The effect of international tax incentives on the activities of multinational corporations

Dissertation
zur Erlangung des Doktorgrades
der Wirtschafts- und Sozialwissenschaftlichen Fakultät
der Eberhard Karls Universität Tübingen

vorgelegt von
Johanna Paraknewitz
aus Rendsburg

Tübingen
2023

Tag der mündlichen Prüfung:	19.09.2023
Dekan:	Prof. Dr. Ansgar Thiel
1. Gutachterin:	Prof. Dr. Valeria Merlo
2. Gutachter:	Prof. Dr. Frank Stähler

Acknowledgements

This dissertation is the culmination of a three-year PhD at the Research School of International Taxation (RSIT) at the University of Tübingen. It has been a challenging but rewarding journey and it goes without saying that this dissertation would not have been possible without the people around me.

First and foremost, I want to thank my supervisors Valeria Merlo and Georg Wamser. I am very grateful for their expertise and support which have helped me elevate my work. I also want to thank them for the opportunities they have given me, including an extended research visit abroad where I had the chance to meet inspiring people and build international friendships.

In addition, this dissertation has benefitted immensely from the excellent research environment at the Economics Department at the University of Tübingen and the RSIT. I appreciate the generous access to different data and the exchange of ideas with colleagues from near and far in various seminars, workshops, and conferences.

Many thanks also go to my former mentors at the University of Bayreuth. Without their support, I would certainly not be where I am today.

Finally, I want to thank my family and friends who have not only provided me with support, but also encouraged me when I felt like giving up and celebrated with me whenever I reached an important milestone.

Contents

1 Introduction **1**

2 Services trade and tax incentives **6**

2.1 Introduction . . . 7
2.2 Related literature . . . 9
2.2.1 Services trade flows and the gravity model . . . 9
2.2.2 DTTs and tax information exchange agreements . . . 9
2.2.3 IP box regimes and royalty payments . . . 11
2.3 Data . . . 12
2.4 Descriptive evidence . . . 13
2.4.1 Different services trade flows . . . 13
2.4.2 Royalties paid to countries with IP box regime . . . 17
2.5 Services trade flows dominated by MNCs and tax treaties . . . 17
2.6 Tax-motivated royalty payments and DTTs . . . 19
2.7 Conclusion . . . 22
Appendix . . . 24
2.A Variable description . . . 24

3 Empirical evidence on the global minimum tax: What is a critical mass and how large is the substance-based income exclusion? **29**

3.1 Introduction . . . 30
3.2 Critical mass of countries . . . 31
3.2.1 Conceptual framework . . . 31
3.2.2 Data, methodology, and results . . . 32
3.2.3 Summary . . . 35
3.3 Substance-based income exclusion . . . 36
3.3.1 Data and methodology . . . 36
3.3.2 The size of the SBIE relative to pre-tax profit . . . 37
3.3.2.1 Sensitivity analysis . . . 38
3.3.2.2 Results by country . . . 39
3.3.2.3 Ownership of assets . . . 40

3.3.2.4 Heterogeneity by sector and source of finance 41
3.3.3 Summary 43
3.4 Conclusion 44
Appendix 45
3.A Sample coverage 45
3.B Share of pre-tax profit covered by SBIE by country (after 10 years) . . . 46

4 Corporate dividend payments along the ownership chain: On repatriation taxes, owner outcomes, and the role of conduit firms 48
4.1 Introduction 49
4.2 Related literature 51
4.2.1 The determinants of dividend repatriations 51
4.2.2 The effect of dividend repatriations 52
4.3 Data 53
4.3.1 Ownership and financial information 53
4.3.2 Dividend tax incentives 54
4.3.3 Additional explanatory variables 55
4.4 Descriptive evidence 56
4.4.1 Ownership links and firm locations 56
4.4.2 Financial information 56
4.5 The determinants of dividend payments 59
4.6 The effect of dividends repatriations 61
4.7 Additional result 65
4.7.1 The location choice of firms 65
4.7.2 Dividend repatriations and "foreign" intermediate firms 67
4.8 Conclusion 69
Appendix 70
4.A Additional descriptives with ownership information 70
4.B Additional descriptives with ownership and financial information 71
4.C Variable description 72
4.D Endogenous regression results 73
4.E First-stage regression results 75
4.F Robustness 77

5 Double counting of dividend income in unconsolidated financial statement data: On the role of ownership structures and implications for profit shifting estimates 82
5.1 Introduction 83
5.2 Related literature 85

5.3 Theoretical considerations . . . 86
5.4 Data . . . 88
5.4.1 Ownership data . . . 88
5.4.2 Financial and other data . . . 89
5.5 MNC ownership network structures . . . 90
5.5.1 The position of low-tax entities . . . 90
5.5.2 Robustness: The position of tax haven entities . . . 91
5.6 Re-assessing the extent of profit shifting . . . 92
5.6.1 Sample description . . . 92
5.6.2 Regression analysis . . . 93
5.6.3 Robustness: Dividend repatriations considering shareholdings . . . 96
5.7 Additional results: MNCs in different countries . . . 99
5.8 Conclusion . . . 101
Appendix . . . 103
5.A Variable description . . . 103
5.B MNC ownership structure: Additional information . . . 104
5.C Regression sample: Additional information . . . 105
5.D Additional results: MNCs in different countries . . . 108

Chapter 1

Introduction

Historically, the right to tax active income (i.e. income from selling products or services) is assigned to those countries where the business activity takes place (hereafter, source countries). In turn, the right to tax passive income, such as dividends and royalties, is often with the residence countries (i.e. countries where the recipient of the payment is located). Notwithstanding this general allocation of taxation rights, however, source countries retain the right to levy so-called withholding taxes and – claiming that foreign investors would otherwise benefit from their infrastructure without contributing sufficiently to it – many countries do impose these taxes on payments to foreign recipients (Petkova, 2020). In order to account for the taxes already paid abroad, many countries often also provide some method of double tax relief.[1] Without further coordination between source countries and resident countries, however, the granted double tax relief is usually imperfect and the likelihood of double taxation remaines high (Beer and Loeprick, 2018; Petkova, 2020). In the mid 1920s, the League of Nations therefore initiated a first attempt to find an international solution to the double taxation of multinational corporations (MNCs). However, it took until the 1990s before governments started to fully recognize the special role of double tax treaties (DTTs): Specifying country-pair specific withholding tax rates and/or methods of double tax relief, DTTs set limits on whether, when, and to what extent the contracting parties can tax cross-border income payments. Today, DTTs are considered to be a key building block of the international tax system (Cavelti, 2013; Hearson, 2016).

Together with the growing importance of DTTs, globalization and digitalization have

[1] Specifically, countries can exempt foreign income from taxation if they operate a territorial (source-based) tax system. Alternatively operating a worldwide (resident-based) tax system, countries usually provide a tax credit for taxes already paid abroad. This implies, that domestic taxes on foreign income are reduced one-for-one with the taxes already paid abroad. This foreign tax credit can be direct in the sense that it only applies to the withholding tax levied by the foreign country. If the foreign tax credit is indirect, in turn, the tax credit applies to both the withholding tax and the underlying corporate income tax in the foreign country. A last option is to deduct foreign taxes from the taxable income. This implies that foreign taxes are seen as a tax-deductible cost of doing business at par with other business costs (Huizinga et al., 2008).

contributed largely to – and benefited from – the proliferation of MNCs. In this process, not only actual activities have become more mobile across countries. Along with the increasing freedom in choosing the location of their most important resources, such as intangible assets, and valuing internal financial flows, such as royalties, reported activities and profit have also gained unprecedented mobility. On the one hand, this led to countries competing for MNCs. For instance, a growing number of countries has introduced preferential tax regimes for income arising from the exploitation of intellectual property (IP). These regimes – often referred to as IP box regimes, patent box regimes, or knowledge box regimes – have in common that they offer substantially lower tax rates on qualified IP income. The incentive to locate IP assets where taxes are low is further increased by the ability to deduct the royalty payments for the use of the IP (OECD, 2018). On the other hand, the increasing mobility of MNC activities and profit has led to concerns about losing tax revenue and demonstrated that improved international cooperation is inevitable. Guided by the Organisation for Economic Co-operation and Development's Base Erosion and Profit Shifting (BEPS) report and the following plan containing 15 concrete actions, 104 jurisdictions therefore signed an agreement by late 2018 to automatically exchange tax-related information under the Common Reporting Standard (CRS). More recently, almost 140 jurisdictions agreed to introduce a global minimum tax on corporate profit in October 2021.

With four self-contained chapters, the aim of this dissertation is to contribute to a broad literature studying the effect of different tax incentives on MNC activities. Thus, the level of analysis ranges from country-level services trade flows dominated by MNCs in Chapter 2 to consolidated financial statement data of large MNCs subject to the global minimum tax in Chapter 3 to dividend payments retrieved from unconsolidated financial statement data in Chapters 4 and 5. In connection with the preparation of these chapters, extensive data were gathered and added to the International Tax Institutions (ITI) database of the Tübingen Reseach School of International Taxation (RSIT). Due to their high relevance for this dissertation, I provide a brief summary: Documenting the growing importance of DTTs for the international tax system, the number of DTTs in the ITI database has increased from two in 1926 to more than 3,297 today. Even more impactful is the proliferation of automatic information exchange arrangements under the CRS: Within only a couple years after their introduction in 2017, the number of automatic exchange of information agreements under the CRS has increased to 2,972 in 2023. With respect to IP box regimes, the ITI database distinguishes between "strict" IP box regimes (i.e. those that focus exclusively on IP assets) and "dual" ones (i.e. those that also provide benefits to income from other geographically mobile activities than IP assets or provide benefits to a wide range of activities and do not necessarily exclude income from IP assets). After the first "dual" IP box regime was introduced by Curacao in 1940, the ITI database registers 16 different countries operating a such regime in 2021.

With respect to "strict" IP box regimes, in turn, there are currently 28 different countries operating a total of 31 such regimes – after the first one was established by France in 1971. The data in the ITI database also show that withholding tax rates have generally decreased over the past decades – with rates negotiated under a DTT generally being lower than rates set unilaterally. Lastly, many countries discriminate between treaty and non-treaty partners in their treatment of foreign royalties and dividends – with the most common treatment being to exempt foreign income from domestic taxation.

Based on joint work with Valeria Merlo and Georg Wamser, Chapter 2 contributes to a better understanding of how international taxation shapes global services trade. According to estimates by the World Trade Organisation, about 60% of this trade takes place between related firms. With respect to trade in financial services, it is more than 75% that is accounted for by MNCs. Other services trade predominately carried out by MNCs include business-related services and charges for the use of IP assets (WTO, 2019). Building on the gravity model of trade, we find significant and positive relationships of the different services trade flows studied with DTTs. In turn, automatic exchange of information agreements under the CRS not appear to have any significant link with the services trade flows studied. Subsequently zooming in on royalty payments, we observe that lower taxation in the destination country of royalties than in the origin country is significantly linked to higher royalty payments. With the introduction of a DTT, however, this relationship vanishes. We take these findings as indication that the enforcement of tax regulations through DTTs can correct the presumably inappropriately high level of royalties paid to low-tax countries. Comparing royalties paid to different destination countries, we eventually find that the existence of a DTT as well as an increase in the withholding tax rate or effective tax rate are linked to a significant decrease in royalties paid to countries with IP box regime.[2] With respect to royalties paid to countries without such regime, in turn, we find substantially smaller and insignificant effects with respect to taxation and a positive and significant one for DTTs.

Chapter 3 is based on joint work with Michael Devereux and Martin Simmler and provides empirical evidence related to the global minimum tax. First, we address how many and which countries can be considered a "critical mass" to implement the global minimum tax for the remaining jurisdictions worldwide to follow suit. Our findings suggest that the G7 countries – or even a subset of these countries – could represent such a critical mass. Subsequently assessing the generosity of the substance-based income exclusion (SBIE), we find that the share of total profit covered by the SBIE is just under 40% in the first year of the global minimum tax and close to 20% after 10 years. This suggests that the minimum total tax on corporate profit will be 9% in the short run and 12% in the medium term.

[2]Similar to Dudar et al. (2015), we calculate the effective tax rate based on corporate taxes, withholding taxes, taxes on qualified IP income, and the method of double tax relief.

Again based on a project co-authored by Valeria Merlo and Georg Wamser, Chapter 4 investigates the dividend policy of MNCs aiming for a better understanding of within-firm profit repatriation behavior. In the process, we provide revealing insights into the structure of MNC ownership chains. Thus, intermediate firms that are foreign to both their subsidiaries and the MNC headquarters firm are often located in countries considered to be tax havens, such as Hong Kong, the Netherlands, and Luxembourg. Subsequently studying the determinants of dividend payments, we focus on an effective tax rate calculated based on corporate tax rates, withholding tax rates, and the method of double tax relief (compare Huizinga et al., 2008). In line with expectations, we observe that taxation is negatively related to dividend payments – especially, when dividends are paid to a foreign owner. Eventually, we study how firms use the dividends received. As endogeneity issues are a central concern when modelling dividend payments (and other outcomes) of a given firm as a function of the amount of dividends received, we exploit the exogenous variation in the tax incentive to repatriate dividends and draw on an instrumental variable approach.[3] Our findings suggest that intermediate firms – especially those located in a country foreign to the firms at the very top and end of an ownership chain – primarily serve as conduits to distribute profit in a tax-efficient way: If repatriated dividends increase, intermediate firms also increase their own dividend payments. We find a similar pattern when focusing on ultimate owner firms paying dividends to unknown shareholders.

In Chapter 5, I join recent efforts to highlight the relevance of accounting issues on the data used for the quantification of profit shifting and to derive implications (e.g. Blouin and Robinson, 2020; Clausing, 2020). As dividend repatriations are double-counted in the pre-tax profit reported in unconsolidated financial statement data, BEPS estimates derived following the standard approach to quantify the profit shifting of MNCs introduced by Hines and Rice (1994) and extended by Huizinga and Laeven (2008) are likely to be biased. Arguing that the ownership network structure of MNCs plays an important role for the direction of this bias, I examine the ownership structure of MNCs for the position of low-tax entities. I show that firms located in countries with a corporate tax rate below 15% (i.e. the tax rate that recently has been set as global minimum tax rate) are often positioned close to the global ultimate owner firm – if not being the global ultimate owner firm themselves. This suggests that conventional profit shifting estimates are too high. Comparing the profit shifting estimates based on unadjusted profit and those based on profit adjusted for dividend repatriations, I find – in line with implications derived from the ownership network structures – that the latter ones are significantly lower for various sample splits.

[3]Specifically, our instrumental variable for the dividends received by a firm is the average effective tax rates of all affiliates for which we have dividend information of the respective firm.

References

Beer, S. and Loeprick, J. (2018). The cost and benefits of tax treaties with investment hubs: Findings from sub-saharan africa. IMF Working Paper No. 227.

Blouin, J. and Robinson, L. (2020). Double counting accounting: How much profit of multinational enterprises is really in tax havens? Retrieved from https://www.taxpolicycenter.org/sites/default/files/blouinrobinson_ssrn.pdf.

Cavelti, L. (2013). Automatic information exchange versus the withholding tax regime globalization and increasing sovereignty conflicts in international taxation. *World Tax Journal*, 5(2):172–214.

Clausing, K. (2020). How big is profit shifting? Retrieved from https://www.taxpolicycenter.org/sites/default/files/clausing_how_big_0.pdf.

Dudar, O., Spengel, C., and Voget, J. (2015). The impact of taxes on bilateral royalty flows. ZEW Discussion Paper No. 15-052.

Hearson, M. (2016). Measuring tax treaty negotiation outcomes: The actionaid tax treaties dataset. ICTD Working Paper No. 47.

Hines, J. and Rice, E. (1994). Fiscal paradise: Foreign tax havens and american business. *The Quarterly Journal of Economics*, 109(1):149–182.

Huizinga, H. and Laeven, L. (2008). International profit shifting within multinationals: A multi-country perspective. *Journal of Public Economics*, 92(5-6):1164–1182.

Huizinga, H., Laeven, L., and Nicodème, G. (2008). Capital structure and international debt shifting. *Journal of Financial Economics*, 88(1):80–118.

OECD (2018). Tax challenges arising from digitalisation – interim report 2018. Retrieved from https://www.oecd-ilibrary.org/sites/9789264293083-en/index.html?itemId=/content/publication/9789264293083-en.

Petkova, K. (2020). Withholding tax rates on dividends: Symmetries vs. asymmetries in double tax treaties. WU International Taxation Research Paper No. 2020-02.

WTO (2019). World trade report 2019. Retrieved from https://www.wto.org/english/res_e/booksp_e/00_wtr19_e.pdf.

Chapter 2

Services trade and tax incentives*

Abstract: *Studying the country pair-specific trade of total services, financial services, business-related services, and charges for the use of intellectual property (IP) assets, this paper contributes to a better understanding of how taxation shapes the global services trade dominated by multinational corporations. Based on the gravity model of trade, we find that the existence of a double tax treaty (DTT) is generally related to higher levels in services trade. Zooming in on royalties, we subsequently identify tax-motivated payments to countries with relatively low taxation. This incentive, however, vanishes with the existence of a DTT. Lastly, we observe that royalties paid to countries with IP box regime – but not so much those paid to countries without such regime – decrease with the introduction of a DTT and an increase in taxation.*

*This chapter is based on joint work with Valeria Merlo and Georg Wamser.

2.1 Introduction

The share of services in world trade has grown from only 9% in 1970 to more than 20% in 2020. Looking ahead, the World Trade Organisation (WTO) forcasts that the cross-border tradability of services could account for as much as one third of world trade by 2040 and enthuses about the unprecedented opportunities that may yet arise for both national economies and individuals (WTO, 2019). In this context, the role of multinational corporations (MNCs) in global services trade is enormous: About 60% of total services and more than 75% of financial services are traded among related firms. Further services considered to be traded predominantly within MNCs are other business-related services and royalties (WTO, 2019).

Building on the gravity model of trade, the objective of this paper is to study the determinants of these services trade flows dominated by MNCs from a tax perspective. In the first part of the paper, we focus on the general impact of double tax treaties (DTTs) and automatic exchange of information (AEOI) agreements under the Common Reporting Standard (CRS) on total services trade in general, trade in financial services, trade in other business-related services, and royalties. DTTs are considered a key building block of today's international tax system (Cavelti, 2013; Hearson, 2016). As they contain both elements that can promote trade (e.g. reducing tax uncertainty through the allocation of rights to tax cross-border corporate income payments) and elements that can discourage trade (e.g. the exchange of information), however, their impact is debatable (e.g. Blonigen and Davies, 2004; Egger et al., 2006; Davies et al., 2009). CRS agreements, in turn, represent the first multilateral approach to the automatic exchange of information from financial institutions at the global level. International policymakers expect them to be an effective tool to combat cross-border tax evasion of MNCs. Empirically, however, their impact is still an open question (Casi et al., 2020). In the second part of the paper, we zoom in on royalty payments. We aim to first identify tax-motivated royalties and then examine how the existence of a DTT plays out for these payments. Given that the location decision of intellectual property (IP) assets is often in favor of countries operating a so-called IP box regime (i.e. countries in which qualified IP assets face particularly low or no taxes), we additionally examine the link between royalties and taxation for destination countries with such a regime. Thereby, we consider not only "strict" IP box regimes (i.e. those that focus exclusively on IP assets) but also "dual" IP box regimes (i.e. those that provide benefits not only to IP assets but also to income from other geographically mobile activities).[1] With this agenda, our

[1]This classification originates from the Organisation for Economic Co-operation and Development (OECD). To the best of our knowledge, it has previously been acknowledged only by Shehaj and Weichenrieder (2021) when studying the effect of corporate taxes on local research and development expenditures by MNCs. However, they do not differentiate between the two types of IP box regime in their analysis.

paper adds to the growing literature studying the international trade in services (e.g. Gruenfeld and Moxnes, 2003; Lejour and de Paiva Verheijden, 2004; Tharakan et al., 2005; Kimura and Lee, 2006). In addition, we extend earlier evidence on the role of DTTs and tax information exchange agreements (e.g. Blonigen and Davies, 2004; Beer et al., 2019; Ahrens and Bothner, 2020). Lastly, we contribute to a literature strand closely studying royalty payments to countries with IP box regime. This strand includes Collins and Shackelford (1998), Grubert (1998), Mutti and Grubert (2009), Dudar et al. (2015), Hebous and Johannesen (2021), and Lejour and van't Riet (2022).

Our analysis relies on data from the OECD-WTO Balanced Trade in Services (BaTIS) dataset and the newly established International Tax Institutions (ITI) database provided by the Research School of International Taxation (RSIT). Additional data come from the gravity variable database by the Centre d'Etudes Prospectives et d'Informations Internationales (CEPII). Our sample contains 299,689 country pair-year observations covering the years 2009 until 2018. Average country-level descriptive statistics show that the United States (US), Germany, and the United Kingdom (UK) are both the biggest exporters and importers of total services and business-related services. Most financial services, in turn, are paid to and from the US, the UK, and Luxembourg. Lastly, royalties are highest originating from the US, the Netherlands, and Japan. Most prominent destination countries of royalties are Ireland, the US, and China.

As a substantial fraction of our outcome variables of interest (country pair-specific trade by year) is equal to zero, we provide estimation results based on Poisson Pseudo-Maximum Likelihood (PPML) regressions including origin county-year fixed effects and destination county-year fixed effects. In general, we find that DTTs are positively linked with trade in services. Specifically, total services trade, trade in financial services, trade in other business-related services, and royalties are 18% to 54% higher if a DTT exists between two countries. The automatic exchange of information introduced under the CRS, in turn, does not show any significant linkages with the services trade flows studied. Subsequently, we provide evidence for tax-motivated royalty payments and highlight the role of DTTs for them. In particular, we observe that lower taxation in the destination country than in the origin country represents a strong and significant incentive to pay royalties. However, this incentive vanishes with the existence of a DTT. Zooming in on different destination countries, an increase in tax rates by one percentage point is linked to a significant decrease in royalties paid to countries with IP box regime of up to 8%. In the case of royalties paid to countries without IP box regime, the effect is substantially smaller and insignificant. Lastly, DTTs are often negatively linked to royalties paid to countries with IP box regime but positively to those paid to countries without such regime.

The remainder of this paper proceeds as follows: In Section 2.2, we review the related literature. In Section 2.3, we introduce the data underlying our analysis. Section 2.4

provides descriptive evidence on global services trade flows. Section 2.5 studies the effect of tax treaties on different services trade flows. In Section 2.6, we zoom in on royalty payments. Section 2.7 concludes.

2.2 Related literature

2.2.1 Services trade flows and the gravity model

An emerging body of literature focuses on the international services trade and uses the gravity model to identify potential determinants. Since the gravity model was originally developed for trade in goods, many papers compare their results to those from goods trade (e.g. Gruenfeld and Moxnes, 2003; Lejour and de Paiva Verheijden, 2004; Tharakan et al., 2005; Kimura and Lee, 2006). Most of them find that standard gravity variables have the same effects with respect to their sign.[2] With respect to their significance, however, results are ambiguous. For instance, Ceglowski (2006), Gruenfeld and Moxnes (2003), and Kimura and Lee (2006) find a negative and significant effect of distance in services trade. However, distance does not appear to significantly affect transactions in commercial services (e.g. Walsh, 2008), software services (e.g. Tharakan et al., 2005), and communication and financial services (e.g. Lejour and de Paiva Verheijden, 2004) (compare Dettmer, 2014).

2.2.2 DTTs and tax information exchange agreements

Blonigen and Davies (2004, 2005) and Davies (2004) provide different approaches to investigate the impact of DTTs on the foreign direct investment (FDI) decisions of MNCs. These approaches address several empirical issues, such as how to distinguish between existing and new DTTs or how to address renegotiated DTTs (compare Daniels et al., 2015). Davies (2004) also reviews the theoretical and empirical literature on DTTs and compares the conventional view that DTTs serve to increase FDI with contrary empirical evidence in the literature (e.g. Blonigen and Davies, 2004; Egger et al., 2006; Louie and Rousslang, 2008). Considering the impact of tax treaties on international FDI stocks, Barthel et al. (2010) find significant and positive effects for both treaty age and treaties negotiated during the sample period. Lastly, Daniels et al. (2015) show that both new and existing US DTTs are associated with lower FDI outflows. In contrast, the total number of DTTs a partner country has in place is found to be associated with higher US FDI outflows.

[2] Among the standard results of employing the gravity model to goods trade is that trade robustly declines with distance (Disdier and Head, 2008) and borders (Anderson and van Wincoop, 2001; Anderson and Yotov, 2010). Preferential trade agreements, in turn, increase trade (Cipollina and Salvatici, 2010) (compare Egger et al., 2017).

Early work assessing the impact of tax information exchange agreements finds only little effect: Studying the effect of both bilateral exchange of information on request (EOIR) agreements and AEOI agreements among OECD member states, Huizinga and Nicodème (2004) find that such agreements do not reduce external liability flows. They take this as evidence for inefficiencies related to the tax information exchange agreement networks, such as their limited country coverage at the time and the little quality of the information exchanged. Focusing on the role of automatic exchange of information under the European Savings Directive (EUSD) for international savings, Hemmelgarn and Nicodème (2009) also do not find any measureable effect. Lastly, Johannesen and Zucman (2014) find no significant decline when studying bank liabilities held in international financial centers. Only a handful of tax haven countries appear to experience a decline in wealth and related income. The autors argue that the lack of a substantial decrease in deposits in international financial centers may be due to a relocation of deposits from countries that signed tax information exchange agreements (i.e. collaborative countries) to non-collaborative ones.

With time, the tax transparency environment has continued to evolve resulting in an increasing number of tax information exchange agreements signed. Assessing this development, an increasing number of studies finds that EOIR agreements and AEOI agreements are – to varying degrees – can be linked to reductions in bank deposits in international financial centers and other MNC activities (O'Reilly et al., 2019). Examining whether and how the decision of German MNCs to locate in a tax haven country is affected by the introduction of an EOIR agreement, for instance, Braun et al. (2015) provide evidence of a 46% reduction in FDI by German MNCs following the introduction of such agreement compared to a control group. In turn, Beer et al. (2019) find that AEOI agreements under both the EUSD, the Foreign Account Tax Compliance Act (FATCA), and the CRS reduce foreign-owned deposits in offshore jurisdictions. The effect of EOIR agreements is not significant. Extending the work of Johannesen and Zucman (2014), Menkhoff and Miethe (2019) find significant effects with regard to tax information exchange agreements negotiated with not only tax haven countries but also high-tax countries. Heckemeyer and Hemmerich (2020) show that outbound portfolio investment from tax haven countries respond significantly more to tax information exchange agreements than outbound FDI from other countries. With respect to the AEOI agreements under the CRS and FATCA, Ahrens and Bothner (2020) find household assets in tax haven countries to be 67% lower than the counterfactual in absence of an AEOI agreement. Focusing on AEOI agreements under the CRS between 2014 and 2017, Casi et al. (2020) find that these agreements induce a reduction of about 12% in cross-border deposits parked in tax haven countries. In contrast to Ahrens and Bothner (2020), the authors find evidence for deposit shifting to non-compliant tax haven countries. Lastly, the round-tripping behavior already observed by Johannesen and Zucman

(2014) is also documented by Johannesen (2014), Hanlon et al. (2015), Caruana-Galizia and Caruana-Galizia (2016), Kemme et al. (2017), and de Simone et al. (2020). Despite this relocation behavior and declining effectiveness over time documented by e.g. Beer et al. (2019), Menkhoff and Miethe (2019), and O'Reilly et al. (2019), Johannesen et al. (2020) argue that increased information exchange has had a positive impact on overall tax compliance. They base this argument on US taxpayers having disclosed around 120 million USD in foreign accounts as a result of the tax information exchange agreements with tax haven countries and ad-hoc legal measures to obtain US client information from Swiss banks.

2.2.3 IP box regimes and royalty payments

IP assets themselves have received considerable attention in the literature on profit shifting by MNCs and overall findings suggest that the patent quality, the number of patents, and the number of patent applications is negatively related to a country's tax rate – including any benefits from IP box regimes (Chen et al., 2019). In contrast, the empirical analysis of royalty payments for the use of such assets appears to be a less developed. Early research based on firm-level royalty data of US MNCs and their subsidiaries includes Collins and Shackelford (1998), Grubert (1998), and Mutti and Grubert (2009). Using different identification strategies, all of them ultimately argue in favor of a negative relationship between taxation and the amount or direction of royalty payments (compare Dudar et al., 2015). Studying bilateral royalty payments between 61 countries and a time span from 1990 to 2012, Dudar et al. (2015) also find a negative impact of taxation. Moreover, they note that tax differentials significantly impact royalty payments. Studying the US payments to foreign parties for the use of IP assets, Ohrn (2016) finds an increase only to countries with IP box regime that allow income from existing IP assets to qualify. Providing a comprehensive study of profit shifting through services trade within German MNCs, Hebous and Johannesen (2021) show that trade flows related to IP assets with affiliates in tax haven countries are heavily skewed towards imports. They find similar excess propensities to import from tax haven affiliates also in headquarters services, information services, financial services, and sea transport. Lastly, Lejour and van't Riet (2022) provide a network analysis to measure the tax gains of shifting IP assets directly and indirectly by shifting the rights of IP assets via other countries. Using the outcomes of this analysis in a gravity framework to explain the size of bilateral royalty flows, they show that conventional determinants are particularly powerful for bilateral royalty flows when they are not motivated by tax benefits.

2.3 Data

For information on services trade flows, we draw on the OECD-WTO BaTIS dataset. This dataset contains bilateral services trade data covering 202 countries and partners on an annual basis. Services trade flows are broken down into 12 main Extended Balance of Payments Services Classification categories as defined in 2010. In our analysis, we focus on four of them: $Total_{ijt}$ is the total services exports from country i to country j in year t. $Financial_{ijt}$ is the export of financial services (e.g. services provided in connection with transactions in financial instruments, deposit taking and lending, and financial advisory services) from country i to country j in year t. $Business_{ijt}$ is the export of other business-related services from country i to country j in year t. It includes services related to research and development activities, professional and management consulting services, and technical, trade-related and other business services. $Royalties_{ijt}$ represents the royalties transferred from country i to country j in year t for the use of IP assets. All trade flows are expressed in million USD.

The tax data employed in our analysis stem from in the ITI database provided by the RSIT. DTT_{ijt} is equal to one if countries i and j have a DTT in force in year t. CRS_{ijt} indicates that countries i and j automatically exchange information under the CRS. LT_{ijt} is an indicator variable equal to one if the corporate tax rate in the destination country j is lower than the one in the origin country i in year t. The indicator variable $LTIP_{ijt}$, in turn, is equal to one if the tax rate applicable for IP income in country j is lower than the one in country i in year t, with the tax rate applicable for IP income being either the tax rate levied on qualifying IP income in countries with an IP box regime or the corporate tax rate. Furthermore, we consider withholding taxe rates and effective taxes rates: WTR_{ijt} is the applicable withholding tax rate for royalties between countries i and j in year t. Unless negotiated bilaterally, it is the withholding tax rate set by the origin country unilaterally. Similar to Dudar et al. (2015), we calculate the effective tax rate applicable for royalty payments from country i to country j in year t (ETR_{ijt}) based on the withholding tax rate between countries i and j in year t (WTR_{ijt}), the tax rate applicable for IP income in country j in year t (TAX_{jt}), and the treatment of foreign royalty income in the destination country. If the destination country exempts foreign-source royalties from taxation, ETR_{ijt} is equal to WTR_{ijt}. Alternatively, the destination country can provide a tax credit for taxes already paid in the origin country. This implies, that domestic taxes on foreign royalties are reduced one-for-one with the taxes already paid abroad. The royalties are taxed at the rate WTR_{ijt} if $TAX_{jt} < WTR_{ijt}$ or TAX_{jt} if $TAX_{jt} > WTR_{ijt}$. The destination country can also deduct foreign taxes from the royalties. This implies that foreign taxes are seen as a tax-deductible cost of doing business at par with other business costs. The associated ETR_{ijt} is given by $WTR_{ijt} + (1 - WTR_{ijt})TAX_{jt}$. Lastly, the effective tax rate is given by $TAX_{jt} + WTR_{ijt}$

if the destination country does not provide any kind of relief of foreign-sourced royalties.

Along with the different tax variables, we consider several country-specific characteristics as potential determinants of services trade flows. All of them are provided by the CEPII's gravity variable database: $ServRTA_{ijt}$ indicates that countries i and j have a regional trade agreement that specifically addresses services in year t . $lnDist_{ijt}$ is the log of the weighted kilometer-distance between the most populated cities of countries i and j in year t. $ComBord_{ijt}$ is an indicator variable capturing common land borders between countries i and j in year t. $ComLang_{ijt}$ indicates that countries i and j share the same ethnological language in year t. $ComRelig_{ijt}$ is an index ranging between zero and one, with higher values meaning higher religious proximity between countries i and j in year t.

2.4 Descriptive evidence

2.4.1 Different services trade flows

Our sample includes 299,689 observations and extends over the period 2009 to 2018. It covers 174 unique origin countries and 196 unique destination countries. Total services trade averages 151.87 million USD (Table 2.1). Thereof, 10.91 million USD are related to financial services, 34.08 million USD are related to business services, and 10.68 million USD to royalties. In 18% (2%) of observations, we report a DTT (AEOI agreement under the CRS) for a specific country pair. In 9%, in turn, country pairs have a regional trade agreement specifically addressing services. Furthermore, countries have the same common ethnological language in 14% of observations and share a land border in 2% of observations. Lastly, religious proximity is rather low.

Table 2.1: *Summary statistics: Different services trade flows*

	N	Mean	Median	SD
Total	299,689	151.87	1.85	1,360.90
Financial	299,689	10.91	0.00	176.22
Business	299,689	34.08	0.07	366.14
Royalties	299,689	10.68	0.00	224.88
CRS	299,689	0.02	0.00	0.13
DTT	299,689	0.18	0.00	0.38
ServRTA	299,689	0.09	0.00	0.29
lnDist	289,692	8.73	8.91	0.77
ComBord	289,501	0.02	0.00	0.13
ComLang	296,389	0.14	0.00	0.34
ComRelig	274,937	0.16	0.04	0.23

Note: This table presents summary statsitics (number of observatios, mean, median, and standard deviation) for all country-pair observations in our full sample. All trade flows are expressed in million USD. Treaty variables as well as those on a shared border or language are indicator variables. Religious proximity comes in form of an index. A detailed description of all variables is included in Appendix 2.A, Table 2.9.

Tables 2.2 and 2.3 show the top 10 countries exporting and importing most total services, financial services, other business-related services, and royalties – on average. The US, Germany, and the UK are both the biggest exporters and importers of total services and business-related services: The US exports 3,801.58 million USD (878.56 million USD) and imports 3,288.70 million USD (779.43 million USD) in total services (business-related services). German exports and imports of total services (business-related services) amount to 1,491.25 million USD (420.22 million USD) and 2,057.89 million USD (510.07 million USD). Lastly, the UK exports 1,795.92 million USD (543.40 million USD) and imports 1879.88 million USD (483.65 million USD) in total services (business-related services). The US, the UK, and Luxembourg, in turn, are the most important countries with respect to trade in financial services. Thus, the exports (imports) amount to 414.40 million USD (262.27 million USD) for the US, 330.44 million USD (236.50 million USD) for the UK, and 146.13 million USD (189.70 million USD) for Luxembourg. Average royalty payments are highest originating from the US (563.87 million USD), the Netherlands (216.58 million USD), and Japan (155.15 million USD). Ireland (280.88 million USD), the US (268.66 million USD) and China (121.90 million USD) are by far the countries receiving the most royalties during the sample period.

Table 2.2: *10 countries with highest average exports over sample period*

Total services		Financial services		Other business-related services		Royalties	
United States	3,801.58	United States	414.40	United States	878.56	United States	563.87
United Kingdom	1,795.92	United Kingdom	330.44	United Kingdom	543.40	Netherlands	216.58
Germany	1,491.25	Luxembourg	146.13	Germany	420.22	Japan	155.15
France	1,161.99	Germany	103.19	France	323.83	Switzerland	112.02
Netherlands	974.40	Switzerland	82.30	Netherlands	267.10	United Kingdom	97.96
China	955.28	Hong Kong	65.05	China	234.87	Germany	93.66
Japan	763.82	Singapore	64.19	India	171.58	France	71.44
Switzerland	656.28	Ireland	55.00	Belgium	166.99	Ireland	61.42
Spain	646.86	France	54.62	Ireland	163.70	Luxembourg	38.78
Singapore	631.32	Japan	34.02	Singapore	158.53	Sweden	31.86

Note: This table presents the 10 countries with highest average exports over the entire sample period. All trade flows are expressed in million USD.

Table 2.3: *10 countries with highest average imports over sample period*

Total services		Financial services		Other business-related services		Royalties	
United States	3,288.70	United States	262.27	United States	779.43	Ireland	280.88
Germany	2,057.89	United Kingdom	236.50	Germany	510.07	United States	268.66
United Kingdom	1,879.88	Luxembourg	189.70	United Kingdom	483.65	China	121.90
China	1,783.19	Germany	124.67	France	358.75	Netherlands	109.33
France	1,343.76	France	101.07	Ireland	349.46	Switzerland	104.87
Netherlands	1,064.13	Netherlands	95.62	Switzerland	341.18	Japan	101.34
Japan	1,049.29	Ireland	67.51	Netherlands	329.34	Singapore	99.19
Switzerland	1,016.91	Italy	65.58	Japan	264.16	United Kingdom	94.12
Ireland	876.66	Japan	65.34	Singapore	227.76	Germany	75.42
Singapore	802.53	Switzerland	62.65	China	214.54	France	70.86

Note: This table presents the 10 countries with highest average imports over the entire sample period. All trade flows are expressed in million USD.

Table 2.4: *Summary statistics: Different destination countries of royalties*

	"Strict" IP box				"Dual" IP box				No IP box			
	N	Mean	Median	SD	N	Mean	Median	SD	N	Mean	Median	SD
Royalties	20,472	56.47	0.02	593.91	36,033	9.18	0.00	190.55	244,036	7.18	0.00	166.27
CRS	20,472	0.10	0.00	0.29	36,033	0.02	0.00	0.14	244,036	0.01	0.00	0.11
DTT	20,472	0.47	0.00	0.50	36,033	0.14	0.00	0.35	244,036	0.16	0.00	0.36
ServRTA	20,472	0.27	0.00	0.44	36,033	0.10	0.00	0.30	244,036	0.08	0.00	0.26
WTR	20,472	11.07	10.00	8.39	36,033	15.06	15.00	8.15	244,036	14.45	15.00	8.23
ETR	20,472	15.38	15.00	8.67	35,861	15.66	15.00	8.20	227,363	27.50	27.50	11.95
lnDist	19,965	8.47	8.70	0.87	32,724	8.91	9.06	0.71	237,667	8.73	8.89	0.76
ComBord	19,958	0.02	0.00	0.15	34,217	0.01	0.00	0.10	235,990	0.02	0.00	0.13
ComLang	20,216	0.13	0.00	0.34	34,667	0.21	0.00	0.41	242,178	0.13	0.00	0.33
ComRelig	19,432	0.19	0.05	0.26	33,422	0.15	0.04	0.23	222,571	0.15	0.04	0.23

Note: This table presents summary statsitics (number of observatios, mean, median, and standard deviation) for all country-pair observations in one of the three groups: Country-pairs where the destination country operates a "strict" IP box regime, the destination country operates a "dual" IP box regime, or the destination country operates no such regime. All trade flows are expressed in million USD. Treaty variables as well as those on a shared border or language are indicator variables. Religious proximity comes in form of an index. Tax rates are in percent. A detailed description of all variables is included in Appendix 2.A, Table 2.9.

2.4.2 Royalties paid to countries with IP box regime

Distinguishing between the different destination countries, we observe that average royalties paid to countries with IP box regime are substantially higher than those paid to countries without such a regime (Table 2.4). Specifically, average royalties paid to countries with "strict" IP box regime amount to 56.47 million USD. Royalties paid to countries with "dual" IP box regime average 9.18 million USD. Countries without IP box regime, in contrast, receive only 7.18 million USD in royalties, on average. We further see that the share of DTTs, AEOI agreements under the CRS, and regional trade agreements specifically addressing services is higher for countries with a "strict" IP box regime than countries with a "dual" IP box regime or countries without any such regime. Average withholding tax rates and effective tax rates, in turn, are lowest for royalties paid to countries with "strict" IP box regime. A potential explanation for these observations is that among the countries with "strict" IP box regime there are many from the European Union (EU) – i.e. countries which benefit from various trade facilitations such as zero withholding tax rates for royalties under the EUSD. Other characteristics such geographical or cultural proximity appear to be similar for royalties paid to the different types of destination countries.

2.5 Services trade flows dominated by MNCs and tax treaties

Pioneered by Tinbergen (1962), the gravity model has become the standard model in the empirical trade literature. Although the gravity model was developed for trade in goods, it has been found to fit trade in services in a similar way (e.g. Kimura and Lee, 2006; Head et al., 2009). In its simplest form, the gravity model often relates bilateral trade patterns to the geographical distance between the trading partners and common land borders (Egger et al., 2017).

Due to the high share of zero-values often ascribed to (services) trade, we use an exponential model estimated by PPML. PPML mitigates the problem of dealing with zero outcome variables and allows joint estimation of effects at the intensive and extensive margins for both positive count and discrete outcome variables (Gourieroux et al., 1984; Silva and Tenreyro, 2006). Formally, we test the following regression specification:

$$X_{ijt} = exp(\alpha_0 + \alpha_1 Y_{ijt} + \alpha_2 Z_{ijt} + \beta_{it} + \gamma_{jt} + \epsilon_{ijt}) \tag{2.1}$$

X_{ijt} is a placeholder for the four different types of services trade flows from country i to country j in year t we study in this paper: $Total_{ijt}$, $Financial_{ijt}$, $Business_{ijt}$, and $Royalties_{ijt}$. Y_{ijt} is a placeholder for the two different tax treaties considered: DTT_{ijt}

and CRS_{ijt}. Z_{ijt} includes the following country-pair control variables: $ServRTA_{ijt}$, $lnDist_{ijt}$, $ComBord_{ijt}$, $ComLang_{ijt}$, and $ComRelig_{ijt}$. We also consider origin country-year fixed effects (β_{it}) and destination country-time fixed effects (γ_{jt}) to control for time varying origin-country level effects as well as time varying destination-country level effects. Lastly, we include the error term ϵ_{ijt} which is clustered at the country-pair level.

Table 2.5: *The role of different treaties for services trade*

	(1)	(2)	(3)	(4)
	Total	Financial	Business	Royalties
DTT_{ijt}	0.2989***	0.1671*	0.2921***	0.4324**
	(0.0522)	(0.0918)	(0.0842)	(0.1743)
CRS_{ijt}	−0.0468	0.0011	0.0196	0.0431
	(0.0408)	(0.0716)	(0.0571)	(0.1077)
$ServRTA_{ijt}$	0.2090***	0.1339	0.2602***	0.3365**
	(0.0490)	(0.0821)	(0.0537)	(0.1455)
$lnDist_{ijt}$	−0.5917***	−0.5335***	−0.4433***	−0.3541***
	(0.0215)	(0.0494)	(0.0270)	(0.0702)
$ComBord_{ijt}$	0.2414***	0.2110*	0.1660**	−0.0552
	(0.0717)	(0.1258)	(0.0840)	(0.2016)
$ComLang_{ijt}$	0.3590***	0.3558***	0.4528***	−0.0306
	(0.0597)	(0.0950)	(0.0759)	(0.1436)
$ComRelig_{ijt}$	0.4835***	0.9701***	0.5084***	0.6142*
	(0.0832)	(0.2585)	(0.1048)	(0.3588)
N	270,034	270,034	270,034	270,034
Psd. R2	0.9587	0.9548	0.9571	0.9438

Note: This table shows regression results for different services trade flows. A detailed description of all variables is included in Appendix 2.A, Table 2.9. Regressions include origin country-year fixed effects and destination country-year fixed effects. Standard errors are clustered at the country-pair level. *, **, and *** denote statistical significance at the 10%, 5%, and 1% level. i refers to the origin country, j to the destination country, and t to the year.

Our regression results reveal a positive and significant relationship between DTTs and the four different service trade flows studied (Table 2.5). Specifically, the existence of a DTT is associated with 34.84% higher total services trade, 18.19% higher trade in financial services, and 33.92% higher trade in business services. At 54.10%, the increase in royalties associated with the existence of a DTT is by far the highest. This suggests that positive aspects usually associated with the introduction of a DTT (e.g. the increased tax certainty) outweigh any negative consequences. With respect to agreements under the CRS to automatically exchange of information, we find no significant relationships. This could be due to the fact that CRS agreements were activated only to the end of our sample period. Thus, their reach may not yet be sufficient and their impact may not yet have fully unfolded. An alternative explanation for the insignificance of CRS_{ijt}

is that information is already exchanged based on regulations set in an existing DTT.[3] With respect to regional trade agreements covering services trade flows, estimates range from 14.33% (financial services) to 40.00% (royalties) and are significant for all trade flows studied but those of financial services. Concerning the other country-pair specific variables studied, we find highly statistically significant estimates for religious proximimity (positive) and distance (negative) for all trade flows studied. A common border or ethnological language has significant effects only on total services trade, financial services trade, and business-related services trade. These results appear reasonable: While royalties are merely a monetary transaction, business services (e.g. management consulting services), financial services (e.g. payment and money transmission services, asset management, and deposit-taking), and large parts of total services (e.g. construction and repair work abroad, telecommunications and computer services, and services related to tourism) often involve human interaction. In order to build trust and a personal connection between the parties involved, cultural aspects are therefore likely to play a more important role in the latter forms of trade than in the transaction of royalties.

2.6 Tax-motivated royalty payments and DTTs

Focusing on royalty payments, we introduce the variables LT_{ijt} ($LTIP_{ijt}$) and WTR_{ijt} (ETR_{ijt}) to Equation 2.1. Table 2.6 shows that if the corporate tax rate (tax rate specific to IP income) in the destination country is lower than the corporate tax rate (tax rate specific to IP income) in the origin country, royalty payments are significantly higher by 45.75% to 67.33% (28.72% to 44.74%) – depending on whether we control for WTR_{ijt} or ETR_{ijt}. Interacting the respective indicator variables with the one for DTTs results in statistically significant and negative estimates. Specifically, the negative interaction term between LT_{ijt} and DTT_{ijt} ($LTIP_{ijt}$ and DTT_{ijt}) is 44.92% to 68.02% (25.02% to 43.96%). This appears to erase the incentive created by the relatively low tax rates in the destination country. From this, we derive the following two implications: First, royalties paid in the absence of a DTT to countries with relatively low corporate tax rates/tax rates applicable for IP income must be inappropriately high. Second, the bilateral exchange of information and the enforcement of tax regulations often specified in DTTs can correct this inappropriate level of royalties paid to these countries.

[3] In fact, in over 66% of cases where we observe the existence of a CRS agreement, a DTT is already in place.

Table 2.6: *Tax-motivated royalties and the impact of DTTs*

	(1)	(2)	(3)	(4)
WTR_{ijt}	−0.0166*	−0.0156*		
	(0.0097)	(0.0090)		
ETR_{ijt}			−0.0055	−0.0041
			(0.0107)	(0.0096)
DTT_{ijt}	0.6069***	0.4808***	0.6571***	0.5455***
	(0.1911)	(0.1721)	(0.1953)	(0.1715)
CRS_{ijt}	0.0530	0.0740	0.0438	0.0580
	(0.1037)	(0.1071)	(0.1035)	(0.1060)
LT_{ijt}	0.5148**		0.3767*	
	(0.2056)		(0.2008)	
DTT_{ijt}xLT_{ijt}	−0.5189**		−0.3710*	
	(0.2257)		(0.2127)	
$LTIP_{ijt}$		0.3698*		0.2525
		(0.2095)		(0.1966)
DTT_{ijt}x$LTIP_{ijt}$		−0.3644*		−0.2233
		(0.1867)		(0.1804)
$ServRTA_{ijt}$	0.3315**	0.3319**	0.3339**	0.3346**
	(0.1439)	(0.1408)	(0.1439)	(0.1412)
$lnDist_{ijt}$	−0.3428***	−0.3441***	−0.3486***	−0.3504***
	(0.0704)	(0.0704)	(0.0710)	(0.0708)
$ComBord_{ijt}$	−0.0527	−0.0530	−0.0503	−0.0521
	(0.1982)	(0.1948)	(0.2013)	(0.1979)
$ComLang_{ijt}$	−0.0070	−0.0085	−0.0302	−0.0311
	(0.1406)	(0.1424)	(0.1401)	(0.1415)
$ComRelig_{ijt}$	0.6068*	0.6034*	0.6280*	0.6216*
	(0.3543)	(0.3589)	(0.3561)	(0.3601)
N	270,034	270,034	256,578	256,578
Psd. R2	0.9443	0.9442	0.9434	0.9433

Note: This table shows regression results for royalties and different DTT interactions. A detailed description of all variables is included in Appendix 2.A, Table 2.9. Regressions include origin country-year fixed effects and destination country-year fixed effects. Standard errors are clustered at the country-pair level. *, **, and *** denote statistical significance at the 10%, 5%, and 1% level. i refers to the origin country, j to the destination country, and t to the year.

Differentiating between countries with and without IP box regime in Tables 2.7 and 2.8, we report that royalties paid to former countries are particularly responsive to withholding taxes and effective taxes. Thus, royalties paid to countries with a "strict" IP box regime significantly decrease by 2.11% following an increase in the withholding tax rate by one percentage point. With an increase in the effective tax rate by one percentage point, in turn, royalties paid to countries with "strict" IP box regime decrease by 1.08%. Since several destination countries operating a "strict" IP box regime are located in the EU, we also provide regression results excluding these observations. The increase in the withholding tax rate (effective tax rate) by one percentage point then leads to a statistically significant reduction in royalties paid to countries with "strict" IP box regime by 6.84% (5.11%). Similarily, royalties paid to "dual" IP box regime decrease by

8.41% (4.75%) following an increase in the withholding tax rate (effective tax rate) by one percentage point. Again, the estimates are statistically significant. For royalties paid to countries without IP box regime, by contrast, the tax estimates are much smaller and insignificant. Tables 2.7 and 2.8 also show that DTTs are detrimental for royalties paid to countries with IP box regime – especially those with a "dual" IP box regime where the estimate is negative and statistically significant. Furthermore, regional trade agreements are statistically significant and positive for royalties paid to countries without IP box regime but not for those paid to countries with "strict" IP box regime (outside of the EU) or countries with "dual" IP box regime. These results could indicate that royalties paid to countries with IP box regime primarily serve the reduction of the overall tax burden but are – to varying degree – hindered by the existence of a DTT. In contrast, royalties paid to countries that do not have such regime are less guided by tax considerations than by other reasons.

Table 2.7: *The role of withholding taxes for royalties paid to IP box regimes*

	(1)	(2)	(3)	(4)
	"Strict" IP box	"Strict" IP box ouside the EU	"Dual" IP box	No IP box
WTR_{ijt}	−0.0211*	−0.0684***	−0.0841***	−0.0065
	(0.0125)	(0.0262)	(0.0293)	(0.0074)
DTT_{ijt}	0.3314	−0.2665	−1.0932**	0.2442
	(0.3106)	(0.3938)	(0.4591)	(0.1704)
CRS_{ijt}	0.2513	0.2533	−0.1666	−0.1937
	(0.2137)	(0.1704)	(0.2126)	(0.1281)
$ServRTA_{ijt}$	0.2999**	0.2772	−0.0174	0.4114***
	(0.1423)	(0.1945)	(0.2534)	(0.1166)
$lnDist_{ijt}$	−0.1983**	−0.0078	−0.7275***	−0.4526***
	(0.1001)	(0.1336)	(0.2436)	(0.0726)
$ComBord_{ijt}$	0.2638	−0.4634	0.0207	−0.2531
	(0.2444)	(0.5285)	(0.8157)	(0.1840)
$ComLang_{ijt}$	−0.1232	0.3439	0.9753**	0.0876
	(0.1691)	(0.2272)	(0.4903)	(0.1212)
$ComRelig_{ijt}$	1.4024***	2.7101**	−3.3125*	0.5685**
	(0.4291)	(1.1585)	(1.7744)	(0.2783)
N	19,244	4,673	31,428	219,441
Psd. R2	0.9401	0.9577	0.9603	0.9507

Note: This table shows sub-sample regression results for different types of destination countries and withholding tax rates. A detailed description of all variables is included in Appendix 2.A, Table 2.9. Regressions include origin country-year fixed effects and destination country-year fixed effects. Standard errors are clustered at the country-pair level. *, **, and *** denote statistical significance at the 10%, 5%, and 1% level. i refers to the origin country, j to the destination country, and t to the year.

Table 2.8: *The role of effective taxes for royalties paid to IP box regimes*

	(1)	(2)	(3)	(4)
	"Strict" IP box	"Strict" IP box ouside the EU	"Dual" IP box	No IP box
ETR_{ijt}	−0.0108	−0.0511*	−0.0475**	0.0041
	(0.0138)	(0.0270)	(0.0233)	(0.0118)
DTT_{ijt}	0.5382	0.0499	−0.7189*	0.3320**
	(0.3330)	(0.3727)	(0.3999)	(0.1672)
CRS_{ijt}	0.2492	0.2317	−0.1756	−0.2308*
	(0.2251)	(0.1872)	(0.2188)	(0.1210)
$ServRTA_{ijt}$	0.3180**	0.2459	−0.2437	0.4130***
	(0.1415)	(0.2097)	(0.3036)	(0.1158)
$lnDist_{ijt}$	−0.2102**	−0.0014	−0.7425***	−0.4506***
	(0.1020)	(0.1421)	(0.2321)	(0.0722)
$ComBord_{ijt}$	0.2380	−0.3952	0.1870	−0.2354
	(0.2488)	(0.5440)	(0.8202)	(0.1851)
$ComLang_{ijt}$	−0.1231	0.2645	0.6312	0.0658
	(0.1727)	(0.2295)	(0.4133)	(0.1185)
$ComRelig_{ijt}$	1.3886***	2.7379**	−2.7261	0.5882**
	(0.4389)	(1.1951)	(1.8270)	(0.2764)
N	19,244	4,673	31,265	206,155
Psd. R2	0.9396	0.9553	0.9569	0.9502

Note: This table shows sub-sample regression results for different types of destination countries and effective tax rates. A detailed description of all variables is included in Appendix 2.A, Table 2.9. Regressions include origin country-year fixed effects and destination country-year fixed effects. Standard errors are clustered at the country-pair level. *, **, and *** denote statistical significance at the 10%, 5%, and 1% level. i refers to the origin country, j to the destination country, and t to the year.

2.7 Conclusion

Our results indicate that DTTs are relevant determinants of international services trade flows dominated by MNCs. Specifically, total services trade, trade in financial services, other business-related services trade, and royalties are 18% to 54% higher if a a DTT is in place between origin country and destination country. For CRS agreements to automatically exchange information, in turn, we find no significant effect.

Subsequently, we link royalties to tax-avoidance motives. We observe that with lower corporate tax rates (tax rates applicable for IP income) in the destination country than in the origin country, royalties increase by up to 68.02% (43.96%). The introduction of a DTT, however, can mitigate this incentive. Differentiating between countries with and without IP box regime, we observe that royalties are particularly sensitive to taxation if paid to those with an IP box regime. Specifically, royalties paid to countries with "strict" IP box regime outside of the EU decrease by 6.84% (5.11%) if the withholding tax rate (effective tax rate) increases by one percentage point. Royalties paid to countries with "dual" IP box regime, in turn, decrease by 8.41% (4.75%) following an increase in the

withholding tax rate (effective tax rate) by one percentage point. Additionally, DTTs appear to be detrimental for royalties paid to countries with IP box regime – especially those with a "dual" IP box regime where the estimate is negative and statistically significant. For royalties paid to countries without IP box regime, the effect of an increase in the withholding tax rate or the effective tax rate is small and insignificant. DTTs, in turn, are positively linked to royalty payments to these countries. These patterns suggest that royalties paid to countries with IP box regime primarily serve tax-motivated reasons whereas those paid to countries without such regime are based on other grounds. This interpretation is supported by the fact that regional trade agreements appear to be relevant only for royalties paid to countries without IP box regime.

Appendix

2.A Variable description

Table 2.9: *Variable description*

Variable	Description
Business	Other business-related services exports in million USD.
ComBord	Indicator variable equal one if two countries share a common land border.
ComLang	Indicator variable equal one if two countries share the common ethnological language.
ComRelig	Index variable ranging between zero and one, with higher values meaning higher religious proximity for two countries.
CRS	Indicator variable equal one if two countries automatically exchange information under the CRS.
DTT	Indicator variable equal one if two countries have a double tax treaty.
ETR	Effective tax rate for royalty payments in percent.
Financial	Financial services exports in million USD.
LT	Indicator variable equal one if the corporate tax rate in the destination country is lower than the one in the origin country.
LTIP	Indicator variable equal one if the tax rate applicable for IP income in the destination country is lower than the one in the origin country.
lnDist	Logarithm of the weighted kilometer-distance between the most populated cities of two countries.
Royalties	Royalty payments in million USD.
ServRTA	Indicator variable equal one if two countries have a regional trade agreement specifically covering services.
TAX	Tax rate applicable for foreign royalty income in the destination country in percent.
Total	Total services trade exports in million USD.
WTR	Withholding tax rate for royalty payments in percent.

Note: This table provides a detailed description of all variables.

References

Ahrens, L. and Bothner, F. (2020). The big bang: Tax evasion after automatic exchange of information under fatca and crs. *New Political Economy*, 25(6):849–864.

Anderson, J. and van Wincoop, E. (2001). *Borders, trade and welfare*. Brookings Institution Press, Washington.

Anderson, J. and Yotov, Y. V. (2010). The changing incidence of geography. *American Economic Review*, 100(1):170–192.

Barthel, F., Busse, M., and Neumayer, E. (2010). The impact of double taxation treaties on foreign direct investment: Evidence from large dyadic panel data. *Contemporary Economic Policy*, 28(3):366–377.

Beer, S., Coelho, M., and Leduc, S. (2019). Hidden treasures: The impact of automatic exchange of information on cross-border tax evasion. IMF Working Paper No. 286.

Blonigen, B. and Davies, R. B. (2004). The effects of bilateral tax treaties on u.s. fdi activity. *International Tax and Public Finance*, 11:601–622.

Blonigen, B. and Davies, R. B. (2005). Do bilateral tax treaties promote foreign direct investment? In Hartigan, J., editor, *Handbook of International Trade, Volume II: Economic and Legal Anaysis of Laws and Institutions*, pages 526–546. Blackwell, Cambridge.

Braun, Julia, and Weichenrieder, A. J. (2015). Does exchange of information between tax authorities influence multinationals' use of tax havens? ZEW Discussion Paper No. 15-015.

Caruana-Galizia, P. and Caruana-Galizia, M. (2016). Offshore financial activity and tax policy: evidence from a leaked data set. *Journal of Public Policy*, 36(3):457–488.

Casi, E., Spengel, C., and Stage, B. (2020). Cross-border tax evasion after the common reporting standard: Game over? ZEW Discussion Paper No. 18-036.

Cavelti, L. (2013). Automatic information exchange versus the withholding tax regime globalization and increasing sovereignty conflicts in international taxation. *World Tax Journal*, 5(2):172–214.

Ceglowski, J. (2006). Does gravity matter in a service economy? *Review of World Economics*, 142(2):307–329.

Chen, S., de Simone, L., Hanlon, M., and Lester, R. (2019). The effect of innovation box regimes on income shifting and real activity. Stanford University Research Paper No. 3453.

Cipollina, M. and Salvatici, L. (2010). Reciprocal trade agreements in gravity models: a meta-analysis. *Review of International Economics*, 18(1):63–80.

Collins, J. and Shackelford, D. (1998). Global organizations and taxes: An analysis of the dividend, interest, royalty, and management fee payments between u.s. multinationals foreign affiliates. *Journal of Accounting and Economics*, 24:151–173.

Daniels, J. P., O'Brien, P., and von der Ruhr, M. B. (2015). Bilateral tax treaties and us foreign direct investment financing modes. *International Tax and Public Finance*, 22(6):999–1027.

Davies, R. B. (2004). Tax treaties and foreign direct investment: Potential versus performance. *International Tax and Public Finance*, 11:775–802.

Davies, R. B., Norbäck, P.-J., and Tekin-Koru, A. (2009). The effect of tax treaties on multinational firms: New evidence from microdata. *The World Economy*, 32(1):77–110.

de Simone, L., Lester, R., and Markle, K. (2020). Transparency and tax evasion: Evidence from the foreign account tax compliance act (fatca). *Journal of Accounting Research*, 58(1):105–153.

Dettmer, B. (2014). International service transactions: Is time a trade barrier in a connected world? *International Economic Journal*, 28(2):225–254.

Disdier, A.-C. and Head, C. K. (2008). The puzzling persistence of the distance effect on bilateral trade. *Review of Economics and Statistics*, 90(1):37–48.

Dudar, O., Spengel, C., and Voget, J. (2015). The impact of taxes on bilateral royalty flows. ZEW Discussion Paper No. 15-052.

Egger, P., Larch, M., Pfaffermayr, M., and Winner, H. (2006). The impact of endogenous tax treaties on foreign direct investment: Theory and evidence. *The Canadian Journal of Economics*, 39(3):901–931.

Egger, P. H., Francois, J., and Nelson, D. R. (2017). The role of goods-trade networks for services-trade volume. *The World Economy*, 40(3):532–543.

Gourieroux, C., Monfort, A., and Trognon, A. (1984). Pseudo maximum likelihood methods: Theory. *Econometrica*, 52(3):681–700.

Grubert, H. (1998). Taxes and the division of foreign operating income among royalties, interest, dividends and retained earnings. *Journal of Public Economics*, 68:269–290.

Gruenfeld, L. and Moxnes, A. (2003). The intangible globalization: Explaining the patterns of international trade in services. NUPI Working Paper No. 657.

Hanlon, M., Lester, R., and Verdi, R. (2015). The effect of repatriation tax costs on u.s. multinational investment. *Journal of Financial Economics*, 116(1):179–196.

Head, K., Mayer, T., and Ries, J. (2009). How remote is the offshoring threat? *European Economic Review*, 53(4):429–444.

Hearson, M. (2016). Measuring tax treaty negotiation outcomes: The actionaid tax treaties dataset. ICTD Working Paper No. 47.

Hebous, S. and Johannesen, N. (2021). At your service! the role of tax havens in international trade with services. *European Economic Review*, 135.

Heckemeyer, J. and Hemmerich, A. (2020). Information exchange and tax haven investment in oecd securities markets. *National Tax Journal*, 73(2):291–329.

Hemmelgarn, T. and Nicodème, G. (2009). Tax co-ordination in europe: Assessing the first years of the eu-savings directive. CESifo Working Paper No. 2675.

Huizinga, H. and Nicodème, G. (2004). Are international deposits tax-driven. *Journal of Public Economics*, 88(6):1093–1118.

Johannesen, N. (2014). Tax evasion and swiss bank deposits. *Journal of Public Economics*, 111:46–62.

Johannesen, N., Langetieg, P., Reck, D., Risch, M., and Slemrod, J. (2020). Taxing hidden wealth: The consequences of us enforcement initiatives on evasive foreign accounts. *American Economic Journal: Economic Policy*, 12(3):312–346.

Johannesen, N. and Zucman, G. (2014). The end of bank secrecy? an evaluation of the g20 tax haven crackdown. *American Economic Journal: Economic Policy*, 6(1).

Kemme, D., Oarikh, B., and Steigner, T. (2017). Tax havens, tax evasion and tax information exchange agreements in the oecd. *European Financial Management*, 23(3):519–542.

Kimura, F. and Lee, H.-H. (2006). The gravity equation in international trade in services. *Review of World Economics*, 142(1):92–121.

Lejour, A. and de Paiva Verheijden, J.-W. (2004). Services trade within canada and the european union: What do they have in common? CPB Discussion Paper No. 42.

Lejour, A. and van't Riet, M. (2022). International taxation and bilateral royalty flows. IIPF Conference Paper.

Louie, H. J. and Rousslang, D. J. (2008). Host-country governance, tax treaties and us direct investment abroad. *International Tax and Public Finance*, 15(3):256–273.

Menkhoff, L. and Miethe, J. (2019). Tax evasion in new disguise? examining tax havens' international bank deposits. DIW Discussion Paper No. 1711.

Mutti, J. and Grubert, H. (2009). The effect of taxes on royalties and the migration of intangible assets abroad. In Reinsdorf, M. and Slaughter, M. J., editors, *International trade in services and intangibles in the era of globalization*, pages 111–137. University of Chicago Press, Chicago.

Ohrn, E. (2016). The effect of ip box regimes on international ip payments and foreign research and development. Retrieved from https://ericohrn.sites.grinnell.edu/files/IP_Box/IP_Box_8_2016.pdf.

O'Reilly, P., Parra Ramirez, K., and Stemmer, M. (2019). Exchagne of information and bank deposits in international financial centres. OECD Taxation Working Paper No. 46.

Shehaj, P. and Weichenrieder, A. J. (2021). Corporate income tax, ip boxes and the location of r&d. WU International Taxation Research Paper No. 10.

Silva, J. and Tenreyro, S. (2006). The log of gravity. *The Review of Economics and Statistics*, 88(4):641–658.

Tharakan, P. K. M., van Beveren, I., and van Ourti, T. (2005). Determinants of india's software exports and goods exports. *The Review of Economics and Statistics*, 87(4):776–780.

Tinbergen, J. (1962). *Shaping the world economy: Suggestions for an international economic policy*. Twentieth Century Fund, New York.

Walsh, K. (2008). Trade in services: does gravity hold? *Journal of World Trade*, 42(2):315–334.

WTO (2019). World trade report 2019. Retrieved from https://www.wto.org/english/res_e/booksp_e/00_wtr19_e.pdf.

Chapter 3

Empirical evidence on the global minimum tax: What is a critical mass and how large is the substance-based income exclusion?*

Abstract: *This paper presents empirical evidence on the proposed global minimum tax (GMT) of the Organisation for Economic Cooperation and Development's Pillar 2. First, it addresses how many, and which, countries or country groups can be seen as constituting a "critical mass" for its successful implementation; given such a critical mass, remaining jurisdictions worldwide will have an incentive to implement the GMT as well. Second, it assesses the generosity of the substance-based income exclusion (SBIE), which is informative for the revenue collected under the GMT.*

*This chapter is based on joint work with Michael Devereux and Martin Simmler. It is published and can be cited like this: Devereux, M., Paraknewitz, J., and Simmler, M. (2023), Empirical evidence on the global minimum tax: what is a critical mass and how large is the substance-based income exclusion? *Fiscal Studies*, 1–13.

3.1 Introduction

In a landmark deal in October 2021, almost 140 countries of the Organisation for Economic Cooperation and Development (OECD) Inclusive Framework agreed to a two-pillar proposal for the fundamental reform of the international tax system (OECD, 2021a). Pillar 1 seeks to reallocate taxing rights for part of the profit of large multinational corporations (MNCs) towards the market country. Pillar 2 introduces a global minimum tax (GMT) on corporate profit. This paper aims to shed light on two important aspects of the GMT. The first concerns the incentive of countries to implement the GMT. This depends on some key features of the proposal and, in particular, the different ways in which the top-up tax can be collected by different countries in which an MNC operates. It also depends on the extent to which MNCs have operations in countries that do introduce the GMT. Our results suggest that most in-scope MNCs operate in several large, developed countries. Given the detailed proposals of how the GMT would operate, this implies that a coordinated implementation of the GMT in a critical mass of even three or four such countries would create a significant incentive for other such countries to follow suit in implementing the GMT. That, in turn, would create an incentive for most other countries also to implement the GMT. In particular, the recent commitment by the 27 member states of the European Union (EU27) to introduce the GMT creates a significant incentive for other countries to follow (European Council, 2022).

The second aspect concerns the revenue from the top-up tax that would be collected under the GMT. The GMT proposes to implement a top-up tax equal to a top-up rate multiplied by "excess profit", defined broadly as financial profit less a "substance-based income exclusion" (SBIE). The SBIE is in turn defined as a proportion of the value of tangible assets and payroll costs. A key factor in the size of the revenue collected is therefore the size of the SBIE relative to financial profit. The SBIE is also important in affecting the likelihood of competition between countries in the presence of the GMT. That is, profit from real activities, as opposed to profit shifted into a country, may generate a relatively large SBIE. In such cases, the top-up tax could be relatively small, and countries may therefore seek to continue to compete to attract such real activities.

Our findings suggest that a GMT implemented in Europe would result in total taxation of around 9% of financial profit of in-scope MNCs in the short run and around 12% in the longer run. We also document that behavioral responses by in-scope MNCs have the potential to substantially increase the share of profit covered by the SBIE.

The remainder of this article proceeds as follows. In Section 3.2, we present methodology, data, and results for determining the critical mass of countries. In Section 3.3, we present methodology, data, and results for share of profit covered by the SBIE. Section 3.4 briefly concludes.

3.2 Critical mass of countries

In this section, we address the question of what would constitute a critical mass of countries to implement the GMT. This depends on two factors: the design of the GMT and the extent to which MNCs are active in a small number of key countries. Note that the countries that signed the agreement have not so far committed to introduce it but only to accept the application of the rules by other countries (European Council, 2022).

3.2.1 Conceptual framework

The GMT allows for the possibility that three types of country might implement the top-up tax. To approach this, let us consider a hypothetical MNC with a parent company and headquarters in a high-tax country A, real activities in other high-tax countries, B and C, and also a subsidiary in a low-tax country, D. Let us assume that the subsidiary in D faces an effective tax rate in D of less than 15%. This triggers a top-up tax of a percentage of "excess profit", as defined in the Pillar 2 Model Rules (OECD, 2021b).

A key question for the incentive to implement the GMT is which countries might collect this top-up tax. There is a clear rule order. First, country D may introduce a qualified domestic minimum top-up tax (QDMTT) equal to the top-up charge. If it does so, then no other countries levy any further tax.[1] If country D does not levy a QDMTT, then country A may levy the top-up tax through an income inclusion rule (IIR). If country A does not do so, then countries B and C may collect the top-up tax through an undertaxed payments rule (UTPR). In practice, the UTPR would operate by denying deductions for costs incurred by the MNC in those countries, and there are rules as to how the revenue would be shared between B and C.

To understand the incentives created by this structure, let us start with country A.[2] In the absence of any GMT, country A would be unlikely to unilaterally implement a tax along the lines of the IIR. Doing so would create a disincentive for MNCs to locate their parent companies in A. Those MNCs that nevertheless did so may face a competitive disadvantage compared with MNCs with parents located elsewhere and which were not subject to the IIR. The US is the only country with a tax akin to the IIR (the GILTI), which reflects the size and market power of the US.[3]

How would country A's incentives be changed if other countries adopted an IIR, but no countries adopted a UTPR or QDMTT? In this case, there would be no competitive

[1] An exception may arise if country A imposes a controlled foreign corporation (CFC) tax on active income arising in country D, such as the United States (US) Global Intangible Low Tax Income (GILTI) provision. The OECD has recently announced (OECD, 2023) that such a tax would not affect the right of country D to introduce the QDMTT. However, country A may levy a CFC tax in addition to taxes levied in country D.

[2] These issues are developed further in Devereux (2023).

[3] Although, as noted above, it appears that GILTI will not be explicitly treated as an IIR.

disadvantage to implementing an IIR. However, there would be a competitive advantage from not implementing an IIR, since A would become a relatively attractive location for parent companies.

The existence of the UTPR may remove this potential competitive advantage, however. In our example, if countries B and C implemented a UTPR, then – at least with respect to our hypothetical MNC – there would be no competitive advantage for A in not implementing an IIR. That is because the top-up tax would simply be collected by countries B and C instead. By not having an IIR, country A would be giving up tax revenue without creating any incentives for MNCs to locate their parent companies there.

The UTPR therefore plays a crucial role in creating an incentive for countries hosting parent companies to implement an IIR. But how crucial the role is depends on the structure of MNCs and on whether other countries implement a UTPR. If most MNCs with parents in A are also present in B and C, and each has a UTPR, then there is a strong incentive for A to implement an IIR. If the MNCs are not present in B and C, then that incentive is much weaker. The empirical analysis below therefore focuses on this issue: "To what extent are MNCs with parents in large and developed countries also present in other large and developed countries?".

Note in passing that if all countries implemented an IIR, then no revenue would be raised from a UTPR. The value to, say, country B of implementing a UTPR is to provide an incentive for other countries – notably A – to introduce an IIR, and thereby make it feasible for B also to have an IIR.

Finally, if A, B, and C had all introduced an IIR and a UTPR, then there is a clear incentive for D to introduce a QDMTT. Again, if D did not introduce a QDMTT, then it would be giving up potential tax revenue, without any effect on incentives for MNCs to shift either real activity, or mobile profit, to D.

In sum, if a critical mass of large and developed countries each introduces an IIR and a UTPR, then that would create an incentive for other countries to follow suit. But it is an empirical question as to what would constitute such a critical mass. We now turn to that question.

3.2.2 Data, methodology, and results

To study the critical mass of the GMT, we analyze parent and subsidiary location data of in-scope MNCs. In the Orbis database (provided by Bureau van Dijk), we observe in 2018 11,334 firm groups that have consolidated revenues above the GMT revenue threshold of 750 million EUR. These firms have aggregate turnover of 65 trillion EUR and aggregate pre-tax profit of 5 trillion EUR. For 5,878 of the firm groups, we have subsidiary location data. These firms have aggregate turnover of 35 trillion EUR and

aggregate pre-tax profit of 3.0 trillion EUR.

Most of the firms for which we have subsidiary location data are MNC groups. In total we observe 4,842 MNCs. These have aggregate revenues of 32 trillion EUR and pre-tax profit of 2.8 trillion EUR. By comparison, the OECD (2020) identified a total number of MNCs in 2016 (including those not subject to the GMT) of almost 28,000 with aggregated revenues of 51.5 trillion USD (46.8 trillion EUR) and pre-tax profit of 4.1 trillion USD (3.7 trillion EUR).

In Table 3.1, we focus on G7 countries. The first column reports the total pre-tax profit of MNCs with a headquarters in each of the countries listed; for example, in 2018, the total worldwide profit of in-scope US-headquartered MNCs in our sample is 949 billion EUR. Of course, only a fraction of this profit might be subject to the GMT. The second column reports the percentage of this total profit that can be attributed to MNCs that have no subsidiary in any of the other G7 countries. Again for example, only 4% of the total profit of in-scope US MNCs is earned by those MNCs that do not have any presence in other G7 countries. The next seven columns examine what percentage of the total profit is attributable to MNCs that have a subsidiary in each other G7 country. For example, 91% of the total profit of in-scope US MNCs is attributable to those MNCs that have a subsidiary in Canada.

As already noted, the total profit figures in the first column do not represent profit that might be subject to the GMT. Nevertheless, the table is instructive. The second column indicates that (with the possible exception of Italy-headquartered MNCs) almost all the profit of in-scope MNCs headquartered in G7 countries is attributable to those MNCs with subsidiaries in at least one other G7 country. Further, taking account of the profit attributable to MNCs headquartered in each country, most of the profit of MNCs headquartered in the G7 is attributable to MNCs that have operations in many G7 countries.

This has important implications for the use of the UTPR, and hence the IIR, in these countries. Suppose that a G7 country – say the United Kingdom (UK) – decided not to implement an IIR, but that the other G7 countries all implemented a UTPR. Then (in the absence of a QDMTT in the source country) it seems very likely that the vast majority of profit that would otherwise be subject to a UK IIR would instead be subject to a UTPR in the other G7 countries. Indeed, even if the US were the only country to implement a UTPR, the same would be true.

Table 3.1 therefore provides strong evidence that an agreement between G7 countries – or even a subset of G7 countries – to introduce a UTPR would constitute a powerful incentive for those countries to also introduce an IIR.

Table 3.1: *Total profit of MNCs by G7 headquarters and subsidiary country*

HQ country	Total profit before tax (billion EUR)	Percentage of profit of MNCs in HQ country without subsidiaries in any other G7 country	Percentage of profit of MNCs in HQ country with subsidiaries in each other G7 country						
			US	Canada	Japan	Germany	France	UK	Italy
United States	949	4		91	65	73	77	86	74
Canada	50	1	98		13	34	30	46	22
Japan	366	5	94	62		71	72	80	59
Germany	116	4	89	80	71		94	90	87
France	97	1	93	85	76	96		94	95
United Kingdom	223	3	94	88	73	84	85		70
Italy	43	11	76	57	27	75	75	82	

Note: This table shows the total profit before tax and percentage profit of MNCs with a subsidiary in each other G7 country by G7 headquarters country.

Table 3.2: *Share of profit of MNCs in top 10 headquarters jurisdictions with subsidiaries in at least n of the EU27 countries*

Top 10 HQ jurisdiction (excluding EU27)	Total profit before tax (billion EUR)	Percentage of profit of MNCs in HQ jurisdiction with subsidiaries in at least n of the EU27 countries				
		n=1	n=2	n=3	n=4	n=5
United States	949	89	84	81	78	75
Japan	366	84	76	71	69	64
United Kingdom	223	99	97	94	87	86
China	137	33	16	14	11	10
South Korea	102	93	79	78	77	75
Australia	71	70	37	33	10	7
Taiwan	62	50	44	18	15	15
Switzerland	59	98	95	95	95	95
Cayman Islands	58	81	72	71	71	68
Hong Kong	57	17	12	11	4	4
Total (not just top 10)	2835	84	77	73	69	66

Note: This table shows total profit before tax of MNCs and the percentage of profit of MNCs with subsidiaries in at least one, two, three, four or five of the EU27 countries by headquarters jurisdiction for the top 10 headquarters jurisdictions, excluding the EU27 countries.

To investigate this further, we assess whether the EU27 – which recently reached an agreement to introduce the GMT – would represent a critical mass for the implementation of the GMT worldwide (see European Council, 2022). Table 3.2 reports the share of profit for the top 10 jurisdictions for MNC headquarters (excluding the EU27 countries) with operations in at least one, two, three, four, and five of the EU27 countries.

The bottom row of Table 3.2 indicates that of all in-scope MNCs, 77% of their aggregate profit is attributable to MNCs that have subsidiaries in at least two EU27 countries. Assuming that all EU27 countries successfully implement a UTPR, this suggests that between them they would constitute a powerful incentive for other countries to introduce an IIR.

That incentive does vary across jurisdictions, however. The percentage is very high in G7 countries, but considerably lower in other jurisdictions. The EU27 countries would arguably create a critical mass for the US, Japan, the UK, and Switzerland but possibly not for important Asian and Australasian jurisdictions – for example, the percentage is only 16% in China, 37% in Australia, and 44% in Taiwan. However, if some other countries – notably the US, Japan, and the UK – also followed suit by implementing a UTPR, then the incentive to introduce an IIR would be stronger also for those jurisdictions. Our calculations do not, however, suggest that the change to the incentive would be very strong: even if the US, Japan, and the UK in addition to the EU27 countries implemented the GMT, only 39% (22%) of the profit of MNCs headquartered in China would belong to those MNCs that have a subsidiary in at least two (three) of these countries.

More broadly, given the importance of Europe and the US as homes of MNC headquarters, if the EU27 countries created a strong incentive for the US, Japan and the UK to also introduce an IIR, then there would also be a strong incentive for low-tax countries to introduce a QDMTT. In short, the EU27 countries alone may well represent a critical mass that would induce a much broader implementation of the elements of the GMT proposal.

3.2.3 Summary

In this section, we have discussed the incentives from the perspective of individual countries to introduce the various elements of the GMT: the QDMTT, IIR, and UTPR. A key issue is whether the UTPR will be implemented successfully in a small number of key countries. If it is, then that creates a strong incentive for other headquarters countries to implement an IIR, and in turn for low-tax countries to introduce a QDMTT.

The evidence presented indicates that the vast majority of the profit of in-scope MNCs is attributable to MNCs that have a presence in G7 countries. That suggests that the G7 – or probably a subset of the G7 – could represent a critical mass sufficient for the

GMT to be implemented much more broadly. Indeed, the EU27 countries, which have recently reached an agreement to implement the GMT, would very probably constitute a critical mass as well.

3.3 Substance-based income exclusion

In this part of the paper, we turn to analyzing the generosity of the substance-based income exclusion. The SBIE is a formulaic carve-out. Initially it will be set to the sum of 10% of payroll and 8% of tangible assets (an average of the beginning and the end of the financial year). The percentages will decline gradually until the tenth year, after which they will be 5% of both payroll and tangible assets.

The size of the SBIE plays an important role for the GMT. The SBIE is deducted from total global anti-base erosion (GloBE) income – adjusted financial accounting profit – to derive the measure of "excess profit". This is the base for any top-up tax levied, whether it is applied in the form of a QDMTT, an IIR, or a UTPR. A higher SBIE therefore reduces the top-up tax, and hence the overall effective tax rate ultimately levied. As Devereux et al. (2022) point out, the GMT puts a minimum floor on total tax paid of 15% of excess profit (at least in the absence of qualified refundable tax credits).

3.3.1 Data and methodology

We assess the size of the SBIE using unconsolidated financial statements of foreign-owned EU subsidiaries of MNCs. We use data from the Amadeus database, collected by Bureau van Dijk. We use data for 2019 on sales, pre-tax profit, wage costs, tangible assets, and depreciation provisions. We use 2019 data to remove the impact of COVID-19 on corporate profit. Dropping foreign-owned firms with no data on depreciation provisions leaves us without any firms in Cyprus, Greece, and Lithuania.

Our main measure of interest is the share of pre-tax profit covered by the SBIE. We therefore exclude firms with non-positive profit. We also consider other measures of expected profit, based on a return to equity, and we therefore also exclude firms with non-positive equity. Some elements of profit may be non-taxable – for example, dividends received. In our base case, we address this issue by removing firms with a ratio of pre-tax profit to sales in the top 5% of the distribution (a ratio of around 34%). We report the robustness of our results to this below.

The GMT applies only to firms belonging to an MNC with aggregate revenue above 750 million EUR. However, we do not observe complete ownership structures, nor aggregate revenue for the consolidated MNC. We therefore apply our analysis to all foreign-owned firms in the EU27 and the UK. Our sample consists of 43,564 firms. We test the robustness of this approach by also using only data on MNCs on which we have the

necessary data to identify them as being in-scope for the GMT.

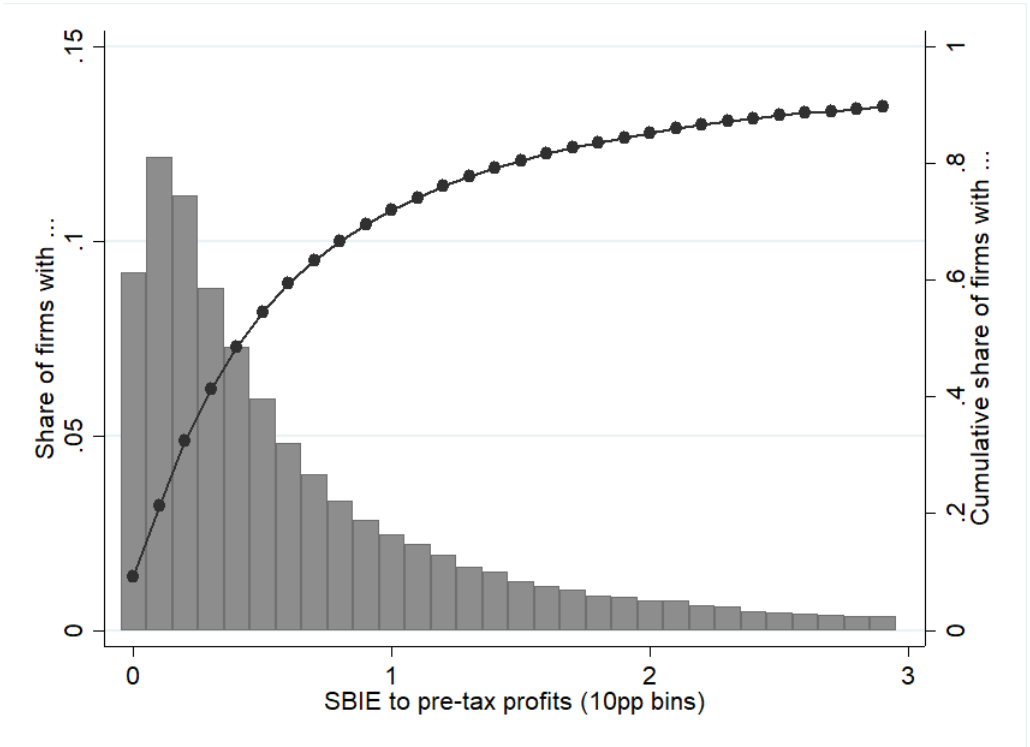
Table 3.6 in Appendix 3.A compares the aggregate turnover of the EU firms in the raw data and our sample with country-level macroeconomic data from Eurostat. The sample coverage is good for most countries, and the sample restrictions have only a modest impact on the coverage. However, since coverage is less than 5% for Latvia and the Netherlands, we exclude these countries from the analysis. Thus, our analysis is based on foreign-owned firms in 22 EU countries plus the UK.

3.3.2 The size of the SBIE relative to pre-tax profit

Figure 3.1 shows the distribution and cumulative distribution of the ratio of SBIE to pre-tax profit for our sample. As described above, we use data from 2019, and apply the rules of the proposed GMT. We do not account for any behavioral change in response to the introduction of the GMT.

The figure indicates significant heterogeneity among firms. The SBIE (based on the initial proportions of payroll and tangible assets) is below pre-tax profit for around 70% of firms; for the remaining 30%, the SBIE exceeds pre-tax profit, sometimes by a wide margin.

Figure 3.1: *Distribution and cumulative distribution of SBIE to pre-tax profit (first year)*



Note: This figure shows the distribution and cumulative distribution of firms by the ratio of SBIE to pre-tax profit (using 10-percentage-point bins). Firms with a ratio of SBIE to pre-tax profit in the top 10% of the distribution are not shown.

Since unused SBIE cannot be carried forward, in our base case summary statistics in Table 3.3 we cap the ratio of SBIE to pre-tax profit for each firm to 1, meaning the SBIE cannot exceed pre-tax profit. Based on this adjustment, we calculate that in the first year that the GMT applies, the average ratio of SBIE to pre-tax profit is 57% and the median ratio is 52%. These shares fall to 41% and 28% respectively after 10 years due to the reduction in the percentages for the calculation of the SBIE. Based on an average ratio of SBIE to pre-tax profit of 57%, excess profit is on average approximately 43% of GloBE income, implying a minimum tax of 6.45% of GloBE income. This rises to 8.85% after 10 years.

Table 3.3: *Ratio of SBIE to pre-tax profit*

	First year	After 10 years
% of pre-tax profit shielded by SBIE		
Average firm	57	41
Median firm	52	28
% of total pre-tax profit shielded by SBIE	37	23

Note: This table shows the share of pre-tax profit covered by the SBIE for the average and the median firm, and the share of total pre-tax profit covered by the SBIE. Results are reported for the first year the GMT applies and after 10 years.

Table 3.3 also shows the ratio of total SBIE relative to total pre-tax profit. The share of total pre-tax profit shielded is 37% in the first year and 23% after 10 years.[4] Given that this ratio is below the share of profit covered by the SBIE for the average (and median) firms, this implies that firms with higher absolute profit have a higher ratio of profit to SBIE. In other words, the share of profit covered by the SBIE tends to fall with the absolute amount of profit. The minimum total tax on aggregated profit of all the firms included in our sample is 9.45% in the first year and 11.55% after 10 years.

3.3.2.1 Sensitivity analysis

We report two forms of sensitivity analysis.

First, the ratios reported in Table 3.3 are based on all foreign-owned firms in our sample, for the reasons set out above. When we instead use only a subsample of foreign-owned firms for which aggregate revenue data are available, and which we determine to be in-scope for the GMT, we calculate an average ratio of SBIE to pre-tax profit of 56% – almost identical to our base case.[5] This falls to 38% after 10 years.

Second, we also repeat this exercise dropping only the top 1% of firms in the distribution of the ratio of pre-tax profit to sales, instead of the top 5%. This has little impact

[4]These results are comparable to those of Barake et al. (2021) who use country-level data to assess the impact of the substance-based carve-out on tax revenue collected under the GMT.

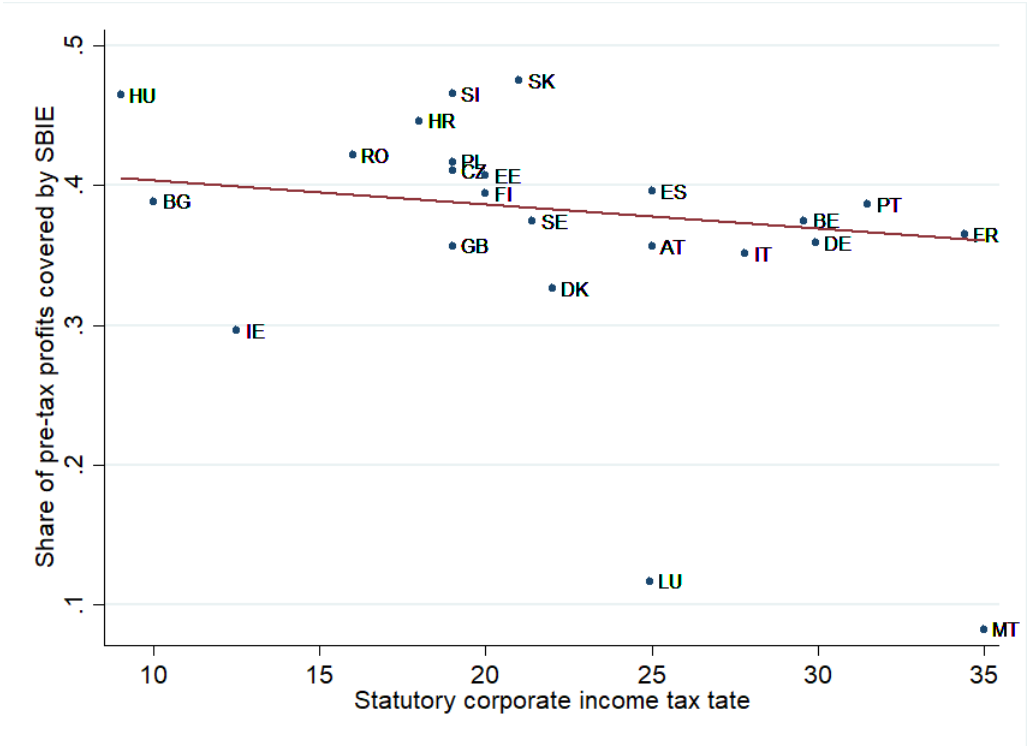
[5]The average ratio for out-of-scope firms is also 56% initially and 39% after 10 years. We find similar results for subsidiaries of domestic MNCs.

on the average or median ratio. However, in this case, the share of total profit shielded by the SBIE is lower: it is initially 28%, and falls to 18% after 10 years, substantially below the results reported in Table 3.3.[6] This reduction in the total ratio is somewhat stronger in countries with a low statutory tax rate, and in Ireland and Luxembourg.

3.3.2.2 Results by country

Given that our sample includes both low-tax and high-tax jurisdictions, the sample average may hide important heterogeneity across countries. We therefore also report results by country. In Figure 3.2, for each country we plot the share of total profit shielded by the SBIE against the statutory corporate income tax rate (this is for the first year; Figure 3.4 in Appendix 3.B shows the position after 10 years).

Figure 3.2: *Share of pre-tax profit covered by SBIE by country (first year)*



Note: This figure plots for each country the share of total pre-tax profit covered by the SBIE in the first year the GMT applies against the statutory corporate tax rate. GB is the United Kingdom.

Two results emerge. First, the share of total profit covered by the SBIE declines with the statutory tax rate, albeit only to a small degree. Second, Luxembourg, Malta and, to some extent, Ireland are different; their share of total profit covered by the SBIE is substantially lower than those for the other EU countries. Given that these three countries are known for offering favorable tax conditions to MNCs, these results are in

[6]Not dropping any firms in the distribution of the ratio of pre-tax profit to sales reduces the share of total profit shielded to 26% in the first year the GMT applies and to 17% after 10 years.

line with the hypothesis that MNCs book higher profit in low-tax jurisdictions and that statutory tax rates are only a weak predictor of the tax burden on company profit.

3.3.2.3 Ownership of assets

We now return to an issue raised above – that some firms may have unused SBIE since their SBIE exceeds their pre-tax profit. This creates an incentive for firms with unused SBIE to mix with in-scope firms with SBIE that is insufficient to prevent a top-up charge. In principle, this could be done by exchanging assets (and the associated income stream) or by merging firms. Here we ask: "How much of the profit of foreign-owned firms that are not covered by the SBIE could be covered by using unused SBIE of other firms?". In this case, we consider merging firms. For example, a profitable domestic firm could be acquired by an in-scope MNC. The combined profit would then be subject to the GMT, and we examine how far that would reduce the top-up charge of the MNC. In considering other firms, we examine both profitable foreign-owned firms and profitable domestic firms located in the same country.[7] The results for the first year of the GMT are shown in Table 3.4. The first column indicates the share of aggregate profit of foreign-owned firms not shielded by the SBIE, expressed as a percentage of pre-tax profit of these firms. The next two columns show the unused SBIE of profitable foreign-owned and domestic firms respectively, also expressed as a percentage of the pre-tax profit of foreign-owned firms. The final column combines these two groups of other firms.

We find that the size of unused SBIE of other foreign-owned firms is small relative to the total profit of foreign-owned firms. For example, in aggregate in Austria, 64% of the profit of foreign-owned firms is not shielded by the SBIE. But if all of the surplus SBIE of other foreign-owned firms were allocated to those without surplus SBIE, this percentage would only be reduced by 4 percentage points to 60%. The size of the unused SBIE of domestic firms, in contrast, is more important: in the case of Austria, the share of total profit not shielded is reduced by a further 15 percentage points by including the surplus SBIE of purely domestic firms. Across countries, a more efficient use of the SBIE could increase the share of total profit covered by the SBIE by around 15 percentage points or almost 40%. While this would benefit in-scope MNCs, it may well lead to economic inefficiencies by inducing acquisitions purely for tax purposes. These findings should be interpreted with some caution, since our sample of foreign-owned firms is not restricted to in-scope MNCs, and the coverage of domestic firms varies by country.

[7] We focus only on profitable firms here since affected firms are unlikely to acquire unprofitable firms only because they have unused SBIE. We assume firms to be profitable if their return on equity is above 10%. In undertaking this exercise, we are not able to distinguish between in-scope and out-of-scope firms.

Table 3.4: *Aggregate unused SBIE by country (first year)*

	Aggregate profit of foreign-owned firms not shielded as a percentage of aggregate pre-tax profit of foreign-owned firms	Aggregate unused SBIE of ... as a percentage of aggregate pre-tax profit of foreign-owned firms		
		Profitable foreign-owned firms	Profitable domestic firms	Profitable foreign-owned and domestic firms
Austria	64	4	15	19
Belgium	63	7	7	14
Bulgaria	61	4	3	7
Czech Republic	59	4	2	6
Croatia	55	3	5	8
Denmark	67	6	12	18
Estonia	59	4	12	16
Finland	61	6	22	28
France	64	4	6	10
Germany	64	8	9	17
Hungary	54	6	7	13
Ireland	70	4	6	10
Italy	65	5	14	19
Luxembourg	88	4	1	5
Malta	92	0	0	0
Poland	58	3	3	6
Portugal	61	6	5	11
Romania	58	4	4	8
Slovakia	53	6	2	8
Slovenia	53	5	7	13
Spain	60	7	9	16
Sweden	63	7	14	21
United Kingdom	64	6	9	15

Note: This table shows the ratio of aggregate unused SBIE for profitable foreign-owned firms and for profitable domestic firms to aggregate pre-tax profit of foreign-owned firms by country.

3.3.2.4 Heterogeneity by sector and source of finance

We now explore heterogeneity in the ratio of the SBIE to pre-tax profit. We analyze two factors that may affect the ratio: the use of intermediate materials and the use of debt finance.

First, we consider variation in the costs of materials. Some firms may produce intermediate materials themselves, using tangible assets and labor, while others buy such intermediate materials. The former group is likely to have a higher ratio of SBIE to pre-tax profit. We explore this variation in Table 3.5 by considering sector-level differences. The table reports the ratios of average material costs, average wage costs, and average tangible assets, all to pre-tax profit. Unlike the ratio of SBIE to pre-tax profit, these ratios are not percentages: for example, a ratio of material costs to pre-tax profit of 40 means that for each 1 pound of profit there are on average 40 pound of material costs.

Table 3.5 indicates that the sectors with the lowest average ratios of SBIE to profit are retail (46%) and finance (49%). The low ratio for retail seems to be driven by the high importance of material inputs, with a very high ratio of material inputs to pre-tax profit. This is not true for finance, where the low ratio seems instead to reflect very high average profitability. The sectors with the highest ratios of SBIE to pre-tax profit are accommodation (78%), transportation and storage (68%), and real estate (68%). These are all industries with a relatively low importance of material costs, and a high relevance of tangible assets (real estate and accommodation) or wages (transportation and storage).

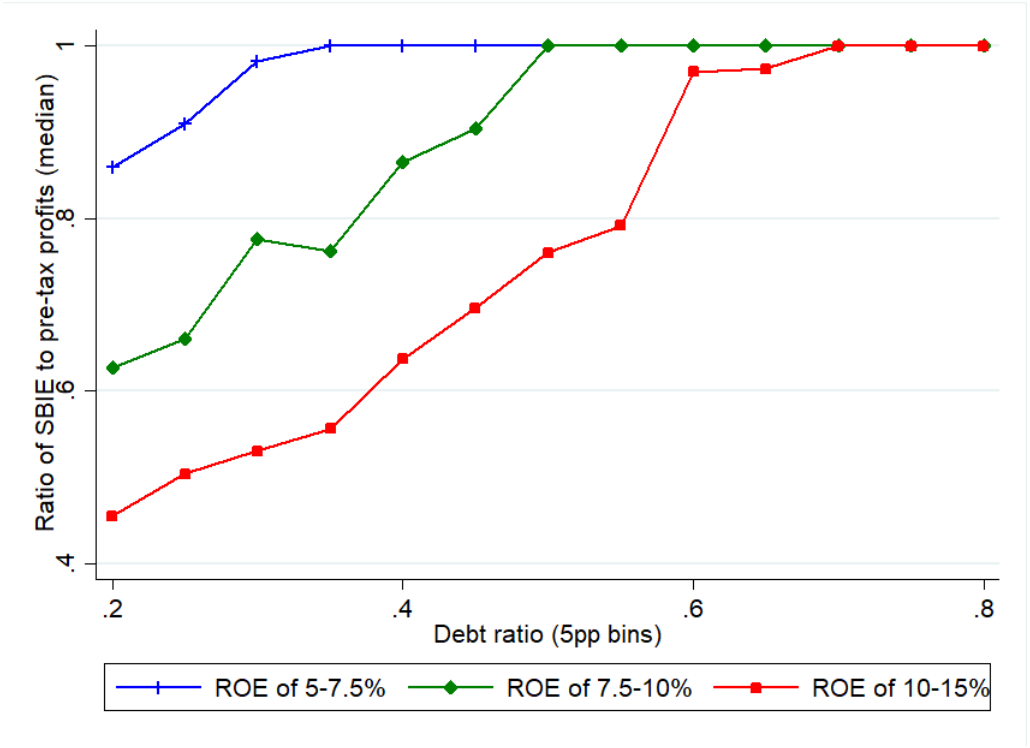
Table 3.5: *SBIE to pre-tax profit by industry (first year)*

	Average ... to pre-tax profit			
	SBIE (%)	Material costs	Wage costs	Tangible assets
Agriculture	64	40	9	36
Mining and quarrying	62	15	11	19
Manufacturing	61	32	10	13
Electricity	54	63	4	22
Utilities	59	19	6	10
Construction	58	22	12	6
Retail	46	63	7	5
Transportation/storage	68	21	16	12
Accommodation	78	10	11	25
Information	62	7	11	4
Financial sector	49	7	9	10
Real estate	68	10	8	47
Professional activities	62	13	14	5
Other	68	12	19	10

Note: This table shows the average ratio of SBIE, material costs, wage costs, and tangible assets to pre-tax profit by industry (NACE Rev 2 Codes).

Second, we analyse how the ratio of SBIE to pre-tax profit depends on the use of debt finance. Since pre-tax profit is after interest payments, greater use of debt will tend to reduce pre-tax profit and hence yield a higher ratio of SBIE to pre-tax profit. Figure 3.3 provides evidence on the relationship between debt financing and the share of profit covered by the SBIE. It shows the median ratio of SBIE to profit of firms with a particular debt ratio (using 5-percentage-point bins) and a particular rate of return on equity (ROE). As expected, the share of profit covered by the SBIE increases substantially with firms' debt ratio: the ratio is around 60% for a firm with a return on equity of between 10% and 15% and a debt ratio of 40%, and around 70% for an otherwise similar firm that has a debt ratio of 50%. The figure also demonstrates that, for a given debt ratio, the ratio of SBIE to pre-tax profit rises as the ROE falls.

Figure 3.3: *Share of pre-tax profit covered by SBIE by country (first year)*



Note: This figure shows the median ratio of SBIE to pre-tax profit by debt ratio (5-percentage-point bins) for companies with pre-tax profit over equity (ROE) between 5% and 7.5%, between 7.5% and 10%, and between 10% and 15%.

3.3.3 Summary

In this section, we have investigated various aspects of the size of the SBIE, measured as a proportion of pre-tax profit – effectively the share of profit shielded by the SBIE. This is important in determining the minimum tax burden on profit, and hence the revenue consequences, of the GMT.

We find that the share of total profit covered by the SBIE is just under 40% in the first year the GMT applies and 23% after 10 years. This implies a minimum tax burden on total profit of 9% and 12% respectively. There is considerable heterogeneity in the share of profit covered by the SBIE. We explored two elements of the heterogeneity, depending on the use of material inputs and the use of debt finance.

We also investigated the scale of unused SBIE in each country, and considered how aggregate SBIE could be used more "efficiently" by MNCs to reduce their tax burden, if they acquire other firms with unused SBIE. We calculate that a more efficient use of the SBIE within a country could increase the share of profit covered by the SBIE by almost 40%.

3.4 Conclusion

The aim of this paper is to shed light on two central issues of the GMT: (i) the critical mass of countries required to implement the GMT for a worldwide roll-out and (ii) the generosity of the SBIE. We present evidence that the EU27 countries, which have recently reached an agreement to implement the GMT, most likely constitute a critical mass. In addition, we document that, for our sample of firms, the share of total profit covered by the SBIE is around 40% in the first year the GMT applies and close to 20% after 10 years. This suggests that the minimum total tax on corporate profit around the globe will be at 9% in the short run and around 12% in the medium term.

Appendix

3.A Sample coverage

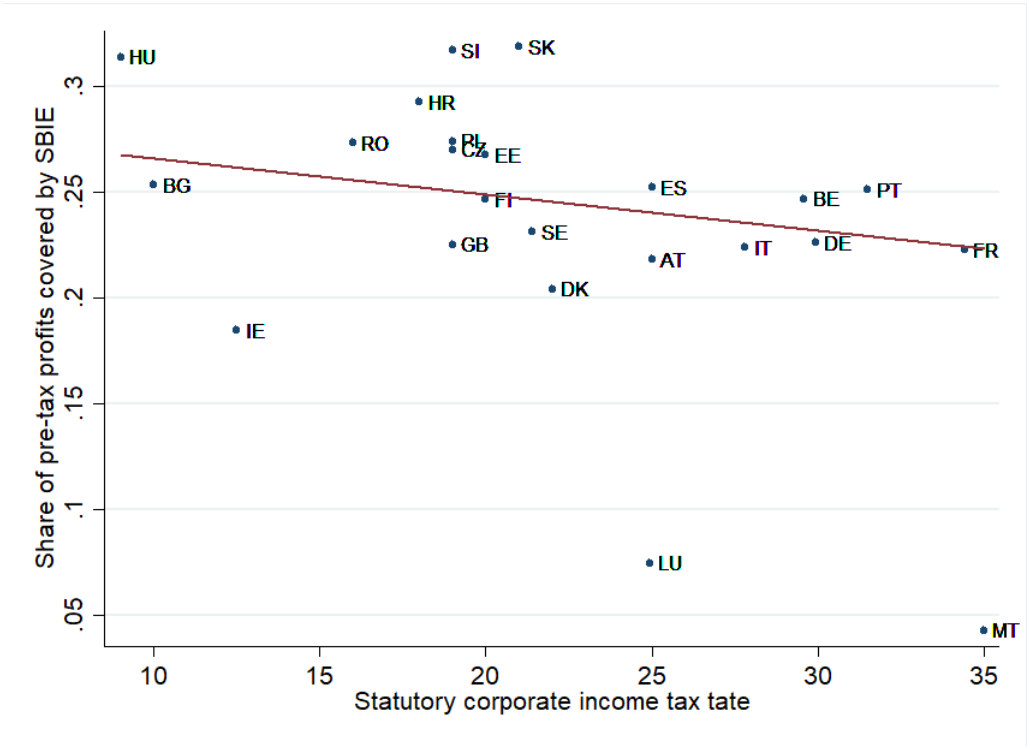
Table 3.6: *Sample coverage*

Country	Operating revenues of firms to operating revenues of all firms in %:		Operating revenues of foreign-owned firms to operating revenues of all firms in %:	
	Raw data	Sample	Raw data	Sample
Austria (AT)	60	47	82	66
Belgium (BE)	75	50	122	73
Bulgaria (BG)	73	60	98	78
Czech Republic (CZ)	73	61	98	81
Germany (DE)	29	19	50	34
Denmark (DK)	21	17	33	28
Estonia (EE)	75	63	97	82
Spain (ES)	54	39	75	55
Finland (FI)	34	25	59	45
France (FR)	65	40	145	93
Croatia (HR)	63	54	83	67
Hungary (HU)	70	54	81	57
Ireland (IE)	59	24	71	25
Italy (IT)	50	39	86	62
Luxembourg (LU)	90	28	113	40
Latvia (LV)	3	2	3	3
Malta (MT)	11	7	32	20
Netherlands (NL)	4	3	4	3
Poland (PL)	55	45	67	57
Portugal (PT)	59	48	103	85
Romania (RO)	76	61	94	75
Sweden (SE)	31	23	46	33
Slovenia (SI)	65	55	84	74
Slovakia (SK)	62	46	87	62

Note: This table shows the ratio of aggregate operating revenues of the firms (the foreign-owned firms) included in the raw data and the sample to total operating revenues of all firms (all foreign-owned firms) by country. Total operating revenues of all firms and foreign-owned firms are provided by Eurostat. No data available for the UK.

3.B Share of pre-tax profit covered by SBIE by country (after 10 years)

Figure 3.4: *Share of pre-tax profit covered by SBIE by country (after 10 years)*



Note: This figure plots for each country the share of total pre-tax profit covered by the SBIE after 10 years of the introduction of the GMT against the statutory corporate tax rate. GB is the United Kingdom.

References

Barake, M., Neef, T., Chouc, P.-E., and Zucman, G. (2021). Minimizing the minimum tax? the critical effect of substance carve-outs. Retrieved from https://www.taxobservatory.eu/wp-content/uploads/2021/07/EU-Tax-Observatory-Note-n.1-Substance-carve-outs-2.pdf.

Devereux, M. (2023). International tax competition and coordination with a global minimum tax. *National Tax Journal*, 76(1):145–166.

Devereux, M., Vella, J., and Wardell-Burrus, H. (2022). Pillar 2: rule order, incentives, and tax competition. Retrieved from https://papers.ssrn.com/sol3/papers.cfm?abstract_id=4009002.

European Council (2022). International taxation: Council reaches agreement on a minimum level of taxation for largest corporations. Retrieved from https://www.consilium.europa.eu/en/press/press-releases/2022/12/12/international-taxation-council-reaches-agreement-on-a-minimum-level-of-taxation-for-largest-corporations/.

OECD (2020). Tax challenges arising from digitalisation - economic impact assessment. Retrieved from https://www.oecd-ilibrary.org/taxation/tax-challenges-arising-from-digitalisation-economic-impact-assessment_0e3cc2d4-en.

OECD (2021a). Statement on a two-pillar solution to address the tax challenges arising from the digitalisation of the. Retrieved from https://www.oecd.org/tax/beps/statement-on-a-two-pillar-solution-to-address-the-tax-challenges-arising-from-the-digitalisation-of-the-economy-october-2021.htm.

OECD (2021b). Tax challenges arising from digitalisation of the economy - global anti-base erosion model rules. Retrieved from https://www.oecd-ilibrary.org/taxation/tax-challenges-arising-from-digitalisation-of-the-economy-global-anti-base-erosion-model-rules-pillar-two_782bac33-en.

OECD (2023). Tax challenges arising from digitalisation of the economy – administrative guidance on the global anti-base erosion model rules (pillar 2). Retrieved from https://www.oecd.org/tax/beps/agreed-administrative-guidance-for-the-pillar-two-globe-rules.pdf.

Chapter 4

Corporate dividend payments along the ownership chain: On repatriation taxes, owner outcomes, and the role of conduit firms*

Abstract: *This paper investigates the dividend policy of multinational corporations (MNCs) and contributes to a better understanding of within-firm profit repatriation behavior. Based on a multi-country, multi-industry, parent-affiliate level dataset, we examine dividend payments along the ownership chain of MNCs. We find that taxes significantly affect within-firm dividend distributions. Furthermore, estimation results consistently indicate that those firms that receive higher levels of dividends are also the ones that pay more dividends to their respective shareholders. This effect is particularly strong for intermediate firms. It appears that these primarily serve as conduits and pass on dividends to global ultimate owner firms – only for those to distribute dividends to their investors.*

*This chapter is based on joint work with Valeria Merlo and Georg Wamser.

4.1 Introduction

A significant part of the total profit of multinational corporations (MNCs) is naturally earned through foreign business operations. The decision of whether, when, and to what extent to repatriate earnings from foreign affiliates to the parent firm (i.e. their owner) is a central one.[1] Often, taxation is a crucial determinant for profit repatriations being deferred. Exploiting fundamental tax reforms where countries moved from a system of worldwide taxation (i.e. one where dividends are taxed upon repatriation) to a territorial system where foreign earnings are exempt from taxation, for instance, Egger et al. (2015) and Hasegawa and Kiyota (2017) demonstrate that dividend repatriations increased after countries introduced territorial taxation. Moreover, Dharmapala et al. (2011) provide evidence from the "Homeland Investment Act" (HIA), a tax holiday for the repatriation of foreign earnings in the United States (US), suggesting that repatriations increased from an average of about 62 billion USD before the HIA by about 237 billion USD in 2005 (the year of the tax holiday).

The objective of this paper is to examine dividend payments along ownership chains of MNCs. Based on a unique dataset on multinational firm entities and their direct shareholders, we differentiate between firms on three different levels in the ownership chain: *(i)* subsidiaries (i.e. those firms at the end of an ownership chain), *(ii)* intermediate firms, and *(iii)* global ultimate owner (GUO) firms. With this, we contribute to two strands of the literature. The first focuses on the determinants of repatriation behavior – with particular interest in taxes. These studies include the work by Desai et al. (2001), Desai et al. (2007), Bellak and Leibrecht (2010), Tajika and Shibata (2014), Egger et al. (2015), Hasegawa and Kiyota (2017), and Boissel and Matray (2022). The other strand of the literature investigates the effects of dividend repatriations from foreign subsidiaries on economic outcomes in resident countries. This includes the work by Blouin and Krull (2009), Graham et al. (2010), Dharmapala et al. (2011), Faulkender and Petersen (2012), and Brennan (2014).

Our analysis is based on ORBIS, a micro-level dataset provided by the Bureau van Dijk. The ORBIS data allow us to identify ownership links on a global scale. For the identification of MNC networks, we rely on information on direct shareholders with ownership shares of at least 50%, from which we construct ownership chains. Adding financial variables and calculating dividend payments following the method suggested by Bellak and Leibrecht (2010) or Egger et al. (2015), results in a sample of 3,189,892 firm-year observations, covering the years 2010 until 2018. Our sample includes 39,864 distinct global ultimate owners, 151,002 intermediate firms, and 417,590 subsidiaries at the end of the ownership chain. These are located in 122 different countries. All tax

[1] The predominant form of profit repatriation is considered to be dividends (Mutti, 1981). See also Altshuler and Grubert (2002), for alternative strategies and tax-favored repatriation channels.

variables are taken from the International Tax Institutions (ITI) database provided by the Tübingen Research School of International Taxation (RSIT). Control variables are provided by the World Bank.

Our descriptive exploration of ownership chains reveals interesting regularities – specifically, in terms of the location of intermediate firms. Quite frequently, these are located in countries such as the Netherlands, Luxembourg, Hong Kong, Switzerland, or Cyprus. Clearly, the choice of these locations seems to be tax-driven (among the top 10 locations for such firms, there are several tax haven countries).[2]

Studying the determinants of dividend distributions shows that corporate income taxes as well as bilateral withholding taxes – depending on bilateral ownership and the respective source-residence (i.e. affiliate-parent) country pair – reduce dividend payments, suggesting that repatriation taxes significantly distort repatriation behavior.[3] We provide estimates on repatriation-tax semi-elasticities that lie in the range of 1% to 3%. The responsiveness to taxes of subsidiaries and intermediate firms is statistically significant and substantially higher than for ultimate owner. In line with expectations, we further note that taxes have a stronger effect on dividends if repatriated to a foreign parent firm than to a domestic one.

Subsequently, we model dividend payments (and other outcomes) of a given firm as a function of the amount of repatriated dividends received by this firm. As endogeneity issues are a central concern, we draw on instrumental variable (IV) methods to account for the endogeneity of dividends received. In particular, we exploit the average bilateral country-pair specific variation in effective tax rates between an affiliate and its parent firm of all affiliates of a given parent firm in a given year. The exogenous variation in effective rates should directly affect the dividends the parent firm receives, but not own payments to the respective owner up the ownership chain. Our findings support the hypothesis that intermediate firms primarily serve as conduits to distribute profit in a tax-efficient way. For example, we show that higher dividend repatriations received lead to a significant increase in dividend payments by intermediate firms. We find the same pattern for ultimate owner firms: Higher repatriated dividends lead to higher dividends paid to shareholders. With respect to real outcomes, we only find a small effect of dividend repatriations on tangible fixed assets on both the intermediate firm-level and the GUO firm-level as well as employee compensation on the intermediate firm-level.

The remainder of this paper proceeds as follows: Section 4.2 reviews the most relevant

[2]Only few papers have investigated such firms. For instance, Garcia-Bernardo et al. (2017) identify a small set of five countries that route the majority of international investments as conduit countries: the Netherlands, the United Kingdom (UK), Ireland, Singapore, and Switzerland. A recent paper by Lejour et al. (2021) demonstrates that the tax savings of Dutch special purpose intermediate entities are large.

[3]The cost of tax distortions add to the administrative cost to comply with tax regulations across countries (HM Treasury, 2007; Matheson et al., 2013).

literature related to this paper. Section 4.3 describes the data we employ. In Section 4.4, we provide descriptive evidence on ownership links, firm locations and balance-sheet data. In Section 4.5, we explain the empirical strategy to investigate the determinants of dividend payments and discuss the results. Section 4.6, in turn, presents the empirical approach to study the effect of dividend repatriations on outcome variables at the parent firm and the corresponding results. In Section 4.7, we provide additional results pertaining to intermediate firms. Section 4.8 concludes.

4.2 Related literature

4.2.1 The determinants of dividend repatriations

In their seminal work, Hartman (1985) and Sinn (1987) argue that taxes on dividend repatriations are neutral and do not distort the decision of (mature) subsidiaries to repatriate or reinvest abroad, as they reduce the investment's return and opportunity cost by the same amount (henceforth Hartman-Sinn model). This, however, seems to be inconsistent with empirical evidence (e.g. Mutti, 1981; Alworth, 1987; Hines and Hubbard, 1990; Altshuler et al., 1993). Altshuler et al. (1995) argue that this relates to the assumption of time-constant taxes in the Hartman-Sinn model. In fact, the authors show that profit repatriated by subsidiaries is higher (lower) if taxes due upon repatriation vary over time and the repatriation tax costs are temporarily lower (higher) than the permanent long-run average tax. Altshuler et al. (1995) separate the permanent and transitory variation in dividend repatriation tax rates for their repeated cross-section tax return data of US MNCs and find that, unlike the permanent tax component, the effect of the transitory tax component is negative and significant. They conclude that this is consistent with the predictions of the Hartman-Sinn result.

The subsequent empirical literature further exploring the impact of repatriation taxes on dividends paid by foreign subsidiaries to their parent firms all report negative and significant effects, irrespective of the methodological approach applied to the data used. Desai et al. (2001, 2007) and Bellak and Leibrecht (2010), for instance, provide estimates on the determinants of dividend payout, with empirical specifications drawing on the structural process described by Lintner (1956). Focusing on dividend distributions of foreign subsidiaries of US MNCs between 1982 and 1997, Desai et al. (2001) find that a one percent change in repatriation taxes reduces dividend repatriations by about the same amount. Furthermore, highly taxed foreign subsidiaries have higher desired payout ratios than lower taxed ones. Desai et al. (2001) attribute this to the lower repatriation taxes associated with receiving dividends from highly taxed subsidiaries. Desai et al. (2007) distinguish three factors that shape dividend repatriation policy: taxes, domestic financing and investment needs of the parent, and agency problems inside the MNC. They

find that tax considerations influence dividend repatriations by US MNCs. In addition, they observe that (highly leveraged) parent firms – in need of cash to finance domestic investments or with high payout ratios to common shareholders – repatriate significantly more profit from abroad. Finally, incompletely controlled subsidiaries seem to be more likely to make regular dividend payments. Desai et al. (2007) ascribe this to the fact that regular dividend payments limit the financial discretion of foreign managers and reduce associated agency problems. Bellak and Leibrecht (2010) explore the determinants of dividend repatriations from foreign subsidiaries in the manufacturing sector to German parent firms. They find that, in addition to the variables highlighted by Lintner (1956) (i.e. previous dividends and current profit), the initial dividend payment, repatriation taxes as well as subsidiary debt and size determine the repatriation behavior of a firm.

Egger et al. (2015) and Hasegawa and Kiyota (2017) exploit fundamental tax reforms in the UK and Japan, substantially changing incentive effects to repatriate foreign income. In particular, evaluating the effects of the UK moving from a worldwide tax system to a territorial one in 2009, Egger et al. (2015) find that the reform induced foreign subsidiaries to pay out significantly more dividends in the short-run.[4] They estimate that the average UK-owned subsidiary paid out about 2.15 million USD more dividends immediately after the reform than its counterfactual in the absence of the reform. Tajika and Shibata (2014) and Hasegawa and Kiyota (2017) investigate the impact of the Japanese enactment to dividend exemption in 2009 on dividend repatriations. They find that Japanese parent firms received more dividends from their foreign subsidiaries in response to the change in repatriation taxes related to the tax system change. A recent paper by Boissel and Matray (2022) shows that firms reduced dividend distributions in response to an increase in the French dividend tax rate from 15.5% to 46% in 2013. Lastly, Bilicka et al. (2022) evaluate the introduction of a dividend tax in Greece and find that firms responded by reducing their regular dividend payments.

4.2.2 The effect of dividend repatriations

A considerable number of papers exploit the HIA to investigate the effect of repatriated dividends on the parent firm.[5] Blouin and Krull (2009) find a 55.80 to 60.85 billion USD increase of share repurchases by repatriating firms during the tax holiday relative to non-repatriating ones. Asking over 400 tax executives at firms with foreign source earnings about their response to the HIA, Graham et al. (2010) report that one of the

[4]When it comes to domestic taxation, a worldwide tax system usually allows a credit or deductions for taxes already paid related to foreign dividends. Under the territorial one, in turn, foreign-earned income is exempted from domestic taxation. For more on this, please refer to subsection 4.3.2.

[5]Passed by US Congress in 2004, the HIA provided a one-time only tax holiday from the worldwide tax system the country was operating to that time in favor of exempting dividend repatriations from taxation. This temporarily dereased the tax burden on dividend repatriations and was aimed at encourage firms to invest profit held back overseas in the US.

two most common uses for repatriated profit were repurchasing shares. Dharmapala et al. (2011) find that shareholder payouts increased by 0.60 to 0.92 USD following a one USD increase in repatriations that was not due to increased dividend payments but to increased share repurchases. They note that it is particularly well-governed US firms that paid out more of the repatriated funds to their shareholders rather than weakly-governed firms. Also noting that firms increased distributions to shareholders during the HIA, Faulkender and Petersen (2012) claim that these results are a consequence of an upward trend in equity payouts among those firms that repatriated under the HIA and not the HIA itself.

A handful of these papers investigate whether dividends repatriated during the HIA also affected other firm outcome variables. Graham et al. (2010) note that in addition to repurchasing stocks, firms claimed to also use repatriated funds to pay down debt. In contrast, Dharmapala et al. (2011) do not find evidence of repatriated dividends having had any effect on firms' debt levels. Extending the scope of analysis, Dharmapala et al. (2011) furthermore suggest that dividend repatriations did not increase domestic investment, employment compensation, or research and development spendings – even if firms lobbied for the tax holiday or appeared to be financially constraint. Only Faulkender and Petersen (2012) claim that repatriations of financially constrained firms under the HIA appeared to be associated with increased domestic investment, but not employment.

4.3 Data

4.3.1 Ownership and financial information

Our analysis is based on the ORBIS database provided by the Bureau van Dijk. This firm-level database harmonizes global financial information and allows for the identification of ownership with global reach. We focus on direct shareholdings of at least 50% and assume that this implies full control. Starting with the subsidiaries at the lowest level, we connect the identified pairs of affiliates and parent firm until we end up with the GUO firm. Having identified ownership chains with a maximum of five firm (including the GUO firm), we have found the GUO firm reported by ORBIS in over 96% of all subsidiaries. Focusing on the firm networks with correctly identified GUO firms, we discard ownership chains where firm locations are unknown.[6] Furthermore, we ignore chains reaching the origin firms or a firm previously visited in the considered chain to avoid infinite loops. Lastly, we consider only networks of MNCs (i.e. corporations where at least one firm is located in a different country than the GUO firm). Subsequently,

[6]In the notation of ORBIS, we discard observations with country codes WW for individuals, YY for companies, and ZZ for any official identifier formed by more than one company or mixed with an individual (Gregori et al., 2019).

we add financial information of unconsolidated financial statements if the balance sheet total is not negative.[7]

Since dividend payments are not directly observed in the data, we follow Bellak and Leibrecht (2010) and Egger et al. (2015) to approximate dividends paid by a firm i in year t ($Dividends_{it}$) as the difference between available shareholder funds after profit in the preceding year and available shareholder funds before profit in the year of interest.[8] We replace approximated dividends in a specific year by the shareholder funds after profit in the preceding year if the dividend payments in the year of interest are larger than the shareholder funds after profit in the preceding year. Where values are negative, we replace dividends by zero. Observations with missing $Dividends_{it}$ are discarded. Dividend repatriations received by firm i in year t ($RepatDiv_{it}$), in turn, are calculated as the sum of the dividend payments of all the firm's affiliates k, $RepatDiv_{it} = \sum_k Dividends_{kt}$. In our regression analyis, we consider repatriated dividends in logarithmic form ($lnRepatDiv_{it}$).

We further consider the following firm-level financial information from ORBIS as potential determinants of dividend payments: $lnTOAS_{it-1}$ is the total assets of firm i in year $t-1$ to approximate firm size in logarithmic form. $PRMA_{it-1}$, in turn, is the profit margin (i.e. profit before taxation relative to operating revenues) in percent of firm i in year $t-1$ in order to control for a firm's profitability.

4.3.2 Dividend tax incentives

An important determinant of dividend distributions are tax incentives. In order to build the effective tax rate dividend payments are subject to, we use data from the ITI database provided by the RSIT. This database gathers various tax rule information including in particular investor-level taxes, statutory corporate tax rates, withholding tax rates, double tax treaties (DTTs), and methods of double tax relief.

We compute tax incentives following Huizinga et al. (2008). The effective tax rate on dividend distributions depends on whether they are paid to a domestic parent firm or foreign parent firm. In case of domestic dividend repatriations, the tax that dividends of firm i in year t depend on ($DivTax_{it}$) is the corporate tax rate of source country j in year t (τ_{jt}). To specify $DivTax_{it}$ in case of cross-border dividend repatriations, we need to take into account not only the corporate income tax in the source country, but also the withholding tax (w^e_{jt}) in this country and/or the corporate income tax in

[7] Since ownership information in our ORBIS download is provided only on a most-recent basis, this enforces the assumption that the ownership structure does not change over time. Without explicitly discussing its implications, it is common practice in the firm-level literature on MNCs to assume their ownership structures to remain constant over time (e.g. Huizinga et al., 2008; de Simone et al., 2017; Markle, 2016) (Großkurth, 2019).

[8] In the notation of ORBIS this is: $SHFD_{it-1} + PLBT_{it-1} - SHFD_{it}$.

the resident country (τ_{lt}).[9] The exact calculation depends on how the resident country treats foreign dividends (see Huizinga et al., 2008). If the resident country operates a territorial (source-based) tax system, it exempts foreign-source income from taxation. In this case, $DivTax_{it}$ is $\tau_{jt} + w^e_{jt} - \tau_{jt}w^e_{jt}$. Alternatively, the parent country can operate a worldwide (resident-based) tax system. In this case, it usually provides a tax credit for taxes already paid in the source country. This implies, that domestic taxes on foreign source income are reduced one-for-one with the taxes already paid abroad. This foreign tax credit can be direct in the sense that the tax credit only applies to the withholding tax levied by the source country. In this case, the repatriated dividends are taxed at the rate $\tau_{jt} + w^e_{jt} - \tau_{jt}w^e_{jt}$ if $\tau_{lt} < w^e_{jt}$ or $\tau_{jt} + (1 - \tau_{jt})\tau_{lt}$ if $\tau_{lt} > w^e_{jt}$. If the foreign tax credit is indirect, in turn, it applies to both the dividend withholding tax and the underlying source country corporate income tax. The associated repatriation tax rate on the dividend income is then $\tau_{jt} + w^e_{jt} - \tau_{jt}w^e_{jt}$ if the parent country corporate income tax rate τ_{lt} is smaller than $\tau_{jt} + w^e_{jt} - \tau_{jt}w^e_{jt}$ or τ_{lt} if it is larger. As alternative to the tax credit, the parent country can also deduct foreign taxes from a firm's taxable income. This implies that foreign taxes are seen as a tax-deductible cost of doing business at par with other business costs. The associated $DivTax_{it}$ is given by $1-(1-\tau_{jt})(1-w^e_{jt})(1-\tau_{lt})$. Lastly, the repatriation tax rate if the resident country does not provide any kind of relief of foreign-sourced income is given by $\tau_{lt} + \tau_{jt} + w^e_{jt} - \tau_{jt}w^e_{jt}$.

For dividends distributed by GUO firms, the dividend tax rate is composed on the basis of the corporate income tax and the personal dividend income tax (p_{jt}). Specifically, $DivTax_{it}$ is then calculated as $\tau_{jt} + p^e_{jt} - \tau_{jt}p^e_{jt}$.

4.3.3 Additional explanatory variables

Along with the firm-level control variables and the dividend tax rate, we consider several other country-specific variables that may affect dividend payments. We gather these variables either from the World Development Indicators database or the Worldwide Governance Indicators database, both being provided by the World Bank. First, $lnGDP_{jt}$ reflects the gross domestic product (GDP) in country j and year t (base year 2010) in logarithmic form. Second, we include the domestic credit to private sector in percent of GDP ($CRED_{jt}$) referring to the financial resources (e.g. loans or purchases of non-equity securities) provided to the private sector by financial institutions. Lastly, $CORR_{jt}$ measures the perceived extent to which public power is exercised for private gain and "capture" of the state by elites and private interests. $CORR_{jt}$ is provided in form of an index ranging between -2.5 and 2.5, higher values implying less corruption.

[9] Unless the withholding tax rate is bilaterally negotiated between the source country and the resident country in a DTT, it is unilaterally set by the source country.

4.4 Descriptive evidence

4.4.1 Ownership links and firm locations

Using the information on ownership links, we identify 1,063,983 distinct GUO firms, 373,179 distinct intermediate firms, and 3,918,574 distinct subsidiaries. The average chain consists of three firms (including the GUO firm). This indicates a rather flat hierarchy, which is in accordance with findings by Großkurth (2019).

The GUO firms are located in 207 different countries (including island states). However, over 90% of GUO firms are located in only 58 different countries – led by China (7.44%), Italy (5.73%), and Romania (4.83%).[10] The subsidiaries, in turn, are located in 208 different countries. Over 90% of firms are located in only 30 different countries – led by the US (29.38%), the UK (16.28%), and Germany (4.82%). With most frequent intermediate countries being the US (12.61%), the UK (8.85%), and Germany (8.67%), the location of intermediate firms is similar to the one of subsidiaries and/or GUO firms. Considering intermediate firms that are located in countries other than the ones of the subsidiary and/or the GUO firm (hereafter, "foreign" intermediate firms), most frequent locations are the UK (10.02%), Hong Kong (9.69%), and the Netherlands (8.46%). Further prominent "foreign" intermediate countries are Luxembourg (8.30%), the British Virgin Islands (5.90%), Cyprus (4.72%), Singapore (4.52%), and Switzerland (3.34%).[11] These findings with respect to "foreign" intermediate firms are in line with previous findings of e.g. Garcia-Bernardo et al. (2017) and particularly striking because most of the identified countries are frequently considered as tax haven countries (e.g. Gravelle, 2015).

4.4.2 Financial information

Adding financial information to the identified firms results in an (unbalanced) firm-year dataset including 3,189,892 observations from 2010 to 2018. There are 39,864 distinct GUO firms, 151,002 distinct intermediate firms, and 417,590 distinct subsidiaries.

Table 4.1 reports summary statistics on different outcomes for the firms in our sample. The average firm in our sample has total assets of 164.37 million USD, a profit margin of 6.09%, and 170 employees. Differentiating between the different firm levels, we find the following: GUO firms have total assets of 646.07 million USD and employ 450 people, on average. Their average profit margin is 8.93%. Furthermore, GUO firms distribute dividends worth 21.84 million USD while receiving dividends equal to 18.43 million USD, on average. GUO firms appear to most often operate in the manufacturing

[10] The GUO firms of largest MNCs (based on the number of group members), in turn, are located in the US (22.04%), China (5.95%), and Germany (5.19%) (Appendix 4.A, Table 4.9).

[11] An overview of the most frequent countries of GUO firms, "foreign" intermediate firms, and subsidiaries based on the availability of only ownership information is given in Appendix 4.A, Table 4.10.

sector (25.33%), the professional, scientific and technical services sector (16.15%), and the financial and insurance sector (14.01%).[12] Most frequent GUO firm locations are Belgium (13.18%), Italy (12.19%), and Spain (10.80%).[13] The average intermediate firm, in turn, has total assets equal to 46.63 million USD, a profit margin of 6.00%, and employs 310 people. It repatriates dividends equal to 15.83 million USD and receives dividend repatriations equal to 18.23 USD million. Intermediate firms most often operate in the manufacturing sector (20.96%), the wholesale and retail trade sector (19.01%), and the professional, scientific and technical services sector (11.68%). Most frequent intermediate firm locations are Italy (18.68%), France (9.95%), and the UK (7.29%). "Foreign" intermediate firms are most frequently located in Italy (13.16%), the UK (10.20%), and Spain (9.71%). Lastly, the average subsidiary owns total assets worth 46.63 million USD, has a profit margin of 5.81%, and 70 employees. It repatriates dividends equal to 2.46 million USD. Subsidiaries most often operate in the wholesale and retail trade sector (22.34%), the manufacturing sector (15.09%), and the real estate sector (12.31%). Subsidiaries are most frequently located in Romania (11.71%), the UK (7.16%), and Italy (6.58%). Based on the above descriptions, we conclude that GUO firms are, on average, by far the largest (both in terms of assets and employment) and most profitable firms, followed by intermediate firms and subsidiaries – a finding that is quite intuitive.[14]

We find that 51.03% of firms in our sample do not distribute dividends. Looking at firms on the three different levels identified in the ownership chain, we find that dividends are zero in 53.38% of the subsidiary observations in our sample. The same is true for 46.59% of the observations on intermediate firms and 44.34% of the observations on GUO firms. Comparing distributing and non-distributing firms, the former appear to be larger, more profitable, and employers to more people than the latter – both on average and in the median (Table 4.1, columns 2 and 3). While the share of distributing firms is slightly smaller than observed in previous literature, firm characteristics are similar. Bellak and Leibrecht (2010), for instance, report that about 47.00% of the firms in their sample do not repatriate dividends and note marked differences in size and profitability between repatriating and non-repatriating firms.

[12]The sector affiliation is based on the NACE Rev. 2, Level 1 classification. All industry affiliations are untabulated.

[13]An overview of the most frequent locations of GUO firms, "foreign" intermediate firms, and subsidiaries in the sample available for regression analysis is given in Appendix 4.B, Table 4.11.

[14]A ranking based on median values corresponds to the ranking based on average values in terms of all variables considered.

Table 4.1: *Summary statistics*

		All observations				$Dividends_{it} > 0$				$Dividends_{it} = 0$			
	Variable	N	Mean	Median	SD	N	Mean	Median	SD	N	Mean	Median	SD
All firms	*TOAS*	3,189,892	164.37	2.56	4,687.44	1,562,199	195.61	3.76	4,849.27	1,627,693	134.40	1.70	4,526.48
	EMPL	2,098,303	0.17	0.01	2.89	1,040,162	0.20	0.02	3.12	1,058,141	0.14	0.01	2.65
	PRMA	2,313,878	6.09	3.62	26.57	1,190,911	7.01	3.74	24.76	1,122,967	5.11	3.47	28.34
	DivTax	3,180,688	28.22	27.84	10.32	1,558,389	28.56	28.00	10.27	1,622,299	27.89	27.81	10.35
	Dividends	3,189,892	7.72	0.00	242.33	1,562,199	15.76	0.25	346.09	.	.	.	.
	RepatDiv	480,233	18.29	0.06	406.25	268,106	24.51	0.16	451.81	212,127	10.42	0.00	339.89
GUO firms	*TOAS*	246,986	646.07	11.12	10,512.98	137,482	700.20	12.78	10,363.84	109,504	578.12	9.19	10,696.94
	EMPL	161,127	0.45	0.03	4.63	92,234	0.49	0.03	5.19	68,893	0.40	0.02	3.76
	PRMA	162,443	8.93	4.88	26.30	93,959	8.89	4.70	25.18	68,484	8.98	5.12	27.76
	DivTax	246,236	46.30	46.58	10.11	137,046	46.24	46.71	10.05	109,190	46.37	46.58	10.19
	Dividends	246,986	21.84	0.03	311.46	137,482	39.23	0.82	416.65	.	.	.	.
	RepatDiv	139,109	18.43	0.09	255.60	80,510	24.86	0.22	310.85	58,599	9.60	0.01	149.00
Intermediate firms	*TOAS*	896,562	300.42	9.84	5,672.21	478,832	331.56	11.74	6,213.25	417,730	264.73	7.84	4,980.02
	EMPL	628,033	0.31	0.03	4.68	343,231	0.33	0.04	4.66	284,802	0.30	0.03	4.71
	PRMA	666,419	6.00	3.56	23.81	367,107	6.76	3.77	22.31	299,312	5.08	3.30	25.50
	DivTax	895,975	28.07	28.60	7.67	478,561	28.02	29.48	7.44	417,414	28.13	28.00	7.92
	Dividends	896,562	15.83	0.01	321.50	478,832	29.64	0.74	439.46	.	.	.	.
	RepatDiv	341,124	18.23	0.04	453.55	187,596	24.36	0.14	500.28	153,528	10.73	0.00	388.77
Subsidiaries	*TOAS*	2,046,344	46.63	1.07	2,600.90	945,885	53.45	1.55	1,901.78	1,100,459	40.77	0.76	3,077.40
	EMPL	1,309,143	0.07	0.01	0.44	604,697	0.08	0.01	0.47	704,446	0.06	0.01	0.40
	PRMA	1,485,016	5.81	3.49	27.73	729,845	6.90	3.59	25.84	755,171	4.76	3.39	29.41
	DivTax	2,038,477	26.10	25.00	9.16	942,782	26.26	25.50	8.98	1,095,695	25.96	25.00	9.31
	Dividends	2,046,344	2.46	0.00	185.64	945,885	5.32	0.11	273.03	.	.	.	.
	RepatDiv	.	.	.	.	.	.	.	.	.	.	.	.

Note: This table provides summary statistics (i.e. number of observations, mean, median, and standard deviation) for the sample available for regression analysis. All monetary values are provided in million USD. Employment is in thousands. Profit and tax rate variables are in percent. A detailed description of all variables is included in Appendix 4.C, Table 4.12.

Aggregated at the country-level, dividends repatriated by subsidiaries are highest for the UK (1.28 trillion USD), China (0.51 trillion USD) and the Netherlands (0.29 trillion USD). Dividend repatriations received by GUO firms aggregated at the country-level, in turn, are highest for Japan (9.10 trillion USD), the UK (7.57 trillion USD) and Poland (7.53 trillion USD).[15]

4.5 The determinants of dividend payments

We first explore the determinants of dividend distributions. Due to the nature of dividend payments and to the firms' decision on how to use their profit, dividend payout is not only non-negative but often also equal to zero. Applying a linear model to investigate the determinants of dividend repatriations is likely to lead to inconsistent estimates in this case (Wooldridge, 2010). Consequently, we use an exponential model including fixed effects instead. Formally, we test the following regression specification in order to explore the determinants of both subsidiaries', intermediate firms', and GUO firms' dividend distributions:

$$Dividends_{it} = exp(\alpha_0 + \alpha_1 DivTax_{it} + \alpha_2 X_{it} + \alpha_3 Y_{jt} + \beta_i + \gamma_t)\epsilon_{it} \tag{4.1}$$

where $Dividends_{it}$ measures the dividends paid by firm i in year t. $DivTax_{it}$ is the effective tax rate that dividends of firm i in year t are subject to. In addition, we include time-varying firm characteristics X_{it} ($lnTOAS_{it-1}$ and $PRMA_{it-1}$) as well as time-varying country characteristics Y_{jt} ($CRED_{jt}$, $lnGDP_{jt}$, and $CORR_{jt}$). To control for time-invariant firm characteristics as well as time shocks that are common to all firms, we include firm-fixed effects(β_i) and time-fixed effects (γ_t). ϵ_{it} is an error term that is robust to heteroskedasticity. We estimate the model by Poisson Pseudo-Maximum Likelihood as it has been shown to be useful not only for positive count outcome variables but also for discrete ones (Gourieroux et al., 1984; Silva and Tenreyro, 2006). It mitigates the problem of dealing with zero outcome variables and allows joint estimation of effects at the intensive and extensive margins.

Table 4.2 presents the results. We find that the tax incentives negatively affect dividend distributions across all ownership levels: The estimate of $DivTax_{it}$ in column 1 indicates that an increase of the tax rate by one percentage point is associated with a statistically significant decrease of dividend repatriations by 2.38% for subsidiaries. For intermediate firms, the effect of a one percentage point increase of the tax on dividend payments is negative and statistically significant at 2.77% (column 2). With respect to GUO firms, we find that an increase in the dividend tax by one percentage point goes hand in hand with a statistically insignificant decrease of dividend distributions by 0.73%

[15]Numbers are based on the entire sample period.

(column 3). These findings show that the decision to distribute dividends for GUO firms is different from the one of subsidiaries and intermediate firms. One explanation could be that in the case of dividend distributions by GUO firms, part of the tax burden is borne by the outside shareholders. In contrast, the tax burden of intra-firm repatriations by subsidiaries and intermediate firms is shouldered exclusively by the MNCs themselves.

Along with the tax variable, the two included firm control variables also appear to be decisive for dividend payments on all three firm levels. If total assets increase by one percent, dividend payments rise by 1.34% to 1.92%. An increase in the profit margin by one percentage point, in turn, goes along with an increase of dividends by 1.67% to 1.79%. With respect to the country control variables, $CRED_{jt}$ has a statistically significant and positive relationship with dividend repatriations for subsidiaries and intermediate firms but not for GUO firms. This suggests that the cost/benefit evaluation of access to more financial resources is evaluated differently by GUO firms than by the other firms. Higher corruption control is associated with higher dividend distributions on all three MNC levels. Lastly, the coefficient for $lnGDP_{jt}$ is positive and statistically significant for intermediate firms and GUO firms but not for subsidiaries.

Table 4.2: *Determinants of dividend payments*

	(1) Subsidiaries	(2) Intermediate firms	(3) GUO firms
$DivTax_{it}$	−0.0238***	−0.0277***	−0.0073
	(0.0085)	(0.0083)	(0.0091)
$lnTOAS_{it-1}$	1.3360***	1.4600***	1.9154***
	(0.0714)	(0.0845)	(0.1779)
$PRMA_{it-1}$	0.0179***	0.0171***	0.0167***
	(0.0019)	(0.0013)	(0.0023)
$CRED_{jt}$	0.0039**	0.0059***	−0.0079**
	(0.0018)	(0.0018)	(0.0033)
$lnGDP_{jt}$	−0.0085	1.9670***	6.4551***
	(0.0018)	(0.0018)	(0.0033)
$CORR_{jt}$	0.3120*	0.3199**	0.9748***
	(0.1773)	(0.1416)	(0.2754)
N	1,291,688	621,316	144,991
Psd.R2	0.8513	0.8633	0.8896

Note: This table shows the regression results related to investigating the determinants of dividend repatriations. A detailed description of all variables is included in Appendix 4.C, Table 4.12. Regressions include firm- and year fixed effects. *, **, and *** denote statistical significance at the 10%, 5%, and 1% level. i refers to the firm, j to the country, and t to the year.

In Table 4.3, we differentiate between dividends repatriated by subsidiaries and intermediate firms to domestic parent firms versus foreign parent firms and find that the dividend tax has a stronger effect if repatriated to the latter firm type. Specifically, an increase in the applicable tax rate of one percentage point is associated with a decrease

of dividend distributions to a foreign parent firm by 3.14% and a domestic parent firm by 1.36% for subsidiaries. For intermediate firms, the semi-elasticities are -4.38% and -1.71%, respectively. This difference in the tax effect for dividend repatriations to foreign and domestic parent firms is not surprising as repatriating dividends cross-border is considered to be particularly burdensome – both from a tax perspective and an administrative one (e.g. Altshuler and Grubert, 2002; Matheson et al., 2013).

Table 4.3: *Determinants of dividend repatriations by parent location*

	(1) Subsidiaries	(2) Intermediate firms
$DivTax_{it}$*CB_i	−0.0314**	−0.0438***
	(0.0147)	(0.0125)
$DivTax_{it}$*$\overline{CB_i}$	−0.0136	−0.0171*
	(0.0099)	(0.0095)
$lnTOAS_{it-1}$	1.3362***	1.4629***
	(0.0715)	(0.0842)
$PRMA_{it-1}$	0.0179***	0.0170***
	(0.0019)	(0.0012)
$CRED_{jt}$	0.0037**	0.0055***
	(0.0018)	(0.0018)
$lnGDP_{jt}$	−0.0336	1.9435***
	(0.4166)	(0.4899)
$CORR_{jt}$	0.2856*	0.3307**
	(0.1657)	(0.1407)
N	1,291,688	621,316
Psd.R2	0.8513	0.8634

Note: This table shows the regression results related to investigating the determinants of dividend repatriations. A detailed description of all variables is included in Appendix 4.C, Table 4.12. Regressions include firm- and year fixed effects. *, **, and *** denote statistical significance at the 10%, 5%, and 1% level. i refers to the firm, j to the country, and t to the year.

4.6 The effect of dividends repatriations

We now turn to the effect of (aggregated) dividend repatriations received by intermediate firms and GUO firms on their own dividend payments as well as on their asset and employment positions. To address endogeneity concerns related to the simultaneity of the decision to repatriate and those related to dividend distributions, investments, or employment, we exploit the exogenous variation in tax incentives to repatriate dividends from different affiliates and follow a Control Function (CF) approach.[16]

[16]Endogenous regression results can be found in Appendix 4.D, Tables 4.13 and 4.14.

The implementation of the CF approach is in two stages. In the first stage, the endogenous variable is regressed on the chosen IV(s) and all baseline covariates. In the second stage, the dependent variable of interest is regressed on the endogenous variable, the baseline covariates, and the residuals of the first-stage regression. Treating the residuals as explanatory variable effectively splits the error term into two parts: One that is correlated with the endogenous variable and "controlled for" by the residuals, and another one that is uncorrelated with the endogenous variable (Wooldridge, 2010).

Our first-stage regression specification is:

$$lnRepatDiv_{it} = \alpha_0 + \alpha_1 IV_{it} + \alpha_2 DivTax_{it} + \alpha_3 X_{it} + \alpha_4 Y_{jt} + \beta_i + \gamma_t + u_{it} \tag{4.2}$$

$lnRepatDiv_{it}$ is the logarithm of aggregated dividend repatriations firm i receives from all affiliates in year t.[17] It is considered to be endogenous. IV_{it} is our instrumental variable. It is the average dividend repatriation tax rate of all affiliates for which we have dividend information of firm i in year t. The exogenous variation comes from both cross-country variation in the tax rules that determine effective tax incentives to repatriate dividends as well as from changes over time in those rules. $DivTax_{it}$ is the tax rate that dividends of firm i in year t is subject to. X_{it} and Y_{jt} include time-varying firm characteristics ($lnTOAS_{it-1}$ and $PRMA_{it-1}$) and country characteristics ($CRED_{jt}$, $lnGDP_{jt}$, and $CORR_{jt}$). β_i and γ_t represent firm-fixed effects and time-fixed effects. Lastly, we include the error term u_{it} and make standard errors robust to heteroskedasticity.[18]

On the second stage, we estimate the following non-linear regression equation:

$$\begin{aligned} Z_{it} = exp(&\alpha_0 + \alpha_1 lnRepatDiv_{it} + \alpha_2 DivTax_{it} + \alpha_3 X_{it} + \alpha_4 Y_{jt} + \alpha_5 \hat{u}_{it} \\ &+ \beta_i + \gamma_t)\epsilon_{it} \end{aligned} \tag{4.3}$$

Z_{it} is a placeholder for a firm's dividend payments ($Dividends_{it}$), level of employment ($EMPL_{it}$), employee compensation ($WAGE_{it}$), tangible assets ($TFAS_{it}$), and inventories ($STOK_{it}$). $lnRepatDiv_{it}$ is the aggregated dividend repatriations firm i receives from all of its affiliates in year t in logarithmic form. $DivTax_{it}$ is the tax rate that dividends of firm i in year t is subject to. X_{it} includes time-varying firm characteristics ($lnTOAS_{it-1}$ and $PRMA_{it-1}$). Y_{jt} includes time-varying country characteristics ($CRED_{jt}$, $lnGDP_{jt}$, and $CORR_{jt}$). We consider firm fixed-effects (β_i) and time fixed-effects (γ_t) to control for time-invariant firm characteristics as well as time shocks that are common to all firms. Lastly, we include the predicted error term $\hat{u}_{it}$ from the first stage and the error

[17] Due to exceptionally high outliers, we trim observations at the 95%-level of $RepatDiv_{it}$ for both intermediate firms and GUO firms before taking the logarithm.

[18] First-stage regression results are depicted in Appendix 4.E, Tables 4.15 and 4.16. Unlike for GUO firms, our IV satisfies the relevance criterion for most outcomes of intermediate firms.

term ϵ_{it}. Again, we make standard errors robust to heteroskedasticity.

The inclusion of $lnRepatDiv_{it}$ as explanatory variable of the dividend payments and other outcomes of intermediate firms (Table 4.4) and GUO firms (Table 4.5) entails that regression results are based on much smaller samples than before. This is because for some firms for which we have financial information and can calculate dividends, we do not have corresponding information for their affiliates. Consequently, we cannot report dividend repatriations received.

Table 4.4: *The effect of dividend repatriations at the intermediate firm-level*

	(1) $Dividends_{it}$	(2) $EMPL_{it}$	(3) $WAGE_{it}$	(4) $TFAS_{it}$	(5) $STOK_{it}$
$lnRepatDiv_{it}$	5.6470***	0.1820	2.1193*	1.3580***	0.4382
	(2.0740)	(0.1568)	(1.0814)	(0.4957)	(0.4596)
$DivTax_{it}$	0.0271	0.0020	0.0337**	0.0131***	0.0078
	(0.0229)	(0.0018)	(0.0145)	(0.0039)	(0.0050)
$lnTOAS_{it-1}$	0.4226	0.2702***	−0.2046	0.0556	0.4088***
	(0.4906)	(0.0450)	(0.2919)	(0.2128)	(0.1317)
$PRMA_{it-1}$	0.0046	0.0001	−0.0053**	−0.0015	−0.0022
	(0.0046)	(0.0004)	(0.0021)	(0.0017)	(0.0020)
$CRED_{jt}$	−0.0086**	−0.0008*	−0.0034**	−0.0025***	−0.0017**
	(0.0035)	(0.0005)	(0.0015)	(0.0009)	(0.0008)
$lnGDP_{jt}$	−3.7882**	−0.3447*	0.7851***	−0.3142	0.0064
	(1.8319)	(0.1834)	(0.1306)	(0.4769)	(0.4926)
$CORR_{jt}$	−0.1714	−0.2168***	−0.0734	−0.4137***	−0.3039***
	(0.3339)	(0.0433)	(0.0537)	(0.0849)	(0.1035)
N	114,082	94,124	89,835	110,941	85,509
Psd.R2	0.8374	0.7150	0.9498	0.9830	0.9492

Note: This table shows the second-stage regression results related to investigating the effect of dividend repatriations for intermediate firms. A detailed description of all variables is included in Appendix 4.C, Table 4.12. Regressions include firm- and year fixed effects. *, **, and *** denote statistical significance at the 10%, 5%, and 1% level. i refers to the firm, j to the country, and t to the year.

In Tables 4.4 and 4.5, we report a statistically significant and positive effect of dividends received on a firm's own dividend distributions for both intermediate firms and GUO firms. Specifically, intermediate firms (GUO firms) increase their own dividend payments by 5.65% (8.50%) following an increase in dividends received by one percent. This increase in effect size in favor of GUO firms could be related to external shareholders' return expectations. Furthermore, we report the results of the effect of dividend repatriations on the employment level (column 2), the employee compensation (column 3), tangible fixed assets (column 4), and inventories (column 5) of intermediate firms and GUO firms. We make the following two observations: First, the coefficients of $lnRepatDiv_{it}$ are rather small for all of the investigated outcome variables as compared to the one for dividends. Second, there appears to be a statistically significant effect of dividend repatriations only on tangible fixed assets (for both intermediate firms and

GUO firms) and on wages (for intermediate firms only). Specifically, an increase of dividend repatriations by one percent is associated with an increase of tangible fixed assets by 1.36% for intermediate firms and 3.41% for GUO firms. The increase in employee compensation by intermediate firms is 2.12% following the same increase in dividend repatriations. With respect to other real outcomes of intermediate firms and GUO firms, we only find positive but statistically insignificant effects of dividends received.[19]

Table 4.5: *The effect of dividend repatriations at the GUO firm-level*

	(1) $Dividends_{it}$	(2) $EMPL_{it}$	(3) $WAGE_{it}$	(4) $TFAS_{it}$	(5) $STOK_{it}$
$lnRepatDiv_{it}$	8.4985***	−0.3946	1.4319	3.4133*	−0.7332
	(2.7584)	(0.9275)	(1.0368)	(1.8377)	(0.8965)
$DivTax_{it}$	−0.1043***	0.0105	−0.0153*	−0.0410*	0.0130
	(0.0367)	(0.0108)	(0.0089)	(0.0232)	(0.0146)
$lnTOAS_{it-1}$	−0.6215	0.5424*	0.0704	−0.5706	0.8640**
	(0.8752)	(0.2843)	(0.2760)	(0.5653)	(0.3576)
$PRMA_{it-1}$	−0.0025	−0.0021	−0.0037	−0.0079	0.0036
	(0.0065)	(0.0019)	(0.0039)	(0.0050)	(0.0022)
$CRED_{jt}$	0.0136	−0.0037	−0.0020	0.0097	−0.0016
	(0.0104)	(0.0049)	(0.0015)	(0.0063)	(0.0042)
$lnGDP_{jt}$	−9.6124**	0.0252	0.4590*	−5.3029*	1.2156
	(4.1875)	(1.7238)	(0.2380)	(2.7773)	(1.4825)
$CORR_{jt}$	−1.2961	0.2178	0.0560	−1.1968*	0.3159
	(1.0099)	(0.4216)	(0.1491)	(0.6458)	(0.3351)
N	48,026	40,150	36,010	46,522	33,840
Psd.R2	0.8254	0.6870	0.9734	0.9890	0.9722

Note: This table shows the second-stage regression results related to investigating the effect of dividend repatriations for intermediate firms. A detailed description of all variables is included in Appendix 4.C, Table 4.12. Regressions include firm- and year fixed effects. *, **, and *** denote statistical significance at the 10%, 5%, and 1% level. i refers to the firm, j to the country, and t to the year.

Our findings suggest that intermediate firms primarily pass repatriated dividends on to the next parent firm in the MNC network – only for GUO firms to eventually distribute these dividends to their outside investors. This is in contrast to previous literature (e.g. Blouin and Krull, 2009; Dharmapala et al., 2011) finding that the positive and significant effect of repatriations on payouts is mainly driven by increased share repurchases instead of increased dividend payments. One reason for our deviating results may be that we are dealing with dividend repatriations that are not triggered by a specific event – like the HIA in Blouin and Krull (2009) and Dharmapala et al. (2011).

[19] To test the robustness of the regression results in this section, we consider $lnRepatDivS_{it}$ instead of $lnRepatDiv_{it}$. $lnRepatDivS_{it}$ is the logarithm of repatriated dividends considering the shareholding of firm i in its affiliates in year t ($RepatDivS_{it}$). Again, we trimmed $RepatDivS_{it}$ at the 95%-level before taking the logarithm. Regression results can be found in Appendix 4.F, Tables 4.17 and 4.18. Supporting the results in this section, we find that repatriated dividends have a statistically significant and positive effect on dividends paid by intermediate firms and GUO firms as well as on tangible fixed assets of both firm types. In addition, we also observe a statistically significant effect on employee compensation on the intermediate firm-level.

4.7 Additional result

4.7.1 The location choice of firms

The location of firms is naturally not random. To learn about the location choices of subsidiaries, intermediate firms, and GUO firms, we use a mixed logit approach following Merlo et al. (2020). Here, each choice yields a potential (latent) payoff and the actual choice of a location is based on the maximum attainable profit. We express potential profit as follows:

$$\pi_j = \alpha_{0j}\tau_j + \alpha_{1j}NDTT_j + \alpha_2 HAVEN_j + \alpha_3 Y_j + \epsilon_j \tag{4.4}$$

The choice set in our data consists of 180 possible locations in 2020 (i.e. the year for which we have the ownership structure of MNCs). π_j is the latent profit to be made in country j. The tax determinants we are interested in are the following ones: First, we use the statutory corporate tax rate of country j (τ_j). Second, we count the number of DTTs by country to have an indicator of how well a country is integrated in terms of bilateral tax agreements ($NDTT_j$). Third, the indicator variable $HAVEN_j$ is equal to one if j is on the tax haven list of Hines and Rice (1994), to which we add additional countries listed as tax havens in Torslov et al. (2022). In addition, we include the parsimonious set of country-level control variables from above – $lnGDP_j$, $CRED_j$, and $CORR_j$ – to the location decision model.[20] ϵ_j is an error term.

The parameters on the statutory corporate tax rate (α_{0j}) and the number of DTTs (α_{1j}) are defined as country-specific random coefficients and assumed to be normally distributed with the parameters α_0, α_1, and σ, which are to be estimated.[21] Specifying the coefficients α_{0j} and α_{1j} as random directly relates to the expectation of large heterogeneity in tax elasticities and treaty integration. The parameters α_2 and α_3, in turn, are fixed population parameters.

In line with expectations, Table 4.6 shows that a higher statutory tax rate has a statistically significant and negative effect on the probability of choosing a given location for both subsidiaries, intermediate firms, and GUO firms. For instance, a one percent higher tax in a specific country is associated with a 0.03% reduced probability of GUO firms to locate there. Credit supply also has a negative and statistically significant effect on the decision of firms to locate in a specific country. The number of DTTs and the level of GDP, in turn, have a positive and statistically significant effect on the location decision of both subsidiaries, intermediate firms, and GUO firms. Only for the tax haven status

[20] Note that the mixed logit approach does not allow including firm-specific determinants as it is a choice among countries.

[21] Assuming $\alpha_{0j} \sim N(\alpha_0, \sigma^2)$, $\alpha_{1j} \sim N(\alpha_1, \sigma^2)$, and $\epsilon_j \sim iid$ extreme value yields the mixed (or random parameters) logit model. For an extensive discussion of the mixed logit model, see Merlo et al. (2020) and Train (2022).

and corruption control of a country, regression results appear mixed across the different firm types. For instance, the haven status of a country increases the probability for intermediate firms and GUO firms locating there but not for subsidiaries. This suggests that the incentives often offered by tax haven countries (e.g. low taxation or secrecy of ownership) particularly appeal to GUO firms and intermediate firms.

Table 4.6: *The location choice of firms*

	(1) Subsidiaries	(2) Intermediate firms	(3) GUO firms
τ_j	−0.0813***	−0.0008**	−0.0342***
	(0.0001)	(0.0004)	(0.0002)
$NDTT_j$	0.0021***	0.0112***	0.0201***
	(0.0000)	(0.0001)	(0.0001)
$HAVEN_j$	−0.2882***	0.3287***	0.2024***
	(0.0022)	(0.0053)	(0.0037)
$CRED_j$	−0.0021***	−0.0007***	−0.0069***
	(0.0000)	(0.0000)	(0.0000)
$lnGDP_j$	0.9902***	0.6202***	0.5255***
	(0.0006)	(0.0017)	(0.0011)
$CORR_j$	0.5807***	0.6003***	−0.0013
	(0.0007)	(0.0024)	(0.0015)
N	466,126,788	41,554,172	116,426,948

Note: This table shows the regression results related to investigating firms' location choices. τ_j and $NDTT_j$ are defined as random. All other variables are defined as fixed. A detailed description of all variables is included in Appendix 4.C, Table 4.12. *, **, and *** denote statistical significance at the 10%, 5%, and 1% level. j refers to the country.

In order to provide a more in depth analysis of the location choice of intermediate firms, Table 4.7 differentiates between intermediate firms that are located in a different country than both subsidiaries and GUO firms (i.e. "foreign" intermediate firms) and others. With respect to the tax haven status of countries, we observe that the probability to locate in a tax haven country is exceptionally high for "foreign" intermediate firms and substantially higher than for other intermediate firms. This is consistent with the findings in Section 4.4.1 and appears reasonable: With an intermediate firm being located in a country that is not the subsidiary country or GUO firm country, the risk of double taxation is usually high if, for example, dividends are to be repatriated along the ownership chain. In this case, tax haven countries with low or zero taxation and/or tax exemption for dividends received may appear more attractive than other countries.

Table 4.7: *The location choice of intermediate firms*

	(1) "Foreign"	(2) Non-"foreign"
τ_j	−0.0079***	−0.0031***
	(0.0011)	(0.0004)
$NDTT_j$	0.0262***	0.0100***
	(0.0003)	(0.0001)
$HAVEN_j$	1.5170***	0.0331***
	(0.0131)	(0.0061)
$CRED_j$	0.0089***	−0.0027***
	(0.0001)	(0.0000)
$lnGDP_j$	0.1363***	0.6946***
	(0.0051)	(0.0019)
$CORR_j$	0.5184***	0.6312***
	(0.0086)	(0.0025)
N	3,857,552	36,628,392

Note: This table shows the regression results related to investigating intermediate firms' location choices. τ_j and $NDTT_j$ are defined as random. All other variables are defined as fixed. A detailed description of all variables is included in Appendix 4.C, Table 4.12. *, **, and *** denote statistical significance at the 10%, 5%, and 1% level. j refers to the country.

4.7.2 Dividend repatriations and "foreign" intermediate firms

The repatriation of dividends from foreign affiliates to their parent firms is often considered to be more burdensome than from domestic ones (e.g. Altshuler and Grubert, 2002; Matheson et al., 2013). In line with this notion, we find that the response of intermediate firms to an increase in repatriated dividends is less sensitive if their parent firm is located in a different country than if located in the same one (Table 4.8, column 1). Specifically, intermediate firms with a parent firm in the same country increase own dividend payments by 10.84% following an increase in repatriated dividends by one percent. If the parent firm is located in a different country, in contrast, the increase in dividend payments following the same increase in dividends received is only 7.44%.

Table 4.8: *Dividend repatriations, cross-border dividend payments, and the role of "foreign" intermediate firms*

	(1)	(2)
$lnRepatDiv_{it}$*CB_i	7.4370***	
	(2.8359)	
$lnRepatDiv_{it}$*CB_i*FOR_i		7.9912***
		(2.2156)
$lnRepatDiv_{it}$*CB_i*$\overline{FOR_i}$		5.5630**
		(2.3656)
$lnRepDiv_{it}$*$\overline{CB_i}$	10.8428**	8.2065**
	(5.0994)	(3.6923)
$DivTax_{it}$	0.0335	0.0293
	(0.0252)	(0.0253)
$lnTOAS_{it-1}$	−0.5005	−0.0383
	(1.0040)	(0.7720)
$PRMA_{it-1}$	−0.0036	0.0003
	(0.0090)	(0.0070)
$CRED_{jt}$	−0.0123**	−0.0086**
	(0.0052)	(0.0041)
$lnGDP_{jt}$	−5.9746**	−4.9279**
	(2.8671)	(2.4281)
$CORR_{jt}$	−0.5643	−0.4671
	(0.5194)	(0.4791)
N	114,082	114,082
Psd.R2	0.8377	0.8378

Note: This table shows the regression results related to investigating the effect of dividend repatriations for intermediate firms. A detailed description of all variables is included in Appendix 4.C, Table 4.12. Regressions include firm- and year fixed effects. *, **, and *** denote statistical significance at the 10%, 5%, and 1% level. i refers to the firm, j to the country, and t to the year.

Differentiating between "foreign" intermediate firms and others that pay cross-border dividends – in addition to those intermediate firms with a domestic parent firm – shows that the former react much more sensitively to repatriated dividends than the latter (column 2). Specifically, "foreign" intermediate firms increase own dividend payments to a parent firm located in a different country by 7.99% following an increase in repatriated dividends by one percent. Other intermediate firms do so by only 5.56% if repatriating cross-border. This highlights the particular role of "foreign" intermediate firms in cross-border dividend repatriations, suggesting that they facilitate repatriations from firms located outside of the GUO firm country up the ownership chain to the GUO firm and eventually to (unknown) investors.

4.8 Conclusion

Our results indicate that taxes are a relevant determinant of dividend payments for both subsidiaries, intermediate firms, and GUO firms. Specifically, a one percentage point higher tax rate is associated with up to 2.77% lower dividend payments. We find markable differences in the negative impact of the tax rate on dividends paid to foreign parent firms and those paid to domestic ones across subsidiaries and intermediate firms. The relationship between the dividend tax rate and cross-border dividend repatriations is -3.14% to -4.38%. With respect to domestic repatriations, the tax estimate only ranges between -1.36% and -1.71%. Other significant determinants of dividends paid by both subsidiaries, intermediate firms, and GUO firms appear to be firm size and profitability, as well as GDP, credit supply, and corruption control in a country.

Analyzing the effect of repatriated dividends, we observe a positive and statistically significant effect of dividends received on dividends distributed for both intermediate firms and GUO firms. Apart from their impact on dividend payments, repatriated dividends are found to have a significant effect on the level of tangible fixed assets (for both intermediate firms and GUO firms) and wages (only for intermediate firms). Given that these effects are substantially smaller than for dividends, however, our results suggest that intermediate firms primarily pass dividends up the ownership chain of MNCs only for these dividends to be distributed by the GUO firms to the MNCs' investors.

Appendix

4.A Additional descriptives with ownership information

Table 4.9: *Most frequent GUO firm locations of largest MNCs*

Country	%
United States	22.04
China	5.95
Germany	5.19
Italy	5.03
France	4.41
United Kingdom	4.34
Australia	2.46
Spain	2.42
Netherlands	2.25
Japan	2.13

Note: This table is based on 5,355,736 observations. The size of a MNC is based on the total number of entities (i.e. GUO firms, intermediate firms, and subsidiaries).

Table 4.10: *Most frequent locations of GUO firms, "foreign" intermediate firms, and subsidiaries (1)*

GUO firms		**"Foreign" intermediate firms**		**Subsidiaries**	
Country	%	Country	%	Country	%
China	7.44	United Kingdom	10.02	United States	29.38
Italy	5.73	Hong Kong	9.69	United Kingdom	16.28
Romania	4.83	Netherlands	8.46	Germany	4.82
Poland	4.35	Luxembourg	8.30	China	4.26
Germany	4.34	British Virgin Islands	5.90	France	3.99
India	4.07	United States	4.79	Italy	3.97
United States	3.69	Cyprus	4.72	Spain	2.61
France	3.19	Singapore	4.52	Australia	2.32
United Kingdom	3.00	Germany	4.40	Romania	1.81
Ireland	2.81	Switzerland	3.34	Brazil	1.73

Note: Only based on the availability of ownership information, this table shows the 10 most frequent countries distinct guo firms, "foreign" intermediate firms (i.e. intermediate firms located in a country other than that of the GUO firm and/or subsidiary), and subsidiaries are located in. The sample comprises 1,063,983 distinct GUO firms, 43,479 distinct „foreign“ intermediate firms, and 3,918,574 distinct subsidiaries. Ownership information is based on most recent information.

4.B Additional descriptives with ownership and financial information

Table 4.11: *Most frequent locations of GUO firms, "foreign" intermediate firms, and subsidiaries (2)*

GUO firms		"Foreign" intermediate firms		Subsidiaries	
Country	%	Country	%	Country	%
Belgium	13.18	United Kingdom	11.31	Romania	11.71
Italy	12.19	Italy	10.05	United Kingdom	7.16
Spain	10.80	France	8.03	Italy	6.58
Sweden	7.33	Spain	7.17	Russia	6.36
Japan	7.10	Germany	5.55	Spain	5.38
France	4.85	Sweden	5.24	Czech Republic	4.71
Taiwan	4.16	Belgium	5.20	France	4.33
Germany	3.35	Singapore	4.19	Slovakia	4.14
Portugal	2.98	Netherlands	4.17	Sweden	3.98
Hungary	2.98	Czech Republic	3.47	Ukrain	3.95

Note: This table shows the 10 most frequent countries of GUO firms, "foreign" intermediate firms, and subsidiaries in the sample available for regression analysis. There are 39,864 distinct GUO firms, 15,446 distinct "foreign" intermediate firms, and 417,590 distinct subsidiaries.

4.C Variable description

Table 4.12: *Variable description*

Variable	Description
CB	Dummy variable indicating a foreign parent firm.
$CORR$	Corruption level. Index ranging from -2.5 to 2.5, higher values implying less corruption.
$CRED$	Domestic credit to private sector in percent of GDP.
$DivTax$	Tax rate for dividends in percent. Calculated following Huizinga et al. (2008).
$Dividends$	Dividends in million USD. Calculated following Bellak and Leibrecht (2010).
$EMPL$	Number of employees in thousands.
FOR	Dummy variable indicating "foreign" intermediate firm.
$HAVEN$	Dummy variable indicating country is a tax haven based on Hines and Rice (1994) and Torslov et al. (2022).
IV	Average dividend tax of all subsidiaries of a firm.
$lnGDP$	Log of gross domestic product (base year 2010).
$lnRepatDiv$	Log of dividend repatriations received.
$lnRepatDivS$	Log of dividend repatriations received depending on shareholding.
$lnTOAS$	Log of total assets.
$NDTT$	Number of double tax treaties.
p	Personal dividend income tax rate.
π	Latent profit.
$PLBT$	Profit or loss before taxation in million USD.
$PRMA$	Profit margin (i.e. profit before taxation relative to operating revenues) in percent.
$RepatDiv$	Dividend repatriations received in million USD.
$RepatDivS$	Dividend repatriations received depending on shareholding in million USD.
$SHFD$	Shareholder funds in million USD.
$STOK$	Inventories in million USD.
τ	Statutory corporate tax rate in percent.
$TFAS$	Tangible fixed assets in million USD.
$TOAS$	Total assets in million USD.
w	Withholding tax rate on dividend payments in percent.
$WAGE$	Employee compensation in million USD.

Note: This table describes the variables employed in this paper.

4.D Endogenous regression results

Table 4.13: *Endogenous regression results: Intermediate firms*

	(1) $Dividends_{it}$	(2) $EMPL_{it}$	(3) $WAGE_{it}$	(4) $TFAS_{it}$	(5) $STOK_{it}$
$lnRepatDiv_{it}$	0.0628***	0.0055*	0.0016	0.0024	−0.0035
	(0.0137)	(0.0029)	(0.0038)	(0.0042)	(0.0062)
$DivTax_{it}$	−0.0121	0.0007	0.0056***	0.0015	0.0034
	(0.0153)	(0.0014)	(0.0012)	(0.0021)	(0.0032)
$lnTOAS_{it-1}$	1.6888***	0.3166***	0.3649***	0.3833***	0.5270***
	(0.0760)	(0.0173)	(0.0186)	(0.1284)	(0.0502)
$PRMA_{it-1}$	0.0147***	0.0004	−0.0011***	0.0011	−0.0013
	(0.0021)	(0.0003)	(0.0003)	(0.0011)	(0.0017)
$CRED_{jt}$	−0.0013	−0.0006	−0.0006*	−0.0008	−0.0013*
	(0.0021)	(0.0004)	(0.0004)	(0.0007)	(0.0007)
$lnGDP_{jt}$	0.9012	−0.2163	0.5985***	0.7399***	0.3726
	(0.6063)	(0.1532)	(0.0981)	(0.2313)	(0.3533)
$CORR_{jt}$	0.5408***	−0.1924***	0.0057	−0.2380***	−0.2366***
	(0.1877)	(0.0372)	(0.0320)	(0.0630)	(0.0719)
N	114,082	94,124	89,835	110,941	85,509
Psd.R2	0.8371	0.7150	0.9498	0.9830	0.9492

Note: This table shows the endogenous regression results related to investigating the effect of dividend repatriations for intermediate firms. A detailed description of all variables is included in Appendix 4.C, Table 4.12. Regressions include firm- and year fixed effects. *, **, and *** denote statistical significance at the 10%, 5%, and 1% level. i refers to the firm, j to the country, and t to the year.

Table 4.14: *Endogenous regression results: GUO firms*

	(1) $Dividends_{it}$	(2) $EMPL_{it}$	(3) $WAGE_{it}$	(4) $TFAS_{it}$	(5) $STOK_{it}$
$lnRepatDiv_{it}$	0.0631***	−0.0035	−0.0107**	−0.0091***	0.0001
	(0.0224)	(0.0027)	(0.0051)	(0.0032)	(0.0060)
$DivTax_{it}$	0.0001	0.0056*	−0.0037**	0.0013	0.0007
	(0.0110)	(0.0031)	(0.0017)	(0.0021)	(0.0035)
$lnTOAS_{it-1}$	1.9935***	0.4200***	0.4383***	0.4882***	0.6384***
	(0.1572)	(0.0478)	(0.0299)	(0.0605)	(0.1390)
$PRMA_{it-1}$	0.0156***	−0.0029***	−0.0007	0.0010**	0.0015
	(0.0027)	(0.0006)	(0.0018)	(0.0005)	(0.0011)
$CRED_{jt}$	−0.0169***	−0.0018***	−0.0024*	−0.0030**	0.0016
	(0.0033)	(0.0007)	(0.0014)	(0.0012)	(0.0011)
$lnGDP_{jt}$	2.6858***	−0.6724***	0.2976	−0.2827	−0.0398
	(0.8684)	(0.2143)	(0.1836)	(0.2149)	(0.2967)
$CORR_{jt}$	1.6525***	0.0496	0.1027	0.0859	0.0310
	(0.3480)	(0.0613)	(0.1384)	(0.0758)	(0.0747)
N	48,026	40,150	36,010	46,522	33,840
Psd.R2	0.8248	0.6870	0.9733	0.9889	0.9722

Note: This table shows the endogenous regression results related to investigating the effect of dividend repatriations for GUO firms. A detailed description of all variables is included in Appendix 4.C, Table 4.12. Regressions include firm- and year fixed effects. *, **, and *** denote statistical significance at the 10%, 5%, and 1% level. i refers to the firm, j to the country, and t to the year.

4.E First-stage regression results

Table 4.15: *First-stage regression results for different second-stage dependent variables: Intermediate firms*

	(1) $Dividends_{it}$	(2) $EMPL_{it}$	(3) $WAGE_{it}$	(4) $TFAS_{it}$	(5) $STOK_{it}$
IV_{it}	−0.0061*	−0.0100***	−0.0014	−0.0053	−0.0091**
	(0.0034)	(0.0038)	(0.0038)	(0.0035)	(0.0038)
$DivTax_{it}$	−0.0028	−0.0008	−0.0123***	−0.0039	−0.0038
	(0.0035)	(0.0039)	(0.0040)	(0.0036)	(0.0039)
$lnTOAS_{it-1}$	0.2260***	0.2618***	0.2688***	0.2400***	0.2651***
	(0.0142)	(0.0166)	(0.0172)	(0.0145)	(0.0173)
$PRMA_{it-1}$	0.0018***	0.0018***	0.0019***	0.0018***	0.0020***
	(0.0003)	(0.0003)	(0.0003)	(0.0003)	(0.0004)
$CRED_{jt}$	0.0014**	0.0014**	0.0013**	0.0013**	0.0010
	(0.0006)	(0.0006)	(0.0006)	(0.0006)	(0.0007)
$lnGDP_{jt}$	0.8252***	0.7528***	−0.0925	0.7566***	0.8411***
	(0.1642)	(0.1865)	(0.2088)	(0.1688)	(0.1837)
$CORR_{jt}$	0.1250**	0.1335**	0.0367	0.1284**	0.1540***
	(0.0499)	(0.0553)	(0.0559)	(0.0511)	(0.0579)
N	114,082	94,124	89,835	110,941	85,509
Adj.R2	0.6697	0.6707	0.6680	0.6692	0.6674

Note: This table shows the first-stage regression results related to investigating the effect of dividend repatriations for intermediate firms. A detailed description of all variables is included in Appendix 4.C, Table 4.12. Regressions include firm- and year fixed effects. *, **, and *** denote statistical significance at the 10%, 5%, and 1% level. i refers to the firm, j to the country, and t to the year.

Table 4.16: *First-stage regression results for different second-stage dependent variables: GUO firms*

	(1) $Dividends_{it}$	(2) $EMPL_{it}$	(3) $WAGE_{it}$	(4) $TFAS_{it}$	(5) $STOK_{it}$
IV_{it}	0.0044	0.0026	−0.0070	0.0042	0.0055
	(0.0043)	(0.0048)	(0.0053)	(0.0043)	(0.0050)
$DivTax_{it}$	0.0112***	0.0120***	0.0092**	0.0116***	0.0156***
	(0.0032)	(0.0036)	(0.0036)	(0.0032)	(0.0041)
$lnTOAS_{it-1}$	0.3078***	0.3109***	0.2630***	0.3031***	0.3038***
	(0.0287)	(0.0343)	(0.0307)	(0.0285)	(0.0362)
$PRMA_{it-1}$	0.0021***	0.0019***	0.0023***	0.0023***	0.0027***
	(0.0004)	(0.0005)	(0.0005)	(0.0004)	(0.0007)
$CRED_{jt}$	−0.0036***	−0.0049***	−0.0002	−0.0034***	−0.0043***
	(0.0009)	(0.0010)	(0.0011)	(0.0009)	(0.0011)
$lnGDP_{jt}$	1.4489***	1.7677***	−0.1186	1.4567***	1.7153***
	(0.2875)	(0.3361)	(0.3593)	(0.2915)	(0.3289)
$CORR_{jt}$	0.3414***	0.4223***	0.0454	0.3511***	0.3635***
	(0.0829)	(0.0904)	(0.1005)	(0.0841)	(0.0982)
N	48,026	40,150	36,010	46,522	33,840
Adj.R2	0.6630	0.6735	0.6586	0.6658	0.6658

Note: This table shows the first-stage regression results related to investigating the effect of dividend repatriations for GUO firms. A detailed description of all variables is included in Appendix 4.C, Table 4.12. Regressions include firm- and year fixed effects. *, **, and *** denote statistical significance at the 10%, 5%, and 1% level. i refers to the firm, j to the country, and t to the year.

4.F Robustness

Table 4.17: *Second-stage robustness regression results: Intermediate firms*

	(1) $Dividends_{it}$	(2) $EMPL_{it}$	(3) $WAGE_{it}$	(4) $TFAS_{it}$	(5) $STOK_{it}$
$lnRepatDivS_{it}$	3.6819*	0.1906	2.3098**	1.3073***	0.4416
	(2.1014)	(0.1572)	(1.1351)	(0.4895)	(0.4437)
$DivTax_{it}$	0.0138	0.0023	0.0354**	0.0130***	0.0082*
	(0.0230)	(0.0018)	(0.0149)	(0.0039)	(0.0047)
$lnTOAS_{it-1}$	0.8641*	0.2639***	−0.2539	0.0711	0.4108***
	(0.4959)	(0.0453)	(0.3067)	(0.2108)	(0.1264)
$PRMA_{it-1}$	0.0081*	−0.0001	−0.0058**	−0.0013	−0.0023
	(0.0048)	(0.0005)	(0.0023)	(0.0017)	(0.0020)
$CRED_{jt}$	−0.0061	−0.0008	−0.0037**	−0.0027***	−0.0018**
	(0.0038)	(0.0005)	(0.0016)	(0.0009)	(0.0008)
$lnGDP_{jt}$	−2.1597	−0.2836	0.7590***	−0.3507	0.0259
	(1.8535)	(0.1966)	(0.1205)	(0.4835)	(0.4940)
$CORR_{jt}$	0.0687	−0.2155***	−0.0712	−0.3925***	−0.3036***
	(0.3338)	(0.0431)	(0.0500)	(0.0838)	(0.1013)
N	114,115	94,147	89,796	110,956	85,554
Psd.R2	0.8401	0.7151	0.9497	0.9834	0.9494

Note: This table shows the second-stage robustness regression results related to investigating the effect of dividend repatriations for intermediate firms. A detailed description of all variables is included in Appendix 4.C, Table 4.12. Regressions include firm- and year fixed effects. *, **, and *** denote statistical significance at the 10%, 5%, and 1% level. i refers to the firm, j to the country, and t to the year.

Table 4.18: *Second-stage robustness regression results: GUO firms*

	(1) $Dividends_{it}$	(2) $EMPL_{it}$	(3) $WAGE_{it}$	(4) $TFAS_{it}$	(5) $STOK_{it}$
$lnRepatDivS_{it}$	7.1415**	−0.5472	1.1076	3.5836*	−0.8135
	(3.0577)	(0.0000)	(0.9191)	(1.9358)	(0.9100)
$DivTax_{it}$	−0.0866**	0.0127	−0.0136*	−0.0434*	0.0146
	(0.0407)	(0.0000)	(0.0082)	(0.0247)	(0.0150)
$lnTOAS_{it-1}$	−0.1946	0.5789	0.1720	−0.6253	0.8800**
	(0.9645)	(0.0000)	(0.2447)	(0.5934)	(0.3642)
$PRMA_{it-1}$	0.0003	−0.0016	−0.0034	−0.0084	0.0037
	(0.0072)	(0.0000)	(0.0037)	(0.0053)	(0.0023)
$CRED_{jt}$	0.0092	−0.0042	−0.0031*	0.0100	−0.0019
	(0.0114)	(0.0000)	(0.0017)	(0.0065)	(0.0043)
$lnGDP_{jt}$	−8.1161*	0.3183	0.2580	−5.6555*	1.3367
	(4.7758)	(0.0000)	(0.2261)	(2.9804)	(1.5457)
$CORR_{jt}$	−0.8590	0.2523	0.1502	−1.2754*	0.3572
	(1.1066)	(0.0000)	(0.1514)	(0.6868)	(0.3552)
N	48,020	40,137	35,982	46,505	33,856
Psd.R2	0.8269	0.6949	0.9737	0.9891	0.9723

Note: This table shows the second-stage robustness regression results related to investigating the effect of dividend repatriations for GUO firms. A detailed description of all variables is included in Appendix 4.C, Table 4.12. Regressions include firm- and year fixed effects. *, **, and *** denote statistical significance at the 10%, 5%, and 1% level. i refers to the firm, j to the country, and t to the year.

References

Altshuler, R. and Grubert, H. (2002). Repatriation taxes, repatriation strategies and multinational financial policy. *Journal of Public Economics*, 87:73–107.

Altshuler, R., Newlon, S., and Randolph, W. (1995). Do repatriation taxes matter? evidence from the tax returns of u.s. multinationals. In Feldstein, M., Hines, J., and Hubbard, G., editors, *The Effects of Taxation on Multinational Corporations*, pages 63–72. University of Chicago Press.

Altshuler, R., Newlon, S., and Slemrod, J. (1993). The effects of u.s. tax policy on the income repatriation patterns of u.s. multinational corporations. In Giovannini, A., Hubbard, G., and Slemrod, J., editors, *Studies in International Taxation*, pages 77–116. University of Chicago Press, Chicago.

Alworth, J., editor (1987). *The financial, investment, and taxation decision of multinationals*. Basil Blackwell, Oxford.

Bellak, C. and Leibrecht, M. (2010). Does lowering dividend tax rates increase dividends repatriated? evidence of intrafirm cross-border dividend repatriation policies by german multinational enterprises. *FinanzArchiv*, 66(4):350–383.

Bilicka, K., Güceri, I., and Koumanakos, E. (2022). Dividend taxation and firm performance with heterogeneous payout responses. CESifo Working Paper No. 10185.

Blouin, J. and Krull, L. K. (2009). Bringing it home: A study of the incentives surrounding the repatriation of foreign earnings under the american jobs creation act of 2004. *Journal of Accounting Research*, 47(4):1027–1059.

Boissel, C. and Matray, A. (2022). Dividend taxes and the allocation of capital. *American Economic Review*, 112(9):2884–2920.

Brennan, T. (2014). Where the money really went: A new understanding of the ajca tax holiday. *Northwestern Law & Econ Research Paper*.

de Simone, L., Klassen, K. J., and Seidman, J. K. (2017). Unprofitable affiliates and income shifting behavior. *The Accounting Review*, 92(3):113–136.

Desai, M. A., Foley, C. F., and Hines, J. (2007). Dividend policy inside the multinational firm. *Financial Management*, 36(1):5–26.

Desai, M. A., Foley, C. F., and Hines, J. R. (2001). Repatriation taxes and dividend distortions. *National Tax Journal*, 54(4):829–851.

Dharmapala, D., Foley, C. F., and Forbes, K. (2011). Watch what i do, not what i say: The unintended consequences of the homeland investment act. *The Journal of Finance*, 66(3):753–787.

Egger, P., Merlo, V., Ruf, M., and Wamser, G. (2015). Consequences of the new uk tax exemption system: Evidence from micro-level data. *The Economic Journal*, 125(589):1764–1789.

Faulkender, M. and Petersen, M. (2012). Investment and capital constraints: repatriations under the american jobs creation act. *Review of Financial Studies*, 25:3351–3388.

Garcia-Bernardo, J., Fichtner, J., Takes, F. W., and Heemskerk, E. M. (2017). Uncovering offshore financial centers: Conduits and sinks in the global corporate ownership network. *Scientific reports*, 7(1):6246.

Gourieroux, C., Monfort, A., and Trognon, A. (1984). Pseudo maximum likelihood methods: Theory. *Econometrica*, 52(3):681–700.

Graham, J. R., Hanlon, M., and Shevlin, T. J. (2010). Barriers to mobility: The lockout effect of the u.s. taxaation of worldwide corporate profits. *National Tax Journal*, 63(2):1111–1144.

Gravelle, J. G. (2015). Tax havens: International tax avoidance and evasion. Congressional Research Service No. 7-5700.

Gregori, W., Nardo, M., Ndacyayisenga, N., and Rancan, M. (2019). Foreign investment in the eu: The fown dataset. JRC Working Paper No. 118266.

Großkurth, P. (2019). *Multinational Enterprises under Regulation: Three Empirical Essays on Corporate Ownership Structures*. Dissertation, Ruhr-Universität Bochum, Bochum.

Hartman, D. (1985). Tax policy and foreign direct investment. *Journal of Public Economics*, 26:107–121.

Hasegawa, M. and Kiyota, K. (2017). The effect of moving to a territorial tax system on profit repatriation: Evidence from japan. *Journal of Public Economics*, 153:92–110.

Hines, J. and Hubbard, G. (1990). Coming home to america: Dividend repatriation by u.s. multinationals. In Razin, A. and Slemrod, J., editors, *Taxation in the Global Economy*. University of Chicago Press, Chicago.

Hines, J. and Rice, E. (1994). Fiscal paradise: Foreign tax havens and american business. *The Quarterly Journal of Economics*, 109(1):149–182.

HM Treasury (2007). Taxation of the foreign profits of companies: a discussion document.

Huizinga, H., Laeven, L., and Nicodème, G. (2008). Capital structure and international debt shifting. *Journal of Financial Economics*, 88(1):80–118.

Lejour, A., Möhlmann, J., and Riet, M. v. (2021). The immeasurable tax gains by dutch shell companies. *International Tax and Public Finance*.

Lintner, J. (1956). Distribution of incomes of corporations among dividends, retained earnings, and taxes. *American Economic Review*, 46(2):97–113.

Markle, K. (2016). A comparison of the tax-motivated income shifting of multinationals in territorial and worldwide countries. *Contemporary Accounting Research*, 33(1):7–43.

Matheson, T., Perry, V., and Veung, C. (2013). Territorial vs. worldwide corporate taxation: Implications for developing countries. IMF Working Paper No. 205.

Merlo, V., Riedel, N., and Wamser, G. (2020). The impact of thin–capitalization rules on the location of multinational firms' foreign affiliates. *Review of International Economics*, 28(1):35–61.

Mutti, J. (1981). Tax incentives and repatriation decisions of u.s. multinational corporations. *National Tax Journal*, 34:241–248.

Silva, J. and Tenreyro, S. (2006). The log of gravity. *The Review of Economics and Statistics*, 88(4):641–658.

Sinn, H.-W. (1987). *Capital income taxation and resource allocation*. North Holland, Amsterdam, 35 edition.

Tajika, E. and Shibata, M. (2014). The effects of dividend-exemption method on repatriation of income from abroad: the case of 2009 japanese tax reform. *Economic Analysis and Policy*, 188:70–91.

Torslov, T., Wier, L., and Zucman, G. (2022). The missing profits of nations. *The Review of Economic Studies*, 0:1–36.

Train, K. (2022). *Discrete choice methods with simulation*. Cambridge University Press, Cambridge, 2 edition.

Wooldridge, J. M. (2010). *Econometric Analysis of Cross Section and Panel Data*. MIT Press, Cambridge.

Chapter 5

Double counting of dividend income in unconsolidated financial statement data: On the role of ownership structures and implications for profit shifting estimates

Abstract: *As dividend repatriations are double-counted in the pre-tax profit reported in unconsolidated financial statement data, profit shifting estimates derived following the standard approach in tax literature are likely to be biased. Arguing that the ownership network structure of multinational corporations (MNCs) plays an important role for the direction of this bias, this paper examines the position of low-tax entities in MNC ownerhip chains. Based on a rich parent-affiliate dataset including MNC worldwide, I show that low-tax entities are predominately positioned close to the global ultimate owner firm. This finding suggest that pre-tax profit in these countries is reported too high and that previous profit shifting estimates based on pre-tax profit from unconsolidated financial statement data are overstated. In line with this notion, my regression analysis provides profit shifting estimates for various sample splits that are significantly lower once pre-tax profit is adjusted for repatriated dividends.*

5.1 Introduction

The profit shifting by multinational corporations (MNCs) has become one of the most important issues on the agenda of international tax policy in recent years. Along with the political debate, a growing number of empirical studies has investigated the tax avoidance behavior of MNCs and – in large parts – reported evidence in line with tax-motivated profit shifting. In a review of the empirical profit shifting literature at the time, Dharmapala (2014) documents a shift from country-level analyses to those based on firm-level accounting data – most often, unconsolidated financial statement data. With these data at hand, the common empirical approach to measure the profit shifting incentive of a firm is to regress its profit on the tax differential between taxes it pays itself and all other firms in the MNC group as well as a set of control variables.[1] The exact set of control variables often varies between the different studies but usually includes both firm-level and country-level factors. The tax differential, in turn, can be based on a simple average or an average weighted by e.g. firm size. With respect to the firm's profit considered, lastly, Heckemeyer and Overesch (2017) report that most studies investigate the tax effect on pre-tax profit (earnings before taxation, EBT).

The issue with a firm's EBT is that it can include double-counted income: If two firms are related to each other as parent and affiliate, dividend income repatriated by the former from the latter is included in the EBT reported by both firms. This double-counting of dividend income is more pronounced, the more affiliates a parent firm controls directly or indirectly through ownership chains – provided that intermediate firms pass dividends from their affiliates up the ownership chain. Consequently, the ownership network structure of MNCs plays a major role for profit shifting estimates based on unconsolidated financial statement data: If MNCs are headquartered in a country with exceptionally low tax rates or have entities in such a country that are close to the headquarters firm, profit shifting estimates are likely to be overstated. In turn, if low-tax entities happen to be near the end of their ownership chain, profit shifting estimates are likely to be too low.

The objective of this paper is twofold: First, I examine the ownership network structure of MNCs for their susceptibility to distort profit shifting measures based on unconsolidated financial statement data. For this, I focus on entities located in countries with a statutory corporate tax rate below 15% – the rate recently set as minimum corporate tax rate under Pillar 2 of the Base Erosion and Profit Shifting (BEPS) proposal by the Organisation for Economic Cooperation and Development (OECD). Second, I quantify the bias of BEPS estimates based on unadjusted profit over those based on profit adjusted for dividend repatriations. With this, I add to a relatively small literature discussing

[1] This approach was first introduced by Hines and Rice (1994) and later extended by Huizinga and Laeven (2008).

the "appropriate income distribution" and their implications for BEPS estimates.[2] Correcting for double-counted equity income resulting from the accounting treatment of indirectly-owned foreign affiliates in data from the Bureau of Economic Analysis (BEA), for instance, Blouin and Robinson (2020) estimate that the loss of United States (US) tax revenue from BEPS in 2012 reduces from up to 111 billion USD to only 10 billion USD. With respect to the Country-by-Country Reporting (CbCR) data of US MNCs from 2017, in turn, Horst and Curatolo (2020) suggest that up to 23% of income (0.47 trillion USD) is double-counted.

The analysis in this paper is based on data from ORBIS provided by the Bureau van Dijk. This database harmonizes financial information of firms worldwide and enables the identification of ownership at a global level. I identify corporate ownership networks based on information of a firm's direct shareholder with an ownership share of at least 50%. The resulting dataset includes 1,063,983 MNCs with global ultimate owner (GUO) firms in 207 different countries (including island states). Adding financial information to the identified MNC entities, calculating firm dividend payments following a method previously applied by Bellak and Leibrecht (2010) and Egger et al. (2015), and allocating repatriated dividends to their owners results in a sample available for regression analysis of 1,706,908 firm-year observations. The firms are located in 110 different countries and the period covered stretches from 2009 to 2018. The number of distinct GUO firms, intermediate firms, and firms owning no affiliates is 22,286, 53,489, and 360,486, respectively. Information on the corporate taxes in the different countries comes from the International Tax Institutions (ITI) database provided by the Tübingen Research School of International Taxation (RSIT). Country-level data are taken from the World Bank.

My descriptive exploration of MNC ownership network structures shows that the largest MNCs in terms of the number of group entities have their GUO firms in the US, China, and Germany. They most often operate in the financial and insurance industry, the manufacturing sector, and the wholesale and retail trade sector. With respect to the position of low-tax entities in the ownership network structure of MNCs, I observe that low-tax entities appear to be predominately positioned close to the GUO firm – if not being the GUO firm themselves – for any given ownership chain length. Alternatively focusing on tax haven entities rather than low-tax entities, the identified pattern holds suggesting that existing BEPS estimates may be overstated.[3]

Studying the profit shifting incentive of MNCs, the BEPS semi-elasticity for both unadjusted and adjusted pre-tax profit is -0.55% in the overall sample and, thus, within

[2]The "appropriate distribution of income" in the BEPS context is where the income was earned – and taxed (Blouin and Robinson, 2020).

[3]The tax haven status of countries is based on the tax haven list of Hines and Rice (1994), to which I add additional countries considered as tax havens by Torslov et al. (2022).

the range of previous estimates (compare Heckemeyer and Overesch, 2017). However, the fact that there is no material difference in the profit shifting estimates for unadjusted and adjusted pre-tax profit does not support the implications for BEPS estimates derived from the ownership network structure of MNCs. Reasons for this may be rooted in the availability of financial information in the ORBIS data: The regression sample includes a high share of observations covering firms that are at the end of the ownership chain (i.e. firms that do not receive any dividends and, thus, whose profit is not affected by potential dividend repatriations) and a low share of observations covering low-tax/tax haven entities. To show that dividend repatriations and their double-counting do affect BEPS estimates, I provide regression results related to several relevant sample splits. These sample splits focus on 1) firms that hold at least one affiliate, 2) firms belonging to a MNC with at least one low-tax entity, 3) firms belonging to a MNC with at least one tax haven entity, 4) firms belonging to the 5% largest MNCs based on the number of group entities, and 5) firms belonging to the 5% largest MNCs based on the consolidated total assets in 2018. Overall, the BEPS semi-elasticity of adjusted pre-tax profit is significantly smaller than the one for unadjusted pre-tax profit.

The remainder of this paper is structured as follows: In Section 5.2, I provide an overview of the recent literature discussing how accounting methods can affect reported profit in different datasets. In Section 5.3, I explain how the double-counting of dividends can occur in the unconsolidated financial statements as shareholdings exist and how the structure of MNC ownership networks affects profit shifting estimates. Section 5.4 introduces the data employed. In Section 5.5, I provide insights in the ownership network structures of MNCs worldwide. In Section 5.6, I compare the profit shifting estimates based on adjusted pre-tax profit to those based on unadjusted pre-tax profit. In Section 5.7, I provide additional results related to MNCs headquartered in different countries. Section 5.8 concludes.

5.2 Related literature

Action 11 of the OECD BEPS report advocates for the collection and improvement of data and analyses to quantify the impact of profit shifting. Nevertheless, the literature discussing how accounting methods affect reported profit in different datasets – resulting in the inadvertent inclusion of double-counted data or the misallocation of profit due to incorrect inferences about the location of profit where chains of ownership exist – is rather scarce (Blouin and Robinson, 2020). With respect to BEA data, the first to point out double counting-issues are Altshuler and Grubert (2006) when stating that unadjusted BEA income duplicates the reporting of equity income in the data. This perception continues through studies including Yorgason (2009), Clausing (2009), Clausing (2011),

Clausing (2016), and Beer et al. (2019). Blouin and Robinson (2020) note that all these previous studies are correct about the duplication of the equity income in the BEA data, but mistakenly explain that this income represents intercompany dividends. They argue that equity income is neither dividend income nor an asset, such as cash, but merely an accounting construct.[4] Correcting the BEA data used by Clausing (2016) for the distribution of income, Blouin and Robinson (2020) estimate that the loss of US tax revenue from BEPS in 2012 reduces from between 77 billion USD and 111 billion USD to only 10 billion USD. Clausing (2020)'s reply to Blouin and Robinson (2020), arguing that the adjustments made to correct the BEA data inadvertently eliminate some foreign-to-foreign profit shifting, indicates that the discussion is likely to continue beyond the time frame of this paper.

As far as the rather new CbCR data is concerned, it is indeed dividend income that distorts the profit reported in the different countries (e.g. Horst and Curatolo, 2020; Garcia-Bernardo et al., 2021; Fuest et al., 2022): Until 2020, CbCR guidelines provided that dividends shall be excluded from the parent firm's revenue. However, they did not say that dividends shall also be excluded from the parent firm's pre-tax profit. This led to countries making different recommendations regarding whether dividends paid by one affiliate should be included in the profit of another one. Considering this lack of specification in CbCR guidelines, Horst and Curatolo (2020) compare the aggregate pre-tax profit reported in the CbCR data of US MNCs from 2017 with the consolidated pre-tax profit reported in the S&P Capital IQ's Compustat database for the same year. Their results suggest that 14% to 23% of income (0.26 trillion USD to 0.47 trillion USD) is double-counted.

Lastly, Clausing (2020) and Garcia-Bernardo et al. (2021) acknowledge that dividend income may also be double-counted in other data – specifically, tax return data and data from unconsolidated financial statements. To date, however, no literature seems to have taken this up further and shed light on how high this double-counted income could be or derived implications for BEPS estimates.

5.3 Theoretical considerations

Consider two firms, A and B. Firm A is directly and fully owned by firm B. Both firms report revenues of 100 monetary units in their unconsolidated profit and loss statement. After substracting 80 monetary units for cost of goods solds and without having any

[4] According to Blouin and Robinson (2020), the double counting issue arises when a MNC headquartered in the US owns a foreign affiliate (A1), which in turn owns another foreign affiliate (A2). A1 is the direct owner of A2, while the MNC is the indirect owner. The BEA requires the US MNCs to report affiliate-level financial data by jurisdiction such that both A1 and A2 include the income of A2 in their income statements. A2's income in A1's accounts is referred to in the data as equity income from investments.

other operating expenses, each of their reported gross profit as well as their operating profit is 20 monetary units. Since firm A does not have any other financial renvenues and/or expenses, pre-tax profit amounts to 20 monetary units. After taxation (50%) and without any extraordinary other revenues and/or expenses, both profit after taxes and profit for the period of firm A is 10 monetary units. If firm A distributes dividends equal to its total profit for the period to firm B, firm B may recognize these repatriations as financial revenues. As a result, the pre-tax profit of firm B amounts to 30 monetary units. After taxation (again 50%) and without any extraordinary other revenues and/or expenses, both profit after taxes and profit for the period of firm B is 20 monetary units.

Table 5.1: *EBT bias along the ownership chain*

	EBIT	FIRE=REPAT	EBT	PL=DIV	BIAS
E	20	40	60	50	200%
D	20	30	50	40	150%
C	20	20	40	30	100%
B	20	10	30	20	50%
A	20	0	10	10	0%

Note: This table shows the distortion of EBT figures due to double-counted dividend income along the ownership chain. EBIT is the earnings before interest and taxation. FIRE is the financial revenues and, in this case, the dividends repatriated to a firm (REPAT). EBT is the earnings before taxation. PL is the profit/loss of the period and, in this case, the dividend payment (DIV) of a firm to its owner. BIAS is the percentage bias of EBT compared to the EBT adjusted for dividend repatriations – which is always 20.

Clearly, the above example is very simplified.[5] Still, it demonstrates how parts of the income of one firm can be double-counted in the pre-tax profit, the profit after taxes, and the profit for the period of another firm if it is repatriated in the form of dividends. Considering a more complex ownership structure, the double-counting of dividends – and distortion of profit figures – is likely to be more pronounced the more affiliates a firm directly holds. Even more problematic appears to be the indirect control over affiliates through ownership chains – provided that intermediate firms pass dividends from their affiliates up the ownership chain: The higher a firm is in a given chain – and consequently the more dividend repatriations can accumulate from lower levels –, the

[5]For instance, dividend income that has already been taxed once at firm A may or may not be taxed a second time at firm B. As implicitly assumed in this example, countries can exempt dividends distributed by domestic and/or foreign firms to avoid double taxation. Alternatively, they can offer a credit or deduction for taxes already paid. Furthermore, the country in which firm A is located may levy withholding taxes on dividends distributed by that firm if the parent firm B is located in a different country. These taxes can be specified unilaterally or bilaterally between the two countries in order to tax foreign investors that would otherwise benefit from their infrastructure without contributing sufficiently to it or to distribute taxing rights among the treaty partners (Petkova, 2020).

greater the double-counting of dividend income. Specifically, the reported EBT of firm B is 50% higher than it would be if the double-counted dividend income was excluded (Table 5.1). For firms further up the ownership chain, the EBT bias constantly increases provided that their direct affiliate repatriates its total profit for the period. Eventually, firm E – the headquarters firm of the MNC in this example – reports pre-tax profit that is 200% higher than it would be excluding double-counted dividend income.[6]

From the above, I can derive the following link between the ownership structure of MNCs and BEPS estimates based on unconsolidated financial statement data and following the common approach described in the introduction: If MNCs are headquartered in a low-tax country or have entities located there that are close to the headquarters firm, then their reported pre-tax profit is likely to be overstated. This, in turn, would cause profit shifting estimates to be upward biased. In contrast, if firms located in a low-tax countries are positioned further to the end of an ownership chain, profit shifting estimates are likely to be too low.

5.4 Data

5.4.1 Ownership data

The analysis of MNC ownership network structures is based on a 2020 download from the ORBIS database provided by the Bureau van Dijk. For the identification of corporate ownership networks, I focus on direct shareholdings of at least 50% and assume that this implies full control.[7] Starting with the firms owning no affiliates themselves, I connect identified parent-affiliate pairs until I end up with the GUO firm reported by ORBIS. I have found this GUO firm for over 96% of all firms at the end of an ownership chain once identified ownership chains include a maximum of five firm (including the GUO firm). Focusing on the corporate ownership networks with correctly identified GUO firms, I discard ownership chains with unknown firm locations.[8] I also drop chains that reach the firm I started with or a firm previously visited in the considered chain to avoid infinite loops. Lastly, I consider only ownership networks of MNCs (i.e. ownership networks where at least one firm is located in a different country than the GUO firm).

[6]The underlying assumption is, that firm B is fully and directly held by firm C, which is fully and directly held by firm D, which is fully and directly held by firm E. Both firms C, D, and E have the same revenue, cost, and tax structure as firms A and B.

[7]Note that this criterion neglects all other forms of control that are independent of majority shares and the possibility of veto rights. Additionally, this criterion excludes joint ventures with 50/50 share distributions as well as all forms of portfolio investment that are not undertaken to gain control over another company (Großkurth, 2019).

[8]In the notation of ORBIS, I drop chains with firm locations WW for individuals, YY for companies, and ZZ for any official identifier formed by more than one company or mixed with an individual (Gregori et al., 2019).

5.4.2 Financial and other data

In order to quantify the dividend income bias in profit shifting estimates based on firm-level accounting data, I add information from unconsolidated financial statements reported by ORBIS to the above identified firms if the balance sheet total is non-negative.[9] Since dividends paid by a firm i in year t ($Dividends_{it}$) are not directly observable in the data, I approximate them following an approach previously used by Bellak and Leibrecht (2010) and Egger et al. (2015) as the difference between available shareholder funds after profit in $t-1$ and available shareholder funds before profit in t.[10] I replace approximated dividends in t by the shareholder funds after profit in $t-1$ if the dividend payments in t are larger than the shareholder funds after profit in $t-1$. Where values are negative, I replace dividends by zero. Next, I calculate the repatriated dividends received by a firm i in year t ($RepatDividends_{it}$) as the sum of the dividend payments of all the firms's affiliates in that year. Subsquently, I correct the EBT of firm i in year t by subtracting the repatriated dividends received in that year. Taking the logarithm of uncorrected and corrected pre-tax profit results in $lnEBT_{it}$ and $lnEBTC_{it}$, respectively. Lastly, I discard observations with missing $lnEBT_{it}$ or $lnEBTC_{it}$.

The profit shifting incentive is given by the tax differential $TAXD_{it}$. $TAXD_{it}$ is the difference between the statutory corporate tax rate of firm i in year t and the simple average of the statutory corporate tax rates of all other firms in the same corporate group in year t. The data I rely on for this calculation come from the ITI database provided by the RSIT. This database gathers various tax rule information including in particular statutory corporate tax rates.

I consider two firm-specific characteristics in the regression analysis. Both of them are provided in the ORBIS dataset: $lnTOAS_{it}$ represents the logarithm of total assets and $lnEMPL_{it}$ is the logarithm of the number of employees. Furthermore, I control for four country-specific variables: $lnGDP_{jt}$ reflects the logarithm of the gross domestic product (GDP) in country j and year t (base year 2010). $lnPOP_{jt}$ is the logarithm of the population level in country j and year t. $INFL_{jt}$ is the inflation rate in country j in year t. $REGQ_{jt}$ captures the perceived government ability to formulate and implement sound policies and regulations that permit and promote the private sector to develop. It is provided in form of an index ranging between -2.5 and 2.5, higher values implying higher quality. All country variables stem from the World Development Indicators database or the Worldwide Governance Indicators database by the World Bank.

[9] Note that ownership information in the ORBIS download is provided only on a most-recent basis. The matching of ownership information and financial information thus enforces the assumption that the ownership structure does not change over time. According to Großkurth (2019), however, it appears to be common practice in the firm-level literature on MNCs to assume their ownership structures to remain constant over time (e.g. Huizinga et al., 2008; de Simone et al., 2017; Markle, 2016) without explicitly discussing the implications.

[10] In the notation of ORBIS, this is: $SHFD_{it-1} + PLBT_{it-1} - SHFD_{it}$.

5.5 MNC ownership network structures

5.5.1 The position of low-tax entities

The dataset documenting the ownership network structures of MNCs worldwide consists of 1,063,983 GUO firms, 373,179 intermediate firms, and 3,918,574 firms owning no affiliates. Most MNCs have their GUO firm in China (7.44%), Italy (5.73%), and Romania (4.83%). The GUO firms of the largest MNCs (i.e. those with the most entities), in turn, are located in the US (22.04%), China (5.95%), and Germany (5.19%).[11] With respect to their industry affiliation, I find that most MNCs operate in the financial and insurance industry (25.19%), the manufacturing sector (18.62%), and the scientific sector (14.49%). The overall order of MNC industry affiliations of most MNCs is similar to the one of the largest MNCs: 22.66% operate in the financial and insurance industry, 20.66% are affiliated with the manufacturing sector, and 14.17% do business in the wholesale and retail trade sector.[12]

Table 5.2 reports key characteristics of the MNCs in the sample. The average MNC has five entities (including the GUO firm). The share of foreign entities (i.e. entities located in a different country than the GUO firm) is 38.86%. Most foreign entities are located in the UK (27.71%), the US (9.94%), and Germany (5.23%). The share of entities located in a country with a statutory tax rate below 15%, in turn, is 5.66%. Most frequent locations of low-tax entites are Bulgaria (17.47%), Ireland (15.73%), and Cyprus (11.38%).[13] The average number of ownership chains per MNC is four. The share of foreign chains is 49.40%. The share of foreign chains with at least one low-tax entity, in turn, is 8.96%. The average chain length is about three (including the GUO firm).

Table 5.2: *MNC characteristics*

Average number of entities	5.03
Share of foreign entities	38.86
Share of low-tax entities	5.66
Average number of chains	3.68
Share of foreign chains	49.40
Share of foreign chains with a low-tax entity	8.96
Average chain length	2.82

Note: This table shows key characteristics of the 1,063,983 MNCs in the sample.

The position of low-tax entities is crucial for the double-counting of repatriated div-

[11] See Appendix 5.B, Table 5.13 for the most frequent GUO firm locations of the most/largest MNCs.
[12] See Appendix 5.B, Table 5.14 for the industry affiliations of the most/largest MNCs.
[13] See Appendix 5.B, Table 5.15 for the most frequent foreign and low-tax countries.

idends – and, thus, for BEPS estimates – only in foreign ownership chains. For these chains, Table 5.3 reports information on the share of low-tax entities on different levels by chain length – provided there is at least one such entity in the chain. It shows that the share of low-tax entities generally decreases the further away from the GUO firm for any ownership chain length. Thus, 39.50% of firms directly held by the GUO firm and 3.23% of those on the last level are located in a low-tax country in chains including five firms of low-tax GUO firms. For the other MNCs, the share of low-tax entities in a chain of five firms is 43.46% on the second level and 36.25% on the last level.

Table 5.3: *Share of low-tax entities by ownership chain length in foreign chains with at least one such entity*

	Low-tax GUO firm				Other GUO firm			
Chain length	2	3	4	5	2	3	4	5
GUO firm	100.00	100.00	100.00	100.00	0.00	0.00	0.00	0.00
Level 2	*6.75*	*24.10*	*31.46*	*39.50*	*100.00*	65.03	*52.78*	43.56
Level 3	.	8.69	12.06	16.71	.	*78.34*	42.62	*44.59*
Level 4	.	.	5.93	6.72	.	.	49.80	33.11
Level 5	.	.	.	3.23	.	.	.	36.25
No. of chains	152,757	37,332	21,508	17,321	74,309	19,644	16,129	12,161

Note: This table shows the share of low-tax entities on each level (out of 100%) by ownership chain length. The highest share of low-tax entities below the GUO firm is in italics. There are 228,918 foreign ownership chains including at least one low-tax entity that belong to 130,494 MNCs having their GUO firm located in a low-tax country. There are 122,243 foreign ownership chains including at least one low-tax entity that belong to 74,170 MNCs having at least one entity other than the GUO firm that is located in a low-tax country.

The pattern described above suggests that the pre-tax profit reported by firms located in a low-tax country is likely to be inflated if dividend income is passed along the ownership chains by intermediate firms. Given that foreign chains with at least one low-tax entity make up a non-negligible share of all chains reported in the dataset, this in turn suggests that profit shifting estimates based on pre-tax profit from unconsolidated financial statement data are bound to be overstated.

5.5.2 Robustness: The position of tax haven entities

As alternative to entities located in a country with a statutory corporate tax rate below 15%, I focus on entities located in a tax haven country as these countries often have particularly low corporate tax rates as well. The share of tax haven entities in the ownership dataset is 10.33% (untabulated). The most frequent tax haven locations are the Netherlands (16.28%), Belgium (11.62%), and Hong Kong (11.34%).[14] The share of foreign chains with at least one tax haven entity, in turn, is 16.15% (untabulated).

[14]See Appendix 5.B, Table 5.15 for the most frequent tax haven countries.

Table 5.4: *Share of tax haven entities by ownership chain length in foreign chains with at least one tax haven entity*

	Tax haven GUO firm				Other GUO firm			
Chain length	2	3	4	5	2	3	4	5
GUO firm	100.00	100.00	100.00	100.00	0.00	0.00	0.00	0.00
Level 2	*20.71*	*37.91*	*53.88*	*63.62*	*100.00*	72.97	*65.93*	49.99
Level 3	.	17.89	23.86	41.98	.	*73.37*	42.90	*59.39*
Level 4	.	.	13.94	13.78	.	.	39.42	36.02
Level 5	.	.	.	9.04	.	.	.	31.06
No. of chains	199,807	84,691	59,407	47,715	120,480	43,256	39,619	37,711

Note: This table shows the share of tax haven entities on each level (out of 100%) by ownership chain length. The highest share of tax haven entities below the GUO firm is in italics. 391,620 foreign chains including at least one tax haven entity belong to 158,884 MNCs having their GUO firm located in a tax haven country. 241,066 foreign chains with at least one tax haven entity, in turn, belong to 126,435 MNCs having at least one entity other than the GUO firm that is located in a tax haven country.

Studying the position of tax haven entities in foreign chains with at least one such entity, Table 5.4 shows that tax haven entities appear to be positioned close to the GUO firm – if not being the GUO firm themselves. In chains of five entities, for instance, the share of tax haven entities directly held by a GUO firm located in a tax haven country is 63.62%. The share of tax haven entities on the lowest level, in turn, is only 9.04%. Considering the chains with at least one tax haven entity of MNCs with their GUO firm located elsewhere, 49.99% of firms directly held by the GUO firm and 31.06% of those on the fifth level are located in a tax haven country. This pattern is in line with the one reported for low-tax entities in the previous subsection and supports the implication derived from it.

5.6 Re-assessing the extent of profit shifting

5.6.1 Sample description

The regression sample includes 1,706,908 firm-year observations and covers the years 2009 to 2018. The number of distinct GUO firms, intermediate firms, and firms owning no affiliates are 22,286, 53,489, and 360,486, respectively. They are located in 110 different countries, led by Romania (7.82%), the UK (7.77%), and Italy (7.58%). 22.45% of firms operate in the wholesale and retail trade sector. This is followed by firms doing business in the manufacturing sector (18.26%) and the scientific sector (10.79%).[15]

[15] An overview of the most frequent countries as well as industry affiliations of firms in the regression sample is provided in Appendix 5.C, Tables 5.16 and 5.17.

Table 5.5: *Summary statistics*

	N	Mean	Median	SD
EBT	1,706,908	10.54	0.16	211.73
$EBTC$	1,706,908	9.46	0.16	198.11
$TOAS$	1,706,908	205.92	2.61	5,812.61
$EMPL$	1,147,446	0.20	0.01	3.46
GDP	1,704,529	1.45	0.53	1.88
$INFL$	1,703,437	2.24	1.52	3.67
POP	1,704,564	95.07	37.97	264.20
$REGQ$	1,706,906	0.96	1.01	0.70
$TAXD$	1,706,806	-1.82	-0.20	7.15

Note: This table presents summary statsitics (number of observations, mean, median, and standard deviation) for all variables of interest (without logarithm) in the sample available for regression analysis. Monetary values are provided in million USD, except for GDP which is provided in trillion USD. Employment figures are in thousands. Population figures are provided in million. Information on inflation and the tax differential are in percent. The regulatory quality is in form of an index. A detailed description of all variables is included in Appendix 5.A, Table 5.12.

Table 5.5 shows that unadjusted and adjusted pre-tax profit are similar in the overall sample available for regression analysis: Unadjusted pre-tax profit amounts to 10.54 million USD, on average. Adjusting the pre-tax profit for repatriated dividends results in average pre-tax profit of 9.46 million USD. Furthermore, the average firm in the sample has 205.92 million USD in total assets and employs 200 people. With respect to the countries included, average GDP is 1.45 trillion USD and average inflation rate is at 2.24%. Average population size is 95.07 million.

5.6.2 Regression analysis

Based on the conceptual framework that was developed by Hines and Rice (1994) and extended by Huizinga and Laeven (2008), I estimate the following equation to examine the overall extent of tax-motivated profit reallocation:

$$X_{it} = \alpha_0 + \alpha_1 TAXD_{it} + \alpha_2 Y_{it} + \alpha_3 Z_{jt} + \beta_i + \gamma_t + \epsilon_{it} \tag{5.1}$$

X_{it} is a placeholder for the two pre-tax profit measures of firm i in year t studied – namely, $lnEBT_{it}$ and $lnEBTC_{it}$. $TAXD_{it}$ is the profit shifting incentive of firm i in year t. Y_{it} and Z_{jt} represent time-varying firm characteristics and time-varying country characteristics, respectively. Specifically, I control for the total assets ($lnTOAS_{it}$) and number of employees ($lnEMPL_{it}$) of firm i in year t. On the country level, I consider the level of GDP ($lnGDP_{jt}$) and the population level ($lnPOP_{jt}$) of country j in year t.

Furthermore, I include the inflation rate ($INFL_{jt}$) and the perceived regulatory quality ($REGQ_{jt}$) of country j in year t. To control for time-invariant firm characteristics as well as time shocks that are common to all firms, I include firm-fixed effects (β_i) and time-fixed effects (γ_t). Lastly, ϵ_{it} is an error term.

In line with previous literature, I find highly significant negative coefficients for the tax differential in the overall sample (Table 5.6). Specifically, if the tax differential increases by one percentage point, unadjusted and adjusted pre-tax profit reduce by 0.55%, respectively. In addition, both firm-level variables are positively and significantly related with pre-tax profit. Thus, an increase in the total assets (the level of employment) by one percentage point is associated with an increase of pre-tax profit by 0.63% (0.13%). With respect to country-level variables, I find coefficients for the level of GDP to be positive and significant. The link between pre-tax profit and the level of population, inflation, and the perceived regulatory quality, in turn, is negative and significant.

The difference in the estimates of $TAXD_{it}$ for $lnEBT_{it}$ and $lnEBTC_{it}$ is only marginal and statistically insignificant.[16] This is may come unsurprisingly for reasons rooted in the availability of financial information in the ORBIS data: First, the regression sample includes a high share of observations covering firms that are at the end of the ownership chain (i.e. firms that do not receive any dividends so that pre-tax profit cannot be biased). Second, the share of observations covering low-tax/tax haven firms (i.e. firms that have been found to be positioned further up in an ownership chain and thus whose pre-tax profit is particularly biased) is rather low in the regression sample. Consequently, unadjusted and adjusted pre-tax profit are bount to be – if not equal – at least similar.

[16]The test of statistical difference in the tax differential estimates for $lnEBT_{it}$ and $lnEBTC_{it}$ is based on seemingly unrelated regressions (Zellner, 1962; Zellner and Huang, 1962; Zellner, 1963). See Appendix 5.C, Table 5.18 for results.

Table 5.6: *Regression results: All firms*

	(1) $lnEBT_{it}$	(2) $lnEBTC_{it}$
$TAXD_{it}$	−0.5507***	−0.5524***
	(0.0574)	(0.0581)
$lnTOAS_{it}$	0.6297***	0.6294***
	(0.0038)	(0.0038)
$lnEMPL_{it}$	0.1313***	0.1326***
	(0.0025)	(0.0025)
$lnGDP_{jt}$	0.3857***	0.3731***
	(0.0275)	(0.0279)
$lnPOP_{jt}$	−0.6522***	−0.7872***
	(0.0852)	(0.0867)
$INFL_{jt}$	−0.1509***	−0.1148***
	(0.0382)	(0.0383)
$REGQ_{jt}$	−0.0712***	−0.0567***
	(0.0121)	(0.0123)
FE	Firm & Year	Firm & Year
N	1,008,763	1,008,763
Adj.R2	0.1163	0.1124

Note: This table shows regression results based on all firms. A detailed description of all variables is included in Appendix 5.A, Table 5.12. Regressions include firm- and year fixed effects. *, **, and *** denote statistical significance at the 10%, 5%, and 1% level. i refers to the firm, j to the country, and t to the year.

To show that dividend repatriations and their double-counting do affect BEPS estimates, I consider five different relevant sample splits (Table 5.7). Focusing only on those firms that have at least one affiliate (columns 1 and 2), I find a statistically significant semi-elasticity of -0.45% for unadjusted pre-tax profit. Adjusting pre-tax profit for repatriated dividends, the BEPS estimate reduces to -0.32%. In columns 3 and 4, I study firms that belong to MNCs with at least one low-tax entity and find that if the tax differential between a firm and its group members increases by one percentage point, unadjusted pre-tax profit decreases by 0.30% while the adjusted one does so by 0.29%. Another sample split only considers firms that have at least one tax haven entity in their group (columns 5 and 6). Again, there is a statistically significant and negative relationship between $TAXD_{it}$ and both unadjusted and adjusted pre-tax profit: If the tax differential between a firm and its group members increases by one percentage point, unadjusted pre-tax profit decreases by 0.49%. The decrease in adjusted pre-tax profit following the same increase in the tax differential is only 0.46%. Lastly, I focus on firms belonging to the largest MNCs (columns 7 to 10). In columns 7 and 8, the largest MNCs are identified as having more entities than 95% of MNCs.[17] The BEPS semi-elasticities

[17]The calculation of the 95 percentile is based on the dataset containing only ownership information.

are -0.53% for unadjusted pre-tax profit and -0.49% for adjusted pre-tax profit. In columns 9 and 10, in turn, the largest MNCs are identified as having consolidated total assets in 2018 higher than 95% of MNCs. Here, unadjusted pre-tax profit decreases by 0.36% following a one percentage point increase in the tax differential between a firm and its group members. Pre-tax profit adjusted for dividend repatriations does so by only 0.28%.

In all but one of the above cases, the difference in BEPS estimates for adjusted and unadjusted pre-tax profit is statistically significant.[18] This finding is in line with implications derived from the MNC ownership structure in Section 5.5: With low-tax/tax haven entities predominately being located further up the ownership chain, double-counted dividend income from the lower levels accumulates more for them than for other entities. Consequently, pre-tax profit that is reported in low-tax/tax haven countries is too high. Without adjustment, in turn, this leads to upward-biased profit shifting estimates.

5.6.3 Robustness: Dividend repatriations considering shareholdings

In order to provide evidence for the robustness of the above results, I calculate the dividends repatriated to a firm based on its shareholding in the affiliates it directly holds ($RepatDividendsS_{it}$). In this case, average adjusted pre-tax profit amounts to 9.74 million USD (instead of 9.66 million USD if adjusting for $RepatDividends_{it}$) in the sample available for regression analysis (untabulated). Taking the log of this adjusted pre-tax profit results in $lnEBTCS_{it}$. As Table 5.8 shows, regression results with respect to adjusted pre-tax profit taking into account the shareholding of a firm in its affiliates support the findings from before. Thus, the coefficients for the tax differential are negative and statistically significant at 0.55% for the overall sample, 0.32% considering only parent firms, 0.30% for firms with at least one low-tax entity in their group, and 0.46% focusing on firms with at least one tax haven entity in their group. With respect to the largest MNCs, the BEPS estimate is negative and statistically significant at 0.50% (size is based on the number of group entities) and 0.31% (size is based on 2018 consolidated total assets). Again, the difference between the estimate of the tax differential for unadjusted pre-tax profit and the one for adjusted pre-tax profit is not statistically significant for all firms, but for most of the sample splits.[19]

[18] See Appendix 5.C, Table 5.18 for results on the statistically significant difference in estimates.
[19] See Appendix 5.C, Table 5.18 for results on the statistically significant difference in estimates.

Table 5.7: *Regression results: Different regression samples*

	Parent firms		Firms with low-tax entity in MNC		Firms with tax haven entity in MNC		Firms of largest MNCs			
							Entity number		Cons. total assets	
	(1) $lnEBT_{it}$	(2) $lnEBTC_{it}$	(3) $lnEBT_{it}$	(4) $lnEBTC_{it}$	(5) $lnEBT_{it}$	(6) $lnEBTC_{it}$	(7) $lnEBT_{it}$	(8) $lnEBTC_{it}$	(9) $lnEBT_{it}$	(10) $lnEBTC_{it}$
$TAXD_{it}$	−0.4514***	−0.3213**	−0.2998***	−0.2913***	−0.4933***	−0.4560***	−0.5438***	−0.4894***	−0.3579**	−0.2817*
	(0.1399)	(0.1603)	(0.0825)	(0.0837)	(0.0762)	(0.0775)	(0.0716)	(0.0731)	0.1660	0.1702
$lnTOAS_{it}$	0.6751***	0.6821***	0.6109***	0.6104***	0.6273***	0.6277***	0.6482***	0.6486***	0.6735***	0.6764***
	(0.0140)	(0.0148)	(0.0058)	(0.0059)	(0.0060)	(0.0060)	(0.0061)	(0.0061)	0.0151	0.0152
$lnEMPL_{it}$	0.0815***	0.0863***	0.1469***	0.1481***	0.1273***	0.1284***	0.1121***	0.1139***	0.1015***	0.1054***
	(0.0065)	(0.0071)	(0.0039)	(0.0039)	(0.0033)	(0.0033)	(0.0032)	(0.0032)	0.0081	0.0082
$lnGDP_{jt}$	−0.0535	−0.3543***	0.2829***	0.2904***	0.3257***	0.3153***	0.2180***	0.1961***	0.2358***	0.2138**
	(0.0724)	(0.0814)	(0.0413)	(0.0418)	(0.0353)	(0.0357)	(0.0338)	(0.0343)	0.0858	0.0872
$lnPOP_{jt}$	−1.0215***	−1.5972***	−0.5717***	−0.7236***	−1.3265***	−1.4550***	−1.2179***	−1.3968***	−1.6246***	−1.6943***
	(0.2018)	(0.2308)	(0.1257)	(0.1279)	(0.1244)	(0.1265)	(0.1087)	(0.1112)	0.3340	0.3395
$INFL_{jt}$	−0.2551*	−0.2349	−0.0040***	−0.0037***	−0.1652***	−0.1263**	−0.0415	0.0137	0.0025	0.0028
	(0.1490)	(0.1587)	(0.0006)	(0.0006)	(0.0547)	(0.0550)	(0.0608)	(0.0612)	0.0020	0.0020
$REGQ_{jt}$	−0.0374	0.0082	−0.0935***	−0.0864***	0.0008	0.0179	−0.0022	0.0168	0.2110***	0.2440***
	(0.0247)	(0.0287)	(0.0194)	(0.0198)	(0.0162)	(0.0166)	(0.0142)	(0.0146)	0.0397	0.0407
N	182,894	182,894	386,441	386,441	504,345	504,345	616,956	616,956	63,497	63,497
Adj.R2	0.0865	0.0697	0.1237	0.1199	0.1173	0.1132	0.1081	0.1030	0.1216	0.1169

Note: This table shows regression results for different samples. A detailed description of all variables is included in Appendix 5.A, Table 5.12. Regressions include firm- and year fixed effects. *, **, and *** denote statistical significance at the 10%, 5%, and 1% level. i refers to the firm, j to the country, and t to the year.

Table 5.8: *Regression results: Robustness*

	All firms	Parent firms	Firms with low-tax entity in MNC	Firms with tax haven entity in MNC	Firms of largest MNCs	
					Entity number	Cons. total assets
	(1) $lnEBTCS_{it}$	(2) $lnEBTCS_{it}$	(3) $lnEBTCS_{it}$	(4) $lnEBTCS_{it}$	(5) $lnEBTCS_{it}$	(6) $lnEBTCS_{it}$
$TAXD_{it}$	−0.5508***	−0.3236**	−0.2962***	−0.4636***	−0.4964***	−0.3068*
	(0.0580)	(0.1572)	(0.0835)	(0.0773)	(0.0728)	(0.1693)
$lnTOAS_{it}$	0.6295***	0.6809***	0.6104***	0.6276***	0.6485***	0.6757***
	(0.0038)	(0.0147)	(0.0059)	(0.0060)	(0.0061)	(0.0152)
$lnEMPL_{it}$	0.1325***	0.0859***	0.1479***	0.1282***	0.1138***	0.1046***
	(0.0025)	(0.0070)	(0.0039)	(0.0033)	(0.0032)	(0.0081)
$lnGDP_{jt}$	0.3755***	−0.3044***	0.2916***	0.3189***	0.2010***	0.2279***
	(0.0278)	(0.0795)	(0.0417)	(0.0356)	(0.0342)	(0.0869)
$lnPOP_{jt}$	−0.7697***	−1.5282***	−0.7116***	−1.4389***	−1.3769***	−1.6888***
	(0.0864)	(0.2262)	(0.1275)	(0.1261)	(0.1108)	(0.3385)
$INFL_{jt}$	−0.1212***	−0.2494	−0.0037***	−0.1324**	0.0048	0.0028
	(0.0383)	(0.1567)	(0.0006)	(0.0550)	(0.0611)	(0.0020)
$REGQ_{jt}$	−0.0600***	−0.0065	−0.0884***	0.0129	0.0117	0.2301***
	(0.0122)	(0.0279)	(0.0197)	(0.0165)	(0.0145)	(0.0405)
N	1,008,763	182,894	386,441	504,345	616,956	63,497
Adj.R2	0.1133	0.0724	0.1206	0.1141	0.1041	0.1179

Note: This table shows regression results related to robustness tests. A detailed description of all variables is included in Appendix 5.A, Table 5.12. Regressions include firm- and year fixed effects. *, **, and *** denote statistical significance at the 10%, 5%, and 1% level. i refers to the firm, j to the country, and t to the year.

5.7 Additional results: MNCs in different countries

Quite a few BEPS analyses are not based on global data but focus on MNCs headquartered in specific countries. For this reason, I repeat the analysis of ownership network structures for the three most frequent locations of the largest MNCs in the ownership dataset – namely, the US, China, and Germany. With over 30 entities, the average US MNC is much larger than the average MNCs with their GUO firm in China and Germany (Table 5.9). In contrast, the share of foreign entities, low-tax entities, and tax haven entities is often much smaller for US MNCs than for the other MNCs.[20] Another distinction between MNCs with their GUO firm in the US and the other two countries is their average number of ownership chains. Thus, the average US MNC has 28 ownership chains. The average Chinese (German) MNC, in turn, has only three (four) ownership chains. Lastly, only the average chain length is similar among MNCs in all countries.

Table 5.9: *MNC characteristics by GUO firm location*

	United States	China	Germany
Average number of entities	30.05	4.03	6.02
Share of foreign entities	12.68	30.52	42.92
Share of low-tax entities	0.79	0.78	1.75
Share of tax haven entities	2.15	10.48	5.32
Average number of chains	27.74	2.78	4.33
Share of foreign chains	12.53	42.02	54.97
Share of foreign chains with a low-tax entity	1.01	1.31	2.38
Share of foreign chains with a tax haven entity	2.92	15.33	8.86
Average chain length	2.83	2.87	3.04

Note: This table shows characteristics of MNCs headquartered in different countries. There are 39,287 US MNCs, 79,199 Chinese MNCs, and 46,172 German MNCs.

[20] For the most fequent locations of foreign entities, low-tax entities, and tax haven entities of US, Chinese, and German MNCs, see Appendix 5.D, Tables 5.19 to 5.21.

Table 5.10: *Share of low-tax entities by ownership chain length in foreign chains with at least one low-tax entity of MNCs in different countries*

	United States				China				Germany			
Chain length	2	3	4	5	2	3	4	5	2	3	4	5
GUO firm	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Level 2	*100.00*	46.43	*45.77*	37.66	*100.00*	63.31	60.83	40.93	*100.00*	56.18	19.45	2.48
Level 3	.	*78.25*	32.89	*44.64*	.	*67.53*	*81.48*	*63.87*	.	*90.58*	54.18	24.76
Level 4	.	.	44.44	23.76	.	.	40.17	59.67	.	.	*83.45*	73.14
Level 5	.	.	.	38.38	.	.	.	28.19	.	.	.	*91.43*
No. of chains	4,658	2,046	2,259	2,079	1,217	308	702	667	2,859	817	550	525

Note: This table shows the share of low-tax entities on each level (out of 100%) by ownership chain length. The highest share of low-tax entities below the GUO firm is in italics. There are 11,042/2,894/4,751 foreign chains including at least one low-tax entity that belong to 3,479/1,426/2,983 US/Chinese/German MNCs.

Table 5.11: *Share of tax haven entities by ownership chain length in foreign chains with at least one tax haven entity of MNCs in different countries*

	United States				China				Germany			
Chain length	2	3	4	5	2	3	4	5	2	3	4	5
GUO firm	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Level 2	*100.00*	66.99	*61.58*	49.15	*100.00*	82.29	*75.90*	52.78	*100.00*	57.98	47.15	22.42
Level 3	.	*72.25*	45.74	*63.28*	.	*72.24*	55.46	*62.34*	.	*75.00*	50.38	*70.56*
Level 4	.	.	39.15	35.16	.	.	48.99	49.07	.	.	*51.04*	38.58
Level 5	.	.	.	29.78	.	.	.	43.72	.	.	.	34.97
No. of chains	10,230	6,274	7,837	7,434	27,402	2,468	1,888	1,997	6,536	3,796	3,319	4,046

Note: This table shows the share of tax haven entities on each level (out of 100%) by ownership chain length. The highest share of tax haven entities below the GUO firm is in italics. There are 31,775/33,755/17,697 foreign chains including at least one tax haven entity that belong to 8,162/28,483/7,965 US/Chinese/German MNCs.

Focusing on the foreign ownership chains with at least one low-tax (tax haven) entity of US, Chinese, and German MNCs, markable differences become apparent (Tables 5.10 and 5.11). Thus, the position of low-tax (tax haven) entities in foreign ownership chains with at least one such entity of US and Chinese MNCs is similar to the overall pattern described in Section 5.5. Consequently, also the implications for BEPS estimates derived there are likely to apply when focusing on these MNCs. In contrast, German MNCs appear to position their low-tax entities to the end of an ownership chain: In foreign ownership chains with at least one low-tax entity consisting of three firms (including the GUO firm), 90.58% of firms on the lowest level but only 56.18% firms directly held by the GUO firm are located in a low-tax country. With 83.45% and 91.43% in chains of four and five entities respectively, the share of low-tax entites is again highest on the level furthest away from the GUO firm. With respect to tax haven entities in foreign ownership chains with at least one such entity of German MNCs, the trend is less pronounced but still noticeable. This suggests that the BEPS estimates considering only German MNCs are likely reported too low rather than too high.

5.8 Conclusion

This paper addresses how the accounting of dividend income in unconsolidated financial statement data can have a crucial impact on BEPS estimates. Since dividends repatriated to a firm from its affiliates represent financial revenues to that firm, they are not only reported in the affiliates' profit and loss statements but also in the one of the respective firm. This double-counting of dividends is more pronounced the more affiliates a firm holds directly or indirectly through ownership chains. Consequently, the ownership structure of MNCs matters to BEPS estimates: If MNCs are headquartered in a low-tax/tax haven country or have entities there that are close to the headquarters firm, profit reported in a low-tax/tax haven country is likely to be too high and BEPS estimates are bound to be overstated.

Exploiting a rich parent-affiliate dataset identifying corporate ownership networks, I study the position of low-tax (tax haven) entities in foreign ownership chains with at least one such entity. I find that low-tax (tax haven) entities are predominately positioned further up an ownership chain – for any given ownership chain length. These results suggest that profit reported by firms in low-tax (tax haven) countries is likely to be too high and, thus, BEPS estimates are overstated.

In line with the above reasoning derived from the ownerhsip structure of MNCs, my regression analysis shows that BEPS estimates based on unadjusted pre-tax profit are overstated for a number of different sample splits. Based on a sample including MNC entities that hold at least one affiliate, I find a profit shifting semi-elasticity of -0.45% before

and -0.32% after correcting pre-tax profit for repatriated dividends. For firms that have at least one low-tax (tax haven) entity in their group, the profit shifting semi-elasticity is -0.30% (-0.49%) if pre-tax profit is unadjusted and -0.29% (-0.46%) otherwise. With respect to the largest MNCs in the sample based on the number of entities, unadjusted pre-tax profit decreases by 0.54% following an increase in the tax differential – adjusted pre-tax profit does so by only 0.49%. Considering the 2018 consolidated total assets, unadjusted (adjusted) pre-tax profit of the largest MNCs decreases by 0.36% (0.28%). Overall, these differences are statistically significant.

Appendix

5.A Variable description

Table 5.12: *Variable description*

Variable	Description
Dividends	Dividends in million USD.
EBT	Earnings before taxation in million USD.
EBTC	Earnings before taxation corrected for dividend repatriations in million USD.
EMPL	Number of employees in thousands.
GDP	Gross domestic product in trillion USD.
INFL	Inflation rate in percent.
lnEBT	Earnings before tax in logarithmic form.
lnEBTC	Earnings before tax adjusted for total dividends received from direct subsidiaries in logarithmic form.
lnEBTCS	Earnings before tax adjusted for share dividends received from direct subsidiaries in logarithmic form. The share is calculated considering a firm's shareholding in its subsidiaries.
lnEMPL	Number of employees in logarithmic form.
lnTOAS	Total assets in logarithmic form.
lnGDP	Level of the GDP (base year 2010) in logarithmic form.
lnPOP	Population level in logarithmic form.
PLBT	Profit or loss before taxation in million USD.
POP	Population level in million.
REGQ	Regulatory quality in form of an index ranging between -2.5 and 2.5. Higher values imply higher quality.
RepatDividends	Total dividends repatriated from all direct subsidiaries in million USD.
RepatDividendsS	Share dividends repatriated from all direct subsidiaries in million USD.
SHFD	Shareholder funds in million USD.
TAXD	Difference between the corporate tax rate of a firm and the simple average of the corporate tax rates of all other firms in the corporate group in percent.
TOAS	Total assets in million USD.

Note: This table provides a detailed description of all variables.

5.B MNC ownership structure: Additional information

Table 5.13: *Most frequent locations of most/largest MNCs*

Most MNCs		Largest MNCs	
Country	Share	Country	Share
China	7.44	United States	22.04
Italy	5.73	China	5.95
Romania	4.83	Germany	5.19
Poland	4.35	Italy	5.03
Germany	4.34	France	4.41
India	4.07	United Kingdom	4.34
United States	3.69	Australia	2.46
France	3.19	Spain	2.42
United Kingdom	3.00	Netherlands	2.25
Ireland	2.81	Japan	2.13

Note: This table shows the 10 most frequent headquarters locations of most/largest MNCs. This table is based on 5,355,736 observations. 1,063,983 of these observations belong to GUO firms.

Table 5.14: *Industry affiliation of most/largest MNCs*

Most MNCs		Largest MNCs	
Industry	Share	Industry	Share
K: Financial and Insurance	25.19	K: Financial and Insurance	22.66
C: Manufacturing	18.62	C: Manufacturing	20.66
M: Scientific Activities	14.49	G: Wholesale and Retail Trade	14.17
G: Wholesale and Retail Trade	11.40	O: Public Administration	7.68
J: Information/Communication	7.46	M: Scientific Activities	6.99
N: Administrative Activities	5.60	J: Information/Communication	5.05
L: Real Estate Activities	4.50	N: Administrative Activities	4.29
F: Construction	3.18	H: Transportation and Storage	2.84
H: Transportation and Storage	2.41	I: Accommodation	2.47
B: Mining and Quarrying	1.54	S: Other Service Activities	2.27

Note: This table shows the 10 most frequent industry affiliation of most/largest MNCs. This table is based on 2,720,718 observations. 92,165 of these observations belong to GUO firms.

Table 5.15: *Most frequent locations of foreign, low-tax, and tax haven entities*

Foreign entities		Low-tax entities		Tax haven entities	
Country	Share	Country	Share	Country	Share
United Kingdom	27.71	Bulgaria	17.47	Netherlands	16.28
United States	9.94	Ireland	15.73	Belgium	11.62
Germany	5.23	Cyprus	11.38	Hong Kong	11.34
Italy	3.48	United Arab Emirates	11.06	Singapore	10.15
Romania	3.40	Hungary	10.90	Ireland	8.63
France	2.82	Virgin Islands	8.33	Luxembourg	8.40
Czech Republic	2.75	Bahrain	5.31	Switzerland	7.23
Hong Kong	2.56	Cayman Islands	3.88	Cyprus	6.25
Singapore	2.18	Estonia	3.73	Virgin Islands	4.57
Spain	2.15	Moldova	1.87	Bahamas	2.91

Note: This table shows the 10 most frequent locations of foreign entities, low-tax entities, and tax haven entities. There are 2,081,193 foreign entities, 303,389 low-tax entities, and 552,995 tax haven entities belonging to 1,063,983 MNCs.

5.C Regression sample: Additional information

Table 5.16: *Most frequent locations*

Country	Share
Romania	7.82
United Kingdom	7.77
Italy	7.58
Spain	6.02
Russia	5.57
France	5.18
Sweden	4.59
Czech Republic	3.78
Slovakia	3.46
Japan	3.45

Note: This table shows the 10 most frequent locations of firms in the regression sample. This table is based on 1,706,908 observations.

Table 5.17: *Industry affiliation*

Industry sector	Share
G: Wholesale and Retail Trade	22.45
C: Manufacturing	18.26
M: Scientific Activities	10.79
L: Real Estate Activities	9.34
J: Information/Communication	6.43
K: Financial and Insurance	6.33
F: Construction	6.24
N: Administrative Activities	5.96
H: Transportation and Storage	4.80
I: Accommodation	1.87

Note: This table shows the 10 most frequent industry affiliations of firms in the regression sample. This table is based on 1,684,389 observations. The sector affiliation is based on the NACE Rev. 2, Level 1 classification.

Table 5.18: *Difference in $TAXD_{it}$ estimates*

Dependent variables	Difference
All firms	
$lnEBT_{it}$ vs. $lnEBTC_{it}$	0.0017
	(0.0081)
$lnEBT_{it}$ vs. $lnEBTCS_{it}$	0.0001
	(0.0073)
Parent firms	
$lnEBT_{it}$ vs. $lnEBTC_{it}$	−0.1301*
	(0.0728)
$lnEBT_{it}$ vs. $lnEBTCS_{it}$	−0.1278*
	(0.0665)
Firms with low-tax entity in MNC	
$lnEBT_{it}$ vs. $lnEBTC_{it}$	−0.0084
	(0.0132)
$lnEBT_{it}$ vs. $lnEBTCS_{it}$	−0.0036
	(0.0120)
Firms with tax haven entity in MNC	
$lnEBT_{it}$ vs. $lnEBTC_{it}$	−0.0372***
	(0.0137)
$lnEBT_{it}$ vs. $lnEBTCS_{it}$	−0.0297**
	(0.0125)
Firms of largest MNCs (entity number)	
$lnEBT_{it}$ vs. $lnEBTC_{it}$	−0.0544***
	(0.0141)
$lnEBT_{it}$ vs. $lnEBTCS_{it}$	−0.0474***
	(0.0129)
Firms of largest MNCs (cons. total assets)	
$lnEBT_{it}$ vs. $lnEBTC_{it}$	−0.0762**
	(0.0358)
$lnEBT_{it}$ vs. $lnEBTCS_{it}$	−0.0511
	(0.0316)

Note: This table provides results on the difference in point estimates of $TAXD_{it}$ from regression analyses based on Equation 5.1 and different samples. A detailed description of all variables is included in Appendix 5.A, Table 5.12. Regressions include firm- and year fixed effects. *, **, and *** denote statistical significance at the 10%, 5%, and 1% level. i refers to the firm and t to the year.

5.D Additional results: MNCs in different countries

Table 5.19: *Most frequent locations of foreign entities of US, Chinese, and German MNCs*

United States		China		Germany	
Country	Share	Country	Share	Country	Share
United Kingdom	19.04	United Kingdom	33.36	United Kingdom	17.56
Canada	13.75	Hong Kong	23.84	United States	10.92
Germany	5.75	Singapore	6.71	Austria	6.91
Brazil	4.00	Italy	6.03	Spain	6.88
China	3.64	Germany	5.79	Czech Republic	5.31
Netherlands	3.61	Serbia	4.13	France	5.03
Australia	3.48	Romania	3.56	Italy	4.80
France	3.05	Australia	2.24	Romania	4.69
Spain	2.82	United States	1.89	Switzerland	2.73
Italy	2.73	Virgin Islands	1.20	Poland	2.72

Note: This table shows the 10 most frequent locations of foreign entities of MNCs headquartered in different countries. There are 149,686 foreign entities belonging to 39,287 US MNCs. There are 97,314 foreign entities belonging to 79,199 Chinese MNCs. There are 119,327 foreign entities belonging to 46,172 German MNCs.

Table 5.20: *Most frequent locations of low-tax entities of US, Chinese, and German MNCs*

United States		China		Germany	
Country	Share	Country	Share	Country	Share
Cayman Islands	26.47	Virgin Islands	47.05	Bulgaria	34.33
Ireland	20.76	Cayman Islands	12.64	Hungary	19.41
United Arab Emirates	9.14	Bulgaria	9.73	Ireland	9.02
Bulgaria	7.34	United Arab Emirates	8.80	Estonia	8.61
Bermuda	6.68	Ireland	5.45	Cyprus	6.31
Bahrain	5.88	Bahrain	3.96	United Arab Emirates	5.55
Virgin Islands	4.84	Cyprus	3.80	Bosnia and Herzegovina	2.68
Hungary	3.98	Bermuda	2.06	Macedonia	2.44
Cyprus	3.31	Marshall Islands	1.33	Moldova	1.80
Estonia	2.55	Bosnia and Herzegovina	1.21	Cayman Islands	1.46

Note: This table shows the 10 most frequent locations of low-tax entities of MNCs headquartered in different countries. There are 9,300 low-tax entities belonging to 39,287 US MNCs. There are 2,476 low-tax entities belonging to 79,199 Chinese MNCs. There are 4,879 low-tax entities belonging to 46,172 German MNCs.

Table 5.21: *Most frequent locations of tax haven entities of US, Chinese, and German MNCs*

United States		China		Germany	
Country	Share	Country	Share	Country	Share
Netherlands	21.23	Hong Kong	69.42	Switzerland	21.99
Luxembourg	15.20	Singapore	19.55	Luxembourg	21.05
Singapore	11.01	Virgin Islands	3.49	Netherlands	20.87
Cayman Islands	9.68	Netherlands	2.43	Belgium	14.34
Hong Kong	8.49	Cayman Islands	0.94	Singapore	6.77
Ireland	7.59	Luxembourg	0.78	Hong Kong	3.82
Belgium	6.81	Belgium	0.67	Malta	3.23
Switzerland	4.49	Switzerland	0.43	Ireland	2.98
Bermuda	2.44	Ireland	0.40	Cyprus	2.08
Bahrain	2.15	Bahrain	0.29	Cayman Islands	0.48

Note: This table shows the 10 most frequent locations of tax haven entities of MNCs headquartered in different countries. There are 25,431 tax haven entities belonging to 39,287 US MNCs. There are 33,421 tax haven entities belonging to 79,199 Chinese MNCs. There are 14,787 tax haven entities belonging to 46,172 German MNCs.

References

Altshuler, R. and Grubert, H. (2006). Governments and multinational corporations in the race to the bottom. *Tax Notes International*, 41(5):459–474.

Beer, S., Coelho, M., and Leduc, S. (2019). Hidden treasures: The impact of automatic exchange of information on cross-border tax evasion. IMF Working Paper No. 286.

Bellak, C. and Leibrecht, M. (2010). Does lowering dividend tax rates increase dividends repatriated? evidence of intrafirm cross-border dividend repatriation policies by german multinational enterprises. *FinanzArchiv*, 66(4):350–383.

Blouin, J. and Robinson, L. (2020). Double counting accounting: How much profit of multinational enterprises is really in tax havens? Retrieved from https://www.taxpolicycenter.org/sites/default/files/blouinrobinson_ssrn.pdf.

Clausing, K. (2009). Multinational firm tax avoidance and tax policy. *National Tax Journal*, 62(4):703–725.

Clausing, K. (2011). The revenue effects of multinational firm income shifting. *Tax Notes*, 28(3):1580–1586.

Clausing, K. (2016). The effect of profit shifting on the corporate tax base in the united states and beyond. *National Tax Journal*, 68(4):905–934.

Clausing, K. (2020). How big is profit shifting? Retrieved from https://www.taxpolicycenter.org/sites/default/files/clausing_how_big_0.pdf.

de Simone, L., Klassen, K. J., and Seidman, J. K. (2017). Unprofitable affiliates and income shifting behavior. *The Accounting Review*, 92(3):113–136.

Dharmapala, D. (2014). What do we know about base erosion and profit shifting? a review of the empirical literature. *Fiscal Studies*, 35(4):421–448.

Egger, P., Merlo, V., Ruf, M., and Wamser, G. (2015). Consequences of the new uk tax exemption system: Evidence from micro-level data. *The Economic Journal*, 125(589):1764–1789.

Fuest, C., Greil, S., Hugger, F., and Neumeier, F. (2022). Global profit shifting of multinational companies: evidence from cbcr micro data. CESifo Working Paper No. 9757.

Garcia-Bernardo, J., Jansky, P., and Torslov, T. (2021). Multinational corporations and tax havens: Evidence from country-by-country reporting. *International Tax and Public Finance*, 28(6):1519–1561.

Gregori, W., Nardo, M., Ndacyayisenga, N., and Rancan, M. (2019). Foreign investment in the eu: The fown dataset. JRC Working Paper No. 118266.

Großkurth, P. (2019). *Multinational Enterprises under Regulation: Three Empirical Essays on Corporate Ownership Structures*. Dissertation, Ruhr-Universität Bochum, Bochum.

Heckemeyer, J. and Overesch, M. (2017). Multinationals' profit response to tax differentials: Effect size and shifting channels. *Canadian Journal of Economics*, 50(4):965–994.

Hines, J. (2010). Treasure islands. *Journal of Economic Perspectives*, 24(4):103–126.

Hines, J. and Rice, E. (1994). Fiscal paradise: Foreign tax havens and american business. *The Quarterly Journal of Economics*, 109(1):149–182.

Horst, T. and Curatolo, A. (2020). Assessing the double count of pretax profit in the irs summary of cbc data for fiscal 2017. *Tax Notes*, 98(4):427–432.

Huizinga, H. and Laeven, L. (2008). International profit shifting within multinationals: A multi-country perspective. *Journal of Public Economics*, 92(5-6):1164–1182.

Huizinga, H., Laeven, L., and Nicodème, G. (2008). Capital structure and international debt shifting. *Journal of Financial Economics*, 88(1):80–118.

Markle, K. (2016). A comparison of the tax-motivated income shifting of multinationals in territorial and worldwide countries. *Contemporary Accounting Research*, 33(1):7–43.

Torslov, T., Wier, L., and Zucman, G. (2022). The missing profits of nations. *The Review of Economic Studies*, 0:1–36.

Yorgason, D. (2009). Collection of data on income and other taxes in surveys of u.s. multinational enterprises. BEA Paper No. 0097.

Zellner, A. (1962). An efficient method of estimating seemingly unrelated regressions and tests for aggregation bias. *Journal of the American Statistical Association*, 57:348–368.

Zellner, A. (1963). Estimators for seemingly unrelated regression equations: Some exact finite sample results. *Journal of the American Statistical Association*, 58:977–992.

Zellner, A. and Huang, D. (1962). Further properties of efficient estimators for seemingly unrelated regression equations. *International Economic Review*, 3:300–313.