets and liabilities related to the activities of non-financial Irish multinational enterprises operating in the United States. Foreign assets are estimated as the total assets of non-financial Irish MNEs. Foreign liabilities are estimated as the difference between total assets and FDI made by Ireland in the U.S. Data reported in trillions of Euros.

Figure 3.A.16: Foreign assets and liabilities related to Irish non-financial MNEs in Europe



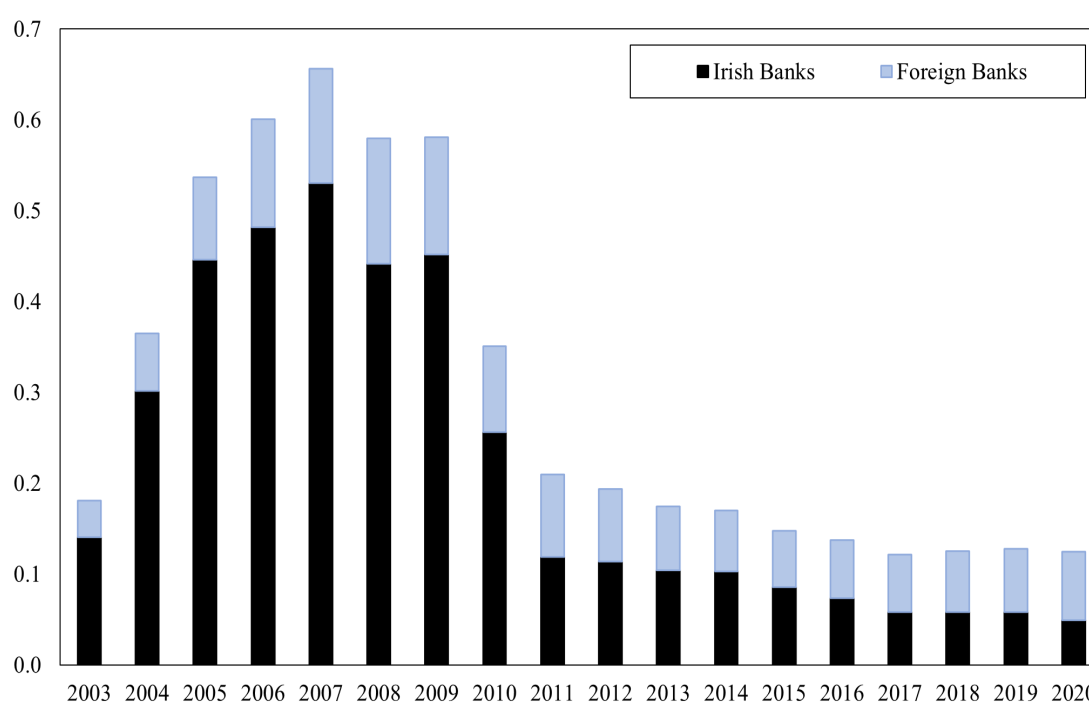
Note: This figure shows estimates of Irish consolidated foreign assets and liabilities related to the activities of non-financial Irish multinational enterprises operating in Europe. These estimates exclude foreign multinationals that have changed their domicile to Ireland. Foreign assets are estimated as the sum of total asset holdings by non-financial Irish MNEs. Foreign liabilities are estimated as the difference between the sum of total asset holdings and the sum of shareholders' funds by these companies. Data reported in trillions of Euros.

Figure 3.A.17: Consolidated foreign assets related to banks



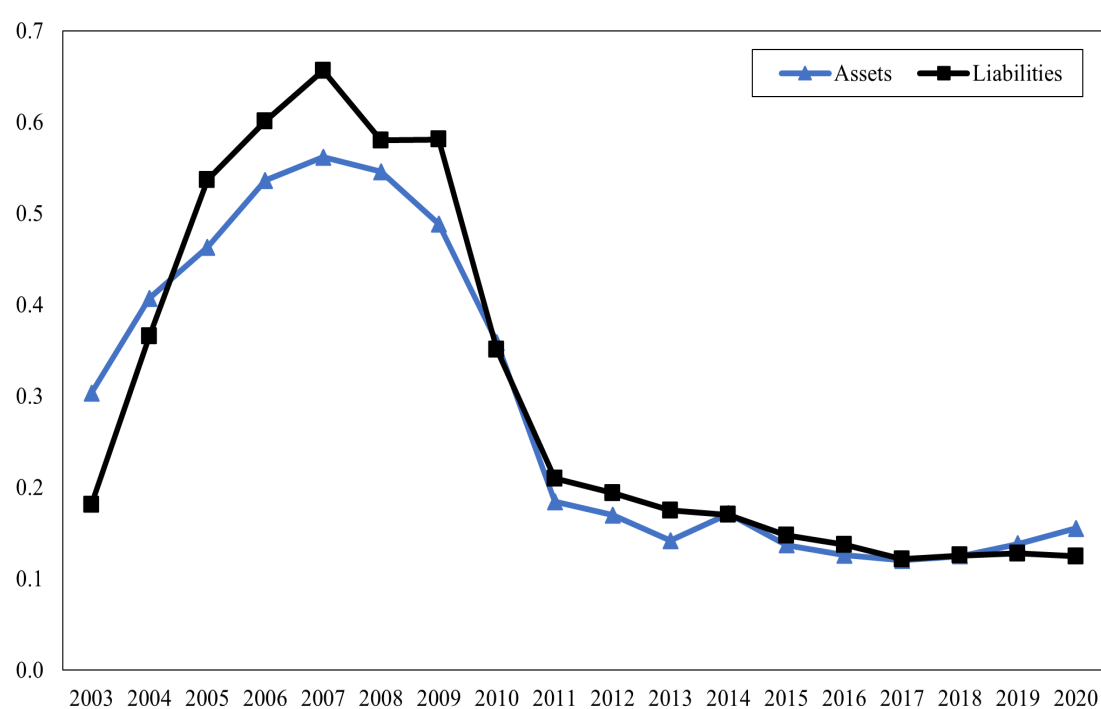
Note: This figure shows estimates of Irish consolidated foreign assets related to the activities of banks. The black bars represent Irish consolidated foreign assets attributed to the activities of Irish banks. The blue bars represent foreign assets attributed to activities of foreign banks. Data reported in trillions of Euros.

Figure 3.A.18: Consolidated foreign liabilities related to banks



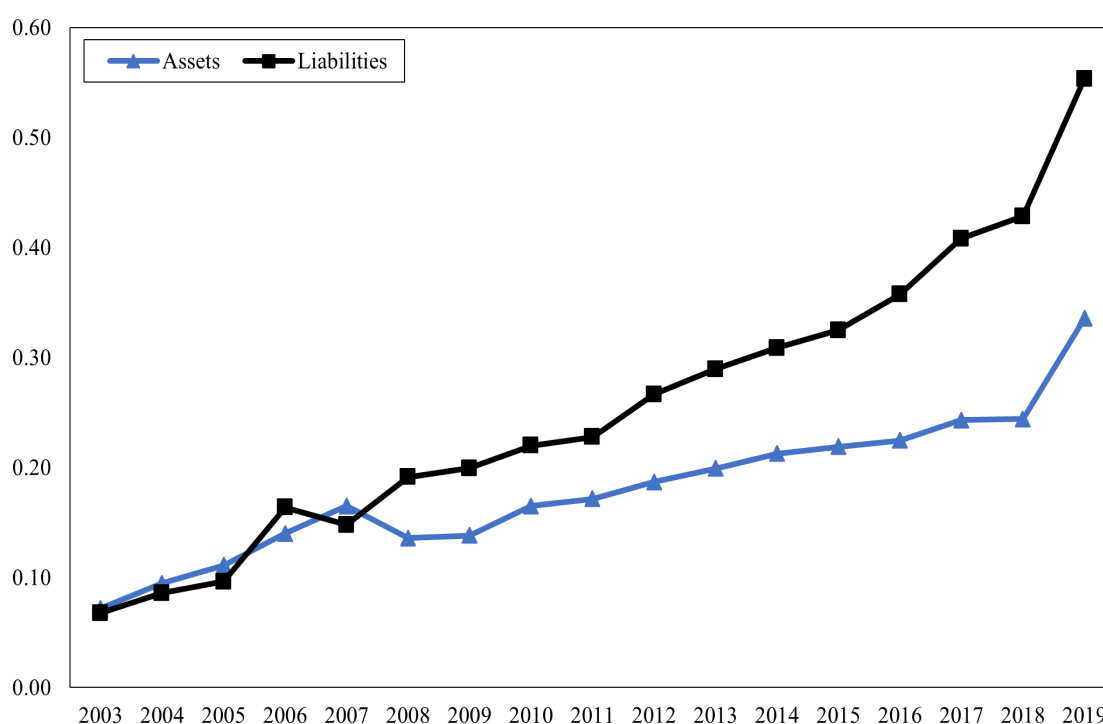
Note: This figure shows estimates of Irish consolidated foreign liabilities related to the activities of banks. The black bars represent Irish consolidated foreign liabilities attributed to the activities of Irish banks. The blue bars represent foreign liabilities attributed to activities of foreign banks. Data reported in trillions of Euros.

Figure 3.A.19: Consolidated foreign assets and liabilities related to banks



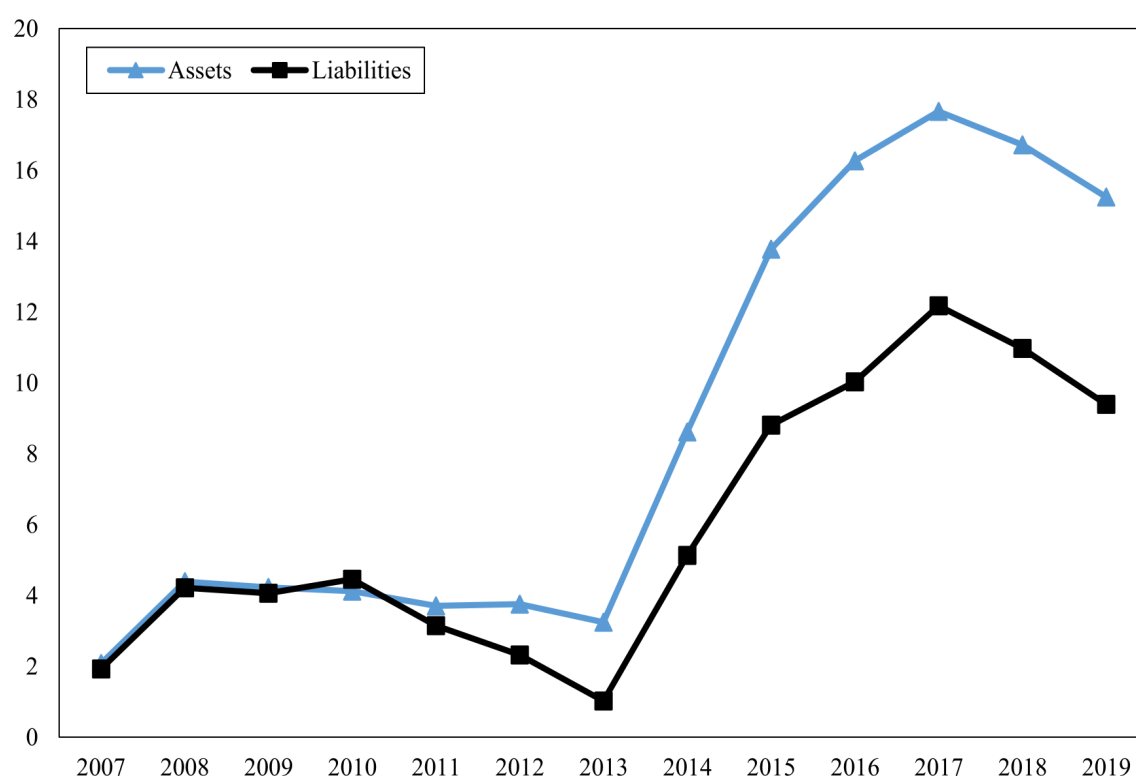
Note: This figure shows estimates of Irish consolidated foreign assets and liabilities related to the activities of banks. It includes both the assets and liabilities related to Irish banks as well as foreign banks. Data reported in trillions of Euros.

Figure 3.A.20: Foreign assets and liabilities related to foreign financial non-banks



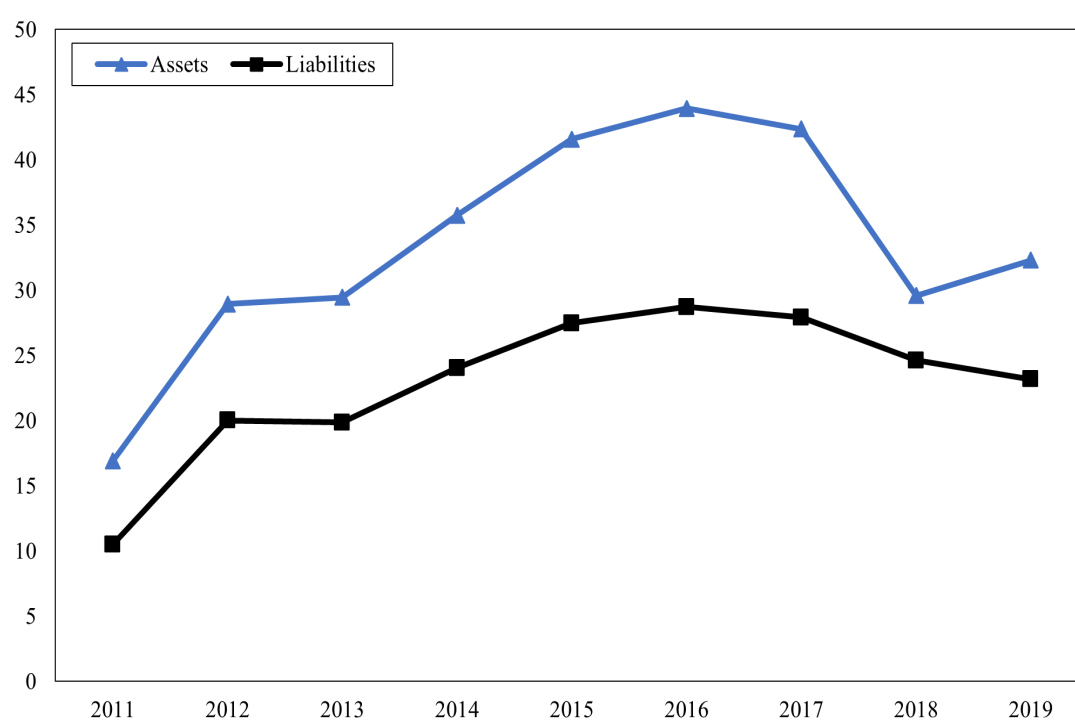
Note: This figure shows estimates of Irish consolidated foreign assets and liabilities related to the activities of foreign financial non-banks operating in Ireland. Companies that have never reported the number of people it employs are removed from the sample. Foreign liabilities are estimated as the difference between total assets and same-group inter-company loan assets of foreign financial non-banks. Foreign assets are estimated as the total assets of these companies minus their shareholders' equity and same-group inter-company loan liabilities. Data reported in trillions of Euros.

Figure 3.A.21: Foreign assets and liabilities related to Irish financial non-banks in the U.S.



Note: This figure shows estimates of Irish consolidated foreign assets and liabilities related to the activities of Irish financial non-banks operating in the United States. Foreign assets are estimated as the total assets of these companies. Foreign liabilities are estimated as the difference between total assets and FDI made by Ireland in this sector in the U.S. Data reported in billions of Euros.

Figure 3.A.22: Foreign assets and liabilities related to Irish financial non-banks in the Europe



Note: This figure shows estimates of Irish consolidated foreign assets and liabilities related to the activities of Irish financial non-banks operating in Europe. These estimates exclude foreign multinationals that have changed their domicile to Ireland. Foreign assets are estimated as the sum of total asset holdings by Irish financial non-banks. Foreign liabilities are estimated as the difference between the sum of total asset holdings and the sum of shareholders' funds by these companies. Data reported in billions of Euros.

4 Consolidated Foreign Wealth of Nations: Nationality-based measures of international exposure

4.1 Introduction

How can policymakers assess the exposure its households and firms have to international risk factors? The conventional approach uses data on countries' foreign holdings to sort out these exposures. These data are collected using the residence of economic agents as the key criterion. For any given country, its external assets (liabilities) represent claims (liabilities) its residents have with respect to non-residents. It follows that only cross-border positions are recorded in residence-based statistics. Furthermore, this approach does not consider ties that exist between entities within the same corporate group. The local positions held by the affiliate of a multinational enterprise operating abroad may not be part of the foreign holdings of its home and host countries using this approach.

These two features of the residence-based approach pose a challenge given the increasing importance of multinational enterprises (MNEs). These corporate groups have affiliates operating in multiple countries. The local assets held by these affiliates in host countries represent investments made by an MNE away from its home country. Yet they may only be recorded in foreign balance sheets of host and home countries if there are cross-border transactions involved. If these investments are funded by raising resources with local agents, no exposure would be recorded for both home and host countries.

Decisions made by MNEs can affect employment and production in foreign countries hosting their affiliates. Blomström and Kokko (1998) provide evidence of these spillovers from activities of MNEs. More recently, Avdjiev et al (2021) have shown how monetary policy changes in the home country of multinational banks affect conditions in foreign countries hosting their affiliates. These studies point to the need for developing measures able to more comprehensively capture these international linkages.

The alternative used in this paper is to adopt a consolidated-by-nationality approach when computing foreign assets and liabilities. Under such approach, assets and liabilities held by affiliates operating abroad are consolidated to the parent group. It takes into account local and cross-border positions. These positions are then sorted according to the nationality of the ultimate owners of such investments. The fact that all positions are taken into account and that positions held by the affiliate are consolidated provide a more nuanced view around countries' international exposure.

The recent literature on nationality-based foreign holdings have revealed important stylized facts. Coppola et al (2021) show that China's net foreign assets position is substantially smaller from a nationality-based perspective. Bénétrix and Sanchez Pacheco (2023) show that the U.S. economy is more financially integrated with the rest of the world when compared to the conventional residence-based data. Despite the recent progress, there is currently no dataset containing information on the entire foreign balance sheet of countries from a consolidated-by-nationality perspective.

In this paper, I construct estimates of foreign assets and liabilities from a consolidated-by-nationality perspective for a group of 14 developed countries. This data contribution contains yearly estimates for the period between 2012 and 2019. It is the first such dataset containing nationality-based estimates of foreign holdings for any group of countries. Then I compare these novel data on foreign holdings with the residence-based ones from Lane and Milesi-Ferretti's *External Wealth of Nations*. A key variable in this analysis is the index of international financial integration (IFI). This variable measures the relative size of a country's foreign balance sheet. For any given country, its IFI is equal to the sum of its foreign assets and liabilities divided by its GDP.

One relevant stylized fact that emerges from the analysis is that on aggregate these fourteen countries present a larger foreign balance sheet from a nationality-based perspective relative to the residence-based one. This result indicates these economies are more internationally finally integrated than previously thought. Such difference is associated with the fact that the consolidated-by-nationality approach takes into account both local and cross-border positions. In contrast, the residence-based approach only considers the latter.

Individually, most but not all countries present a larger consolidated-by-nationality foreign balance sheet. Countries with a sizeable presence of foreign companies engaging in international financial intermediation tend to have a larger residence-based foreign balance sheets. These companies' cross-border holdings inflate their host country's residence-based foreign balance sheet. Meanwhile, these holdings are instead consolidated to their parent country using the nationality approach. Most notably, Ireland stands out as having a substantially larger residence-based balance sheet in line with

Sanchez Pacheco (2022). Lane (2019) argues that the presence of these financial intermediaries opaquely the positions held by Irish nationals in the residence-based data. In this sense, the nationality-based approach provides a clearer view on the international exposure these agents have.

These novel data are then used to study two macroeconomic issues. The first one is on profit shifting from high-tax countries to low-tax countries. Wier and Zucman (2022) estimate that around 37% of profits earned by multinational enterprises are shifted to tax havens. Dischinger and Riedel (2011) have shown that multinational firms tend to shift their intangible assets to affiliates located in low-tax countries. I use consolidated-by-nationality estimates of foreign holdings and the existing residence-based data to focus on their relationship with differences in corporate income tax rates.

A key variable in this analysis is the difference between the consolidated-by-nationality and residence-based measures of foreign holdings. Such difference is a proxy of the foreign holdings not captured by the residence-based approach. I find that the difference between these two measures of foreign holdings is negatively correlated with corporate income tax differentials in a sample of low-tax countries. In contrast, the coefficient estimate is positive when estimated in a sample of high-tax countries. These results provide indirect evidence that nationals from high-tax countries may shift assets and profits to low-tax countries in ways that are not entirely captured by the residence-based approach. This finding is in line with Bénétrix and Sanchez Pacheco (2023) and points to the relevance of consolidated-by-nationality data when analyzing profit shifting activities.

The second application of these novel data presented in this paper is on assessing spillovers from U.S. monetary policy shocks on multinational enterprises. Bergant et al. (2023) show that a tightening in U.S. financial conditions is associated with a decline in global cross-border M&A activities. In this paper, I analyze the relationship between U.S. monetary policy shocks and foreign asset holdings by non-financial multinational enterprises.

I find that a tightening U.S. monetary policy shock is correlated with a decrease in consolidated-by-nationality foreign asset holdings by non-financial multinationals. This result is robust with respect to alternative estimation methods for these monetary policy shocks. Such result suggests that a tightening in U.S. monetary policy generates spillovers that are associated with multinationals reducing their foreign asset holdings.

More broadly, these two sets of results indicate that consolidated-by-nationality estimates of foreign holdings can be useful in tackling important questions across different topics in international macroeconomics. As noted by Lane (2021), the consolidated ap-

proach should complement the existing residence-based data given each approach offers advantages depending on the question at hand.

The remainder of this paper is structured as follows. Section 4.2 discusses the differences between the consolidated-by-nationality approach relative to the conventional residence-based one. Section 4.3 describes how the estimates of consolidated-by-nationality foreign holdings are constructed as well as the data sources used. Section 4.4 describes the key stylized facts that emerge when comparing these novel data with conventional residence-based data. Section 4.5 analyzes the relationship between corporate income tax differentials and foreign holdings. Section 4.6 studies the association between U.S. monetary policy shocks and consolidated-by-nationality foreign asset holding by non-financial multinational enterprises. Section 4.7 concludes.

4.2 Nationality- and residence-based statistics

There are two main data dimensions in which the consolidated-by-nationality approach differs from the residence-based approach. The first one relates to the set of positions that are considered when estimating foreign assets and liabilities. In residence-based statistics, external holdings are recorded when there is an exposure of a resident economic agent relative to a non-resident economic agent. As a result, the residence-based approach focuses exclusively at cross-border positions. Local positions that represent exposures between resident agents of different nationalities within the same country are not captured by this approach. In contrast, the consolidated-by-nationality approach takes into consideration both local and cross-border positions when estimating foreign holdings.

The second difference relates to how entities within the same corporate group are treated under each approach. In residence-based statistics, an affiliate of a foreign multinational enterprise operating in a given host country is seen as a resident of that country. There is no direct linkage between that entity and the corporate group it belongs to. Cross-border assets and liabilities held by this affiliate will be recorded as external holdings of the host country even if the company is controlled by foreign agents. Meanwhile, the consolidated-by-nationality approach takes the assets and liabilities held by this affiliate and consolidates them to the parent company.

One example can illustrate how these differences impact the measurement of foreign assets and liabilities. Consider an affiliate of a foreign multinational enterprise from country A that is operating in host country B. Through this affiliate, the multinational enterprise wants to buy a factory in country B worth \$5 million. Such investment is entirely financed by taking a loan from a local bank in country B.

Under the consolidated-by-nationality approach, this factory is an asset the foreign MNE owns in country B. Therefore, it would be recorded as a foreign asset of country A and a foreign liability of country B. Meanwhile, the loan taken by the affiliate to finance this investment represents a liability the MNE from country A has relative to a bank from country B. This loan would be recorded as a foreign liability of country A and a foreign liability of country B. In this example, both foreign assets and liabilities of countries A and B rise by \$5 million as a result of this investment.

Meanwhile, no exposure would be recorded under the residence-based approach. This affiliate operating in country B is not seen as a foreign entity. There is no cross-border transactions taking place as the investment made by the foreign MNE is funded locally. Crucially, this international exposure a foreign multinational from country A takes on country B would not be recorded in residence-based statistics. Similarly, the exposure the local bank B has relative to a foreign multinational would also not be recorded.

These two data differences are associated with a set of issues raised in the international finance literature. The first one relates to the identification of the ultimate exposure to financial risks. Under the residence-based approach, the foreign affiliate of country A's MNE is treated as a separate entity. Its local exposure is not captured in external residence-based statistics. As a result, relying exclusively on residence-based data pose a challenge for policymakers in country A to identify the exposure its multinational enterprises have. In contrast, local and cross-border positions held by this and others affiliates relative to foreign agents would appear in country A's consolidated-by-nationality foreign balance sheet. This feature makes it easier for policymakers to evaluate the ultimate exposure their agents have when using the consolidated data. In this context, Borio (2013) points to the need for constructing consolidated statistics in order to assess the exposure global firms have to different risk factors, countries and sectors.

During the Global Financial Crisis, European banks held a sizeable exposure to U.S. mortgage-backed securities through their U.S. affiliates as noted by McCauley (2018). Such exposure would not be captured by residence-based measures of foreign exposure but would appear in consolidated-based data. The consolidated-by-nationality approach also provides a more detailed view on the banking developments that came after the crisis. Using nationality-based data, McCauley et al. (2019) show that what appears to be a broad-based decline in international lending post-crisis was in fact related to European banks reducing their global footprint. These two studies highlight that the identification of exposure to financial risks can change in important ways when assessed from a consolidated perspective.

A second issue relates to the triple coincidence literature as in Avdjiev et al. (2016) and Avdjiev et al. (2018). In the standard international finance models, the decision-making

unit coincides with the GDP area and currency area. In reality, however, multinational enterprises make decisions at the home country that affect production in foreign countries where their affiliates operate in. These affiliates may be spread across different currency areas. As a result, treating each entity separately according to their residence fails to capture this complex decision-making and production structure. In contrast, the consolidated-by-nationality approach provides a more nuanced view on these global corporate structures.

The consolidated-by-nationality offers an advantage relative to the residence-based approach when considering the ultimate exposure to financial risks. It also provides a more detailed view on the global footprint of multinational enterprises. This is particularly useful given their increased relevance over the past decades. However, there are also some relative disadvantages too. Unlike the residence-based approach, there is still no unified manual on how national authorities should collect consolidated-by-nationality data. In this sense, Lane (2021) notes that the consolidated-by-nationality approach should complement rather than replace the existing residence-based framework.

Furthermore, residence-based statistics have proven useful in different applications in international finance. For example, Catão and Milesi-Ferretti (2014) show that residence-based data can be employed to construct informative early warning systems around the risk of an external crisis. This is particularly helpful for policymakers when considering how to set macroeconomic policy appropriately.

Another important relative disadvantage of the consolidated-by-nationality approach is that there is no data-set containing estimates of foreign holdings from a nationality perspective for multiple countries as in Lane and Milesi-Ferretti's seminal *External Wealth of Nations* (2001, 2007, 2018). This paper seeks to fill this gap by producing the first data-set on estimates of consolidated-by-nationality foreign holdings for a group of countries over multiple years. Relative to Coppola et al. (2021), this paper presents estimates for the entire foreign balance sheet of countries while their work focuses on portfolio investment.

4.3 Data

I construct consolidated-by-nationality estimates of foreign holdings for a group of countries using data from the U.S. Bureau of Economic Research, the International Monetary Fund, the Bank for International Settlements and from Orbis Europe. Foreign assets and liabilities are divided into the similar functional categories as in BIS (2015) and Sanchez Pacheco (2022). More specifically, foreign assets and liabilities are divided into holdings related to the activities of national companies operating abroad; holdings re-

lated to activities of foreign companies operating in the country; portfolio investment an official assets. Furthermore, holdings related to these multinational enterprises are divided according to their activities into three sectors: banks, financial non-banks and non-financial companies.

The dataset includes the following countries: the United States, the United Kingdom, Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, the Netherlands, Sweden and Switzerland. For most countries, data is available from 2012 to 2019 while for some the first observation starts later due to data limitations. Data for Ireland are taken from Sanchez Pacheco (2022) while data for the U.S. are taken from Bénétrix and Sanchez Pacheco (2023).

In section 4.4, I compare these novel nationality-based data to conventional residence-based holdings. Residence-based estimates of foreign assets and liabilities comes from Lane and Milesi-Ferretti's seminal *External Wealth of Nations* dataset.

4.3.1 Bank-related holdings

Consolidated-by-nationality estimates of foreign holdings related to the banking sector are constructed using data from the Bank for International Settlements (BIS). The methodology follows that employed in BIS (2015) also used in Bénétrix and Sanchez Pacheco (2023) and Sanchez Pacheco (2022). Bank-related foreign holdings are associated to the activities of both national banks as well as to foreign banks.

For any country i , foreign assets related to its national banks are equal to the claims held by them relative to all counterparts except those with same nationality. Foreign assets of country i related to foreign banks operating in it are given by the local liabilities of such banks relative to country i nationals.

Foreign liabilities of country i related to its national banks are estimated as the local liabilities of these banks operating abroad plus their cross-border liabilities excluding those to related offices. Foreign liabilities related to foreign banks are equal to the total claim of foreign banks on country i nationals.

Figure 4.A.6 in the Appendix shows estimates of consolidated-by-nationality foreign holdings related to national banks for 2019. Figure 4.A.7 shows similar estimates related to the activities of foreign banks for the same year.

4.3.2 Non-financial MNEs

Foreign MNEs

The holdings associated with foreign MNEs operating in European countries are computed using Orbis Europe. For a given country i , I download financial, employment and ownership data for all entities operating in it that have foreign nationals as their ultimate owners. I also download data on companies; status which indicates whether they are active or have been liquidated. Companies are sorted according to their 4-digit NACE code into two groups: financial non-banks and non-financial multinational enterprises.¹ Companies identified as banks are excluded from the sample as the assets and liabilities related to their sector are computed using BIS data.

The financial data used in this paper are companies' total asset holdings and shareholders' equity. These data may contain reporting gaps. Whenever there is a reporting gap, I follow the same procedure used in Sanchez Pacheco (2022). If a company is active, a reporting gap in period T would be filled with data from period $T - z$ where $z > 0$ is the smallest possible. If a company's status is not listed as active, then a reporting gap in period T would be filled with data from $T - z$ only if there is at least one future period $T + k$, $k > 0$ in which financial information is available. In case there is no financial information available for subsequent periods, it is assumed that this company became inactive in period T . Therefore, its total assets and shareholders' equity will be set to zero for all $t \geq T$. Such decision rule generates inputted data whenever there is a reporting gap in the sample.

Nationality-based foreign liabilities of country i related to foreign non-financial MNEs operating in it are estimated as the sum of these companies' total assets. Meanwhile, nationality-based foreign assets related to these companies are computed as the sum of their total assets minus their shareholders' funds. Given existing data limitations, such calculations imply that the estimates of foreign holdings presented in this paper represent upper bound estimates. More specifically, these calculations imply that the total asset holdings of foreign multinationals operating in country i have country i nationals as counterparts. They also imply that the financing these companies receive other than shareholders' funds comes from country i nationals. As it is possible that these assumptions may not always hold for all companies, the estimates related to the activities foreign multinationals represent upper bounds.

In the case of the United States, the estimates used from Bénétrix and Sanchez Pacheco (2023) relies on publicly available data from the U.S. Bureau of Economic Analysis.

¹The NACE codes used to identify financial non-banks are all of those included in group K 'Financial and Insurance' activities excluding the codes 6411 related to central banking and 6419 related to other monetary intermediation.

Figure 4.A.8 shows estimates of consolidated-by-nationality foreign holdings related to foreign non-financial MNEs operating abroad. In 2019, the presence of these companies in the U.K. are associated with USD 8.2tn in U.K. foreign liabilities. That is followed by the U.S. where the activities of such companies are associated with USD 7.6tn in U.S. foreign liabilities.

National MNEs operating abroad

Consolidated-by-nationality foreign assets and liabilities related to national MNEs operating abroad are computed using data from Orbis Europe and the U.S. BEA. These data sources contains information on multinational activities in Europe and the United States. It is possible that a given country has many of its MNEs operating outside of these two regions. This would pose a challenge when computing assets and liabilities related to these companies given this regional coverage limitation. Therefore, I first construct a proxy of how well the two data sources cover the activities of MNEs using the IMF Coordinated Direct Investment Survey.

For country i and year y , I compute the share of outbound FDI position to countries included in these two regions relative to the total outbound FDI made by country i . I exclude non-EU tax haven countries from this analysis.² Then I compute the average of such share for the period between 2009 and 2020. Figure 4.A.9 shows the average share per country in the sample. A share equal to one would indicate that these two regions receive all the FDI made by country i . Meanwhile, a share equal to zero would indicate that all the FDI made by country i is received by countries outside of Europe and the United States. The highest average share value in our sample comes from Ireland at 95%. The lowest share comes from the U.K. with 78%. Even at this lower bound, the two regions represent the vast majority of the direct investment made by the United Kingdom. While the regional coverage could potentially pose a challenge to this methodology, this does not appear to be the case for the countries included in the dataset given the elevated average coverage share across countries.

Foreign holdings related to affiliates of country i companies operating in Europe are constructed using Orbis Europe. First, I download financial and sectoral data on all companies who have country i as the country of its ultimate owner. I exclude companies located in country i and focus instead on those located elsewhere in the region. Then

²For country i , the share is computed as the sum of outbound FDI position to all countries in the Orbis Europe database plus the United states divided by the total outbound FDI position of that country excluding to non-EU tax havens. The countries included in Orbis Europe are: Albania, Andorra, Austria, Belarus, Belgium, Bosnia and Herzegovina, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Greenland, Hungary, Iceland, Italy, Kosovo, Latvia, Liechtenstein, Lithuania, Luxembourg, Malta, Moldova, Montenegro, Netherlands, North Macedonia, Norway, Poland, Portugal, Romania, Russia, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey, Ukraine, the United Kingdom. The non-EU tax havens are Bermuda, Cayman Islands and Jersey.

I apply the same procedure described in the subsection above to fill any reporting gaps that might exist. It is possible that the ultimate owners of some of these companies are not from country i but rather have redomiciled there for tax-related purposes. In this case, Orbis Europe will inaccurately indicate that these affiliates have country i as the country of its ultimate owner. In order to correct for this, I use the Bloomberg Tax Inversion Tracker from Mider (2017) to identify companies that have redomiciled. If an ultimate owner is identified as having redomiciled from country j to country i , the country of its affiliates are changed from j to i in the dataset.

Country i 's consolidated-by-nationality foreign assets related to its companies operating in Europe are computed as the sum of their total asset holdings. Its foreign liabilities related to these entities are calculated as the sum of the difference between their total asset holdings and shareholders' funds.

Holdings related to affiliates of country i operating in the United States are constructed using data from the U.S. BEA. The procedure used follows that presented in Sanchez Pacheco (2022). Country i 's foreign assets related to its companies operating in the U.S. are computed as the total asset holdings of these companies in the U.S. Its foreign liabilities are equal to the difference between the total asset holdings of these companies and the FDI stock made by country i in the U.S. non-financial sector.

Consolidated-by-nationality foreign assets related to country i 's non-financial MNEs are equal to the sum of country i 's foreign assets related to these companies operating in the U.S. plus in Europe. Similarly, its foreign liabilities related to its non-financial MNEs are equal to the sum of its foreign liabilities related to these companies operating in these two regions.

Figure 4.A.10 shows estimates of consolidated-by-nationality foreign holdings related to the activities of foreign non-financial MNEs. U.S. MNEs stand out relative to those of other countries in terms of the foreign holdings related to them. In 2019, the activities of U.S. MNEs are associated with USD 20.3tn in U.S. foreign assets and USD 15.4 tn in U.S. foreign liabilities. That is followed by U.K. MNEs whose activities are associated with USD 3.2tn in U.K. foreign assets and USD 1.9tn in foreign liabilities.

4.3.3 Financial non-bank holdings

Foreign Financial non-banks

Consolidated-by-nationality foreign assets and liabilities related to foreign financial non-banks operating in European countries are computed using Orbis Europe. For a country i , I proceed by focusing on the group of companies whose NACE code is associated with financial non-banking activities as described in subsection 4.3.2. I use the same

procedure described in that subsection to fill any reporting gaps that may exist.

Before computing aggregate holdings, an additional step is taken in an attempt to address the potential presence of Special Purpose Entities (SPEs) in the sample. These financial non-bank companies often engage in cross-country financing as documented by Galstyan et al. (2021). Their presence inflate residence-based foreign balance sheet of host country i but virtually no economic to country i nationals or firms. As a result, these companies must be identified and removed when estimating the consolidated-by-nationality foreign holdings related to foreign financial non-banks. The procedure adopted in this paper follows that in Sanchez Pacheco (2022). In particular, a financial non-bank is removed from the sample if it has never reported a number of employees or it has last reported having zero employees.

Once potential SPEs are removed, country i 's consolidated foreign assets related to foreign financial non-banks operating in it are given by the sum of the difference between their total asset holdings and their shareholders' funds. Analogously, country i 's foreign liabilities are given by the sum of these companies total asset holdings.

For the United States, estimates of consolidated foreign assets and liabilities related to foreign financial non-banks come from Bénétrix and Sanchez Pacheco (2023). These estimates are constructed using publicly available data from the U.S. BEA.

Figure 4.A.11 shows estimates of consolidated-by-nationality foreign holdings related to the activities of foreign financial non-banks. In 2019, the presence of these companies in the U.K. are associated with USD 8.2tn in U.K. foreign liabilities. That is followed by the U.S. where the activities of such companies are associated with USD 7.6tn in U.S. foreign liabilities.

National Financial non-banks operating abroad

Foreign holdings related to country i 's financial non-banks operating abroad are constructed using data from Orbis Europe and the U.S. BEA. The procedure adopted is akin to that used in section 4.3.2. We separately estimate the foreign holdings that result from the activities of these companies operating in Europe and the holdings that come from activities in the United States.

For country i 's companies operating in Europe, its foreign holdings related to its financial non-banks are computed using the same procedure as that described in subsection 4.3.2. Accordingly, ultimate owners who are identified as having redomiciled to country i are excluded from the sample. Country i 's consolidated foreign assets related to its financial non-banks operating in Europe are equal to the sum of their total asset holdings. Its foreign liabilities related to these companies are equal to the sum of the difference

between their total asset holdings and shareholders' funds.

Figure 4.A.12 shows estimates of consolidated-by-nationality foreign holdings related to the activities of national financial non-banks.

4.3.4 Portfolio Investment

I rely on data from the International Monetary Fund's Coordinated Portfolio Investment Survey when estimating foreign assets and liabilities. Notwithstanding the important contribution by Coppola et al. (2021), relatively little is known regarding the nationality of the ultimate owners of global portfolio investments. As a result, I use the residence-based estimates of portfolio holdings when constructing the consolidated-by-nationality balance sheet of countries. For a given country, its foreign portfolio assets are equal to the total investment assets from the CPIS survey. Its foreign liabilities are equal to the total investment liabilities from the CPIS survey.

In the case of Ireland, I follow Sanchez Pacheco (2022) and use the Irish Central Statistics Office data on portfolio holdings for the part of the economy not related to international financial intermediation (non-IFSC). In the case of the United States, I use data from Bénétrix and Sanchez Pacheco (2023). U.S. portfolio assets are equal to the total holdings of foreign securities by U.S. residents plus claims on unaffiliated foreigners reported by U.S. non-financial companies. U.S. portfolio liabilities include holdings of U.S. securities by foreign residents, holdings of U.S. currency outside of the country and liabilities to unaffiliated foreigners reported by U.S. non-financial companies.

4.3.5 Official Assets

Official assets are equal to the official reserve assets from the International Monetary Fund International Reserves and Foreign Currency Liquidity database. In the case of Ireland, official assets comes from the Central Bank of Ireland as described in Sanchez Pacheco (2022). For the United States, official assets are equal to the U.S. reserve assets from its International Investment Position released by the U.S. BEA.

4.4 Stylized Facts

4.4.1 Aggregate dynamics

In order to assess broad dynamics, I construct aggregate indices of international financial integration using both the consolidated-by-nationality approach as well as the residence-based one. For any given year, the aggregate index is calculated as the sum of foreign assets and liabilities of selected countries divided by the sum of their GDP. For a specific

country, this index of international financial integration (IFI) expresses the relative size of a country's foreign balance sheet as a percentage of GDP. The countries included when computing the aggregate index are the United States, the United Kingdom, Austria, Belgium, France, Germany, Italy, Netherlands, Sweden, Switzerland, Finland, Greece and Ireland. Denmark is removed from the sample given its nationality-based data starts in 2016. This index is computed for the period between 2013 and 2019 using both approaches.

Figure 4.7.1 shows the evolution of this aggregate IFI under the nationality-based and residence-based approach for the period between 2013 and 2019. It reveals that the consolidated-by-nationality aggregate IFI is larger than the residence-based one for all years in this period. Importantly, this stylized fact indicates that these developed economies are more financially integrated with foreign agents than what resident-based measures suggest. Such result is due to the fact that the consolidated-by-nationality approach takes into account both cross-border as well as local positions while the residence-based approach focuses exclusively on the former. As such, an important part of the international exposure of countries is not captured by the residence-based approach.

Figure 4.7.2 shows the difference between the nationality-based and residence-based aggregate IFI over time. This figure reveals that the nationality-based IFI is not only larger than the residence-based one but the difference between the two increased between 2013 and 2019. There is an important increase in the difference between 2014 and 2017 while it remained largely unchanged from then to 2019.

4.4.2 Country-level analysis

Figure 4.7.3 shows the index of international financial integration (IFI) under both the nationality-based and residence-based approaches per country for 2019. It reveals that most countries present a larger consolidated-by-nationality IFI relative to their residence-based balance sheet. This result is expected as the consolidated-by-nationality approach takes into account both cross-border and local positions while the residence-based one only considers cross-border positions.

The two exceptions to that are Ireland and Greece. In addition, Switzerland and the Netherlands have a nationality-based foreign balance sheet approximately the same size as their residence-based analogues as of 2019. In general, a country will have a relatively smaller consolidated-by-nationality foreign balance sheet if they are host to proportionally relevant number of foreign-owned entities whose activities involve holding cross-border assets and liabilities. These holdings inflate the size of the host country's residence-based foreign balance sheet. However, they are identified as being foreign-

owned under the nationality-based approach. Therefore, these cross-border holdings do not appear in the host country's consolidated-by-nationality foreign balance sheet.

Ireland stands out as having a substantially smaller nationality-based foreign balance sheet relative to its residence-based one. Galstyan (2019) and Sanchez Pacheco (2022) discuss how the vast presence of special purpose entities in Ireland inflate its residence-based balance sheet. These companies have virtually no economic ties to Irish agents and are often involved in international financial intermediation. Their relatively large cross-border holdings enter Ireland's residence-based foreign balance sheet and opaque the positions held by Irish nationals as noted by Lane (2018). In contrast, these holdings do not enter Ireland's consolidated-by-nationality foreign holdings.

Figure 4.7.4 shows the evolution of the consolidated-by-nationality and residence-based IFI for all countries over the sample period. While the two measures of IFI are positively correlated across countries, the difference between them are not constant over time. Using data from the United States, Bénétrix and Sanchez Pacheco (2023) show that the time-varying difference between the U.S. consolidated-by-nationality and residence-based IFI is positively correlated with tax differentials between the U.S. and the rest of the world. In the sections 4.5 and 4.6, these data on multiple countries are used in a panel setting to study profit shifting and spillovers of U.S. monetary policy shocks respectively.

Figure 4.7.5 shows the evolution of consolidated-by-nationality foreign assets and liabilities per country over time. In general, consolidated-by-nationality foreign assets and liabilities move in tandem. However, this needs not always be the case. The difference between foreign assets and liabilities in Greece, Italy and Belgium moved in important ways during the sample period.

4.5 Tax differentials and foreign holdings

Multinational enterprises have an incentive to shift assets and profits to affiliates located in low-tax countries. Dischinger and Riedel (2011) document that the lower an affiliate's corporate tax rate is relative to other subsidiaries within the same group, the higher it is the level of intangible assets held by this affiliate. Wier and Zucman (2022) estimate that 37% of profits earned by such companies were booked in tax havens in 2019. That compares to only 2% in the 1970s, according to their estimates. Hebous and Johannesen (2021) also find evidence of profit shifting activities using firm-level data from Germany.

Using data for the United States, Bénétrix and Sanchez Pacheco (2023) have shown that there is a positive relationship between the difference in consolidated-by-nationality

minus residence-based measures of foreign holdings and corporate income tax differentials. Their analysis provide indirect evidence that asset/profit shifting activities by U.S. multinational enterprises may extend beyond what residence-based statistics can capture as local positions are also considered in the consolidated approach.

In this section, I examine whether consolidated-by-nationality foreign assets are associated with corporate income tax differentials using a panel of fourteen developed countries. I proceed by examining the relationship between foreign holdings and corporate income tax differentials. This analysis is done using both the existing residence-based data as well as the novel consolidated-by-nationality data. Then I focus on the difference between the consolidated-by-nationality and residence-based measures of foreign holdings to assess whether these time-varying differences are also associated with tax differentials. As in Bénétrix and Sanchez Pacheco (2023), such difference is a proxy for the foreign exposure countries have that is not captured by the residence-based approach. The regressions also include control variables that have been documented to such as GDP per capita and trade openness as in Lane and Milesi-Ferretti (2001).

Data on GDP per capita comes from the World Bank and is expressed in thousands of dollars. Trade openness also comes from the World Bank and is measured as a country's trade in goods and services divided by GDP. The difference in the corporate income tax rate for country i is computed as its statutory corporate income tax rate minus the median statutory tax rate from the set of countries included in the OECD Tax database.

These empirical relationships are examined through panel regressions shown in equation 1. The dependent variables $Y_{i,t}$ used are foreign assets, liabilities and IFI under both the consolidated-by-nationality as well as the residence-based approach. Furthermore, I also estimate this regression using the difference between the nationality-based and the residence-based measures as dependent variables as well. The panel data-set includes observations on fourteen developed countries over the period between 2012 and 2019.

$$Y_{i,t} = \alpha_i + \beta_1 * GDPpc_{i,t} + \beta_2 * Open_{i,t} + \beta_3 * TaxDiff_{i,t} + \epsilon_{i,t} \quad (1)$$

The coefficient α_i captures country i fixed effect. $GDPpc_{i,t}$ is the GDP per capita of country i at time t , $Open_{i,t}$ is country i 's trade in goods and services as a % of GDP at time t . $TaxDiff_{i,t}$ is the difference between country i 's statutory corporate income tax rate at time t minus the median corporate tax rate from the OECD Tax database for the same year.

Table 4.1 shows the regression results using data for all countries in the sample. The

coefficient estimate associated with income per capita is positive and statistically significant at the 5% level for both nationality-based foreign assets, liabilities and IFI. This result is in line with Lane and Milesi-Ferretti (2001) that shows a positive correlation between income per capita and foreign assets in a cross-section analysis using residence-based data.

Importantly, this table shows that the difference between nationality- and residence-based measures are also positively correlated with income per capita. The coefficient estimates in the regressions that use the difference between the two approaches are positive and statistically significant for foreign assets, liabilities and IFI. This result indicates that the time-varying difference between foreign holdings using these two alternative approaches is related to macroeconomic factors rather than being orthogonal to them.

The coefficient estimates associated with corporate income tax differentials are not statistically significant across specifications. Furthermore, the coefficient estimates associated with *TaxDiff* in the regressions focusing on the difference between nationality- and residence-based measures of foreign assets, liabilities and IFI are negative. At a first glance, this result seems to be at odds with Bénétrix and Sanchez Pacheco (2023) that show a positive correlation between the difference in U.S. nationality- and residence-based IFI and U.S. corporate income tax differentials.

One possibility for such result is that the sample used in Table 4.1 includes both high and low-tax countries. Consider a high-tax country A and a low-tax country B. Nationals of country A want to benefit from lower taxes in country B thus they shift holdings to that country. If country A nationals shift assets and profits to low tax country B, there would be a positive relationship between country A's tax rate and its foreign holdings. However, there would be a negative relationship between country B's tax rate and its foreign holdings. Therefore, including both high tax country A and low tax country B in the same sample could result in coefficient estimates that are not statistically significant.

In order to overcome such challenge, I divide the countries into two groups: a relatively high-tax group and a relatively low-tax group. A country i will be in the relatively high-tax group if its statutory corporate income tax rate is greater than the median tax rate from the OECD database for most years in the sample. Conversely, it will be in the relatively low-tax group if its statutory corporate income tax rate is smaller than the median tax rate for most years in the sample.

This criterion puts the United States, Austria, Belgium, Denmark, France, Italy, the Netherlands, Sweden and Greece into the relatively high tax group. The United Kingdom, Germany, Switzerland, Finland and Ireland are in the relatively low tax group.

I then estimate regression 4.1 focusing on the difference between nationality- and residence-based measures of foreign holdings for these different country sub-samples.

The coefficient β_3 should be positive for high-tax countries and negative for low-tax countries if MNEs shift profits due to differences in taxation. Consider an economy with a high-tax country A and low-tax country B with respective corporate income tax differentials $TaxDiff_A$ and $TaxDiff_B$. As country A has a relative higher tax rate, $TaxDiff_A > 0$ and $TaxDiff_B < 0$.

Consider a tax cut in country B. Such reduction increases $TaxDiff_A$ for country A while $TaxDiff_B$ for country B becomes more negative. If this tax cut encourages companies in country A to shift profits and holdings to country B, this increase in $TaxDiff_A$ should be multiplied by a positive coefficient β_3 to increase the dependent variable measuring foreign holdings for country A (Y_A). In a sample of relatively high tax countries, a positive β_3 would be consistent with profit shifting away from these countries.

The tax cut in country B makes $TaxDiff_B < 0$ more negative. Crucially, the decision by companies in country A to shift holdings to country B following the tax cut implies an increase in foreign holdings in both countries A (Y_A) and B (Y_B). This can only be achieved if $\beta_3 < 0$ when estimated in a sample of low tax countries. Therefore, profit shifting would be consistent with $\beta_3 > 0$ when estimated in a sample of high-tax countries and $\beta_3 < 0$ when estimated in a sample of low-tax countries.

Table 4.2 shows the regression results for the difference between the nationality- and residence-based foreign assets, liabilities and IFI estimated using these sub-samples. The coefficient estimates associated with $TaxDiff$ are negative and statistically significant in the regressions focused on relatively low tax countries. Meanwhile, the coefficient estimates are positive albeit not statistically significant in the regressions focused on relatively high tax countries.

Taken together, these results are consistent with the notion that nationals of relatively high tax countries shift holdings to relatively low tax countries in a way that is not completely captured by conventional residence-based data. A policy implication of such finding is that there could be more asset and profit shifting activities than what policymakers can observe if focused only on the residence-based data. Similarly, tax differentials may generate an even more significant incentive for agents to shift assets than what analysis relying on existing residence-based data suggest.

4.6 U.S. monetary policy spillovers and non-financial MNEs

The dominant role the U.S. dollar plays in international finance indicates that U.S. monetary policy can generate spillover effects in non-U.S. economic agents. Miranda-Agrippino and Rey (2020) demonstrate how U.S. monetary policy shocks generate co-movements in international financial variables. They also show that a tightening in U.S. monetary policy generates a decline in global capital flows to both banks and non-banks.

Focusing on the banking sector, Avdjiev et al. (2018) show that an easing in U.S. monetary policy increases cross-border bank lending. Similar results analyzing spillovers to cross-border capital flows in the banking sector were found by Bruno and Shin (2015). In this sense, an easing in U.S. monetary policy would be associated with an increase in foreign asset holdings by global banks.

Recent research has also focused on the U.S. monetary policy spillovers to non-bank multinationals. Arbatli-Saxegaard et al. (2022) examine different channels through which U.S. monetary policy shocks affect companies' investments in foreign countries. They find that U.S. monetary policy shocks have a larger effect on firms that present higher share of debt denominated in foreign currency and on firms that are more leveraged. Following a tightening in U.S. monetary policy, Tietz (2020) find that companies operating in countries with pegged or managed exchange rates face a larger reduction in investment relative to companies operating in floaters. Bergant et al. (2023) document spillover effects from U.S. financial conditions to cross-border merger and acquisition activities. In particular, they find that a 100bps easing U.S. financial conditions is associated with a 10% increase in global cross-border M&A activities.

In this section, I investigate whether U.S. monetary policy shocks are associated with changes in consolidated-by-nationality foreign assets by non-financial multinational enterprises. The novel data on such assets for the sample group of developed countries are used in a panel regression setting.

I proceed by estimating the following panel regression of the change in foreign assets by these companies on a series of U.S. monetary policy shocks identified by Bu, Rogers and Wu (2021) as well as some control variables. Among such variables, I include the real exchange rate, the home country's monetary policy rate and an index of U.S. financial conditions. In the robustness check subsection, I use different series of U.S. monetary policy shocks based on alternative estimation methodologies.

$$\Delta FA_{i,t}^{MNEs} = \alpha_i + \beta * USMP_t + \gamma * USFCI_t + \delta \Delta REER_{i,t} + \theta * HomeMP_{i,t} + \epsilon_{i,t} \quad (2)$$

The dependent variable $\Delta FA_{i,t}^{MNEs}$ is computed as the first difference in consolidated-by-nationality foreign asset holdings by country i 's non-financial MNEs as a percentage of GDP between year t and $t - 1$. $USMP_t$ captures changes in U.S. monetary policy. In the baseline specification, it is equal to the sum of the unified U.S. monetary policy shocks estimated by Bu, Rogers and Wu (2021) in year t . An alternative specification is presented in which $USMP_t$ is equal to the average U.S. effective Federal Funds rate for any given year t . $USFCI_t$ is the average U.S. National Financial Conditions Index computed by the Federal Reserve Bank of Chicago. $\Delta REER_{i,t}$ is the percent change in the real exchange rate of country i between years t and $t - 1$. $HomeMP_{i,t}$ represents the average monetary policy rate in country i at year t . α_i captures country fixed effects.³

Table 4.3 shows the regression results for the baseline specification shown in column (3) as well as alternative specifications. The coefficient estimates associated with $USMP_t$ defined as the unified monetary policy shocks are negative and statistically significant at the 5% level across specifications. Similarly, the coefficient estimates associated with the U.S. effective Fed Funds Rate is also negative. These results suggest that a tightening shock in U.S. monetary policy is associated with a decrease in foreign asset holdings by non-financial multinational enterprises. Such finding stands even when incorporating U.S. financial conditions in the regression analysis.

Furthermore, these regression results suggest that the home country's monetary policy is not correlated with changes in foreign asset holdings by non-financial multinationals. They also indicate there is a negative correlation between the changes in the real exchange rate of the home country and the change in foreign assets.

Taken together, I interpret these results as indicating that U.S. monetary policy appears to be a relevant factor in the decision-making of non-financial multinationals. Tighter (easier) U.S. monetary policy is associated with an decrease (increase) in consolidated-by-nationality foreign assets by these companies.

This finding complements the well-documented spillovers of U.S. monetary policy on global financial firms. Using firm level data, this paper provides evidence that U.S. monetary policy shocks also produce spillovers to non-financial multinational enterprises.

The empirical strategy adopted in this subsection does not allow for the disentanglement of the underlying channels through which a tightening U.S. monetary policy shock is associated with a reduction of foreign holdings by non-financial MNEs. A tightening

³For Euro Area countries, the monetary policy rate is the European Central Banks's deposit rate. For Switzerland, the rate is the Swiss overnight average rate. For Sweden, it is the Swedish effective repo rate. For the U.K., the monetary policy rate is the Bank of England's official bank rate. For Denmark, the policy rate is the Danish repo rate.

in U.S. monetary policy is often associated with rising funding costs. It is possible that non-financial multinational enterprises react to this by reducing investment and/or shedding assets abroad.

It is also possible that a part of this reduction in foreign assets is driven by valuation effects. A tightening in U.S. monetary policy is associated with lower asset prices. These lower asset prices could potentially explain this decline in foreign asset holdings by non-financial multinational enterprises. Further research is needed to better understand the channels through which U.S. monetary policy shocks affect investment decision by non-financial MNEs.

4.6.1 Robustness

It is possible that the negative and statistically significant coefficients associated with U.S. monetary policy shocks may be related to the particular estimation method adopted to compute these shocks. As a robustness check, I use different measures of U.S. monetary policy shocks when estimating equation 2. One such measure is the U.S. monetary policy news shocks from Nakamura and Steinsson (2018). The other set of measures are the target and path policy shocks from Gürkaynak, Sack and Swansson (2005). These updates series are taken from Acosta (2023). For each year, the monetary policy shocks used in the regression are equal to the sum of the respective shocks that took place during that year.

Table 4.4 shows the regression results for equation 2 using these different measures of policy shocks. These results show that these alternative measures of U.S. monetary policy shocks are also negatively correlated with changes in foreign asset holdings by non-financial multinationals. They indicate that the association between U.S. monetary policy shocks and changes in foreign assets is not related to the specific identification strategy used by Bu, Rogers and Wu (2021). Rather, such negative correlation also emerges once different estimation methodologies are adopted.

In sum, I find evidence that a tightening shock in U.S. monetary policy is associated with a decrease in foreign asset holdings by non-financial multinational enterprises. Such negative correlation is robust with respect to different identification strategies used to determine U.S. monetary policy shocks.

4.7 Conclusion

Consolidated-by-nationality data on foreign holdings can be particularly helpful for policymakers to identify the ultimate exposure its national economic agents have relative to several risk factors. This approach also provides a more detailed view on the decision-

making units as affiliates operating abroad are consolidated to their ultimate parent. In this paper, I construct the first data-set containing nationality-based estimates of foreign holdings for a group of developed economies over time. This data-set should complement the existing residence-based data from the seminal *External Wealth of Nations* project by Lane and Milesi-Ferretti (2001, 2007, 2018).

These novel data reveal that these developed economies are on aggregate more internationally financially integrated to the world than what is shown in the residence-based data. Such difference comes from the fact that all positions are taken into account when constructing consolidated-by-nationality data. In contrast, only cross-border positions are considered in residence-based statistics.

The country-level data reveals that most but not all countries present a larger foreign balance sheet from a consolidated-by-nationality perspective relative to the residence-based approach. In particular, countries with a significant presence of special purpose entities - most notably Ireland - can have a smaller consolidated-by-nationality balance sheet. Such result comes from the fact that the cross-border holdings related to these foreign entities do not enter their host's nationality-based balance sheet but still appears in their residence-based one.

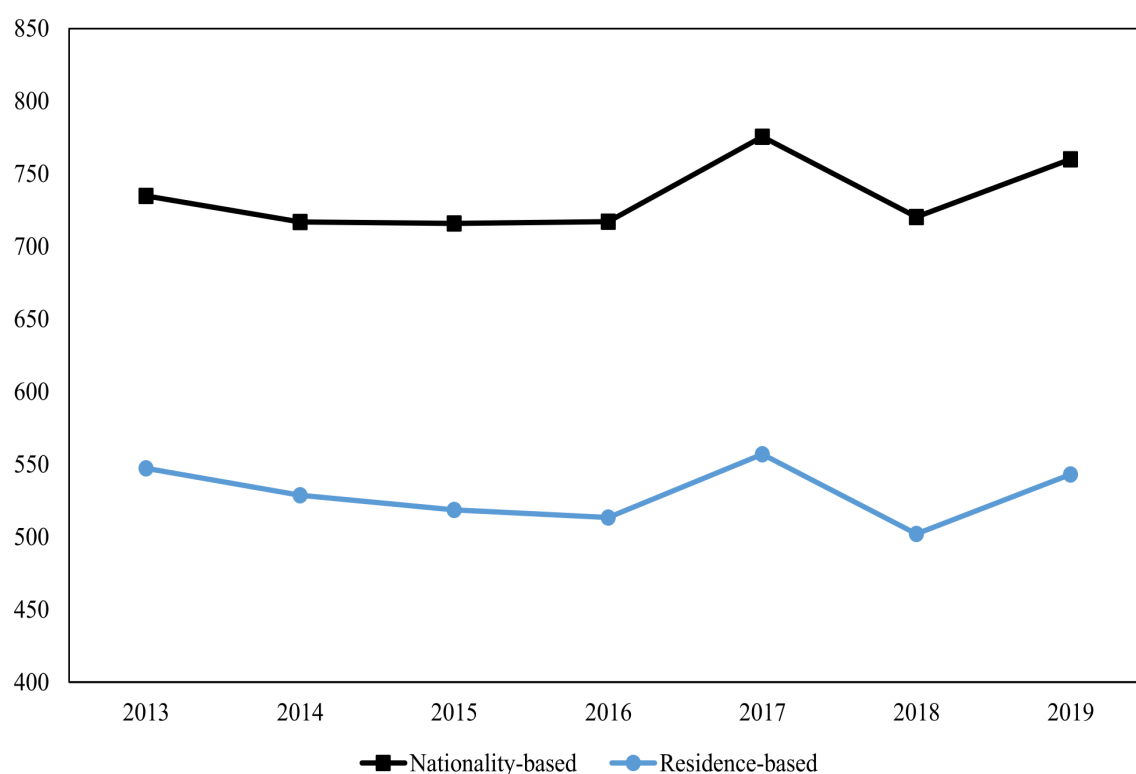
This data-set is used to analyze two separate international macroeconomic issues. The first one is on the profit shifting while the second is on the spillovers from U.S. monetary policy shocks on non-financial multinational enterprises.

For a sample of low-tax countries, I find a negative correlation between corporate income tax differentials and the difference between their consolidated-by-nationality minus residence-based foreign assets. Meanwhile, a positive coefficient estimate emerges in the same panel regression on a sample of high-tax countries. These two results are consistent with the notion that agents in high-tax countries have an incentive to shift assets and profits to low-tax countries. A policy implication that emerges from such findings is that profit shifting activities might extend beyond what is captured by residence-based statistics. This is consistent with the findings by Bénétrix and Sanchez Pacheco (2023) based on U.S. data.

The second application of these novel data is on the analysis of spillovers of U.S. monetary policy shocks on foreign asset holdings by non-financial multinational enterprises. I find a negative correlation between a tightening U.S. monetary policy shock and the change in consolidated-by-nationality foreign assets by these companies. Such negative correlation is robust with respect to different estimation methodologies of U.S. monetary policy shocks. This result suggests that U.S. monetary policy shocks might generate spillovers that are associated with changes in foreign assets by non-financial multinationals.

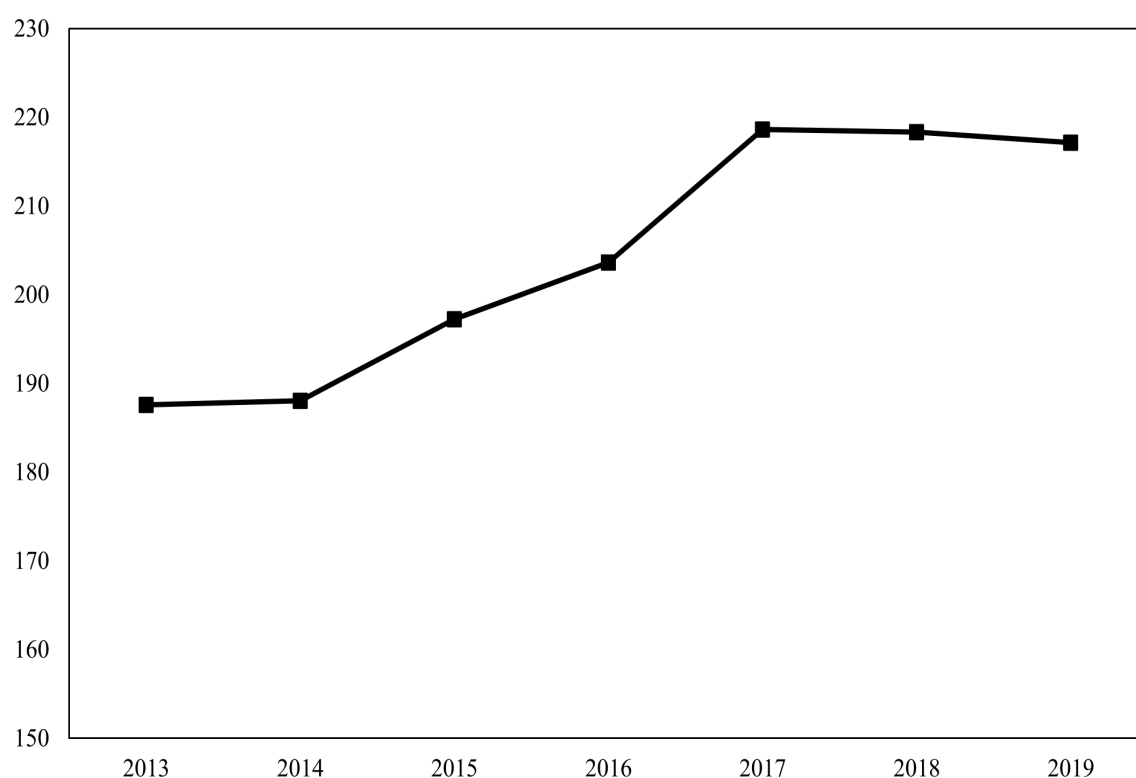
These two sets of results highlight the usefulness of these novel consolidated-by-nationality estimates of foreign holdings in addressing different international macroeconomic issues.

Figure 4.7.1: Aggregate international financial integration - % of GDP



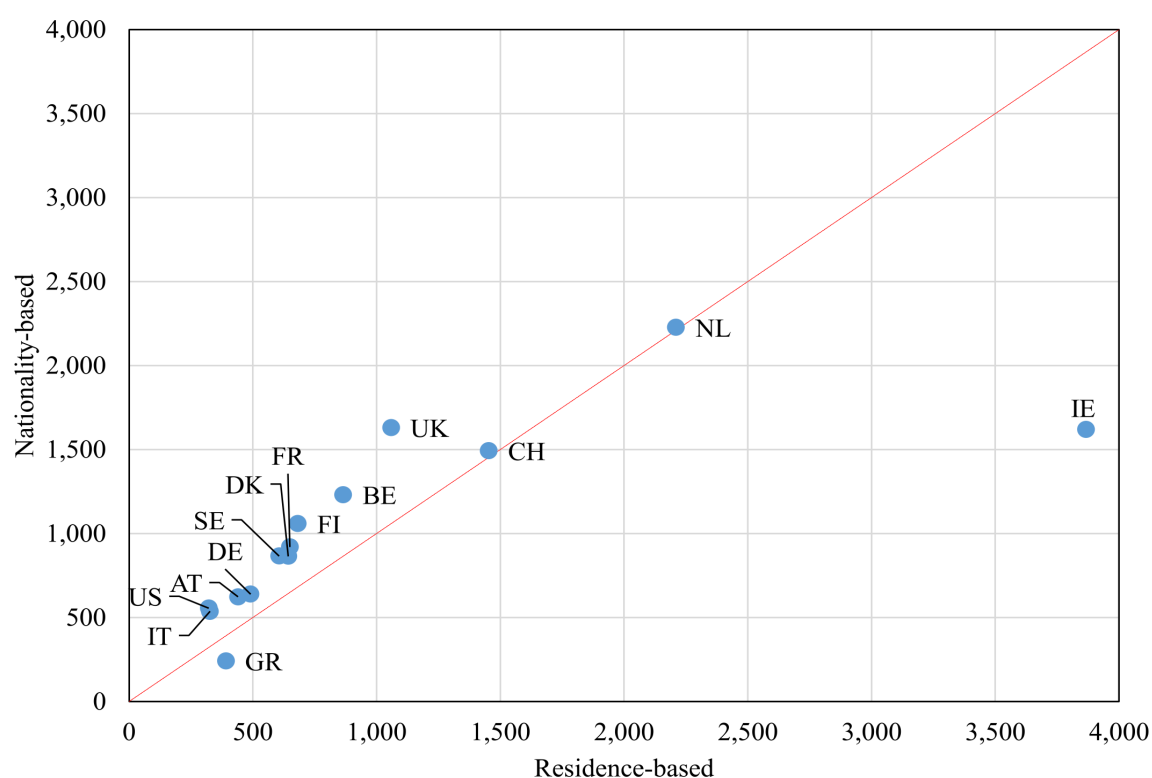
Note: This figure shows the aggregate index of international financial integration under the consolidated-by-nationality and residence-based approach. For a given year, the aggregate index is calculated as the sum of foreign assets and liabilities of selected countries divided by their GDP. It is expressed as a percentage of GDP. The countries included are the United States, the United Kingdom, Austria, Belgium, France, Germany, Italy, Netherlands, Sweden, Switzerland, Finland, Greece and Ireland. The residence-based measures come from Lane and Milesi-Ferretti's *External Wealth of Nations* database.

Figure 4.7.2: Difference between the aggregate nationality- and residence-based IFI



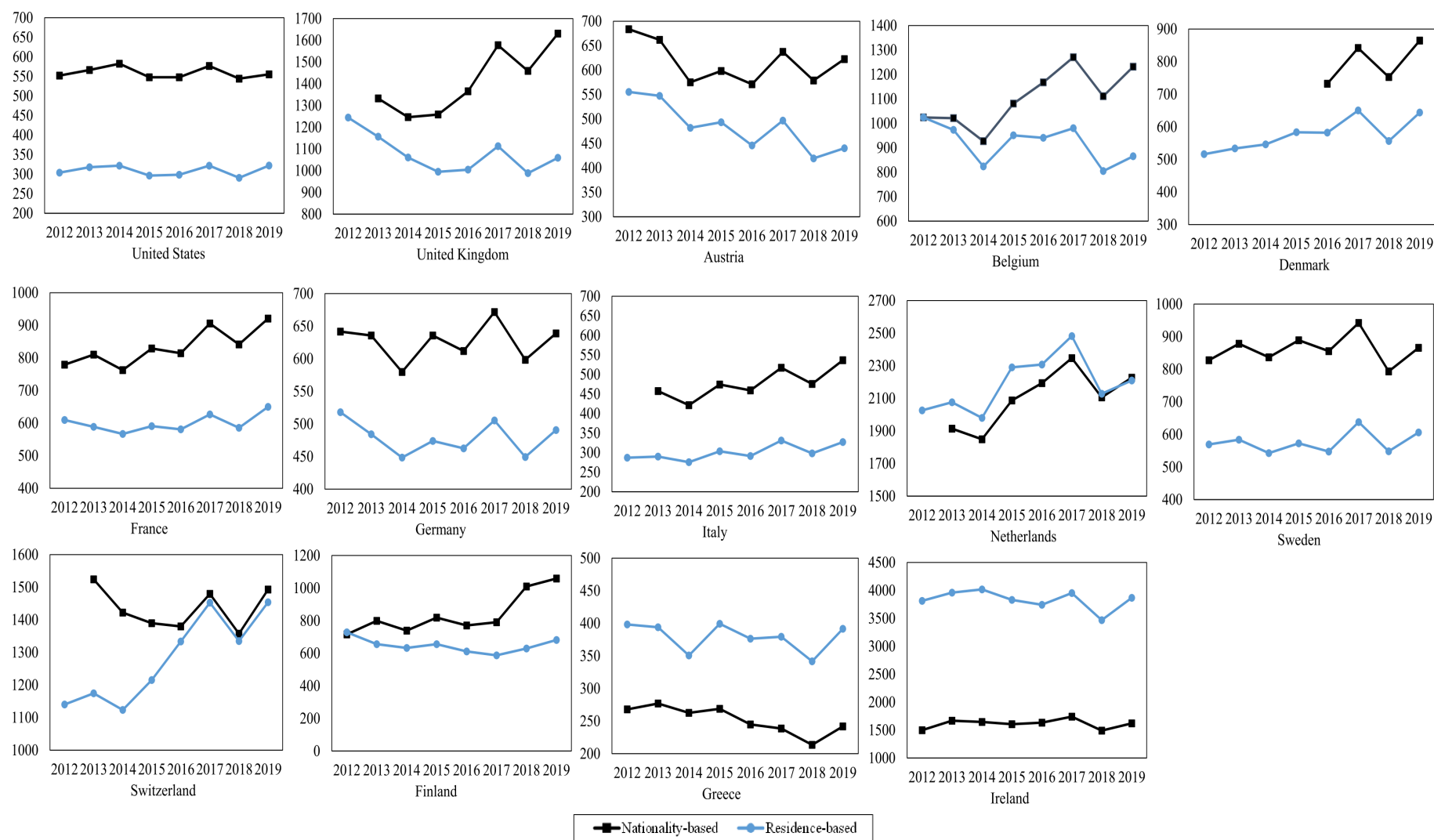
Note: This figure shows the difference between the aggregate index of international financial integration under the consolidated-by-nationality relative to the residence-based approach. It is expressed as a percentage of GDP. The countries included to construct the aggregated are the United States, the United Kingdom, Austria, Belgium, France, Germany, Italy, Netherlands, Sweden, Switzerland, Finland, Greece and Ireland. The residence-based measures come from Lane and Milesi-Ferretti's *External Wealth of Nations* database.

Figure 4.7.3: Consolidated-by-nationality and residence-based IFI - 2019



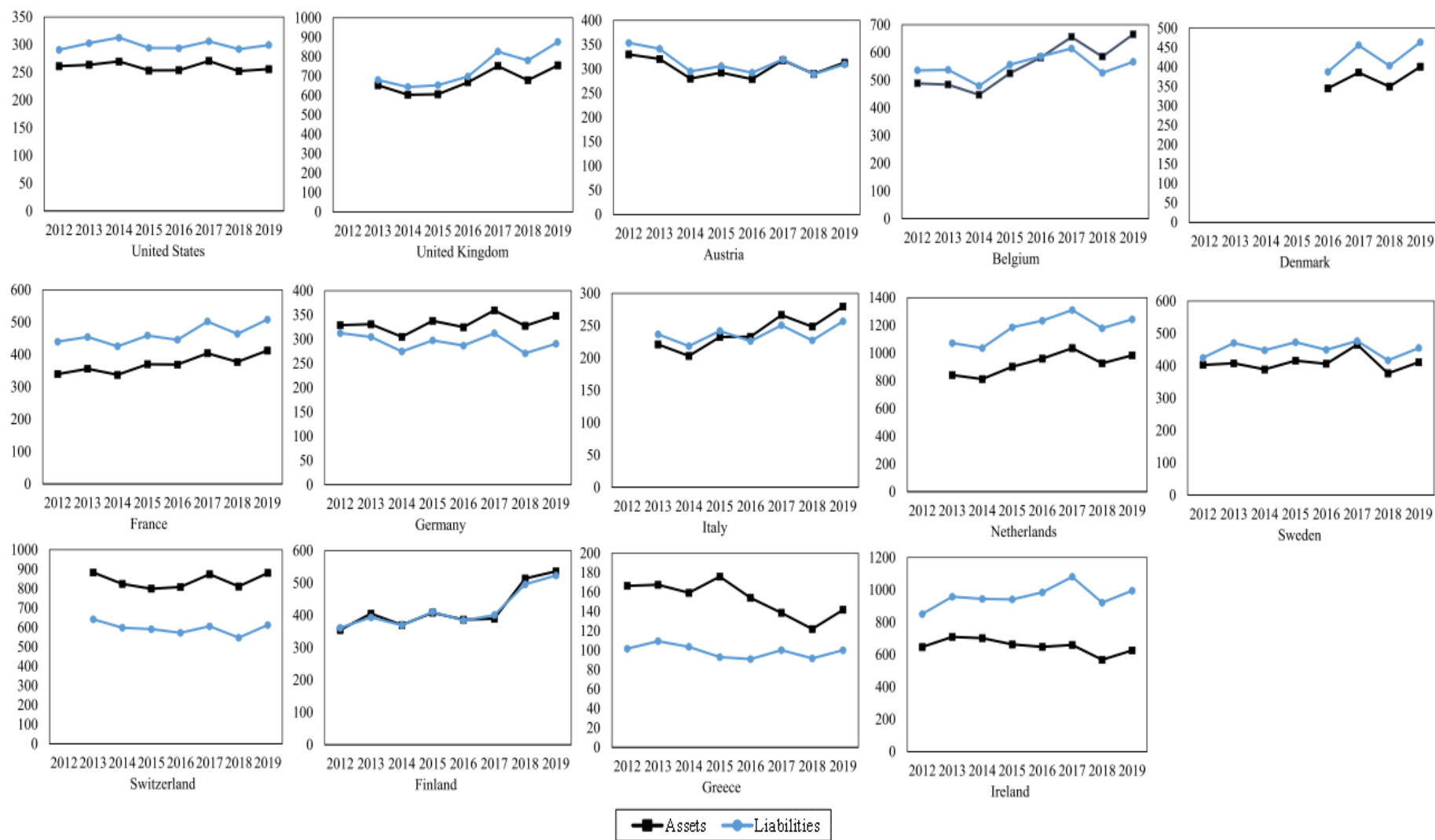
Note: This figure shows the consolidated-by-nationality and residence-based IFI for all countries in the dataset for 2019. The residence-based measures come from Lane and Milesi-Ferretti's *External Wealth of Nations* database. Data is computed as the sum of foreign assets and liabilities divided by GDP and is expressed as percentage of GDP. Countries located above the 45 degree line presented a larger consolidated-by-nationality foreign balance sheet in 2019 relative to their residence-based foreign balance sheet.

Figure 4.7.4: Nationality-based and residence-based IFI



Note: This figure shows the index of international financial integration under both the consolidated-by-nationality and residence-based approaches. It is computed as the sum of a country's foreign assets and liabilities divided by GDP. It is expressed as a percentage of GDP. The residence-based measures come from Lane and Milesi-Ferretti's *External Wealth of Nations* database.

Figure 4.7.5: Consolidated-by-nationality foreign assets and liabilities - % of GDP



Note: This figure shows estimates of consolidated-by-nationality foreign assets and holdings per country. These holdings are expressed as a percentage of GDP.

Table 4.1: Regression Results using full sample of countries

	Assets			Liabilities			IFI		
	Nationality	Residence	Difference	Nationality	Residence	Difference	Nationality	Residence	Difference
GDP pc.	2.52** (1.19)	-0.95 (1.05)	3.94*** (1.07)	2.59** (1.12)	-1.34 (0.98)	4.10*** (1.00)	5.11** (2.19)	-2.29 (2.01)	8.04*** (1.94)
Open	-1.31 (1.03)	0.06 (0.94)	-1.50 (0.93)	0.50 (0.97)	0.45 (0.88)	0.06 (0.87)	-0.82 (1.90)	0.51 (1.81)	-1.44 (1.69)
Tax Diff.	0.09 (2.05)	1.27 (1.89)	-0.75 (1.85)	0.09 (1.94)	0.83 (1.77)	-0.32 (1.73)	0.18 (3.78)	2.10 (3.62)	-1.06 (3.35)
R ²	0.19	0.23	0.31	0.44	0.34	0.12	0.00	0.00	0.03
Obs.	105	112	105	105	112	105	105	112	105

Note: * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$

Note: This table shows regression results of foreign assets, liabilities and IFI under both the consolidated-by-nationality as well as the residence-based approach. Dependent variables as expressed as a percentage of GDP. The independent variables are GDP per capita, trade as a percentage of GDP and the difference between the statutory corporate income tax rate relative to the median of a large set of countries. All regressions include country fixed effects. The number of observations vary due to missing data for some country-year pairs in the *Consolidated Foreign Wealth of Nations* dataset.

Table 4.2: Regression Results of the difference between nationality- and residence-based measures

	Difference in Assets			Difference in Liabilities			Difference in IFI		
	Full Smpl.	High Tax	Low Tax	Full Smpl.	High Tax	Low Tax	Full Smpl.	High Tax	Low Tax
GDP pc.	3.94*** (1.07)	5.93*** (1.31)	5.00** (1.82)	4.10*** (1.00)	4.14*** (0.84)	6.89*** (1.78)	8.04*** (1.94)	10.07*** (1.93)	11.89*** (3.43)
Open	-1.50 (0.93)	-0.75 (1.23)	-1.82 (1.41)	0.06 (0.87)	-0.42 (0.78)	-0.37 (1.38)	-1.44 (1.69)	-1.18 (1.80)	-2.18 (2.66)
Tax Diff.	-0.75 (1.85)	1.06 (1.45)	-24.04** (9.60)	-0.32 (1.73)	1.77* (0.92)	-35.13*** (9.36)	-1.06 (3.35)	2.83 (2.13)	-59.17*** (18.10)
R ²	0.31	0.10	0.06	0.12	0.50	0.19	0.03	0.41	0.04
Obs.	105	66	39	105	66	39	105	66	39

Note: * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$

Note: This table shows regression results of the difference in foreign assets, liabilities and IFI between the consolidated-by-nationality approach relative to the residence-based approach. Regressions are estimated using (1) the full sample of countries, (2) a sample of relatively high tax countries and (3) a sample of relatively low tax countries. Relatively high tax countries are the United States, Austria, Belgium, Denmark, France, Italy, the Netherlands, Sweden and Greece. Relatively low tax countries are the United Kingdom, Germany, Switzerland, Finland and Ireland. The independent variables are GDP per capita, trade as a percentage of GDP and the difference between a country's statutory corporate income tax rate and a median of a large sample of countries. All regressions include country fixed effects. The number of observations vary due to missing data for some country-year pairs in the *Consolidated Foreign Wealth of Nations* dataset.

Table 4.3: Regression Results of the first difference in foreign assets related to national non-financial MNEs (% of GDP)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
U.S. Monetary Policy Shock	-0.579** (0.070)	-0.510** (0.251)	-0.923*** (0.256)				
U.S. FCI			-0.420*** (0.111)	-0.162 (0.107)	-0.249** (0.108)	-0.231** (0.107)	
U.S. Fed Funds Rate						-0.128* (0.070)	-0.142** (0.071)
Real Exchange Rate		-0.011* (0.006)	-0.015** (0.006)		-0.018*** (0.006)	-0.015** (0.006)	-0.012** (0.006)
Home Policy Rate		0.052 (0.122)	0.019 (0.113)		-0.080 (0.118)	0.066 (0.141)	0.134 (0.141)
Country Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R ²	0.07	0.10	0.23	0.03	0.10	0.15	0.09
Obs.	91	91	91	91	91	91	91

Note: * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$

Note: This table shows regression results of first difference in foreign assets related to national non-financial MNEs as a percentage of GDP. The independent variables are (1) the unified measure of U.S. monetary policy shocks by Bu, Rogers and Wu (2021), (2) the U.S. National Financial Conditions Index from the Federal Reserve Bank of Chicago, (3) the U.S. Effective Federal Funds Rate, (4) the real exchange rate for the home country from the International Monetary Fund and (5) the monetary policy rate from the home country. For Euro Area countries, the monetary policy rate is the ECB's deposit rate. For Switzerland, the rate is the Swiss overnight average rate. For Sweden, it is the Swedish effective repo rate. For the U.K., the monetary policy rate is the BoE's official bank rate. For Denmark, the policy rate is the Danish repo rate. All regressions include country fixed effects.

Table 4.4: Regression Results of the first difference in foreign assets related to MNEs using alternative measures of policy shocks

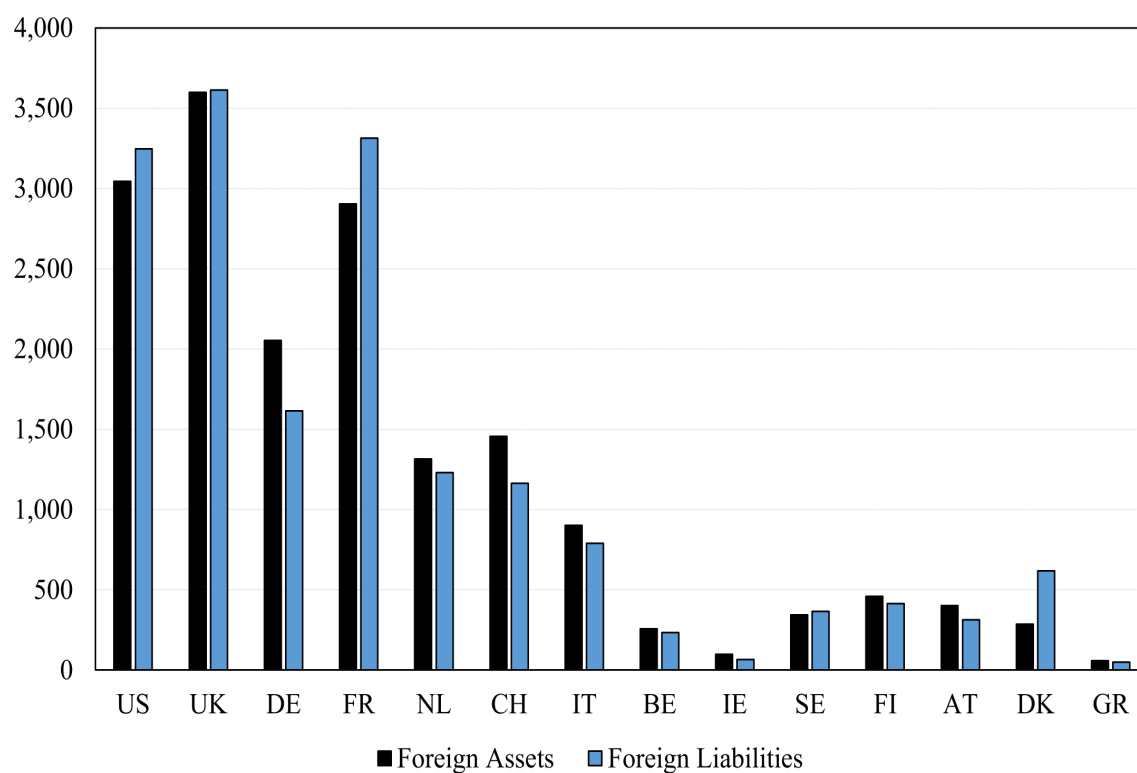
	(1)	(2)	(3)
BRW - Unified Policy shock	-0.923*** (0.256)		
NS - Policy News shock		-1.277** (0.561)	
GSS - Target shock			-0.910* (0.458)
GSS - Path shock			-0.579** (0.265)
US Financial Conditions Index	-0.420*** (0.111)	-0.427*** (0.131)	-0.458*** (0.139)
Real Exchange Rate	-0.011* (0.006)	-0.015** (0.006)	-0.016** (0.006)
Home Monetary Policy	0.019 (0.113)	-0.001 (0.120)	0.033 (0.130)
Country Fixed Effects	Yes	Yes	Yes
R ²	0.23	0.16	0.17
Obs.	91	91	91

Note: * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$

Note: This table shows regression results of first difference in foreign assets related to national non-financial MNEs as a percentage of GDP. Three different measures of U.S. monetary policy shocks are used in this analysis. The baseline specification uses the unified monetary policy shocks from Bu, Rogers and Wu (2021). Another specification uses the policy news shock from Nakamura and Steinsson (2018). A third specification uses the target and path U.S. monetary policy shocks from Gürkaynak, Sack and Swansson (2005). The independent variables are (1) a measure of U.S. monetary policy shock, (2) the U.S. National Financial Conditions Index from the Federal Reserve Bank of Chicago, (3) the U.S. Effective Federal Funds Rate, (4) the real exchange rate for the home country from the International Monetary Fund and (5) the monetary policy rate from the home country. For Euro Area countries, the monetary policy rate is the ECB's deposit rate. For Switzerland, the rate is the Swiss overnight average rate. For Sweden, it is the Swedish effective repo rate. For the U.K., the monetary policy rate is the BoE's official bank rate. For Denmark, the policy rate is the Danish repo rate. All regressions include country fixed effects.

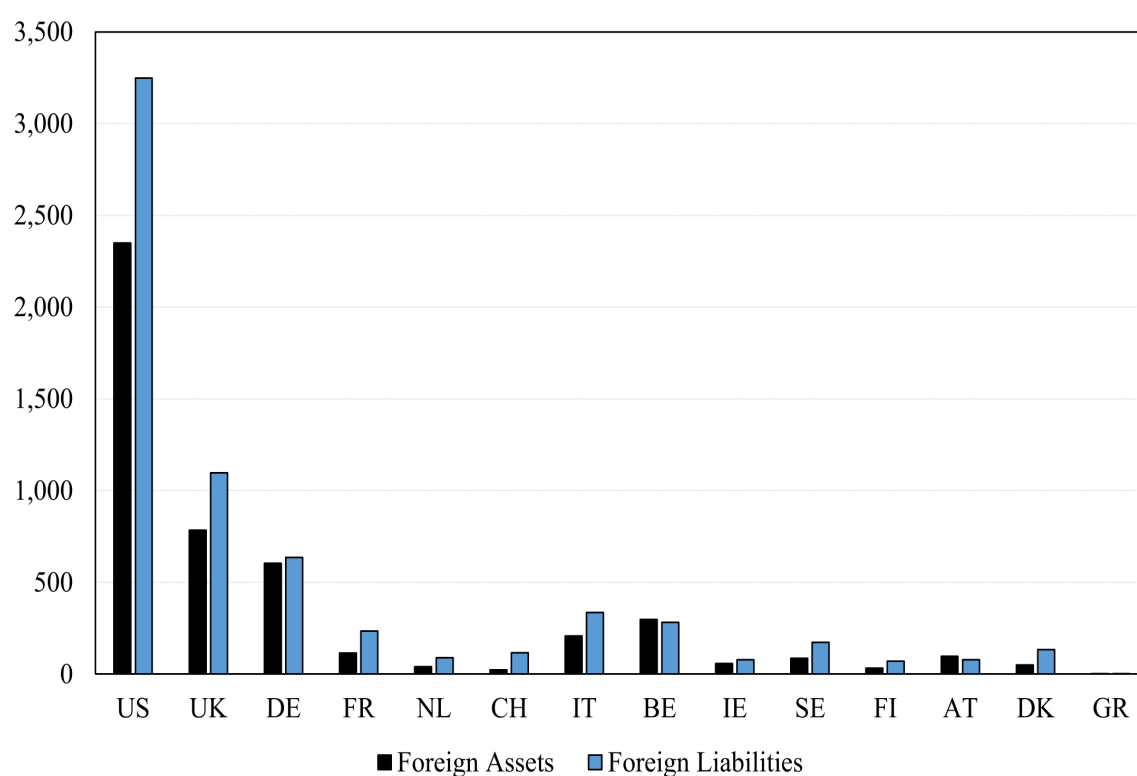
4.A Appendix

Figure 4.A.6: Consolidated-by-nationality foreign holdings related to national banks



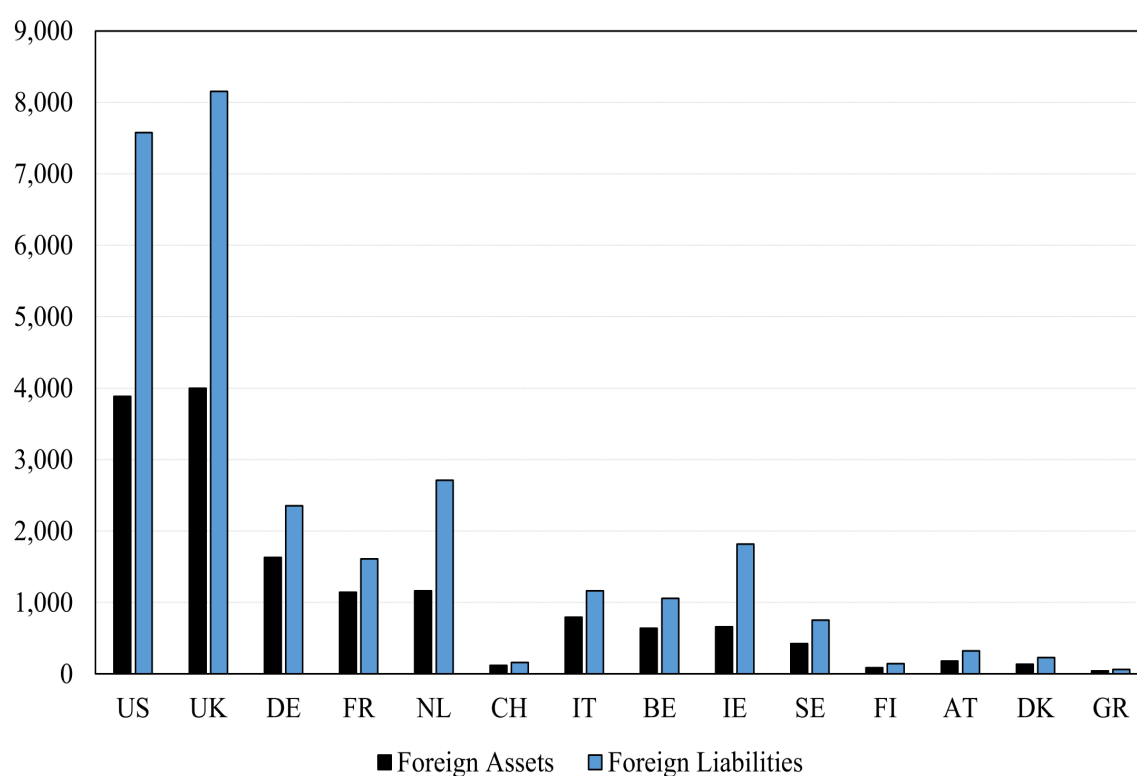
Note: This figure shows estimates of consolidated-by-nationality foreign holdings related to the activities of national banks. Data is shown for 2019 in billions of US dollars. I rely on data from the Bank for International Settlements to construct these estimates.

Figure 4.A.7: Consolidated-by-nationality foreign holdings related to foreign banks



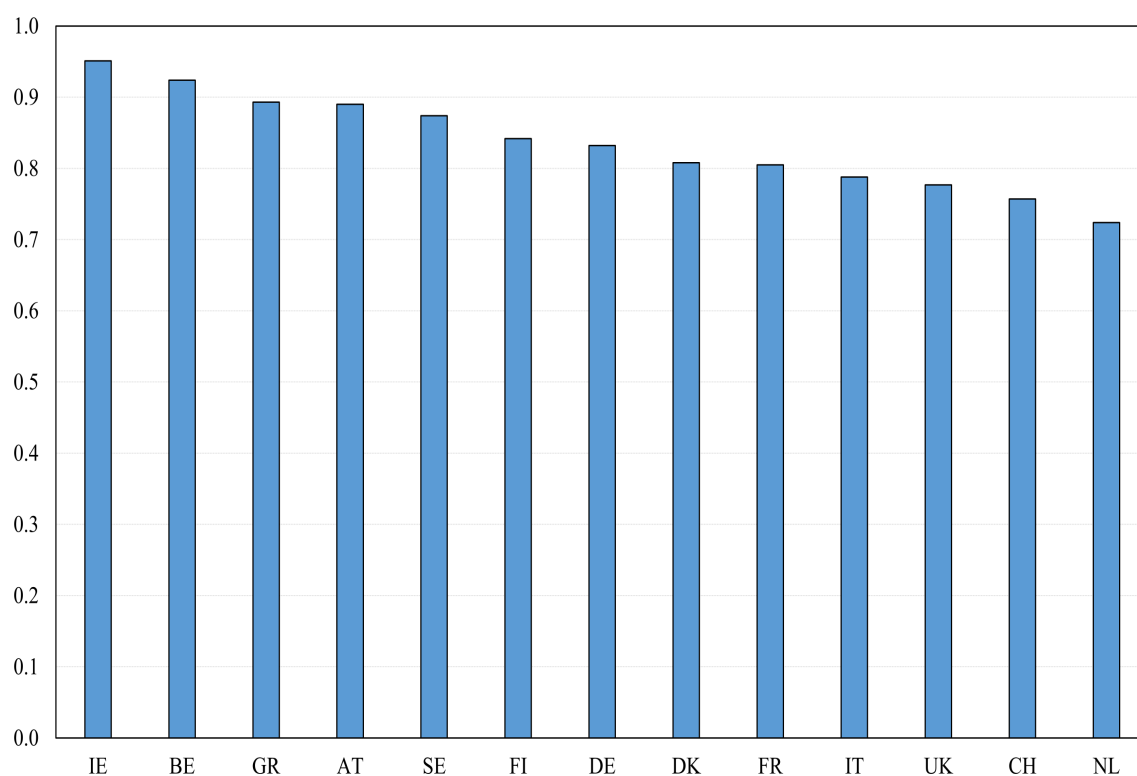
Note: This figure shows estimates of consolidated-by-nationality foreign holdings related to the the activities of foreign banks. Data is shown for 2019 in billions of US dollars. I rely on data from the Bank for International Settlements to construct these estimates.

Figure 4.A.8: Consolidated foreign holdings related to foreign non-financial MNEs



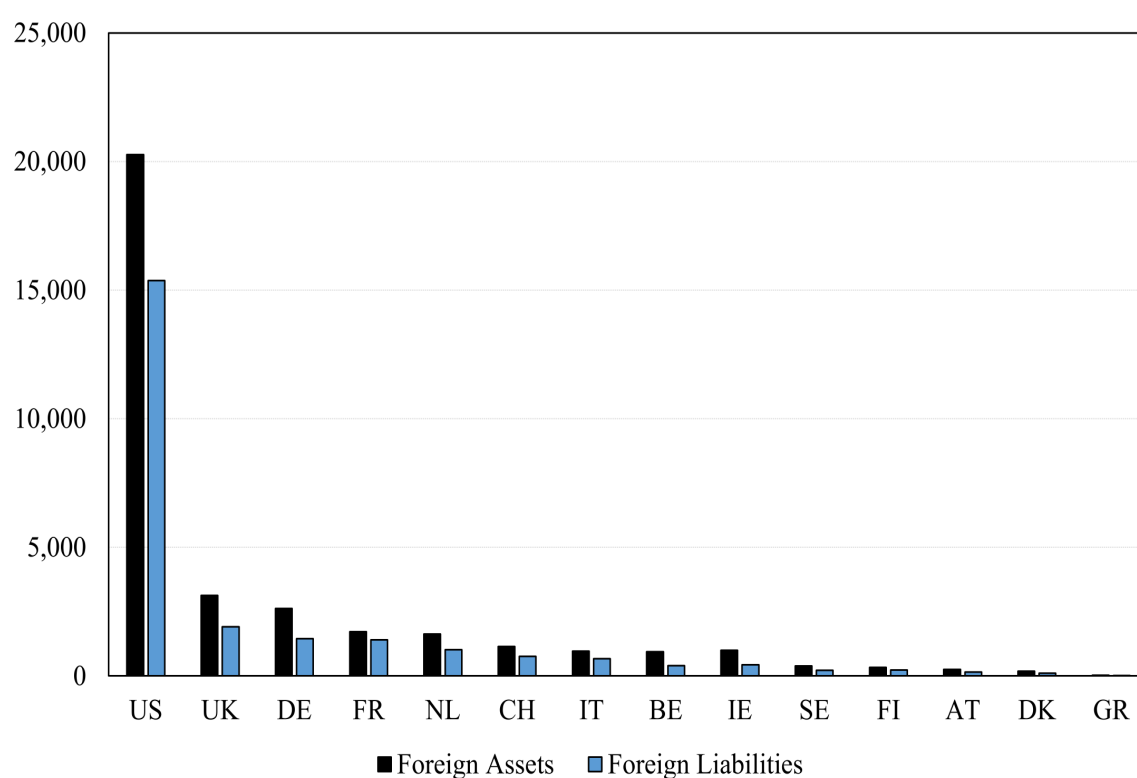
Note: This figure shows estimates of consolidated-by-nationality foreign holdings related to foreign non-financial multinational enterprises (MNEs). Data is shown for 2019 in billions of US dollars. I rely on data from Orbis Europe and the U.S. Bureau of Economic Analysis to construct these estimates.

Figure 4.A.9: Share of outbound FDI position to covered countries relative to total



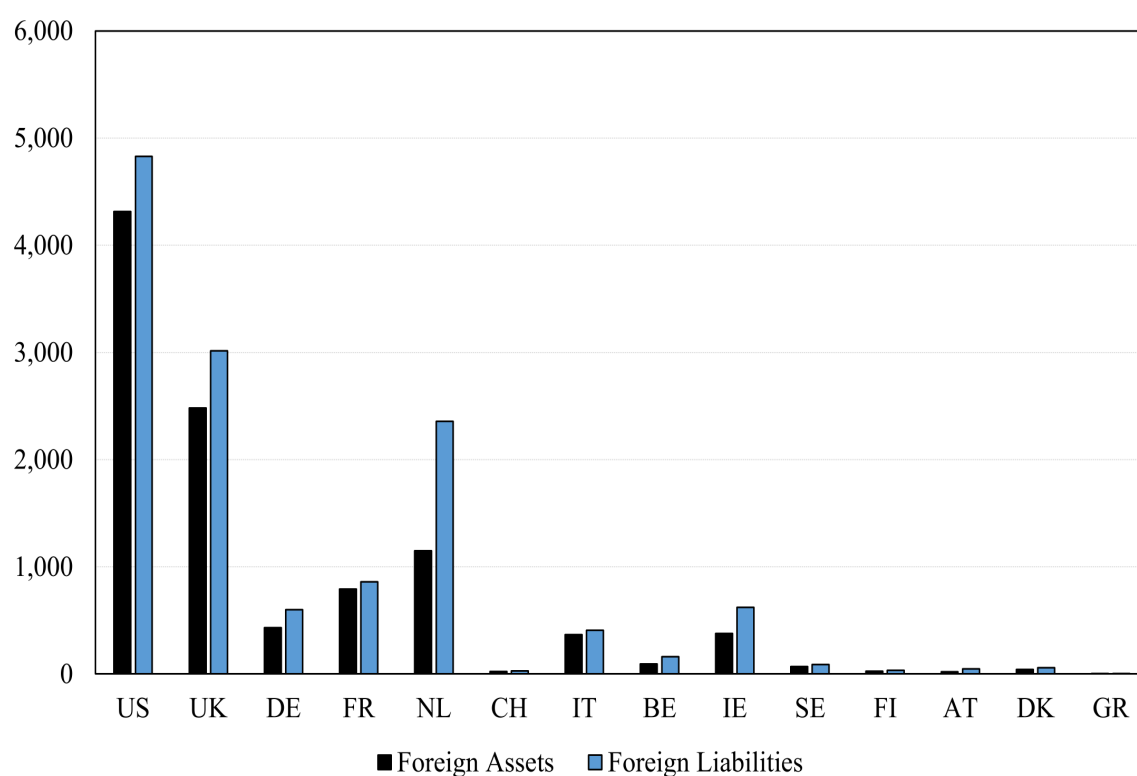
Note: This figure shows the ratio of outbound FDI position sent to countries included in Orbis Europe plus the United states relative to the total outbound FDI position for each country in the CFWN database. The percentages reported are the average shares for the period between 2009 and 2020. These percentages are computed using the IMF Coordinated Portfolio Investment Survey. We exclude from the calculation positions that have non-EU tax havens as the ultimate recipients are not known. These non-EU tax havens include Bermuda, Cayman Islands and Jersey. In the case of the United States, the U.S. BEA data provides coverage of U.S. MNEs activities in all countries. Therefore, the U.S. average share would be equal to one.

Figure 4.A.10: Consolidated foreign holdings related to national non-financial MNEs



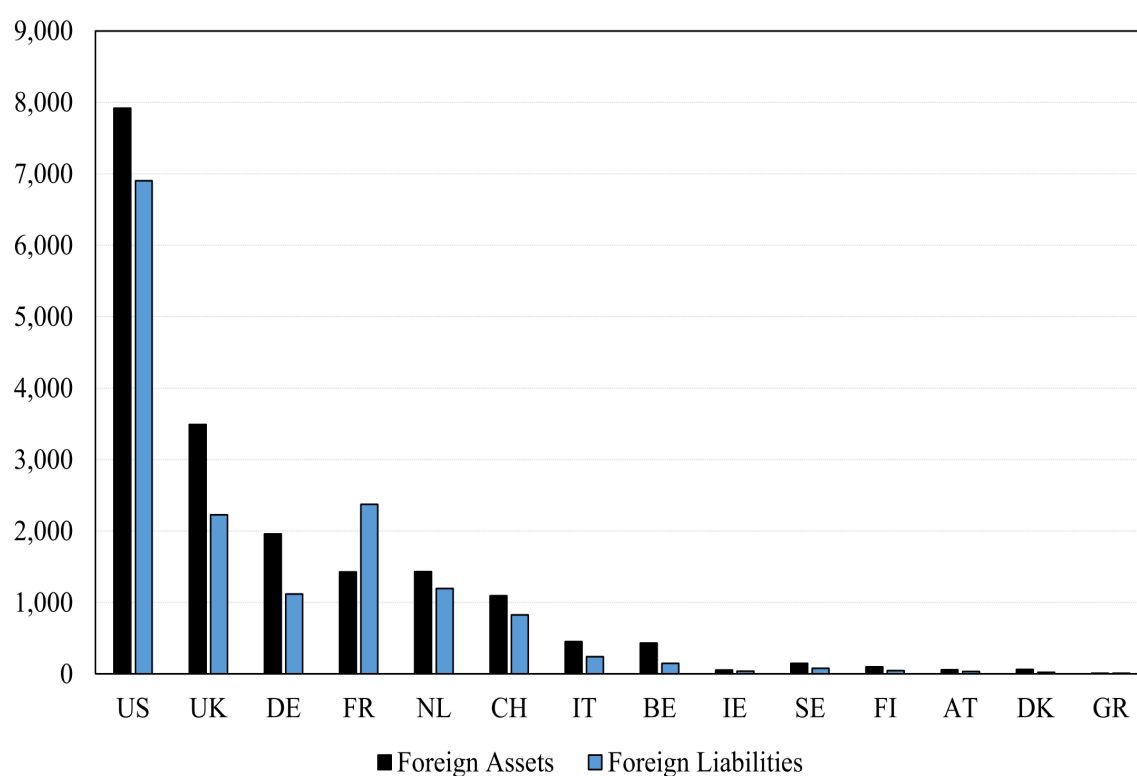
Note: This figure shows estimates of consolidated-by-nationality foreign holdings related to national non-financial multinational enterprises (MNEs). Data is shown for 2019 in billions of US dollars. I rely on data from Orbis Europe and the U.S. Bureau of Economic Analysis to construct these estimates.

Figure 4.A.11: Consolidated foreign holdings related to foreign financial non-banks



Note: This figure shows estimates of consolidated-by-nationality foreign holdings related to foreign financial non-banks. Data is shown for 2019 in billions of US dollars. I rely on data from Orbis Europe and the U.S. Bureau of Economic Analysis to construct these estimates.

Figure 4.A.12: Consolidated foreign holdings related to national financial non-banks



Note: This figure shows estimates of consolidated-by-nationality foreign holdings related to national financial non-banks. Data is shown for 2019 in billions of US dollars. I rely on data from Orbis Europe and the U.S. Bureau of Economic Analysis to construct these estimates.

5 General Conclusion

Residence-based data on external holdings have been widely used when assessing the international exposure of countries. Under this approach, foreign assets and liabilities are attributed according to the residence of the immediate counterparts in a transaction. Among different applications, these data have proven useful when building early warning systems that can alert economic agents to the risk of an external crisis in different countries. However, this residence-based approach presents two main shortcomings. It focuses exclusively on cross-border holdings and does not fully consider existing linkages between companies within the same corporate group.

This thesis focuses on developing an alternative approach to complement the existing residence-based data. This consolidated-by-nationality approach attributes foreign assets and liabilities according to the nationality of the ultimate counterparts. Assets and liabilities held by affiliates are consolidated to their parent entity. Exposures are then sorting according to the nationality of these ultimate owners. This approach has the advantage of incorporating both cross-border and local positions when sorting international exposure. It also provides a clearer identification of the positions held by multinational enterprises in foreign countries.

In the second chapter, we construct the U.S. consolidated-by-nationality foreign balance sheet for the period between 1999 and 2018. We find that the U.S. nationality-based gross foreign exposure as measured by the index of international financial integration is on average two times larger than the residence-based one. The time-varying difference between the two measures of gross exposure is positively correlated with corporate income tax differentials. Such correlation is mostly driven the activities of multinational enterprises. We interpret this as indirect evidence that U.S. MNEs take advantage of differences in corporate taxation in ways not fully captured by the residence-based approach.

In the third chapter, I construct estimates of consolidated-by-nationality foreign holdings for Ireland. Unlike in the case of the United States, there is currently not enough aggregate data to estimate the Irish nationality-based foreign balance sheet. Furthermore, the presence of foreign-owned pass-through entities and of redomiciled entities

pose additional complications. This chapter presents a methodological innovation that relies on company-level data to overcome such challenge. This chapter reveals that Irish nationality-based foreign exposure is substantially smaller than what the residence-based data suggests.

In the fourth chapter, I construct estimates of foreign holdings for a set of developed countries over multiple years using a methodology similar to that presented in chapter three. This novel data-set complements the existing residence-based External Wealth of Nations data-set from Lane and Milesi-Ferretti (2001, 2018). These data show that these countries are on aggregate more internationally financially integrated than what the residence-based data suggest. Such result derives from the fact that the consolidated-by-nationality approach considers both local as well as cross-border positions while the residence-based approach focuses only on the latter.

This data-set is used to analyze two separate international macroeconomic issues. The first one is on the profit shifting while the second is on the spillovers from U.S. monetary policy shocks on non-financial multinational enterprises. I find indirect evidence that is consistent with the notion that agents in high-tax countries have an incentive to shift assets and profits to low-tax countries. A policy implication that emerges from this analysis is that profit shifting activities might extend beyond what is captured by residence-based statistics.

The second application is on the analysis of spillovers of U.S. monetary policy shocks on foreign asset holdings by non-financial multinational enterprises. I find a negative and robust correlation between a tightening U.S. monetary policy shock and the change in consolidated-by-nationality foreign assets by these companies. This result suggests that U.S. monetary policy shocks might generate spillovers that are associated with changes in foreign assets by non-financial multinationals.

The findings presented in this thesis indicate that the consolidated-by-nationality approach can be useful for policymakers to better understand the exposure their economies have to given risk factors. Similarly, these findings show that the consolidated-by-nationality data can be employed to study different topics in international macroeconomics.

There are several avenues for future research on the consolidated-by-nationality agenda. There is currently no data available on the currency composition of nationality-based foreign assets and liabilities. Similarly, there is no data on the different maturity structures of these holdings. In terms of economic models, a framework that breaks free from the triple coincidence by decoupling decision-making units from production and currency areas is yet to be developed.

Bibliography

- [1] Acosta, M. (2023). "The Perceived Causes of Monetary Policy Surprises". Mimeo.
- [2] Arbatli-Saxegaard, E., Firat, M., Furceri, D. and J. Verrier (2022) "U.S. Monetary Policy Shock Spillovers: Evidence from Firm-Level Data". IMF Working Paper No. 2022/191.
- [3] Avdjiev, S., Everett, M., Lane, P. R. and H. S. Shin (2018). "Tracking the international footprints of global firms". BIS Quarterly Review. March 2018: 47-66.
- [4] Avdjiev, S., Hardy, B., McGuire, P. and G. von Peter. (2021). "Home sweet host: Prudential and monetary policy spillovers through global banks". Review of International Economics 29 (1): 20-36.
- [5] Avdjiev, S., Koch, C., McGuire, P. and G. von Peter (2018). "Transmission of monetary policy through global banks: Whose policy matters?" Journal of International Money and Finance 89: 67-82.
- [6] Avdjiev, S., McCauley, R. and H. S. Shin (2016). "Breaking free of the triple coincidence in international finance". Economic Policy 31 (87): 409-451.
- [7] Baldwin, R. and F. Kimura (1998). "Measuring U.S. International Goods and Services Transactions" in Geography and ownership as bases for economic accounting, University of Chicago Press for the National Bureau of Economic Research, pp 9-48.
- [8] Baldwin, R., Lipsey, R. and D. Richardson (1998). "Introduction" in Geography and ownership as bases for economic accounting, University of Chicago Press for the National Bureau of Economic Research, pp 1-8.
- [9] Bank for International Settlements. (2015). 85th Annual Report.
- [10] Bank for International Settlements. BIS Consolidated Banking Statistics.
<https://www.bis.org/statistics/consstats.htm>.

-
- [11] Bénétrix, A. S. and A. Sanchez Pacheco (2023). "Corporate Taxation and International Financial Integration: U.S. evidence from a consolidated perspective". Oxford Open Economics 2. odac011.
 - [12] Bergant, K., Mishra, P. and and R. Rajan (2023). "Cross-border Spillovers: How US Financial Conditions affect M&As Around the World". Working Paper.
 - [13] Bernanke, B. (2005). "The Global Saving Glut and the U.S. Current Account Deficit". Speech delivered at the Sandridge Lecture, Virginia Association of Economics, Richmond, Virginia.
 - [14] Blanchard, O. and J. Acalin (2016). "What Does Measured FDI Actually Measure?". Peterson Institute for International Economics Policy Brief PB 16-17.
 - [15] Bloomberg Tax Inversion Tracker.
<https://www.bloomberg.com/graphics/tax-inversion-tracker/>
 - [16] Blomstrom, M., Kokko, A. (1998). "Multinational Corporations and Spillovers". Journal of Economic Surveys 12 (3): 247–277.
 - [17] Borio, C. (2013). "The Great Financial Crisis: setting priorities for new statistics". Journal of Banking Regulation 13: 306-317.
 - [18] Bureau of Economic Analysis. International Economic Accounts.
<https://www.bea.gov/data/economic-accounts/international>. U.S. Department of Commerce.
 - [19] Bruno, V. and H. S. Shin (2015) "Capital flows and the risk-taking channel of monetary policy". Journal of Monetary Economics 71: 119-132.
 - [20] Bu, C., Rogers, J. and W. Wu (2021). "A unified measure of Fed monetary policy shocks". Journal of Monetary Economics 118: 331-349.
 - [21] Catao, L. and G. M. Milesi-Ferretti. (2014). "External liabilities and crises". Journal of International Economics 94: 18-32.
 - [22] Central Bank of Ireland. Official External Reserves.
 - [23] Central Statistics Office. International Investment Position BPM6.
<https://data.cso.ie/table/BPQ23>
 - [24] Coppola, A., Maggiori, M., Neiman, B. and J. Schreger (2021). "Redrawing the Map of Global Capital Flows: The Role of Cross-Border Financing and Tax Havens". Quarterly Journal of Economics 136 (3): 1499-1556.

-
- [25] Damgaard, J. and T. Elkjaer (2017). "The Global FDI Network: Searching for Ultimate Investors". IMF Working Paper No. 17/258.
- [26] Damgaard, J., Elkjaer T. and N. Johannesen (2019). "What is Real and What is Not in the Global FDI Network". IMF Working Paper No. 19/274.
- [27] Devereux, M. and C. Yu (2020). "International Financial Integration and Crisis Contagion". *The Review of Economic Studies* 87 (3): 1174-1212.
- [28] Di Nino, V., Habib, M. M. and M. Schmitz (2020). "Multinational enterprises, financial centres and their implications for external imbalances: a euro area perspective". *ECB Economic Bulletin* 2/2020.
- [29] Dischinger, M. and N. Riedel (2011). "Corporate taxes and the location of intangible assets within multinational firms". *Journal of Public Economics* 95 (7-8): 691-707.
- [30] Djankov, S., Ganser, T., McLiesh, C., Ramalho, R. and A. Shleifer (2010). "The Effect of Corporate Taxes on Investment and Entrepreneurship". *American Economic Journal: Macroeconomics* 2 (3): 31-64.
- [31] Federal Reserve Bank of Chicago. National Financial Conditions Index.
- [32] Federal Reserve Board. Financial accounts of the United States. <https://www.bea.gov/data/economic-accounts/international>.
- [33] Galstyan, V. (2019). "Estimates of Foreign Assets and Liabilities for Ireland". Central Bank of Ireland Research Technical Paper 2019 (3).
- [34] Galstyan, V., Maqui, E. and P. McQuade (2021). "International debt and special purpose entities: Evidence from Ireland". *Journal of International Money and Finance* 115: 102398.
- [35] Gourinchas, P.-O., M. Obstfeld (2012). "Stories of the Twentieth Century for the Twenty-First". *American Economic Journal: Macroeconomics* 4(1): 226-265.
- [36] Gürkaynak, R., Sack, B. and E. Swansson (2005). "Do Actions Speak Louder Than Words? The Response of Asset Prices to Monetary Policy Actions and Statements". *International Journal of Central Banking* 1, May 2005.
- [37] Hájková, D., Nicoletti, G., Vartia, L. and K.-Y. Yoo (2007). "Taxation and business environment as drivers of foreign direct investment in OECD countries". *OECD Economic Studies* 2006(2): 7-38.
- [38] Hebous, S. and N. Johannessen (2021). "At your service! The role of tax havens in international trade with services". *European Economic Review* 135: 103737.

- [39] Honohan, P. (2021). "Is Ireland really the most prosperous country in Europe?". Central Bank of Ireland Economic Letter 2021 (1).
- [40] International Monetary Fund. Coordinated Portfolio Investment Survey. <https://data.imf.org/?sk=B981B4E3-4E58-467E-9B90-9DE0C3367363>
- [41] International Monetary Fund. Financial Development Index Database. <https://data.imf.org/?sk=f8032e80-b36c-43b1-ac26-493c5b1cd33b>
- [42] Kalemli-Ozcan, S., Sorensen, B., Villegas-Sanchez, C., Volosovych, V. and S. Yesiltas (2015). "How to Construct Nationally Representative Firm Level Data from the ORBIS Global Database". NBER Working Paper 21558.
- [43] Karninsky, T. and N. Riedel (2012). "Corporate taxation and the choice of patent location within multinationals firms". *Journal of International Economics* 88(1): 176-185.
- [44] Lane, P. R. (2019). "Globalisation: A Macro-Financial Perspective - Geary Lecture 2019". *The Economic and Social Review* 50 (2): 249-263.
- [45] Lane, P. R. (2021). "Maximising the user value of statistics: lessons from globalisation and the pandemic". Speech at the European Statistical Forum.
- [46] Lane, P. R. and G. M. Milesi-Ferretti (2001). "The external wealth of nations: measures of foreign assets and liabilities for industrial and developing countries". *Journal of International Economics* 55 (2): 263-294.
- [47] Lane, P. R. and G. M. Milesi-Ferretti (2003). "International Financial Integration". IMF Working Papers 2003/086
- [48] Lane, P. R. and G. M. Milesi-Ferretti (2007). "The External Wealth of Nations Mark II: Revised and Extended Estimates of Foreign Assets and Liabilities, 1970–2004". *Journal of International Economics* 73 (2): 223–250
- [49] Lane, P. R. and G. M. Milesi-Ferretti (2018). "The External Wealth of Nations Revisited: International Financial Integration in the Aftermath of the Global Financial Crisis". *IMF Economic Review* 66: 189–222.
- [50] Lane, P. R. and G. M. Milesi-Ferretti (2021). "The External Wealth of Nations database". Brookings Institution. <https://www.brookings.edu/research/the-external-wealth-of-nations-database/>.
- [51] Lucas, R. (1990). "Why Doesn't Capital Flow from Rich to Poor Countries?". *American Economic Review* 80(2): 92-96.

-
- [52] McCauley, R., Bénétrix, A., McGuire, P. and G. von Peter (2019). "Financial De-globalisation in Banking?" *Journal of International Money and Finance* (94): 116-131
 - [53] McCauley, R. (2018). "The 2008 Crisis: Transpacific or Transatlantic?". *BIS Quarterly Review*. December 2018.
 - [54] Mider, Z. (2017) "Tax Inversion". *Bloomberg Quick Take*. 2 March.
<https://www.bloomberg.com/quicktake/tax-inversion>
 - [55] Miranda-Agrippino, S. and H. Rey (2020). "U.S. Monetary Policy and the Global Financial Cycle ". *The Review of Economic Studies* 87 (6): 2754-2776.
 - [56] Nakamura, E. and J. Steinsson (2018) "High Frequency Identification of Monetary Non-Neutrality: The Information Effect". *Quarterly Journal of Economics* 133 (3): 1283-1330.
 - [57] Organisation for Economic Co-operation and Development. *OECD Tax Database*.
 - [58] Osborne-Kinch, J., Coates, D. and L. Nolan (2017). "The Aircraft Leasing Industry in Ireland: Cross Border Flows and Statistical Treatment," *Central Bank of Ireland Quarterly Bulletin* 01: 58-69.
 - [59] Sanchez Pacheco, A. (2022). "A consolidated-by-nationality approach to Irish Foreign Exposure". *International Economics* 170: 235-247.
 - [60] Svirydenka, K. (2016). "Introducing a New Broad-based Index of Financial Development". *IMF Working Paper* 16/5.
 - [61] Tietz, R. (2020). "Dollar borrowing by non-financial firms and the real effects of US monetary policy abroad". *Mimeo*.
 - [62] Tørsløv, T., Weir, L. and G. Zucman (2022). "The Missing Profits of Nations". *The Review of Economic Studies*. rdac049.
 - [63] Treasury International Capital System. U.S. International Portfolio Investment.
<https://www.treasury.gov/resource-center/data-chart-center/tic/Pages/index.aspx>.
 - [64] Wier, L. and G. Zucman (2022). "Global Profit Shifting, 1975-2019". *UNU-WIDER Working Paper* 2022/121.
 - [65] World Bank. *World Bank Open Data*. <https://data.worldbank.org/>
 - [66] Zucman, G. (2014). "Taxing across Borders: Tracking Personal Wealth and Corporate Profits". *Journal of Economic Perspectives* 28(4): 121-48.