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I would like to dedicate this thesis to my loving parents . . .

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Abstract

Tax-motivated profit shifting refers to the tax planning strategies of multinational enterprises (MNEs) to "shift" profits from the parent or subsidiaries in high-tax jurisdictions to subsidiaries in low-tax jurisdictions, with the aim to increase their net income. Although the relevant literature has produced many insights, especially on how to generally identify the potency of profit shifting, we do not have a comprehensive global dataset on profit-shifting intensity at the firm-year level. The present thesis introduces such a dataset and explores potential determinants of profit shifting.

Specifically, it studies the global variation in profit shifting at the firm-year level. The novelty lies in re-estimating existing models of profit shifting using nonparametric estimation techniques that allow obtaining subsidiary-year estimates of profit shifting. The aim is to offer this dataset to international institutions, policy makers, and the academia to get better insights at the very disaggregated level of the effects of profit-shifting on economic activity. With this approach, also important determinants and outcomes of profit shifting can be studied such as democracy and institutional quality, corporate governance, intangible assets and other financial characteristics, which have not been adequately addressed so far in the literature.

In this thesis, four novel subsidiary-year and country-year indices of profit shifting are presented, for a maximum of 95 countries over 2009-2017. Profit shifting differs a lot across countries and sectors, but with similar time trends. Also, it is conditionally negatively correlated with democratic and transparent institutions, as well as with financially developed and sound banking systems and it displays a high intensity among fossil fuel firms and leveraged firms.

Further this thesis tries to establish three causal relationships between profit shifting and democracy, profit shifting and intangible assets and profit shifting and corporate governance, respectively. More specifically, it studies the effect of constitutional democratization and the subsequent evolution of the host country’s institutions on profit-shifting strategies among firms, using the new subsidiary-year measure of profit-shifting.

Further, it studies the role of firms' intangible assets on profit shifting and how this channel is affected by institutional quality. Finally, it examines tax-motivated profit shifting as the outcome of corporate governance characteristics in multinational enterprises (MNEs), such as audit committee size and experience, as well as CEO duality.

Περίληψη

Η μεταφορά κερδών λόγω φορολογικών κινήτρων των πολυεθνικών επιχειρήσεων αναφέρεται σε στρατηγικές αποφυγής φόρων, μέσω των οποίων αυτοί οι πολυεθνικοί όμιλοι μεταφέρουν τα κέρδη από τις μητρικές ή τις θυγατρικές επιχειρήσεις τους που βρίσκονται σε χώρες με υψηλό φορολογικό συντελεστή στις θυγατρικές επιχειρήσεις του ομίλου που βρίσκονται σε χώρες με χαμηλό φορολογικό συντελεστή, με σκοπό να αυξήσουν τα κέρδη μετά φόρων του ομίλου. Παρόλο που η σχετική βιβλιογραφία έχει αναγνωρίσει το φαινόμενο αυτό, και υπάρχουν πολλές έρευνες που τεκμηριώνουν την ύπαρξη του, δεν υπάρχει μια παγκόσμια βάση δεδομένων που να μετρά αυτό το φαινόμενο σε επίπεδο επιχείρησης-έτους. Η παρούσα διατριβή παρουσιάζει μια τέτοια βάση δεδομένων και μελετά διάφορες σχέσεις με πιθανές μεταβλητές που καθορίζουν την μεταφορά κερδών.

Πιο συγκεκριμένα, μελετάται η μεταφορά κερδών για φορολογικούς λόγους σε επίπεδο επιχείρησης-έτους για πάρα πολλές επιχειρήσεις παγκοσμίως. Η καινοτομία έγκειται στην επανεκτίμηση διαφόρων κυρίαρχων μοντέλων της σχετικής βιβλιογραφίας, χρησιμοποιώντας μη παραμετρικές μεθόδους εκτίμησης. Με αυτόν τον τρόπο επιτυγχάνεται η εκτίμηση του φαινομένου αυτού σε επίπεδο θυγατρικής επιχείρησης-έτους. Σκοπός της διατριβής είναι να προσφέρει μια καινοτόμο παγκόσμια βάση δεδομένων σε διεθνείς οργανισμούς (ΟΟΣΑ), διαφόρους φορείς αλλά και στους υπόλοιπους ερευνητές, ώστε αυτοί να κατανοήσουν καλύτερα το φαινόμενο και να μελετήσουν τυχόν επιδράσεις του στην οικονομική δραστηριότητα. Με αυτή τη βάση δεδομένων, είναι δυνατό να μελετηθούν και να κατανοηθούν καλύτερα, πιθανές σχέσεις της μεταφοράς κερδών για φορολογικούς λόγους με άλλες μεταβλητές, όπως η ποιότητα της δημοκρατίας και των θεσμών μιας χώρας, η εταιρική διακυβέρνηση, τα άυλα περιουσιακά στοιχεία των επιχειρήσεων και διάφορες χρηματοοικονομικές μεταβλητές, οι οποίες δεν έχουν μελετηθεί διεξοδικά μέχρι στιγμής στη σχετική βιβλιογραφία.

Σε αυτή τη διατριβή, παρουσιάζονται τέσσερις καινοτόμοι δείκτες μεταφοράς κερδών για φορολογικούς λόγους σε επίπεδο θυγατρικής-έτους και χώρας-έτους. Αυτοί παρουσιάζονται για 95 χώρες κατά την περίοδο 2009-2017. Η μεταφορά κερδών για φορολογικούς λόγους διαφέρει μεταξύ των διαφόρων χωρών και κλάδων παραγωγής, αλλά παρουσιάζει ίδιες χρονικές τάσεις. Επιπλέον, είναι αρνητικά συσχετισμένη με μεταβλητές που μετρούν την ποιότητα της δημοκρατίας και των θεσμών μιας χώρας, όπως και με μεταβλητές που μετρούν την ποιότητα των χρηματοοικονομικών και τραπεζικών θεσμών μιας χώρας, και παρουσιάζει υψηλή ένταση για τις εταιρίες που είναι μοχλευμένες και που ανήκουν κλάδο των ορυκτών καυσίμων.

Επιπλέον, αυτή η διατριβή προσπαθεί να εισάγει τρεις σχέσεις αιτίου-αιτιατού, μεταξύ της μεταφοράς κερδών για φορολογικούς λόγους και κατά σειρά των κάτωθι μεταβλητών: ποιότητα δημοκρατίας χώρας, άυλα περιουσιακά στοιχεία επιχείρησης και εταιρική διακυβέρνηση. Ειδικότερα, μελετά την επίδραση της ποιότητας της συνταγματικής δημοκρατίας και της επακόλουθης εξέλιξης των θεσμών μιας χώρας στις στρατηγικές μεταφοράς των κερδών των πολυεθνικών επιχειρήσεων για φορολογικούς λόγους.

Επίσης, μελετά τον ρόλο των αύλων περιουσιακών στοιχείων μιας επιχείρησης στη μεταφορά κερδών για φορολογικούς λόγους και την επίδραση της ποιότητας των θεσμών σε αυτόν τον μηχανισμό. Τέλος, εξετάζει την επίδραση διαφόρων μεταβλητών της εταιρικής διακυβέρνησης (μέγεθος και εξειδίκευση της ελεγκτικής επιτροπής, δυαδικότητα του Γενικού Διευθυντή) στη μεταφορά κερδών για φορολογικούς λόγους.

Table of contents

Introduction 1

1. Motivation 1

2. Structure of the Thesis 2

Global Evidence on Profit Shifting: A New Database 4

1. Introduction 5

2. Key methods to identify profit shifting 7

i. Response of subsidiary profits to tax incentives 8

ii. Response of subsidiary profits to parent profits earnings shocks 9

iii. Comparing the two models 11

3. Estimation method and data 12

i. Estimation of profit shifting by subsidiary-year 12

ii. Data and variables 13

4. The global profit-shifting database 15

i. Average estimates 15

ii. Country and time variation of profit shifting 16

iii. Additional robustness tests 18

5. Correlates of profit shifting 18

i. Profit shifting as the outcome variable of country-level characteristics 18

ii. Profit shifting as an explanatory variable of firm-level outcomes 21

6. Conclusion and directions for future research 21

Tables 23

Figures 34

Appendix 39

i. Sample construction 40

ii. Tables 42

Democracy, Institutions, and International Profit-Shifting 57

1. Introduction 58

2. Theoretical Framework 60

i. Constitutional Democracy and Tax-Related Profit-Shifting 60

ii. Democratic Institutions and Tax-Related Profit Shifting 62

3. Empirical Model 64

i. Estimation of Profit-Shifting by Subsidiary Year 64

ii. Democracy and Profit-Shifting 66

iii. Summary Statistics 69
4. Empirical Results 70
i. Democracy and Profit-Shifting: Baseline Results 70
ii. Components of Democracy and Profit-Shifting 71
iii. What Institutions are More Conductive to Less Profit-Shifting? 72
5. Conclusion 73
Tables 74
Figures 84
Appendix 86
i. Sample Construction 86
ii. Tables 88
Global Evidence on Profit Shifting: The Role of Intangible Assets 99
1. Introduction 100
2. Modelling profit shifting 103
i. Empirical model 103
ii. Estimation of profit shifting by subsidiary–year 105
3. Global estimates of profit shifting 106
i. Data and variables 106
ii. Profit shifting estimates 107
iii. Country and time variation of profit shifting 108
iv. Additional robustness tests 110
4. Intangible assets and profit shifting 110
i. Empirical model and data 110
ii. The effect of intangible assets on profit shifting 111
iii. Inference from instrumental variables and events 113
iv. The role of institutional quality in subsidiaries' countries 114
5. Conclusions and directions for future research 115
Tables 117
Figures 125
Appendix 133
i. Sample construction 134
ii. Tables 135
Corporate Governance and Profit Shifting: The Important Role of the Audit Committee 147
1. Introduction 148
2. Hypothesis development 152

i. The unique characteristics of profit shifting and related literature 152
ii. The audit committee 154
3. Estimation of profit shifting 157
i. Empirical model 157
ii. Estimation and results 159
4. Corporate governance and profit shifting 162
i. Identifying the effect of corporate governance on profit shifting 162
ii. Baseline empirical results 165
iii. The roles of audit committee member experience and CEO duality 168
5. Conclusions and policy implications 169
Figures 171
Tables 174
Appendix 185
i. Technical details for the nonparametric estimation 186
ii. Tables 187
Conclusion 203
Bibliography 205

Chapter I

Introduction

1. Motivation

My motivation for my research comes from a personal experience. Some years ago, I worked as a financial consultant in a consulting company in Greece. There, I faced several profit-shifting firms, especially engaging in tactics like transfer pricing. Dealing with these tax avoidance tactics fascinated me and generated many research questions. This, alongside the current discussion regarding all these high-tech companies like Google, which shift huge amounts of profits, using for instance the double-Irish tax arrangement (*The Irish Times*), motivated me to pursue a PhD in international taxation and profit shifting and complete this thesis. With my research I try to answer to the following:

- What drives profit-shifting around the world?
- What are the implications of profit-shifting in global economies?

Tax-motivated profit shifting refers to the tax planning strategies of multinational enterprises (MNEs) to "shift" profits from the parent or subsidiaries in high-tax jurisdictions to subsidiaries in low-tax jurisdictions, with the aim to increase their net income. The practice has attracted considerable interest in recent years by academics and policy makers. Alongside the standard objective of decreased tax fairness by eroding government revenue bases, profit shifting poses welfare and fiscal challenges. Economic globalization, which forces countries to compete for capital, intensified profit shifting and triggered efforts and policies by governments and international organizations to contain it. The most prominent of these efforts are the OECD's Base Erosion and Profit Shifting (BEPS) initiative and the June 2021 agreement among G7 finance ministers to seek a global minimum corporate tax rate of at least 15 percent (Rappeport, 2021). Given the importance of the problem, a substantial empirical literature in economics, accounting, and management science focuses on understanding the potential sources and outcomes of profit shifting.

Although this literature has produced many relevant insights, especially on how to generally identify the potency of profit shifting, we do not have a comprehensive global dataset on profit-shifting intensity. The main contribution of this thesis is that it introduces such a dataset, the global profit shifting database (GPSD), which is obtained from estimating profit shifting by subsidiary-year and then aggregating across country-year.

My analysis is motivated by several research and policy questions regarding profit shifting. To what extent do countries differ? Are corporate tax rates the only macroeconomic determinant of profit shifting? What other factors (such as institutions, culture, and geography) determine profit shifting at the country level? How large is

cross-country variation compared to within country variation? Does profit shifting vary with firm characteristics, such as risk-taking and corporate governance? How does profit-shifting affect MNEs' real investment, financing, and capital structure? What are the macroeconomic-fiscal outcomes of profit-shifting (outcomes on innovation, economic growth, institutional quality, labor market, etc.)? Robustly estimating profit shifting by subsidiary-year and country-year is a prerequisite to answering these questions.

2. Structure of the Thesis

The present thesis aims to introduce a novel firm-year profit shifting dataset with four profit-shifting indices, and establish three causal relationships between profit shifting and possible determinants. To effectively study this issue, the thesis is organized into four essays each one consisting a separate chapter.

The second chapter studies the global variation in profit shifting. I build on two models, which are the ones favored in most of the literature, those of Huizinga-Laeven (2008) and Dharmapala-Riedel (2013). Both these models identify profit shifting in general via a single (constant) parameter estimate. A key novelty of this chapter is to identify profit shifting by subsidiary-year and, to this end, I estimate these models using nonparametric techniques. I construct novel subsidiary-year and country-year indices for a maximum of 95 countries over 2009-2017. Substantive differences in profit shifting across different countries and sectors are uncovered, but with similar time trends. I also show that profit shifting is conditionally negatively correlated with democratic and transparent institutions, as well as with financially developed and sound banking systems. Equally important, profit shifting displays a high intensity among fossil fuel firms and leveraged firms. These data and results open important pathways for analyzing the sources and effects of profit shifting.

The third chapter studies the effect of constitutional democratization on profit-shifting strategies among firms. Using a new subsidiary-year measure of profit-shifting I examine how it responds to changes in constitutional democracy and the subsequent evolution of the host country's institutions. The main findings show that a one-standard-deviation increase in the Polity IV democracy index yields an approximately 37% decrease in profit-shifting to other countries. Protection of property rights, contract enforcement, and superior regulatory quality emerge as the key institutional channels that define the decision to keep profits at home. The results are robust to an instrumental variables approach and a large battery of additional robustness tests.

The fourth chapter considers global variations in profit shifting and the role played therein by firms' intangible assets. The main contribution of this chapter is that the subsidiaries' ratio of intangible assets emerges as a key determinant of profit shifting. Averaging the profit-shifting measure across countries and years, a gradual decline in the intensity of profit shifting from 2011 to 2016 is observed, consistent with the BEPS initiative and the emergence of more stringent policies to fight profit shifting. However, I observe the opposite trend if I average on firms across industries with the highest intangibles ratios, particularly firms in the education, financial, and information and communications technology sectors. The formal empirical analysis shows that a one standard deviation increase in the ratio of intangible assets to total assets increases profit shifting by approximately 3 percent. Moreover, consistent with the hypotheses on the heterogenous effect of firms' intangibility on profit shifting, I find stronger results in countries with weaker institutions.

In the fifth chapter, I examine tax-motivated profit shifting as the outcome of corporate governance characteristics in multinational enterprises (MNEs). A novel subsidiary-year measure of profit shifting is proposed, estimated from the responses of subsidiary profits to exogenous parent earnings shocks. Subsequently, I hypothesize that audit committee size and experience, as well as CEO duality are key factors affecting profit shifting. The baseline results show that increasing audit committee size by one standard deviation increases profit shifting by an economically significant 7.8%. I also find that this positive effect reverses for MNEs with higher numbers of audit committee members who have audit expertise and for MNEs without CEO duality.

Overall, the novel firm-year profit-shifting dataset alongside the causal relationships that I try to establish, are only a first step to uncovering the potential of this dataset for analyzing profit shifting at the firm or aggregate level. The global profit shifting database can be used by researchers to analyze either the factors causally affecting profit shifting or the causal effects of profit shifting on firm-specific or country-specific characteristics.

Chapter II

Global Evidence on Profit Shifting: A New Database

This chapter studies the global variation in profit shifting. For this purpose, we build on existing models on the estimation of profit shifting and use nonparametric estimation techniques that allow obtaining subsidiary-year estimates. We construct novel subsidiary-year and country-year indices for a maximum of 95 countries over 2009-2017. We uncover substantive differences in profit shifting across different countries and sectors, but with similar time trends. We also show that profit shifting is conditionally negatively correlated with democratic and transparent institutions, as well as with financially developed and sound banking systems. Equally important, profit shifting displays a high intensity among fossil fuel firms and leveraged firms. Our data and results open important pathways for analyzing the sources and effects of profit shifting.

1. Introduction

Tax-motivated profit shifting refers to the tax planning strategies of multinational enterprises (MNEs) to "shift" profits from the parent or subsidiaries in high-tax jurisdictions to subsidiaries in low-tax jurisdictions, with the aim to increase their net income. The practice has attracted considerable interest in recent years by academics and policy makers. Alongside the standard objective of decreased tax fairness by eroding government revenue bases, profit shifting poses welfare and fiscal challenges. Economic globalization, which forces countries to compete for capital, intensified profit shifting and triggered efforts and policies by governments and international organizations to contain it (e.g., the OECD's Base Erosion and Profit Shifting – BEPS – initiative). Given the importance of the problem, a substantial empirical literature in economics, accounting, and management science focuses on understanding the potential sources and outcomes of profit shifting.[1]

Although this literature has produced many relevant insights, especially on how to generally identify the potency of profit shifting, we do not have a comprehensive global dataset on profit-shifting intensity. This paper introduces such a dataset, the global profit shifting database (GPSD), which is obtained from estimating profit shifting by subsidiary-year and then aggregating across country-year.

Our analysis is motivated by several research and policy questions regarding profit shifting. To what extent do countries differ? Are corporate tax rates the only macroeconomic determinant of profit shifting? What other factors (such as institutions, culture, and geography) determine profit shifting at the country level? How large is cross-country variation compared to within country variation? Does profit shifting vary with firm characteristics, such as risk-taking and corporate governance? How does profit-shifting affect MNEs' real investment, financing, and capital structure? What are the macroeconomic-fiscal outcomes of profit-shifting (outcomes on innovation, economic growth, institutional quality, labor market, etc.)? Robustly estimating profit shifting by subsidiary-year and country-year is a prerequisite to answering these questions.

The empirical models identifying the potency of profit shifting examine the effect of differential tax rates among countries on the subsidiaries' before-tax profits. We build on two models, which are the ones favored in most of the literature (Dharmapala, 2019). The first is the Huizinga-Laeven (2008) model, which identifies profit shifting from the response of subsidiary profits to tax incentives that are in turn a function of tax differences in the affiliates' (parents and subsidiaries) countries. We call this the *Profit shifting tax incentive*. The assumption of this model is that an increase in tax rate differences incentivizes subsidiaries to send more profit to the low tax jurisdiction. The second is the Dharmapala-Riedel (2013) model, which identifies profit shifting from the response of subsidiary profits to earnings shocks to firms that are comparable with the parent. We call this the *Profit shifting earnings shock*. The assumption of this model is that a positive earnings shock to the parent will increase profits of a subsidiaries in low-tax jurisdictions. We do not take a strong stand on which model is best, especially as each has its own merits and implications for different types of studies. We do note, however, that Huizinga and Laeven's profit shifting tax

[1] A nonexhaustive list includes Huizinga and Laeven (2008); Overesch (2009); Dharmapala (2014); Sugathan and George (2015); Dyreng and Markle (2016); Clausing (2016); Markle (2016); De Simone (2016); Torslov et al. (2018); Koethenbuerger et al. (2019); Guvenen et al. (2019).

incentives model is more inclusive because it encompasses flows from all affiliates (and not just from the parent to subsidiaries).

Both these models identify profit shifting in general via a single (constant) parameter estimate. A key novelty of our approach is to identify profit shifting by subsidiary-year and, to this end, we estimate these models using nonparametric techniques. The simplest of these techniques are those based on the nonparametric kernel regression, which mimics the parametric ordinary least squares (OLS).

The key difference is that the nonparametric regression makes no assumptions for the slope of the regression in the full sample because estimation is carried out for local samples within sliding windows of observations. For example, for an estimate on observation x_i (in our case reflecting the corporate tax differential between subsidiaries and parents), we use the observations closest to it (sliding window around x_i). In this way, we obtain an estimate on x_i for the observations in the corresponding window. Then, we move to the closest to x_i observation x_j and do the same analysis for x_j (estimation using the observations in the window around x_j). Thus, estimation is carried out for each value of x using overlapping sliding windows from which we obtain estimates equal to the number of observations (as long as we have dense observations around each x).

Subsequently, we aggregate the subsidiary-year estimates to produce country-year estimates of profit shifting. Depending on the model used and data availability, the GPSD covers a maximum of 95 countries for the period 2009-2017 (maximum of 26,593 subsidiaries). The maximum number of subsidiary-year observations for which we estimate profit shifting is 106,301.

The different profit shifting measures provide similar inferences when it comes to the main overall trends but do differ when compared at a finer level. Our results show a gradual decline in the intensity of profit-shifting from 2011 to 2016, consistent with the BEPS initiative and the emergence of more stringent policies to fight profit shifting. However, the trend stops in 2016 and this raises interesting questions about the recent emergence of new tax havens. On average, we find that subsidiaries in Cayman Islands, United Arab Emirates, Bermuda, and Oman are the ones engaging in more aggressive profit shifting, especially in the first years of our sample, while Peru and Thailand emerge as key countries in the last few years of our sample.

Equally important, our results reveal that the firms shifting most profit are by far those in the mining and quarrying industries, especially fossil fuel firms. This finding is intuitive because fossil fuel firms have subsidiaries in many countries, but it also reflects a rather unexplored issue in sustainable development and environmental economics.

Our analysis then takes a first stance on the determinants (conditional correlates) of profit shifting at the aggregate (country-year) level. We first show that profit shifting is lower in larger countries, validating the generally accepted notion that tax havens are smaller countries. More importantly, we find low profit shifting in countries with stronger constitutional democracies and with qualitative institutions such as control of corruption. Consistent with our findings on more profit shifting by fossil fuel firms, we find more profit shifting in countries with higher electricity production from oil sources and less renewable energy consumption.

An important conditional correlate of profit shifting is banking development. Specifically, we find more profit shifting in countries with low bank capitalization, bank concentration, and overall financial health. These results call for deeper understanding of the underlying forces linking banks to profit shifting, especially as regards the structure of the banking systems and creditor rights. We also find more profit shifting

in countries with high foreign claims, liquid liabilities, and interest payments, while the opposite holds in countries with high factoring volume.

Finally, at the firm-level, we study the conditional correlation of profit shifting with subsidiaries' capital structure and employment. We find that firms with higher profit shifting take more leverage and have lower working capital and liquidity, consistent with their potential role as tax-haven subsidiaries or their presence in countries with financially less sound banking systems (used by their MNEs as credit-obtaining vehicles). Consistent with these roles, we also find that such subsidiaries have fewer employees.

The structure of the paper is as follows. Section 2 discusses the key empirical models used to identify profit shifting and how we slightly transform them for our estimations. Section 3 provides the details of the nonparametric estimation of these models to produce the subsidiary-year profit-shifting estimates. Section 4 presents the empirical results and reports the aggregate profit-shifting database. Section 5 discusses the conditional correlations of profit shifting. Section 6 concludes the paper.

2. Key methods to identify profit shifting

The costs and benefits of tax planning for MNEs have been the subject of voluminous research (e.g., De Simone et al., 2019; Wilde and Wilson, 2018). Like many corporate strategic decisions, some level of tax planning enhances firm value, but too much can destroy value, especially if the practice is illegal. This results in a firm-specific optimum (Slemrod, 2004; Cook et al., 2017). Excessive tax aggressiveness reduces value in specific settings, such as accounting fraud (Lennox et al., 2013), debt costs (Hasan et al., 2014), and stock price crash risk (Kim et al., 2011). Because the main objective of tax planning is to lower the present value of tax payments to governments, tax planning increases cash flows and sometimes reported income. However, at least as far back as Enron's tax-planning activities came to light in 2001, it is also clear that when tax planning becomes too aggressive, firm value eventually suffers because of the legal and reputational costs (Oppel, 2001).

International profit shifting falls into the category of tax-avoidance tactics but differs in the following ways: (i) it requires an international network of affiliates; (ii) it navigates a complex set of laws and regulations that permit firms to reduce their domestic tax bases and allow foreign countries to tax these earnings (Desai and Dharmapala, 2009); and (iii) it is not necessarily illegal. Moreover, international profit shifting increasingly withstands scrutiny from high-tax-rate countries (Mescall and Klassen, 2018). The enactment and implementation of BEPS under the OECD/G20 framework shows that large countries take considerable steps to reduce tax avoidance.

MNEs exploit loopholes and ambiguities in tax laws of different countries, making it hard for a single country to confront profit-shifting on its own. In the same line, unlike other aggressive tax-planning strategies, profit shifting falls more heavily into the grey area of tax compliance because the taxation is based on concepts (such as the arm's length principal) that are subject to broad interpretation. If this holds for a particular profit shifting strategy, tax reductions might bear lower expected costs than other forms of aggressive tax reductions, raising MNEs' incentives to conduct more aggressive profit shifting. These distinguishing elements of profit shifting compared to other tax-planning strategies generate multiple research questions, which can only be addressed with meaningful measures of the intensity of this phenomenon.

In the literature, there are two main empirical models to identify base erosion and profit shifting. With some modifications, these are the models also used in our analysis. We discuss them in turn.

i. Response of subsidiary profits to tax incentives

The basic premise of Hines and Rice (1994) is that the observed pretax income of a subsidiary of a U.S. multinational that is located in a low-tax jurisdiction represents the sum of "true" income and "shifted" income (where the latter can be either positive or negative). A subsidiary's true income originates from production, which is approximated by a typical Cobb-Douglas production function including measures of capital and labor, such as fixed assets and employment compensation. Shifted income is driven by the tax incentive to move income in or out of the subsidiary, considering the differential tax rate between the parent and the subsidiary countries.

Huizinga and Laeven (2008) extend this simple tax incentive, by allowing for tax-rate differentials across countries of all subsidiaries in the same group. Profit reported by a low-tax subsidiary that cannot be accounted for by the subsidiary's own labor and capital inputs is attributed to profit shifting. Besides, because of the increasing availability of micro-level data, Huizinga and Laeven exploit panel data techniques to control for unobservable time-invariant determinants of corporate profits.

Huizinga and Laeven's empirical model is the following:

$$log\,\pi_{it} = a_1 CT_{it} + a_2\, log\, K_{it} + a_3 log L_{it} + \gamma\, C_{it} + \mu_i + \delta_t + \varepsilon_{it} \qquad (1)$$

In equation 1, π_{it} represents the observed pre-tax income of subsidiary *i* in year *t*, K_{it} represents subsidiary's capital inputs (measured by fixed tangible assets) and L_{it} its labor inputs (measured by employment compensation). C_{it} is a vector of subsidiary-level controls, μ_i represents subsidiary fixed effects (which control for time-invariant unobserved characteristics of subsidiary *i*), δ_t represents year fixed effects (which control for time-varying unobserved common changes in the profitability of all subsidiaries), and ε_{it} is the error term. Huizinga and Laeven use natural logarithms to exclude subsidiaries with negative profits.[2]

The tax incentive variable CT_{it} is defined as:

$$CT_{it} = \frac{1}{(1-\tau_i)} \frac{\sum_{k\neq i}^{n} (\frac{B_k}{1-\tau_k})(\tau_i - \tau_k)}{\sum_{k=1}^{n} (\frac{B_k}{1-\tau_k})}, \qquad (2)$$

where τ_i is the statutory tax rate of the subsidiary's country; τ_k the statutory tax rates of all the affiliated subsidiaries' countries; and B_k are subsidiaries' sales (or assets in case sales data are too distorted by profit shifting) used to proxy for a multinational's scale of activities in different locales.

Changes in the tax rate differential between subsidiary *i* and other subsidiaries in the same group are typically generated by tax reforms in either subsidiary *i*'s country or in the countries of the group's other subsidiaries. Thus, they are unlikely to be attributable directly to the subsidiary's own behavior or choices. The related literature distinguishes between effective and statutory tax rates when calculating the tax rate

[2] By excluding loss-making subsidiaries they might lose part of profit shifting, occurring when real losses exceed shifted income from affiliates (De Simone et al., 2017).

differential CT_{it}. Several tax deductions offered by different national tax systems tend to differ effective tax rates from statutory. Given that effective tax rates relate to corporate endogenous choices, e.g. use of depreciation, amortization, debt or other deductible expenses, statutory tax rates are preferred. Moreover, multinationals shift profits among affiliates in which they already operate. Thus, they exploit tax allowances, which depend on differences in the statutory (and not the effective) tax rate (Deveraux and Mafini, 2007; Huizinga and Laeven, 2008).

The coefficient of main interest in equation 1 is a_1. It reflects the extent to which the multinational shifts profits into or out of subsidiary *i* due to a marginal change in tax rates, *ceteris paribus*. We are interested in the negative a_1 in equation 1, i.e., an increase (decrease) in CT_{it} via an increase (decrease) in τ_i leads subsidiaries to send more profit abroad (receive more profit from abroad) and thus reduce (increase) domestic π_{it}. This implies that we disregard cases of positive responses (i.e., responses when the subsidiary does not send profits abroad when tax rates in the host country increase).

It is important to note that the coefficient a_1 is an aggregate estimate (given that it is a point estimate) and thus cannot be used as a firm-year index of profit shifting. Its importance is in the identification and potency of profit shifting in a given sample of firms (on which equation 1 is estimated).

ii. Response of subsidiary profits to parent profits earnings shocks

Dharmapala and Riedel (2013) further build on the approaches by Hines and Rice (1994) and Huizinga and Laeven (2008), with an effort to identify profit shifting from exogenous shocks. Specifically, their model identifies the effect of an exogenous shock at time *t* to the parent's *p* pretax and pre-shifting profit $\tilde{\pi}_{pt}$, on the subsidiary's *i* profits π_{it} in a low-tax country. The low-tax subsidiaries form a treatment group and are compared to subsidiaries in high-tax countries. In the presence of tax-motivated profit shifting, Dharmapala and Riedel expect that an exogenous increase in the parent pretax and pre-shifting profits (a positive earnings shock) would disproportionately lead to increases in the pretax profits of a low-tax subsidiary relative to a high-tax subsidiary.

The empirical model takes the form:

$$log\pi_{it} = \beta_1\left(d_{it} \cdot log\tilde{\pi}_{pt}\right) + \beta_2 log\tilde{\pi}_{pt} + \beta_3 d_{it} + C_{it} + e_{it} \qquad (3)$$

The dummy variable d_{it} is the differences-in-differences (DID) identifier: it equals one if the subsidiary faces a lower corporate tax rate than the parent firm; it equals zero otherwise. The model includes controls C_{it} for the subsidiary i's size a_{it} (*Subsidiaries' assets*), measured by the natural logarithm of total assets, and its exposure to debt measured by the subsidiary's leverage (*Subsidiaries' leverage*). The term e_{it} is the stochastic disturbance.

The true parent profits (i.e., before profit shifting) are unobserved. To construct $\tilde{\pi}_{pt}$, Dharmapala and Riedel follow the approach by Bertrand et al. (2002),[3] and use the system of equations:

$$\tilde{\pi}_{pt} = \widehat{ROA}_{pt} * \alpha_{pt}, \qquad (4)$$

[3] Bertrand et al. (2002) examine tunneling, an illegal business practice in which a majority shareholder or high-level company insider directs company assets or future business to themselves for personal gain.

$$\widetilde{ROA}_{pt} = \sum_j \frac{\alpha_{jt}}{\sum_j \alpha_{jt}} \cdot ROA_{jt}, p \neq j, \ \forall\, t \in \{1, \dots, T\} \quad (5)$$

In equations 4 and 5, α_{pt} denotes the total assets of the parent firm p. In turn, α_{jt} denotes the total assets of *comparable* parent firms j in year t, and $ROA_{jt} = \pi_{jt}/\alpha_{jt}$ the *comparable* parents' pretax profit over total assets. The product of the average industry profitability ratio $\widetilde{ROA}_{pt}$ with the parent total assets α_{pt} (minus the total assets of each subsidiary) gives the measure of parent earnings $\tilde{\pi}_{pt}$. A firm is defined as comparable if it belongs in the same industry (four-digit NACE) and country each year with the specific parent firm *p*. Dharmapala and Riedel use only subsidiaries that are active in different industries and countries from their parents to avoid potential endogenous effects the earning shocks might exert on them. However, this restriction might confine the precise estimation of profit shifting, as many related firms that engage themselves in transfer-pricing activities operate in the same industry.

Using $\tilde{\pi}_{pt}$ in equation 3 introduces exogenous shocks to parents' earnings by assuming that $\widetilde{ROA}_{pt}$ is a function of comparable firms' *ROA* and the observed subsidiaries operate in a different industry. This process mitigates potential selection bias between the profit-shifting shocks and virtually all characteristics of parent firms. The reason is quite simple: given that the profitability shock to the parent firm is exogenous to the internal firm processes, the firm could not have adjusted (selected) its choices to change its profit shifting in the same period. This is a key advantage of the Dharmapala and Riedel (2013) model.

If tax-motivated profit-shifting occurs, then $\hat{\beta}_1$ is expected to be positive. This implies that a parent-firm earnings shock, $\tilde{\pi}_{pt}$, will propagate asymmetrically toward low-tax subsidiaries compared to high-tax subsidiaries. The issue of course, as in Huizinga and Laeven's model, is that the slope $\hat{\beta}_1$ is a constant and does not change by subsidiary-year.

We slightly deviate from the benchmark Dharmapala and Riedel (2013) model discussed so far. Our premise is that instead of including in equation 3 the deterministic true parent profits $\tilde{\pi}_{pt}$, calculated from equations 4 and 5, we estimate the true parent profits using the prediction from equation 6:

$$log\pi_{pt} = \beta_1\, \tilde{\pi}_{pt} + \beta_2 ce_{pt} + \zeta_p + u_{pt} \quad (6)$$

We prefer this approach because we allow a stochastic component on the effect of an earnings shock to comparable firms on the parent's true earnings. This is important because the earnings shocks do not usually pass deterministically to different firms.

In equation 6, π_{pt} represents the observed parent's pre-tax profit in logs (*Parents' earnings before taxes*), $\tilde{\pi}_{pt}$ represents earnings shocks (*Parents' earning shocks*) and ce_{pt} is parent's cost of employees in logs (*Parents' cost of employees*). We add a full set of parent fixed effects indicated by ζ_p. The error term is denoted by u_{pt}. The intuition behind the use of parent's cost of employees ce_{pt} is that it represents the production factor, labor. According to a Cobb-Douglas production function, we also need a proxy for the production factor of capital (e.g. fixed assets). However, because the earnings shock variable includes total assets of the parent, we do not use an additional asset variable due to collinearity issues.

Next, we use the predicted values of equation 6 in equation 7:

$$log\pi_{it} = \gamma_1\left(d_{it} * log\hat{\pi}_{pt}\right) + \gamma_2 log\hat{\pi}_{pt} + \gamma_3 d_{it} + C_{it} + \varepsilon_{it} \quad (7)$$

The variable $\hat{\pi}_{pt}$ represents these fitted values (*Parents' predicted earnings*). We anticipate positive responses if tax-motivated profit shifting takes place, because they imply that parents shift profits to low-tax subsidiaries.

iii. Comparing the two models

The two methods for profit-shifting identification have an important difference. The Huizinga-Laeven variant (named *Profit shifting tax incentive*) considers the responses of subsidiaries' earnings to changes in tax-rate differentials across countries of all subsidiaries in the same group, essentially representing how much profit subsidiaries send abroad (receive) when tax rates in the host country increase (decrease). On the other hand, the Dharmapala-Riedel variant (named *Profit shifting earnings shock*) considers the responses of subsidiaries' earnings to estimated parent's pre-tax and pre-shifting profits, essentially representing how much profit subsidiaries receive when an exogenous increase in the parent pre-tax and pre-shifting profits (a positive earnings shock) occurs.

To further clarify, consider the examples in Figures 1 and 2. In Figure 1, Affiliate 1 shifts profits to its low-tax subsidiaries in the same multinational group (IP Holdco and the Service Centre). In the estimation technique, a change in the tax rate differential CT_{it} between Affiliate 1 and the other subsidiaries in the same group via an increase in Germany's statutory tax rate leads Affiliate 1 to send more profit abroad and thus reduce its *Subsidiaries' earnings before taxes* (π_{it}). This response is captured by $a_1 < 0$.

In Figure 2, the example is an abstraction from the IKEA structure documented in Auerbach (2016). In our example, the parent firm shifts profits to its low-tax subsidiaries (IP Holdco, Affiliate 2, and the Service Centre). We assume the operating affiliates, Affiliate 1 and Affiliate 2 are not in the same industry as the parent. In the estimation technique, a profit shock in the parent's country, industry and year instruments a shock to the parent's profits. The estimation then uses observed profits in the three non-financial affiliates that are in different industries from the parent. To the extent that the parent's instrumented profit shock shows up to a greater degree in low tax-rate affiliates than in the high tax-rate affiliate (Affiliate 1), captured by $\gamma_1 > 0$, we conclude that there is profit shifting.

[Please insert Figures 1 and 2 about here]

Simplicity and the analysis of all tax rate differentials between subsidiaries of a multinational are strong arguments in favor of the tax incentives model, while accounting for endogeneity issues via the use of earnings shocks to parents justifies the use of the earnings shocks model. We do not take a strong stand on which model better estimates profit shifting, which at the end is a choice based on the aims of each research question. Thus, we build on both models to construct the subsidiary-year estimates.

3. Estimation method and data

i. Estimation of profit shifting by subsidiary-year

To measure profit shifting by subsidiary-year, we estimate subsidiary-year responses $a_{1,it}$ and $\gamma_{1,it}$ in equations 1 and 7, respectively. We do so, using nonparametric models, also called varying coefficient models as they allow coefficients to vary by observation (for an introduction, see e.g., Loader, 1999). These models do not require specifying functional forms for the estimation; the data itself informs the resulting model.

For example, ordinary least squares (OLS) estimate the unknown parameters in a regression equation between an outcome variable *y* and a predictor variable *x*. In graphical form, OLS estimation fits a regression line with a unique slope through the full sample (i.e., globally). In equations 1 and 7, this naturally implies constant estimates for a_1 and γ_1. In contrast, the nonparametric models make no assumption that the slope is the same for the full sample, but this is so only locally around each observation. Although nonparametric regression is a way to obtain varying estimates that are robust to functional form misspecification, this robustness comes at a cost. We need many observations and more time to compute the estimates. The cost increases with the number of covariates; this is referred to as the curse of dimensionality. However, given the large number of available observations on subsidiaries, the curse of dimensionality is not a problem in our study.

In general form, the regression model of outcome *y* is:

$$y_i = v_i\beta + g(x_i) + \varepsilon_i \tag{8}$$

The $v_i\beta$ part is the usual parametric regression for explanatory variables *v*, the function g is unknown (obtains its shape from the data), *x* equals CT_{it} or $d_{it} * log\hat{\pi}_{pt}$ in equations 1 and 7, respectively, and ε is the error term. We estimate equation 8 using the nonparametric kernel regression, which estimates a regression for a subset of observations for each point in our data (Fan and Gijbels, 1996).

To clarify things, let us provide an example with the help of a graph (Figure 3), which plots the observations for a sample in the *y*-*x* space. Now, consider estimating the mean of *y* given that *x* = A when *x* is continuous and A is a value observed for *x*. Because *x* is continuous, the probability of any observed value being exactly equal to A is 0. Therefore, we cannot compute an average for the values of *y* for which *x* is equal to a given value A. We use the average of *y* for the observations in which *x* is close to A to estimate the mean of *y* given that *x* = A. Specifically, we use the observations for which $|x - A| < h$, where *h* is small. The parameter *h* is the bandwidth. In nonparametric kernel regression, a bandwidth determines the amount of information we use to estimate the conditional mean at each point A. The circles in Figure 3 delimit the values of *x* around A for which we are computing the mean of *y*. The square is our estimate of the conditional mean using the observations inside the first circle. Then we move to the next observation. To avoid perplexing the figure by noting the observation that is truly closest to A, let us assume another observation B. Estimation is carried again for the observations in the window around B.

[Please insert Figure 3 about here]

Doing this estimation for each point in our data produces a nonparametric

estimate of the mean for a given value of the covariates. This process repeats several times for each of the observations (fitting points) in this example, each time solving the minimization problem for the nonparametric part, given by:

$$\sum_{i=1}^{n} W\left(\frac{x_i - x}{h}\right)\left(y_i - \left(a_0 + a_{1,i}(x_i - x)\right)\right)^2 \quad (9)$$

The constant a_0 in equation 9 is the conditional mean at a specified point *x*. The slope parameter $a_{1,i}$ is the derivative of the mean function with respect to *x*. The size of the bandwidth *h* determines the shape and smoothness of the estimated conditional mean function, because the bandwidth defines how many observations around each point are used. A too-large bandwidth includes too many observations, so the estimate is biased but it has a low variance. A too-small bandwidth includes too few observations, so the estimate has little bias but the variance is large. In other words, the optimal bandwidth trades off bias and variance. Many alternatives have been proposed for the derivation of the optimal bandwidth (e.g., Greene, 2018; Li and Racine, 2004), and we choose the one that minimizes the integrated mean squared error of the prediction (cross-validation method). We find that our results are not overly sensitive to the bandwidth (unless the choice is far off the one chosen by cross-validation). *W* is the kernel function that assigns weights to observations x_i based on how much they differ from *x* and based on the bandwidth, *h*. The smaller *h* is, the larger the weight assigned to points between x_i and *x*.[4]

Estimation of equation 1 using this estimation method yields subsidiary-year estimates of profit shifting $a_{1,it}$. Our first profit shifting measure (*Profit shifting tax incentive*) comes from estimating equation 1 as a semiparametric local linear regression, where we estimate $a_{1,it}$ nonparametrically and the coefficients on the controls in the usual parametric way.[5] Using control variables provides more accurate estimates of profit shifting. In the same fashion, we estimate equation 7 to obtain *Profit shifting earnings shock* (semiparametric estimates $\gamma_{1,it}$ with controls).

ii. Data and variables

We provide the full step by step details on our data collection and management process in the Appendix. We use an initial firm-year panel of 58,805 subsidiaries and 4,758 parents from 110 countries, for the period 2009-2017. The total number of subsidiary-year observations is 375,958 and the variables are in USD. We list the countries and the country-specific observations in Appendix Table A1.

Our main data source is Orbis, which has worldwide coverage of firm-year accounting data as well as detailed information on firms' ownership structure.[6] We measure π_{it} in equations 1 and 7 using subsidiaries' observed earnings before taxes in

[4] We use an Epanechnikov weight; results are robust to using other weight functions (e.g., Gaussian weights). As we show later, results are also robust to using spline-based nonparametric estimation instead of kernel-based.

[5] This is computationally considerably simpler than estimating the full model nonparametrically without observing significant changes in the estimates $a_{1,it}$.

[6] Orbis data has the drawback that firms' ownership structure is available for the last reported date only. Therefore, there may be some concerns about misclassification bias as the ownership structure may have modified during the sample period. Nevertheless, in consonance with previous papers, this would downward bias our estimates so that if anything the identified profit shifting will be less potent (Budd *et al.*, 2005).

logs (*Subsidiaries' earnings before taxes*). With model notation in parentheses, we further define some aforementioned variables. We use *Subsidiaries' assets* (B_k) in equation (2) and *Parents' assets* (a_{pt}) in equation 4. Further, we use the *comparable* parents' pretax profit over total assets (ROA_{jt}) in equations 4 and 5. For the calculations in equation 2, we use the statutory tax rate of subsidiary's country (τ_i) and the statutory tax rates of all the affiliated subsidiaries' countries (τ_k). We obtain these tax rates from the Ernst &Young's Worldwide Corporate Tax Guides.[7] Explicit definitions of all variables and data sources are in Table 1 and summary statistics in Table 2.[8]

[Please insert Tables 1 and 2 about here]

For the estimation of *Profit shifting tax incentive*, we are interested in the negative effect of CT_{it} on *Subsidiaries' earnings before taxes* (π_{it}), i.e., $a_{1,it}$ is negative, in equation 1. This is the case for 106,301 observations, corresponding to 26,593 subsidiaries in 95 countries. We end up with this number of observations, because we disregard cases of positive responses, i.e., responses when the subsidiary does not send profits abroad (receive profits from abroad) when tax rates in the host country increase (decrease). By using logs, we drop all earnings before taxes of unprofitable subsidiaries, because they deal with zero tax rates, so they have no incentive for profit shifting activities if the local tax authorities do not authorize loss offsets. Further, we drop all the missing observations of the composite tax variable CT_{it}. That is the case for all the subsidiaries of our sample that do not have affiliated subsidiaries in the same multinational group.

For *Profit shifting earnings shock* we have a sample of 65,066 subsidiary-year observations from 16,683 subsidiaries and 1,530 parents for the period 2009-2017. This sample includes subsidiaries from 62 countries. We retain the positive observations (the ones theoretically suggesting tax motivation as in our discussion of equation 7). We arrive at these observations, because we drop all the missing observations of the main variables in equations 6 and 7. Again, we measure subsidiary *i*'s profits at time *t* using the log of *Subsidiaries' earnings before taxes* (π_{it}).

For subsidiaries, we use unconsolidated statements; for parents, we rely on consolidated statements. Consolidated parent profits can shift to low-tax subsidiaries and should be included in the analysis (as opposed to only including unconsolidated profits). Using consolidated data also creates a measure that is immune from profit shifting because any shifting is netted out upon consolidation. Further, because the construction of the average industry profitability index ($\widetilde{ROA}_{pt}$) in equations 4 and 5 uses data for comparable firms, the possible concern that the profits of subsidiary *i* in equation 7 are included is already addressed. Another advantage of consolidated data is that the requirement for separate parent data is not necessary. This allows retaining, for example, U.S. parents whose separate financial statements are not publicly available.

[7] https://www.ey.com/gl/en/services/tax/worldwide-corporate-tax-guide---country-list

[8] In Table A2 we provide additional summary statistics for different samples used in robustness tests for the estimation of Profit shifting tax incentive.

4. The global profit-shifting database

i. Average estimates

Table 3 reports mean coefficient estimates (mean of the $a_{1,it}$) and standard errors from the estimation of equation 1. The different specifications produce a different number of estimates $a_{1,it}$ given the assumptions about the model type, the method for bandwidth selection, and observation density. We only retain the negative observations (the ones theoretically suggesting tax motivation as in our discussion of equation 1). At the lower end of each column, we also report the total observations (the total number of observations we use in the regressions).

[Please insert Table 3 about here]

In the first specification, we estimate a standard OLS regression, to compare our results with those of Huizinga and Laeven (2008). In our baseline specification (specification 2), we estimate a semiparametric model with an Epanechnikov kernel and cross validation for optimal bandwidth selection. In specification 3 we do not include controls in equation 1 and thus use a nonparametric model (i.e., there is no need to parametrically introduce the controls). The results are important to show that adding controls does not significantly affect our estimates. In specification 4, instead of using a kernel-based local regression we use one based on a B-spline.[9] This is important to show that the choice between kernel-based and spline-based methods does not significantly affect our inferences. In line with our expectations, the composite tax variable CT_{it} is negative and statistically significant at the 1% level, showing that profit shifting into a country by a subsidiary is negatively related to a weighted average of international tax rate differences between this country and all other countries where the multinational is active.

Table 4 reports mean coefficient estimates (mean of the γ_{1it}) and standard errors from the estimation of equation 7. We only retain the positive observations (the ones theoretically suggesting tax motivation as in our discussion of equation 7). Moreover, at the lower end of each column, we report the total observations (the total number of observations we use in the regressions).

[Please insert Table 4 about here]

In the first specification, we estimate an OLS regression, to compare our results with those of Dharmapala and Riedel (2013). In the second column, we report results from the semiparametric local-linear model with an Epanechnikov kernel and select the optimal bandwidth with cross-validation. In line with our expectations, the DID term is positive and statistically significant at conventional levels, across the different specifications. According to our results, a 10% increase in *Parent's predicted earnings* implies that low-tax subsidiaries receive approximately 0.10% more profit than high-

[9] This variant entails estimation with a B-spline as a basis function (for a thorough reading, see https://www.stata.com/manuals/rnpregressseries.pdf). We also need some assumptions concerning the particular B-spline. We use a third order B-spline as our basis function. To construct a B-spline basis, we need to define knots that are on the interior of the range of the covariates and knots that are at the upper and lower limits of the range or outside the range. The number of knots that are not in the interior differs depending on the order of the B-spline. Using a cross-validation criterion, we select the number of knots to be used for estimation.

tax subsidiaries. Thus, for every $100 profits that exogenously flow into the parent, approximately $10 more go to each low tax-rate subsidiary, relative to high tax-rate subsidiaries.

In addition to reporting summary statistics for the variables used in our analysis, Table 2 also reports the summary statistics of our profit-shifting measures. We multiply *Profit shifting tax incentive* by -1 so that higher values reflect more aggressive profit shifting. We consider the estimated values as indices that track firms' profit shifting in a standardized way (i.e., they do not have a monetary interpretation such as a dollar value interpretation). The results show substantial heterogeneity across firms in our sample. Concerning *Profit shifting tax incentive*, we report an average of 1.46 and a range between 0 and 36.40. For *Profit shifting earnings shock*, we report an average of 0.33 and a range between 0.11 and 0.44. In Table A2, we provide equivalent summary statistics for *Profit shifting tax incentive 2* and *Profit shifting tax incentive 3*.

In Table 5 we report the pairwise correlation coefficients of our profit shifting measures. All correlation coefficients for our profit-shifting measures are statistically significant at the 1% level. *Profit shifting tax incentive* and *Profit shifting earnings shock* are negatively correlated because the former shows mainly profits leaving the subsidiary's country and the latter profits entering the subsidiary's country.

[Please insert Table 5 about here]

ii. Country and time variation of profit shifting

In the appendix Table A3, we report average profit-shifting estimates by country-year using *Profit shifting tax incentive*. The index ranges between 0.12 in Hong Kong in 2012 and 14.61 in Oman in 2012. Notably, we find that subsidiaries in Cayman Islands, United Arab Emirates, Bermuda, Oman, and some Balkan countries (Bosnia and Herzegovina, Montenegro, and Bulgaria) are the ones engaging in more aggressive profit shifting. This is consistent with our expectations and validates our index because these countries have been notable tax heavens during our sample period.[10] Specifically, the OECD's April 2009 progress report identifies jurisdictions under the heading "Jurisdictions that have committed to the internationally agreed tax standard, but have not yet substantially implemented." Cayman Islands and Bermuda were categorized as tax havens. While the United Arab Emirates were listed in the OECD's April 2009 progress report as "substantially implementing the internationally agreed tax standard," the subsequent reviews (from 2011 onward) identify significant deficiencies in its legal and regulatory framework. Bulgaria is widely considered as a European offshore jurisdiction, while Montenegro and Bosnia are appealing to many entrepreneurs and businesses because of their low corporate tax rates.[11] Other countries appearing on these lists also reflect notable profit shifting on our first index.

To illustrate differences in profit shifting within-countries, we also report the standard deviation of *Profit shifting tax incentive* for each country. We find that subsidiaries in United Arab Emirates, Bermuda, Oman, and Montenegro, which lead the way in aggressive profit shifting behavior, also report the largest within-country variation.

In turn, in the appendix Table A4, we report country-year means of *Profit shifting earnings shock*. The values range between 0.28 in Switzerland in 2015 and 0.42

[10] The EU removed Cayman Islands and Oman from its "non-cooperative jurisdictions for tax purposes" list in 2020 after these countries implemented several reforms to improve their tax-policy framework.
[11] See *European initiatives on eliminating tax havens and offshore financial transactions (2013)*.

in Denmark in 2011. We find that subsidiaries in United Arab Emirates, Ecuador, Denmark, and Thailand are the ones engaging in more aggressive profit shifting. The Financial Action Task Force maintains a list of high-risk and non-cooperative jurisdictions regarding measures to combat money laundering and the funding of terrorism. While tax havens may facilitate money laundering and the financing of terrorism, the countries on the list of the Financial Action Task Force have not been the same as those appearing on lists of tax havens. However, following the revised definition of tax havens agreed by the European Parliament and the Danish EU Presidency on 28 June 2012, countries on this list are automatically classified as tax havens although they do not necessarily exhibit some other tax haven characteristics identified by the OECD and others. The Financial Action Task force lists Ecuador and Thailand. Moreover, in 2013, Denmark was considered as a European offshore jurisdiction.[12] Again, other countries appearing on these lists also reflect notable profit shifting on our second index. We must note, however, that *Profit shifting tax incentive* seems to better capture policy makers' perceptions compared to *Profit shifting earnings shock.*

To show the international picture, we construct two global heat-maps, one for each of *Profit shifting tax incentive* and *Profit shifting earnings shock*. The maps show country averages: countries with higher averages have a red "hot" color and those with low averages a blue "cold" color. On Map 1, we find that subsidiaries in Cayman Islands, United Arab Emirates, Bermuda, and Oman are the ones engaging in more aggressive profit shifting. On Map 2, the countries that receive more profit shifting (red "hot" color), are the Eastern European countries (e.g., Ukraine), United Arab Emirates, Ecuador, Denmark, and Thailand.

[Please insert Maps 1 and 2 about here]

Profit shifting does not vary considerably only across countries and geographical areas but also across different sectors and this has important welfare and policy implications. Sectors with more profit shifting lower their average cost of capital and are thus able to attract more investment potentially overperforming compared to sectors less able to dodge taxes. To the extent that multinationals compete over market shares and input factors, this heterogeneity translates into profit shifting acting as a subsidy to specific industries.

In Table 6, we report the average values of our somewhat preferred *Profit shifting tax incentive* by industry.[13] The results show that mining and quarrying firms engage aggressively into profit-shifting activities. These are firms in the mining of coal and lignite, the extraction of crude petroleum and natural gas, the mining of metal ores, and other mining and quarrying activities. The mining industry has two specific characteristics that favor profit shifting. First, it has many foreign-owned companies because reserves (fossil fuel and other reserves), distilleries, and refinement establishments are usually in different places than the parent. Second, firms in most major mining countries are not obliged to disclose financial accounts of their subsidiaries.

[Please insert Table 6 about here]

[12] See *European initiatives on eliminating tax havens and offshore financial transactions (2013)*.

[13] Average values of our other profit-shifting indices by industry and average values of all our profit-shifting indices by industry-year are also available on request.

In Figure 4 we show the time trend in the annual average of *Profit shifting tax incentive* and *Profit shifting earnings shock*. To facilitate comparison, we scale the two indices on the two vertical axes (left for *Profit shifting tax incentive* and right for *Profit shifting earnings shock*). The two indices identify similar negative trends reflecting that after 2011 there is a significant decrease. This pattern reflects the introduction of the OECD's Base Erosion and Profit Shifting-BEPS Initiative in 2013[14] and the increasing stringency of taxation policies around the world (Buettner et al., 2018). However, the trend stops in 2016 and this raises interesting questions about the recent emergence of new tax havens. Based on the appendix Table A4, we find that subsidiaries in Peru, United Arab Emirates, and Thailand are countries with the largest increase in profit shifting in 2016 and 2017. The European Parliamentary Research Service (2017) includes these countries in a watch list, meaning that they are closely monitored by the EU.

[Please insert Figure 4 about here]

Last, in Appendix Tables A5 and A6, we report the average values of *Profit shifting tax incentive 2 and Profit shifting tax incentive 3* by country-year. *Profit shifting tax incentive 2* ranges between 0 in Iceland in 2014 and 22.54 in Cayman Islands in 2013. *Profit shifting tax incentive 3* ranges between 0.03 in Hong Kong in 2017 and 5.96 in Marshall Islands in 2016. Similar to our baseline indices, we find that subsidiaries in Marshall Islands, Cayman Islands, United Arab Emirates, Bermuda, Côte d'Ivoire, and Oman are the ones engaging into more aggressive profit shifting.

iii. Additional robustness tests

We examine several different indices based on different assumptions used to estimate the nonparametric regressions. Specifically, we use a Gaussian kernel (instead of the Epanechnikov), and we select the bandwidth using the Akaike information criterion (AIC) (instead of cross-validation). Using different methods to select the optimal bandwidth or different kernel functions provides very similar indices (very high correlations with our baseline indices). We also experiment with different splines or different assumptions within the spline-based methods. Finally, we experiment with computationally more involved fully nonparametric methods (all explanatory variables enter the regression nonparametrically); we do not favor the fully nonparametric model only because it adds considerable estimation time without gain in our inferences. In general, all of the above robustness tests yield very similar inferences.

5. Correlates of profit shifting

i. Profit shifting as the outcome variable of country-level characteristics

Having established a pronounced cross-country heterogeneity in profit shifting, we focus on whether other elements besides corporate tax differences are conditionally correlated with profit shifting. We first examine several country characteristics (of subsidiary countries). We use the word "correlates" of "conditionally correlates" because we do not aim to show causal effects. Rather, we aim to provide the first correlational evidence (conditional on controls) to spur new discussion and indicate potential mechanisms through which MNEs take profit shifting decisions.

[14] See OECD (2013), *Addressing Base Erosion and Profit Shifting*.

We use OLS with standard errors clustered by country (the cross-sectional dimension of the explanatory variables we focus on). We control for three key subsidiary-year controls that we find to be very significant: *Subsidiaries' assets*, *Subsidiaries' leverage*, and *Subsidiaries' cost of employees*. We literally examine more than 100 country-year or country variables reflecting economic and financial development, institutional and constitutional quality, cultural and societal traits, and demographics. Variables inside each of these groups are usually multicollinear and thus we do not include them in the same regressions. We define all variables for which we show results in Table 1.

In Table 7 we report the results on the most significant demographic, economic, institutional, and societal correlates. Most generally, we observe higher profit shifting in smaller countries (estimate based on the log of a country's population), consistent with the premise that most tax havens are relatively small countries. We also find that national income per capita growth lowers profit shifting, *inter alia* consistent with the idea that extension of investment and economic growth disincentivizes profit shifting. The estimate on the real interest rate (based on the lending rate) shows that countries with low interest rates shift more profit. This is an interesting finding, reflecting a potentially important role for the financial system, which we more extensively examine in the next table of results.

We find a potentially very important role for institutions. Constitutional democracy is the umbrella that triggers the process of institutional development and provides the first cell for the evolution of institutions that might affect profit shifting. We measure democracy using the variable from the Polity IV Project (*Democracy polity IV*). This is a country-year index that ranges from 0 (lack of institutional democracy) to 10 (institutional democracy of the highest quality) and reflects constitutional elements of democracy (law on the book). As such, this index is more exogenous compared to perception-based democracy indicators. The estimate on *Democracy (Polity IV)* is among the most significant (if not the most significant) correlates of profit shifting. Our finding implies that more democratic institutions in subsidiary countries are linked to substantially lower profit shifting. Economically, every one-point increase in *Democracy (Polity IV)* is associated with a 0.115 lower profit shifting or approximately 8% lower than the subsidiary with a mean profit shifting.

[Please insert Table 7 about here]

Given this finding, we further examine whether the evolution of specific institutions correlates with profit shifting. Prior research shows that better-quality institutions can constrain profit shifting. Sugathan and George (2015) document relevant effects of freedom of expression, government effectiveness, and political stability. In high-tax countries (the party at loss of tax revenues), the institutions dissuading and limiting negative externalities of business activities are likely to increase the costs of shifting transactions. Other research has examined how income shifting is affected by features of tax law (Markle 2016), financial accounting quality and comparability (De Simone 2016), intellectual property protection (Griffith et al. 2014), and other tax reporting requirements (Joshi 2020).

Two key aspects of governance quality that might influence subsidiaries' profit-shifting decisions are trade and investment freedom, and the control of corruption. Investment and trade freedoms reflect each country's policies toward foreign investment and trade, as well as its policies toward capital flows internally, in order to determine its overall investment climate. The two relevant indices from the Heritage

Foundation range between 0 and 100, where 100 represent the maximum degree of investment or trade freedom. *C*onsistent with our results on democracy, both variables carry a negative and highly significant coefficient (statistically and economically). For example, a 10-point increase in *Investment freedom*, is associated with a 0.100 point reduction in *Profit shifting tax incentive* (or approximately 6.8% for the subsidiary with a mean profit shifting).

On the same line, we expect that control for corruption lowers profit shifting. Multinationals that have an incentive to shift profits will likely exploit corrupt institutions, and countries with high levels of corruption face lower tax revenue elasticities (e.g., Bilicka and Seidel, 2020). Moreover, in the presence of corruption, firms face risks, fear of blackmailing, or sudden instability, which makes doing business problematic. For example, bribes, unlike taxes, involve unpredictable distortion in the discretionary and uncertain use of government power. This results in additional costs to businesses and allocates resources to unproductive activities, which impose an extra burden on firms and the economy (Cieślik and Goczek, 2018). *Executive embezzlement and theft* measures the frequency with which members of the executive (the head of state, the head of government, and cabinet ministers), or their agents, steal, embezzle, or misappropriate public funds or other state resources for personal or family use. *Judicial corruption decision* measures the frequency with which individuals or businesses make undocumented extra payments or bribes to speed up or delay the process or to obtain a favorable judicial decision. Note that both these variables take higher values for lower levels of corruption. Thus, our results show that more control of corruption is negatively correlated with profit shifting.

Complementary to Table 6, which shows that mining and quarrying firms engage aggressively into profit-shifting activities, we show that countries with higher *Electricity production from oil sources*, higher *Oil rents*, and *CO2 emissions* have more profit shifting, whereas countries with higher *Renewable energy consumption* engage in less profit shifting. Once again aggressive tax planning is linked to sustainability problems and potentially lower green investments and this is a fruitful avenue for future research.[15]

In Table 8 we report equivalent estimates using measures of financial development and financial liquidity. We find that these measures are amongst the most important conditional correlates of profit shifting. Specifically, profit shifting is considerably higher in low-capitalized and relatively risky banking systems that are prone to crises (estimates on Bank capitalization, Bank Z-score, and Banking crisis dummy), whereas we document less profit shifting when firms originated a loan in the past year (however, in a considerably reduced sample). On the same line, we also find more profit shifting in countries with more concentrated banking systems. The coefficients on *Foreign claims of BIS reporting banks*, *Interest payments*, *Liquid liabilities* and *Total factoring volume* serve as further validation of our main profit shifting index because the profit flows must be documented as foreign claims, enhancing the system's liquidity, with firms accessing domestic services and obtaining interest payments. In a nutshell, banking development seems to be at the center of firms' profit-shifting behavior, an issue that has received very limited attention in the extant literature.

[Please insert Table 8 about here]

[15] Beer and Loeprick (2017) provide evidence on the scale of observable profit shifting among hydrocarbon MNEs.

ii. Profit shifting as an explanatory variable of firm-level outcomes

We next turn to the conditional dependence of important subsidiary characteristics on our profit shifting estimates. Although existing literature studies some of the determinants of profit shifting with special emphasis on taxation (Dharmapala and Riedel, 2013; Weichenrieder 2009; Klassen et al., 1993), there is a dearth of evidence on how profit shifting affects important subsidiary-level characteristics, such as performance and capital structure. The outcome variables in the section are observed at the firm-year level, and we estimate the equations with OLS, firm fixed effects. We cluster the standard errors by firm.

First, our results in the first column of Table 9 show that more profit shifting is significantly correlated with firms' capital structure decisions. Specifically, we find that higher profit shifting is positively linked to *Subsidiaries' leverage* (the basic debt to assets ratio). This finding is consistent with Buettner et al. (2012), who use data on foreign affiliates of German-based multinationals to analyze the effects of tax rates and rules on the use of debt by multinational affiliates. They find a modest impact of tax rates on the use of inter-affiliate debt. Moreover, Huizinga et al. (2008) show that a multinational firm's indebtedness in a country depends on a weighted average of national tax rates and differences between national and foreign tax rates.

Working capital and the *Liquidity ratio* measure a company's liquidity, operational efficiency, and short-term financial health. If a company has substantial positive working capital and liquidity, then it should have the potential to pay off current obligations without raising external capital, invest, and grow. Consistent with the results in column 1, the results in columns 2 and 3 of Table 9 link more profit shifting to lower subsidiary working capital and liquidity. These findings are fully consistent with the hypothesis that subsidiaries are present in low-tax countries not for fully productive purposes but for profit-shifting activities and access to riskier loans (consistent with our findings in Table 8). The negative coefficient on the number of employees also corroborates this view.[16]

[Please insert Table 9 about here]

6. Conclusion and directions for future research

This paper constructs the first database with subsidiary-year measures of profit shifting and aggregates these measures across a maximum of 95 countries over 2009 to 2017. The evidence shows that (i) profit shifting declines up to 2015 but this trend stops in 2016 and 2017; (ii) the usual suspects (tax havens) are the countries in which subsidiaries receive the largest amounts of profit shifting; and (iii) there is significant across and within country heterogeneity in profit shifting that cannot be solely explained by tax differences.

These findings are only a first step to uncover the potential of this database in

[16] There is also little understanding of how profit shifting differs across firm size. Wier and Reynolds (2018) investigate the link between firm size and profit shifting. They estimate that firms owned by a parent in a tax haven avoid taxation on as much as 80 per cent of their true income. However, this aggregate tax loss conceals large differences across firms. Most firms shift little income to tax havens, while a few large firms shift a lot. The top decile of foreign-owned firms accounts for 98 per cent of the total estimated tax loss.

analyzing profit shifting at the firm or aggregate levels. The GPSD and its updates that we aim to provide, can be used by researchers to analyze either the factors causally affecting profit shifting or the causal effects of profit shifting on firm-specific or country-specific characteristics. Among these characteristics, we show that very promising country-specific determinants of profit shifting are the political and institutional environment, and financial development and financial stability. We also find a strong correlation between the presence of fossil fuel activity and profit shifting, which leads the pathway for a thorough examination of the link between environmental economics and profit shifting. Finally, at the firm-level we observe substantial differences in the subsidiaries' capital structure and employability, noting that subsidiaries with high profit shifting intensity have higher leverage, lower liquidity, and fewer employees.

Many of these uncovered conditional correlations are fairly novel, and thus our analysis triggers a need to substantial new research on questions pertaining to the determinants of profit shifting over and above cross-country tax differences, as well as the industry-profiles of firms that shift profit, their capital structure, corporate governance, and investment decisions. Naturally, future research might also be interested in the macroeconomic outcomes of profit-shifting, especially concerning the labor market, investment, innovation, climate change, and economic growth.

Tables

Table 1. Variable definitions and sources

Variable	Definition	Source
Profit-shifting indices		
Profit shifting tax incentive	The estimates $a_{1,it}$ from the estimation of equation 1 using the semiparametric local linear regression. We use an Epanechnikov kernel and select the bandwidth with cross-validation. The control variables include *Subsidiaries' assets* and *Subsidiaries' cost of employees*.	Own estimations
Profit shifting earnings shock	The estimates γ_{1it} from the estimation of equation 7 using the semiparametric local linear regression. We use an Epanechnikov kernel and select the bandwidth with cross-validation. The control variables include *Subsidiaries' assets* and *Subsidiaries' leverage*.	Own estimations
Profit shifting tax incentive 2	Estimates $a_{1,it}$ from the estimation of equation 1 using a nonparametric local linear regression. We use an Epanechnikov kernel and select the bandwidth with cross-validation.	Own estimations
Profit shifting tax incentive 3	The estimates $a_{1,it}$ from the estimation of equation 1 using a nonparametric series estimation model with a B-spline as a basis function. We select the knots using cross-validation. The control variables include *Subsidiaries' assets and Subsidiaries' cost of employees.*	Own estimations
Dependent variables		
Subsidiaries' earnings before taxes	Subsidiary's observed earnings before taxes (log).	Orbis
Parents' earnings before taxes	Parent's observed earnings before taxes (log).	Orbis
Explanatory variables: Firm characteristics		
Composite tax variable	Composite tax variable that summarizes all information about subsidiaries' profit-shifting tax-incentives in year t.	Orbis, EY Tax Guide
Parents' earning shocks	Parent's exogenous earning shocks (log). Estimated using equations (4) and (5).	Orbis
Parents' predicted earnings	Parent's estimated pre-tax and pre-shifting profits (log).	Orbis
Parents' cost of employees	Parent's cost of employees (log).	Orbis
Parents' assets	Parent's total assets.	Orbis
Subsidiaries' assets	Subsidiary's total assets (log).	Orbis
Subsidiaries' cost of employees	Subsidiary's cost of employees (log).	Orbis
Subsidiaries' leverage	Subsidiary's leverage, defined as total debt/ total assets.	Orbis
Number of employees	The log of the number of employees per subsidiary.	Orbis

Working capital	Working capital (net current assets) = Current assets (log) - Current liabilities (log).	Orbis
Liquidity ratio	The ratio of total cash to short-term liabilities. It shows the number of times short-term liabilities are covered by cash.	Orbis
Explanatory variables: Country tax characteristics		
Statutory tax rates	Statutory tax rate of the subsidiary's country.	EY Tax Guide
	Statutory tax rates of all the subsidiaries' countries in the same group.	EY Tax Guide
DID identifier	Dummy variable equal to one if the corporate tax rate in the subsidiary's country is lower than the one in the parent's country and zero otherwise.	EY Tax Guide
Population	Subsidiary country's population in logs.	WDI
GNI per capita growth	Annual percentage growth rate of GNI per capita based on constant local currency. GNI per capita is gross national income divided by midyear population.	WDI
Real interest rate (%)	Real interest rate is the lending interest rate adjusted for inflation as measured by the GDP deflator.	WDI
Democracy (polity IV)	Ranges from 0 to 10, with 0 indicating no institutional democracy and 10 indicating a maximum level of institutional democracy.	Polity IV Project (2018)
Investment freedom	This factor scrutinizes each country's policies toward foreign investment, as well as its policies toward capital flows internally, in order to determine its overall investment climate. The country's investment freedom ranges between 0 and 100, where 100 represents the maximum degree of investment freedom.	Heritage Foundation
Trade freedom	The trade freedom score is based on two inputs: The trade-weighted average tariff rate, Non-tariff barriers (NTBs). Weighted average tariffs is a purely quantitative measure and accounts for the basic calculation of the score. The presence of NTBs in a country affects its trade freedom score by incurring a penalty of up to 20 percentage points, or one-fifth of the maximum score. The country's trade freedom ranges between 0 and 100, where 100 represents the maximum degree of trade freedom.	Heritage Foundation
Executive embezzlement and theft	The frequency with which members of the executive (the head of state, the head of government, and cabinet ministers), or their agents, steal, embezzle, or misappropriate public funds or other state resources for personal or family use.	V-Dem
Judicial corruption decision	The frequency with which individuals or businesses make undocumented extra payments or bribes in order to speed up or delay the process or to obtain a favorable judicial decision.	V-Dem
Electricity production from oil sources (% of total)	Sources of electricity refer to the inputs used to generate electricity. Oil refers to crude oil and petroleum products.	WDI
Oil rents (% of GDP)	Oil rents are the difference between the value of crude oil production at world prices and total costs of production.	WDI
CO2 emissions	Carbon dioxide emissions (metric tons per capita) are from the burning of fossil fuels and the manufacture of cement. They include carbon dioxide produced during consumption of solid, liquid, and gas fuels and gas flaring.	WDI

Renewable energy consumption	The share of renewable energy in total final energy consumption.	WDI
Explanatory variables: Financial characteristics		
Bank capitalization	The ratio of bank capital and reserves to total assets.	GFD
Bank concentration	The asset share of a country's three largest banks.	GFD
Bank Z-score	Z-score (defined as the sum of capital to assets and return on assets, divided by the standard deviation of return on assets) is used to measure financial stability. It explicitly compares buffers (capitalization and returns) with the potential for risk (volatility of returns). The z-score has a direct link with the probability of default.	GFD
Banking crisis dummy	Banking crisis dummy in each country in each year (1 = banking crisis, 0 = no banking crisis)	Laeven and Valencia (2012)
Loan in the past year	The percentage of respondents who borrowed any money in the past 12 months from any of the following sources: a formal financial institution, a store by using installment credit, family or friends, employer, or another private lender (% age 15+).	GFD
Foreign claims of BIS reporting banks	The ratio of consolidated foreign claims to GDP of the banks that are reporting to BIS. Foreign claims are defined as the sum of cross-border claims plus foreign offices' local claims in all currencies. In the consolidated banking statistics claims that are granted or extended to nonresidents are referred to as either cross-border claims. In the context of the consolidated banking statistics, local claims refer to claims of domestic banks' foreign affiliates (branches/subsidiaries) on the residents of the host country (i.e., country of residence of affiliates).	GFD
Interest payments	Interest payments as percentage of revenue include interest payments on government debt–including long-term bonds, long-term loans, and other debt instruments–to domestic and foreign residents.	WDI
Total factoring volume	Total factoring volume on the GDP (%), indicates the factoring turnover share on GDP for each country.	GFD
Liquid liabilities	Ratio of liquid liabilities to GDP. Liquid liabilities are also known as broad money, or M3.	GFD

Table 2. Summary statistics (period: 2009-2017)

The table reports the number of observations, the mean, standard deviation, minimum, maximum, first quartile, third quartile, and median of the main variables used to estimate our two main profit-shifting measures. The variables are defined in Table 1.

	Obs.	Mean	St. Dev.	Min.	Max.	Q1	Q3	Median
Profit shifting tax incentive	106,301	1.46	1.01	0	36.40	0.90	1.80	1.44
Subsidiaries' earnings before taxes	106,301	7.24	2.17	-9.63	17.58	5.87	8.63	7.25
Composite tax variable	106,301	0.03	0.08	-0.39	0.60	0	0.07	0.03
Subsidiaries' assets	106,301	9.83	2.07	-6.61	18.38	8.45	11.18	9.76
Statutory tax rates	106,301	0.27	0.06	0	0.40	0.24	0.31	0.28
Subsidiaries' cost of employees	106,301	8.21	1.85	-6.70	15.90	7.06	9.39	8.21
Profit shifting earnings shock	65,066	0.33	0.02	0.11	0.44	0.31	0.34	0.33
Subsidiaries' earnings before taxes	65,066	6.99	2.46	-13.56	16.83	5.53	8.56	7.08
Subsidiaries' assets	65,066	9.59	2.28	-1.79	18.93	8.13	11.08	9.59
Subsidiaries' leverage	65,066	0.53	0.29	0	1.43	0.30	0.76	0.53
Parents' earnings before taxes	62,420	13.22	1.90	0.02	18.10	12.02	14.65	13.33
Parent's predicted earnings	65,066	13.12	1.65	6.45	17.11	12.11	14.37	13.26
Parent's cost of employees	65,066	13.33	2.49	1.79	17.36	11.45	15.66	13.76
Parents' assets	65,066	15.99	1.87	6.63	19.83	14.85	17.50	16.10

Table 3: Estimation of profit shifting from equation 1 (tax incentive)

The table reports coefficient estimates and standard errors (in parentheses) from the estimation of equation 1. Dependent variable is *Subsidiaries' earnings before taxes* and all variables are defined in Table 1. The first specification is estimated with OLS. The second and third specifications are estimated with the semiparametric local linear regression and the nonparametric local linear regression (without controls) and produce *Profit shifting tax incentive* and *Profit shifting tax incentive 2*, respectively. Specification 4 is estimated with the nonparametric series estimation, using a B-spline as a basis function. We report White's (1980) heteroskedasticity-consistent standard errors in parentheses for specification 1. For all the other specifications, the standard errors are from bootstrapping. Total observations refer to the total number of observations we use in the regressions. Negative profit shifting is the number of observations for which our profit shifting estimates (the subsidiary-year coefficients on the *Composite tax variable*) are negative. The ***, **, and * marks denote statistical significance at the 1%, 5%, and 10% level, respectively.

	(1) OLS estimation	(2) Profit shifting tax incentive	(3) Profit shifting tax incentive 2	(4) Profit shifting tax incentive 3
Composite tax variable	-0.660***	-0.646***	-0.775***	-0.620***
	(0.033)	(0.030)	(0.105)	(0.033)
Subsidiaries' assets	0.763***	0.763***		0.763***
	(0.003)	(0.002)		(0.003)
Subsidiaries' cost of employees	0.165***	0.164***		0.164***
	(0.003)	(0.002)		(0.003)
Total observations	166,979	166,979		166,979
Negative profit shifting		106,301	82,459	111,268

Table 4: Estimation of profit shifting from equation 7 (earnings shock)

The table reports coefficient estimates and standard errors (in parentheses) from the estimation of equation 7. Dependent variable is *Subsidiaries' earnings before taxes* and all variables are defined in Table 1. The first specification is estimated with OLS. The second specification is estimated with the semiparametric local linear regression. We report White's (1980) heteroskedasticity-consistent standard errors in parentheses for specification 1. For specification 2, the standard errors are from bootstrapping. Total observations refer to the total number of observations we use in the regressions. Positive profit shifting is the number of observations for which our profit shifting estimates (the subsidiary-year coefficients on the DID term) are positive. The ***, **, and * marks denote statistical significance at the 1%, 5%, and 10% level, respectively.

	(1) OLS estimation	(2) Profit shifting earnings shock
DID identifier * Parent's predicted earnings	0.011**	0.009***
	(0.052)	(0.050)
Parent's predicted earnings	0.021***	0.021***
	(0.004)	(0.003)
DID identifier	-0.132*	-1.030
	(0.068)	(1.200)
Subsidiaries' assets	0.871***	0.870***
	(0.002)	(0.002)
Subsidiaries' leverage	-0.720***	-0.713***
	(0.018)	(0.016)
Total observations	112,102	112,102
Positive profit shifting		65,066

Table 5. Correlations between the profit-shifting indices

The table reports correlation coefficients for our profit-shifting measures. The * denotes statistical significance at the 1% level.

	1	2	3	4
1. Profit shifting tax incentive	1			
2. Profit shifting tax incentive 2	0.23*	1		
3. Profit shifting tax incentive 3	0.63*	0.41*	1	
4. Profit shifting earnings shock	-0.04*	-0.05*	-0.03*	1

Table 6. Average estimates of profit shifting by industry using *Profit shifting tax incentive*

Industry	Profit shifting tax incentive
Mining and quarrying	2.054
Water supply; sewerage, waste management and remediation activities	1.719
Agriculture, forestry and fishing	1.642
Arts, entertainment and recreation	1.621
Human health and social work activities	1.537
Transportation and storage	1.535
Construction	1.531
Accommodation and food service activities	1.521
Manufacturing	1.498
Wholesale and retail trade; repair of motor vehicles and motorcycles	1.490
Education	1.474
Real estate activities	1.465
Administrative and support service activities	1.458
Information and communication	1.457
Professional, scientific and technical activities	1.452
Financial and insurance activities	1.424
Other service activities	1.384
Electricity, gas, steam and air conditioning supply	1.347
Public administration and defense; compulsory social security	0.878

Table 7. Country-level general determinants of profit shifting

The table reports the results (coefficient estimates and t-statics in brackets) on 12 variables in 12 different regressions. Dependent variable is *Profit shifting tax incentive*. The explanatory variables are defined in Table 1. Estimation method is OLS with standard errors clustered by subsidiary's country. Each regression (in each row) includes Subsidiaries' assets, Subsidiaries' leverage, and Subsidiaries' cost of employees as control variables. We also report the number of observations and the adjusted-R-squared of each regression. The ***, **, and * marks denote statistical significance at the 1%, 5%, and 10% level, respectively.

	(1)	(2)	(3)
	Estimates	Observations	Adjusted R-squared
Population	-3.654***	100,996	0.431
	[-3.056]		
GNI per capita growth	-0.010***	87,636	0.465
	[-2.779]		
Real interest rate (%)	-0.045**	19,652	0.415
	[-2.478]		
Democracy (polity IV)	-0.115***	101,040	0.437
	[-2.830]		
Investment freedom	-0.010***	101,070	0.439
	[-3.448]		
Trade freedom	-0.016**	101,070	0.437
	[-2.259]		
Executive embezzlement and theft	-0.159***	39,016	0.438
	[-3.743]		
Judicial corruption decision	-0.502***	39,016	0.439
	[-2.816]		
Electricity production from oil sources	0.036***	28,724	0.521
	[2.752]		
Oil rents (% of GDP)	0.034***	33,973	0.505
	[5.742]		
CO2 emissions	0.093**	24,367	0.489
	[2.191]		
Renewable energy consumption	-0.047***	29,419	0.494
	[-3.774]		

Table 8. Country-level financial determinants of profit shifting

The table reports the results (coefficient estimates and t-statics in brackets) on 9 variables in 9 different regressions. Dependent variable is *Profit shifting tax incentive*. The explanatory variables are defined in Table 1. Estimation method is OLS with standard errors clustered by subsidiary's country. Each regression (in each row) includes Subsidiaries' assets, Subsidiaries' leverage, and Subsidiaries' cost of employees as control variables. We also report the number of observations and the adjusted-R-squared of each regression. The ***, **, and * marks denote statistical significance at the 1%, 5%, and 10% level, respectively.

	(1)	(2)	(3)
	Estimates	Observations	Adjusted R-squared
Bank capitalization	-0.091***	89,769	0.458
	[-4.932]		
Bank concentration	0.013***	101,136	0.473
	[3.481]		
Bank Z-score	-0.024***	101,082	0.474
	[-3.678]		
Banking crisis dummy	0.162***	101,169	0.479
	[3.272]		
Loan in the past year	-0.025***	13,954	0.308
	[-3.637]		
Foreign claims of BIS reporting banks	0.003**	100,987	0.439
	[2.464]		
Interest payments	0.048***	33,206	0.505
	[2.726]		
Total factoring volume	-0.035***	99,522	0.426
	[-2.989]		
Liquid liabilities	0.000***	100,653	0.443
	[6.289]		

Table 9. Effect of profit shifting on subsidiary-level characteristics

The table reports coefficients and t-statistics (in brackets). The dependent variable is denoted in the second line of the table and all variables are defined in Table 1. Estimation method is OLS with standard errors clustered by subsidiary. Subsidiary fixed effects are used in each specification. The explanatory variable is *Profit shifting tax incentive*. Each regression (in each column) includes Subsidiaries' assets, Subsidiaries' leverage, and Subsidiaries' cost of employees as control variables. We also report the number of observations and the adjusted-R-squared of each regression. The ***, **, and * marks denote statistical significance at the 1%, 5%, and 10% level, respectively.

	(1) Subsidiaries' leverage	(2) Working capital	(3) Liquidity ratio	(4) Number of employees
Profit shifting tax incentive	0.002***	-0.029***	-0.103***	-0.012***
	[3.426]	[-3.824]	[-4.239]	[-3.084]
Observations	100,213	29,170	34,427	30,930
Adjusted R-squared	0.789	0.877	0.537	0.934
Subsidiary effects	Y	Y	Y	Y
Clustered standard errors	subsidiary	subsidiary	subsidiary	subsidiary

Figures

Figure 1: Profit shifting flows based on equation 1

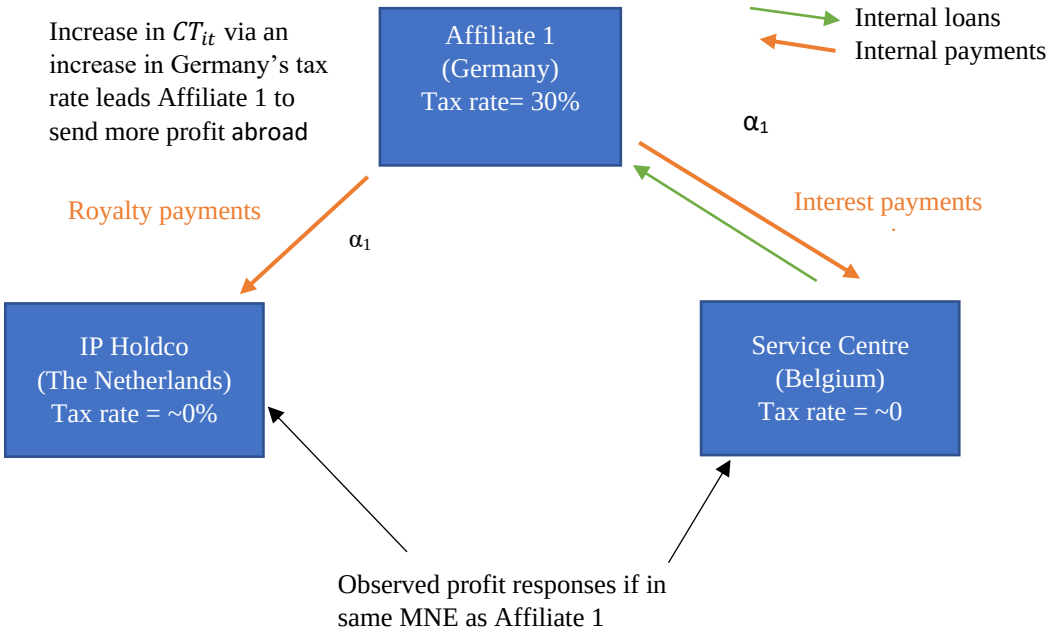


Figure 2: Profit shifting flows based on equation 7

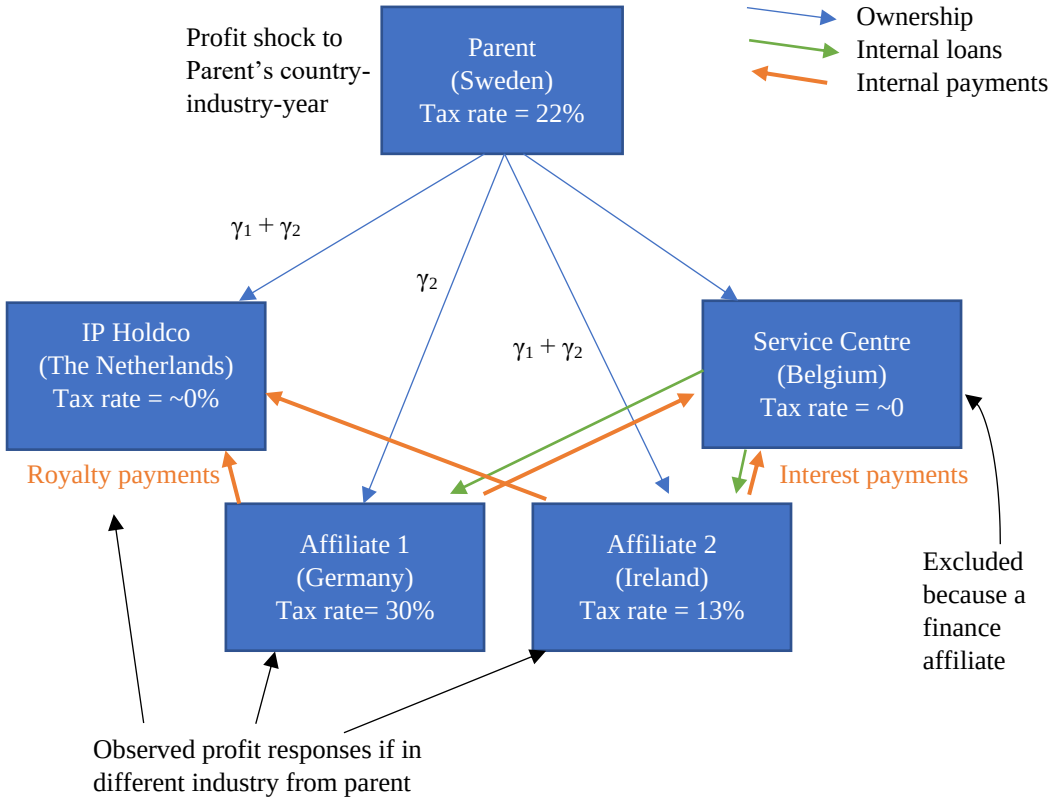


Figure 3: Nonparametric estimates at two points

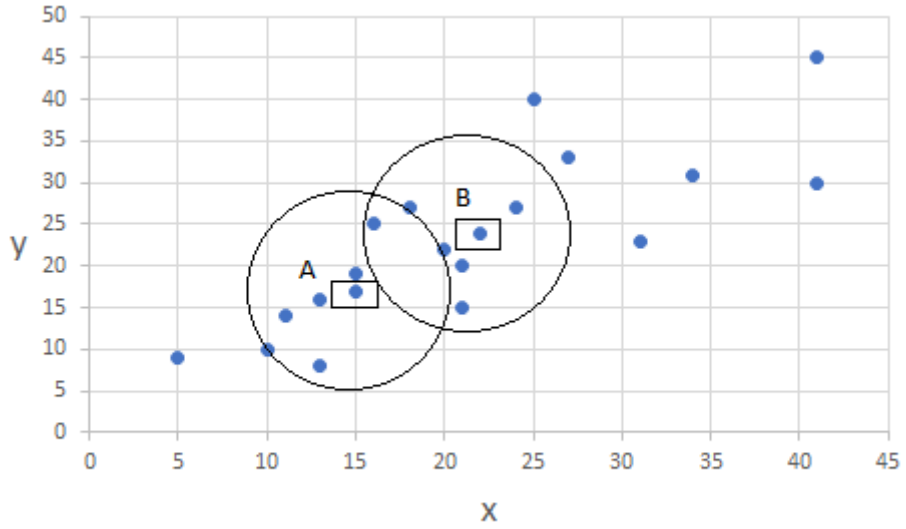
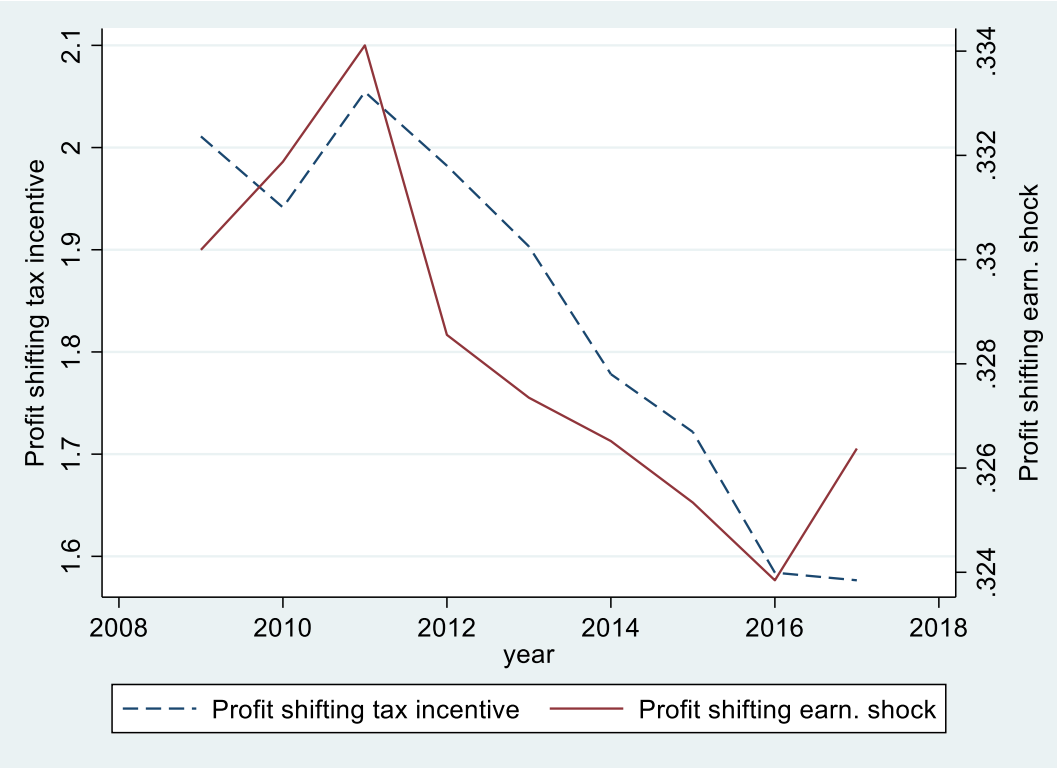
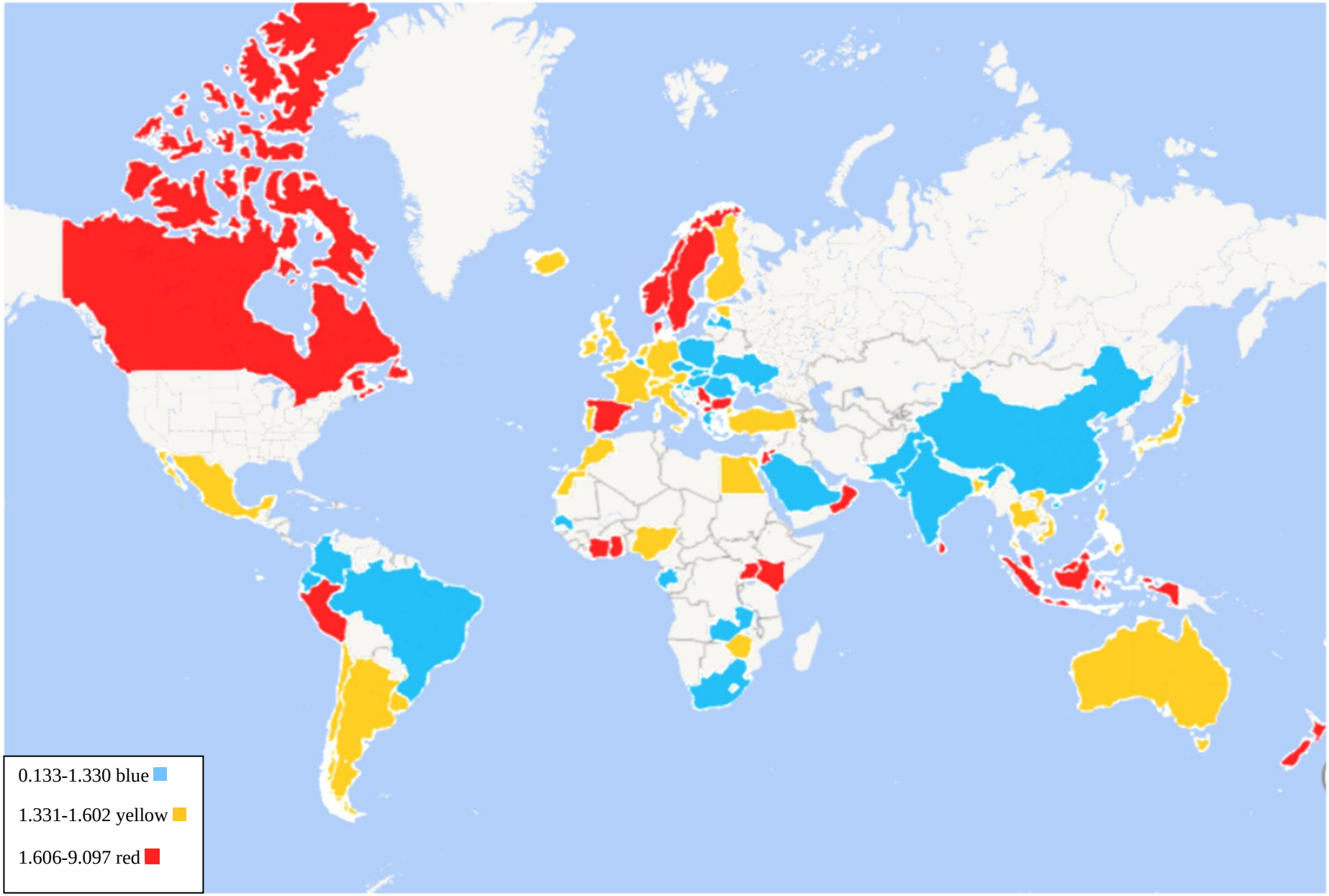


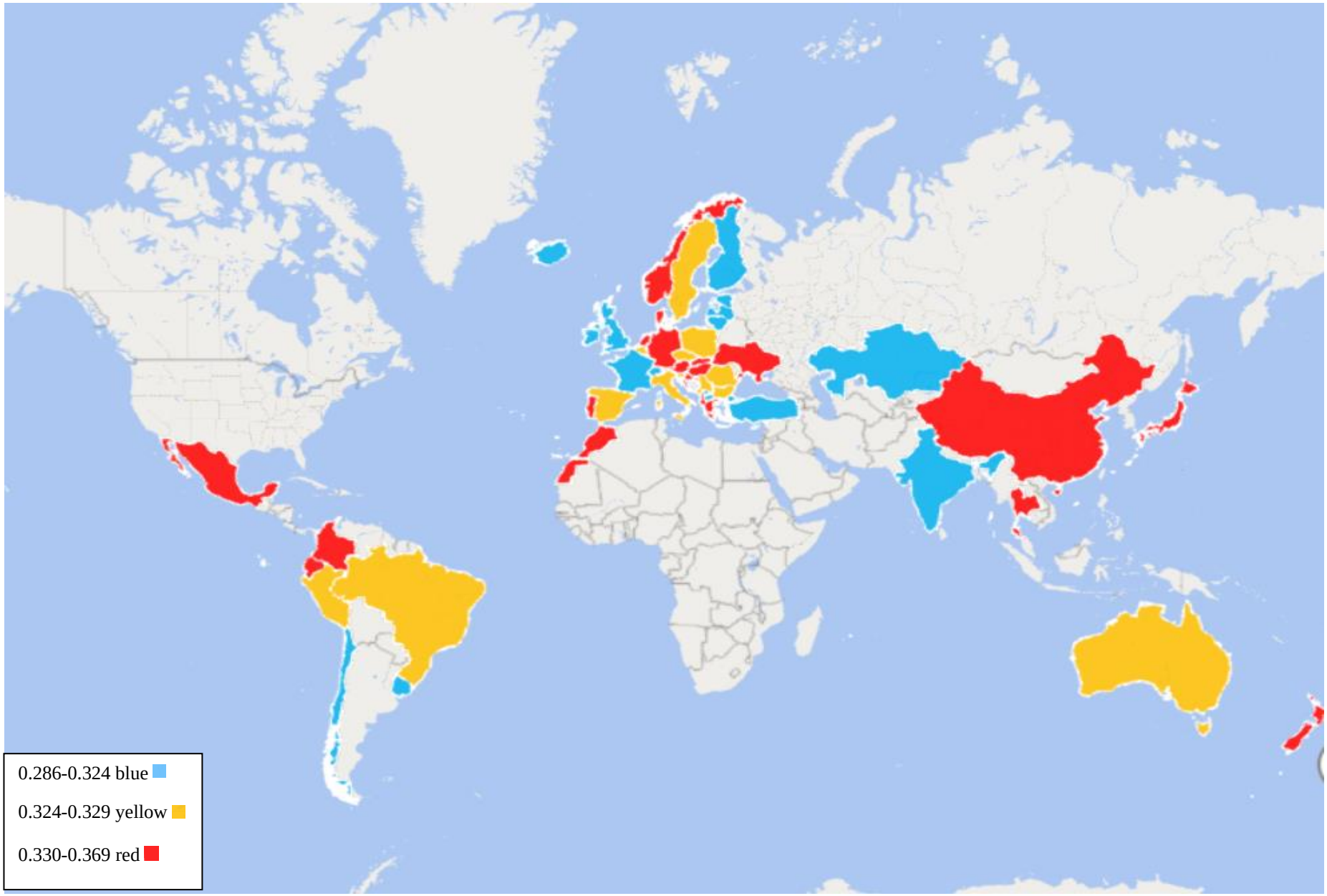
Figure 4: The time trend of profit shifting measures



Map 1



Map 2



Appendix

Global Evidence on Profit Shifting: A New Database

This appendix, intended for online use only, includes more information on our sample construction and the average values of our profit-shifting indices by country-year. The first table includes a country list and reports the number of observations by country in our initial subsidiary-year level dataset. Table A2 provides summary statistics of the main variables used to estimate our two OLS specifications of equations (1) and (7) and our third and fourth profit-shifting measure (*Profit shifting tax incentive 2* and *Profit shifting tax incentive 3*). Tables A3 to A6 report average estimates of Profit shifting by country-year using *Profit shifting tax incentive* to *Profit shifting tax incentive 3*, respectively.

i. Sample construction

We begin with the full worldwide set of subsidiaries with listed global ultimate owners (GUOs) in Orbis.[17] This search strategy provides detailed accounting data for the subsidiaries (and not for the GUO). Next, we create a data set for GUO, for which we search for shareholders with foreign subsidiaries anywhere in the world (excluding firms for which the country is not listed). For subsidiaries, we rely on unconsolidated statements; for GUOs we rely on consolidated statements (there are very few unconsolidated statements for GUOs). Consolidated data net out potential profit-shifting movements among affiliates of a multinational group. We then merge the data sets by GUO and year. Both the subsidiaries and their GUO are of one of the following types: (i) very large or large companies, active, with recent detailed financials, (ii) medium-sized companies, active, with recent detailed financials, (iii) small companies, active, with recent detailed financials. We exclude public authorities.

Our criterion for specifying a subsidiary is the existence of a GUO that owns at least 25.01% of the subsidiary. Note also that the minimum percentage of 25.01% includes both the ultimate owner's direct and indirect holdings, in case there are chains of ownership among the related firms of a specific group. Unlike previous studies, we relax the restriction that GUOs owning at least 51% of their foreign subsidiaries, as one might expect that even lower but still strong ownership could provide an incentive for profit shifting. Relaxing this restriction allows wider coverage. However, all of our results are robust to majority ownership, which might important to avoid results due to "tunneling" (i.e., the phenomenon of individual or family shareholders who control a group of firms shifting income from firms in which they own a relatively small stake to firms in which they own a relatively large stake).

To construct our composite tax variable (equation 2), we collect statutory tax rates from Ernst & Young's Worldwide Corporate Tax Guide. Deveraux and Mafini (2007) and many others henceforth use statutory (as opposed to effective) tax rates and justify this as follows. Multinationals shift profits among affiliates they already operate. Thus, they exploit tax allowances, which depend on differences in statutory (and not effective) tax rates. If multinationals were to decide where to produce (country, location) or measure an investment's value via the margin, effective average tax rate is preferred.

From this initial sample, we exclude subsidiaries in the same countries as their GUOs in order to capture the propagation of earnings among related subsidiaries in different countries due to tax differences. As discussed for the estimation of *Profit shifting tax incentive*, we are interested in the negative responses of *Subsidiaries' earnings before taxes* (π_{it}) to CT_{it} in equation (1). This yields a sample of 26,593 subsidiaries in 95 countries from 2009 to 2017. The total number of subsidiary-year observations is 106,301. We disregard cases of positive responses, i.e., responses when the subsidiary does not send profits abroad (receive profits from abroad) when tax rates in the host country increase (decrease). By using logs, we drop all earnings before taxes of unprofitable subsidiaries, because they deal with zero tax rates, so they have no incentive for profit shifting activities if the local tax authorities do not authorize loss offsets. Further, we drop all the missing observations of the composite tax variable CT_{it}. That is the case for all the subsidiaries of our sample that do not have affiliated subsidiaries in the same multinational group.

For *Profit shifting earnings shock* we have a sample of 65,066 subsidiary-year

[17] Following Orbis, we use the more technical term *GUO*; however, this is exactly the same as our description of an MNE.

observations from 16,683 subsidiaries and 1,530 parents for the period 2009-2017. This sample includes subsidiaries from 62 countries. We retain the positive observations (the ones theoretically suggesting tax motivation as in our discussion of equation 7). We arrive at these observations, because we drop all the missing observations of the main variables in equations 6 and 7.

ii. Tables

Table A1. Country list

This Table reports the number of observations by country in our initial subsidiary-year level dataset. The total number of observations is 375,958.

Country	Observations	Country	Observations	Country	Observations
Albania	22	Hungary	5,618	Saint Martin	16
Argentina	68	Iceland	365	Saudi Arabia	9
Australia	6,523	India	3,268	Senegal	16
Austria	4,890	Indonesia	181	Serbia	1,667
Bahrain	7	Ireland	9,012	Singapore	18,106
Bangladesh	45	Isle of Man	9	Slovakia	4,392
Belgium	20,204	Israel	84	Slovenia	1,472
Bermuda	151	Italy	22,003	South Africa	92
Bolivia	1	Jamaica	18	Spain	17,073
Bosnia and Herzegovina	441	Japan	798	Sri Lanka	36
Botswana	9	Jersey	18	Sweden	13,744
Brazil	1,499	Jordan	63	Switzerland	34
Bulgaria	2,783	Kazakhstan	74	Taiwan	176
Canada	212	Kenya	77	Thailand	10,381
Canary Islands	265	Kosovo	10	Trinidad and Tobago	4
Cayman Islands	319	Latvia	1,609	Tunisia	9
Ceuta	20	Lithuania	694	Turkey	637
Chile	148	Luxembourg	1,392	Uganda	9
China	13,239	Macedonia	224	Ukraine	1,619
Colombia	4,379	Malaysia	915	UAE	17
Croatia	1,844	Malta	390	United Kingdom	71,037
Cyprus	19	Marshall Islands	8	Tanzania	4
Czech Republic	7,813	Martinique	3	USA	368
Côte d'Ivoire	79	Mauritius	4	Uruguay	63
Denmark	6,111	Mexico	198	Vietnam	1,696
Dominica	2	Montenegro	87	Virgin Islands	22
Ecuador	14	Morocco	1,136	Zambia	11
Egypt	18	Netherlands	14,267	Zimbabwe	27
El Salvador	4	New Zealand	2,080		
Estonia	1,758	Nigeria	96		
Faroe Islands	9	Norway	10,343		
Fiji	18	Oman	22		
Finland	4,539	Pakistan	176		
France	32,603	Peru	95		
Gabon	9	Philippines	58		
Georgia	3	Poland	9,378		
Germany	7,526	Portugal	7,793		
Ghana	54	South Korea	6,262		
Greece	1,290	Reunion	6		
Guadeloupe	7	Romania	6,857		
Hong Kong	21	Russia	8,564		

Table A2. Additional summary statistics for the different estimation samples

The table reports the number of observations, the mean, standard deviation, minimum, maximum, first quartile, third quartile and median of the main variables used to estimate our two OLS specifications of equations 1 and 7 (results in the first columns of Tables 3 and 4, respectively) and for the samples used to estimate *Profit shifting tax incentive 2 and Profit shifting tax incentive 3*. The variables are defined in Table 1.

	Obs.	Mean	St. Dev.	Min.	Max.	Q1	Q3	Median
Subsidiaries' earnings before taxes	166,979	7.20	2.15	-9.63	17.58	5.85	8.58	7.22
Composite tax variable	166,979	0.00	0.09	-0.39	0.60	-0.05	0.07	0
Subsidiaries' assets	166,979	9.78	2.06	-6.61	18.55	8.43	11.10	9.72
Statutory tax rates	166,979	0.26	0.06	0	0.40	0.20	0.31	0.26
Subsidiaries' cost of employees	166,979	8.16	1.85	-6.70	15.90	7.02	9.34	8.17
Subsidiaries' earnings before taxes	112,102	7.05	2.41	-13.56	17.58	5.62	8.58	7.13
Subsidiaries' assets	112,102	9.67	2.23	-1.86	19.33	8.25	11.11	9.65
Subsidiaries' leverage	112,102	0.54	0.29	0	1.43	0.32	0.77	0.55
Parents' earnings before taxes	108,486	13.08	1.92	0.02	18.10	11.87	14.53	13.17
Parent's predicted earnings	112,102	7.62	6.59	0	17.11	0	13.49	11.38
Parent's cost of employees	112,102	13.41	2.32	1.29	17.36	11.79	15.40	13.72
Parents' assets	112,098	15.83	1.89	6.31	19.83	14.64	17.38	15.89
Profit shifting tax incentive 2	82,459	0.78	0.68	0	32.33	0.31	1.13	0.67
Subsidiaries' earnings before taxes	82,459	7.19	2.37	-9.63	16.59	5.80	8.71	7.26
Composite tax variable	82,459	0.09	0.05	-0.39	0.48	0.05	0.12	0.08
Subsidiaries' assets	82,442	9.92	2.23	-6.63	19.08	8.50	11.38	9.89
Statutory tax rates	82,459	0.31	0.04	0	0.40	0.30	0.33	0.31
Subsidiaries' cost of employees	62,524	8.32	1.82	-6.59	15.90	7.15	9.49	8.30
Profit shifting tax incentive 3	111,268	1.10	0.66	0	11.15	0.53	1.67	1.14
Subsidiaries' earnings before taxes	111,268	7.25	2.17	-9.63	17.58	5.89	8.65	7.26
Composite tax variable	111,268	0.03	0.08	-0.39	0.60	-0.00	0.08	0.03
Subsidiaries' assets	111,268	9.85	2.07	-1.09	18.55	8.47	11.19	9.77
Statutory tax rates	111,268	0.27	0.06	0	0.40	0.24	0.33	0.29
Subsidiaries' cost of employees	111,268	8.24	1.85	-6.70	15.90	7.08	9.41	8.23

Table A3. Average estimates of *Profit shifting tax incentive* by country-year

This Table reports average estimates of Profit shifting by country-year using *Profit shifting tax incentive* (semi-parametric) and the number of observations by country. The total number of observations is 106,301.

Country	Obs.	2009	2010	2011	2012	2013	2014	2015	2016	2017	Mean	St. Dev.
Argentina	7					1.428		1.816	1.054	1.040	1.334	0.368
Australia	2,430	1.595	1.757	1.863	1.497	1.458	1.440	1.340	1.412	1.319	1.520	0.185
Austria	1,744	0.634	1.212	1.275	1.441	1.419	1.479	1.502	1.672	1.812	1.383	0.335
Bahrain	7			0.133	0.133	0.133	0.133	0.133	0.133	0.133	0.133	0.000
Bangladesh	16	0.646	1.165	2.214	1.443	1.470	1.943	1.109	0.398	1.878	1.363	0.601
Belgium	9,449	1.468	1.447	1.429	1.331	1.319	1.280	1.252	1.213	1.233	1.330	0.096
Bermuda	41	4.310	4.569	5.617	7.644	8.439	4.710	4.602	6.180	3.190	5.474	1.686
Bosnia and Herzegovina	145	2.439	2.432	2.676	2.639	3.960	3.586	4.169	4.027	3.360	3.254	0.716
Brazil	53	1.781	1.368	1.425	0.949	0.937	1.312	0.967	1.302	1.374	1.268	0.277
Bulgaria	865	2.249	2.546	2.817	2.209	2.176	2.565	2.386	2.424	1.653	2.336	0.327
Canada	27	1.568	2.493	1.721	2.254	1.909	1.182	0.994	1.167	1.721	1.668	0.505
Canary Islands (Spain)	143	1.487	1.503	1.337	1.295	1.302	1.596	1.580	1.620	2.116	1.537	0.251
Cayman Islands	113	7.720	7.989	8.831	8.718	9.497	8.853	8.835	9.026	8.482	8.661	0.536
Ceuta (Spain)	14	1.506	1.321	1.344	1.340	1.312	1.375	2.747	0.761		1.463	0.564
Chile	33			1.687	0.514	1.459	1.122	2.002	1.619	0.925	1.333	0.509
China	2						1.236	0.650			0.943	0.414
Colombia	12			1.038	0.790	1.012	2.148	1.516	1.579	1.124	1.315	0.463
Croatia	478	1.215	1.046	1.294	1.175	1.224	1.217	1.261	1.196	1.228	1.206	0.069
Czech Republic	2,246	1.064	1.164	0.993	1.014	1.035	0.992	1.037	1.050	1.134	1.054	0.060
Côte d'Ivoire	35	9.458	13.080	13.349	9.142	7.958	9.304	9.097	2.251	1.822	8.384	4.041
Denmark	2019					1.668	1.639	1.578	1.649	1.794	1.666	0.079
Dominica	1								1.638		1.638	
Ecuador	4								1.116	1.083	1.099	0.023
Egypt	3				1.415	1.403	1.534				1.451	0.072
El Salvador	4								0.904	1.314	1.109	0.290
Estonia	383	1.205	1.137	1.109	1.163	1.397	1.712	1.460	1.404	1.412	1.333	0.197
Fiji	6	2.474	2.777	2.843	1.520			0.598		1.329	1.923	0.911
Finland	1,056	1.462	1.444	1.503	1.455	1.692	1.178	1.195	1.168	1.439	1.393	0.177
France	14,764	1.502	1.466	1.495	1.356	1.276	1.307	1.312	1.246	1.200	1.351	0.112

Gabon	6	1.054	1.124	0.715	0.881	1.806	1.625				1.201	0.427
Germany	4,494	1.643	1.722	1.596	1.572	1.518	1.423	1.381	1.417	1.303	1.508	0.137
Ghana	14	1.419	2.107	1.238	1.995	2.780	1.347	1.409	1.502	1.512	1.701	0.499
Greece	2	0.504		0.160							0.332	0.243
Guadeloupe (France)	3			1.677	1.405	0.781					1.288	0.459
Hong Kong	12	0.196	0.181	0.193	0.123	0.265	0.503	0.960	1.229	1.347	0.555	0.490
Hungary	1,577	1.087	1.171	0.967	0.974	1.018	1.006	1.049	1.068	2.118	1.162	0.364
Iceland	19	1.654		1.214	1.307		1.066	0.944	1.286	1.844	1.331	0.317
India	1,391	1.382	1.324	1.329	1.309	1.070	1.036	1.214	1.076	1.373	1.235	0.139
Indonesia	65	1.616	1.373	1.738	1.640	1.745	1.544	2.119	2.004	1.416	1.688	0.248
Ireland	1,365	1.718	1.715	1.623	1.705	1.544	1.715	1.541	1.516	1.172	1.583	0.175
Isle of Man (United Kingdom)	2						2.436	2.856			2.646	0.297
Israel	43	1.654	1.821	1.507	1.696	1.574	1.681	1.393	1.571	1.559	1.606	0.123
Italy	12,177	1.526	1.489	1.406	1.442	1.393	1.335	1.301	1.247	1.598	1.415	0.112
Jamaica	4					2.495	1.599		0.806	0.838	1.434	0.796
Japan	264	2.196	1.021	2.236	1.300	1.458	0.859	1.131	1.453	1.414	1.452	0.479
Jersey (United Kingdom)	7	0.636			1.813	1.103	1.044	1.559	0.853	1.363	1.196	0.409
Jordan	19	1.938			1.938	1.938	1.938	1.938	1.938	1.938	1.938	0.000
Kenya	51	5.221	1.316	1.497	1.704	1.549	1.602	1.412	1.840	1.709	1.983	1.225
Latvia	35	0.856				0.697	1.186	0.959	1.065	1.194	0.993	0.195
Luxembourg	580	1.751	1.742	1.644	1.712	1.511	1.523	1.549	1.640	1.505	1.620	0.101
Macedonia (Fyrom)	67				1.306	1.101	1.817	2.297	2.137	1.910	1.762	0.468
Malaysia	211	1.586	1.572	1.673	1.787	1.574	1.535	1.603	1.686	1.625	1.627	0.077
Malta	24	1.272	1.220	1.894	1.799	2.255	2.139	1.912	1.132	1.565	1.687	0.410
Martinique (France)	3		0.712	1.091						0.425	0.742	0.334
Mexico	6			0.949	0.714	1.333	1.470	1.582		2.056	1.351	0.476
Montenegro	35	7.790	1.313		1.364	5.652	1.890	2.398	1.488	2.965	3.108	2.369
Morocco	587	1.191	1.906	1.738	1.561	1.551	1.465	1.413	1.392	1.273	1.499	0.222
Netherlands	1,540	1.108	1.197	1.296	1.446	1.557	1.518	1.543	1.637	1.803	1.456	0.220
New Zealand	1,270	1.903	1.827	1.812	1.660	1.653	1.665	1.612	1.537	1.551	1.691	0.128
Nigeria	57	1.826	1.668	1.575	1.807	1.238	1.529	1.255	1.443	1.519	1.540	0.210
Norway	4,621	1.779	1.744	1.858	1.688	1.637	1.646	1.640	1.623	1.689	1.701	0.079
Oman	15	5.955	4.452	12.854	14.609	5.348	1.991	0.798	0.671	0.519	5.244	5.248
Pakistan	113	1.202	1.143	1.289	1.063	0.976	1.179	1.377	1.433	1.483	1.238	0.171

Peru	10					1.598		1.899	2.199	1.316	1.753	0.381
Philippines	40	1.420	1.256	1.115	1.951	1.720	1.509	1.334	1.518	1.187	1.446	0.266
Poland	2,183	1.057	0.989	0.959	1.046	1.093	1.102	1.153	0.983	1.105	1.054	0.066
Portugal	2,146	1.558	1.382	1.789	1.483	1.793	1.550	1.275	1.270	1.544	1.516	0.191
Republic of Korea	2,538	1.180	1.239	1.206	1.490	1.674	1.611	1.615	1.687	1.632	1.481	0.213
Reunion (France)	5		1.792				2.334	1.224		2.334	1.921	0.530
Romania	1,363	1.029	1.050	1.061	0.975	1.136	1.048	0.914	1.051	1.148	1.046	0.072
Russian Federation	6					0.424	1.186	1.347	1.026	0.726	0.942	0.369
Saudi Arabia	1									1.270	1.270	
Senegal	8			0.525			1.316	1.490	1.315	1.465	1.222	0.398
Serbia	399	2.698	2.466	2.337	1.832	0.866	0.994	1.141	1.053	1.119	1.612	0.724
Singapore	14	1.582	0.496	0.638	1.142			1.627	1.191	1.306	1.140	0.434
Slovakia	1,191	1.108	1.170	1.038	1.104	1.296	1.216	1.645	1.572	1.574	1.302	0.233
Slovenia	527	0.958	1.025	1.124	1.200	1.249	1.296	1.259	1.398	1.396	1.212	0.153
South Africa	51	1.305	1.457	1.164	1.021	1.303	0.907	1.412	1.684	1.516	1.307	0.245
Spain	9,172	1.801	1.832	1.666	1.544	1.487	1.427	1.558	1.653	1.653	1.625	0.135
Sri Lanka	26	1.272	1.323	1.680	2.182	2.230	2.306	2.824	0.950	2.022	1.865	0.601
Sweden	3,307	1.530	1.719	1.776	1.973	1.207	1.432	1.643	1.649	1.739	1.630	0.220
Switzerland	1								1.512		1.512	
Taiwan	47	1.364	0.720	0.989	1.081	0.839	1.056	1.189	1.226	1.198	1.073	0.201
Thailand	268	1.624	1.308	1.425	1.410	1.241	1.385	1.386	1.290	1.341	1.379	0.110
Turkey	37	1.232	1.021	1.158	1.031	1.155	2.038	1.432	1.708	2.004	1.420	0.402
Uganda	8	2.100		1.437	1.323	1.411	1.334	1.387	2.325	2.831	1.769	0.576
Ukraine	216	1.236	1.275	1.224	0.401	1.147	1.311	1.032	1.061	0.927	1.068	0.280
United Arab Emirates	6	8.164	9.178	11.170	11.394	7.420	7.257				9.097	1.825
United Kingdom	15,921	1.676	1.673	1.563	1.366	1.364	1.397	1.296	1.304	1.285	1.436	0.159
United Republic of Tanzania	4					2.795		2.709	2.453	1.395	2.338	0.645
United States of America	9					0.521	1.601		1.163	1.362	1.162	0.463
Uruguay	1							1.602			1.602	
Vietnam	8				1.708		1.938	2.275	1.426	0.186	1.506	0.801
Zambia	4					1.505	0.838	0.508	1.749		1.150	0.576
Zimbabwe	5	1.403	1.110		0.269	2.883	1.497				1.433	0.944

Table A4. Average estimates of *Profit shifting earnings shock* by country-year

This Table reports average estimates of Profit shifting by country-year using *Profit shifting earnings shock* (semi-parametric) and the number of observations by country. The total number of observations is 65,066.

Country	Obs.	2009	2010	2011	2012	2013	2014	2015	2016	2017	Mean	St. Dev.
Albania	15						0.336	0.329	0.331	0.335	0.333	0.003
Australia	623	0.328	0.330	0.335	0.332	0.328	0.326	0.326	0.327	0.328	0.329	0.003
Austria	1,039	0.319	0.331	0.333	0.330	0.332	0.332	0.332	0.333	0.332	0.331	0.004
Belgium	1,008	0.326	0.325	0.326	0.323	0.326	0.325	0.323	0.325	0.326	0.325	0.001
Bosnia and Herzegovina	184	0.324	0.327	0.327	0.323	0.328	0.325	0.324	0.314	0.318	0.323	0.005
Brazil	34						0.319	0.330	0.327	0.330	0.327	0.005
Bulgaria	972	0.324	0.328	0.324	0.325	0.325	0.324	0.323	0.324	0.326	0.325	0.001
Canary Islands (Spain)	22	0.329	0.335	0.347	0.325	0.324	0.326	0.335	0.315	0.314	0.328	0.010
Chile	9							0.323	0.315	0.317	0.319	0.004
China	1,227	0.330	0.334	0.336	0.332	0.330	0.330	0.329	0.332	0.334	0.332	0.002
Colombia	565	0.332	0.330	0.335	0.333	0.329	0.331	0.325	0.327	0.323	0.330	0.004
Croatia	492	0.332	0.336	0.333	0.334	0.331	0.329	0.334	0.332	0.334	0.333	0.002
Cyprus	2								0.300	0.304	0.302	0.003
Czech Republic	2,783	0.327	0.329	0.329	0.327	0.327	0.327	0.326	0.327	0.330	0.327	0.001
Denmark	1,225	0.386	0.401	0.418		0.324	0.323	0.323	0.324	0.326	0.353	0.041
Ecuador	7							0.353	0.355	0.356	0.355	0.002
Estonia	651	0.315	0.316	0.315	0.314	0.312	0.316	0.317	0.314	0.315	0.315	0.001
Finland	1,409	0.321	0.322	0.321	0.317	0.324	0.319	0.316	0.318	0.320	0.320	0.003
France	1,906	0.318	0.317	0.318	0.321	0.323	0.323	0.321	0.322	0.323	0.321	0.002
Germany	1,208	0.335	0.337	0.337	0.334	0.332	0.332	0.331	0.332	0.334	0.334	0.002
Greece	359	0.337	0.337	0.342	0.340	0.334	0.337	0.337	0.337	0.335	0.337	0.002
Guadeloupe (France)	2				0.328	0.328					0.328	0.000
Hungary	1,994	0.333	0.333	0.331	0.330	0.330	0.328	0.328	0.326	0.328	0.330	0.002
Iceland	140	0.317	0.299	0.312	0.316	0.308	0.315	0.315	0.318	0.316	0.313	0.006
India	176	0.320	0.322	0.325	0.327	0.328	0.325	0.322	0.322	0.321	0.324	0.003
Ireland	2,263	0.325	0.321	0.322	0.322	0.323	0.322	0.320	0.320	0.324	0.322	0.002
Italy	2,980	0.328	0.328	0.329	0.324	0.325	0.326	0.325	0.327	0.327	0.327	0.002
Japan	52					0.345	0.342	0.339	0.342	0.337	0.341	0.003
Kazakhstan	8		0.341	0.333		0.315	0.302				0.323	0.018

Kosovo	9					0.318	0.305	0.305	0.306	0.308	0.308	0.006
Latvia	690	0.322	0.323	0.325	0.323	0.324	0.323	0.323	0.321	0.324	0.323	0.001
Lithuania	400	0.318	0.318	0.318	0.319	0.321	0.318	0.318	0.316	0.321	0.318	0.002
Luxembourg	250	0.333	0.327	0.331	0.328	0.328	0.327	0.326	0.329	0.332	0.329	0.002
Macedonia (Fyrom)	107		0.332	0.324	0.319	0.331	0.322	0.312	0.313	0.314	0.321	0.008
Malta	4					0.318	0.314		0.318	0.314	0.316	0.002
Martinique (France)	1									0.327	0.327	
Mauritius	2									0.316	0.316	
Mexico	22					0.342	0.337	0.335	0.330	0.328	0.335	0.006
Montenegro	25						0.330	0.323	0.324	0.327	0.326	0.003
Morocco	205			0.339	0.330	0.322	0.329	0.327	0.330	0.331	0.330	0.005
Netherlands	2,109	0.334	0.335	0.336	0.328	0.328	0.325	0.325	0.328	0.331	0.330	0.004
New Zealand	249	0.331	0.341	0.335	0.335	0.336	0.331	0.333	0.333	0.332	0.334	0.003
Norway	1,219	0.332	0.333	0.336	0.331	0.332	0.332	0.330	0.331	0.331	0.332	0.002
Peru	4								0.317	0.331	0.324	0.010
Poland	3,352	0.327	0.329	0.329	0.326	0.327	0.327	0.326	0.326	0.329	0.327	0.001
Portugal	2,228	0.330	0.328	0.330	0.325	0.330	0.331	0.331	0.329	0.331	0.330	0.002
Republic of Korea	850	0.330	0.334	0.336	0.329	0.329	0.330	0.329	0.330	0.332	0.331	0.003
Romania	2,354	0.323	0.324	0.328	0.324	0.327	0.325	0.324	0.324	0.326	0.325	0.002
Russian Federation	1,863	0.325	0.328	0.328	0.325	0.325	0.328	0.325	0.324	0.326	0.326	0.002
Serbia	539	0.325	0.328	0.329	0.327	0.330	0.327	0.322	0.319	0.319	0.325	0.004
Singapore	4,016	0.335	0.333	0.341	0.333	0.324	0.320	0.318	0.319	0.321	0.327	0.008
Slovakia	1,272	0.331	0.331	0.332	0.330	0.330	0.329	0.334	0.334	0.333	0.332	0.002
Slovenia	598	0.335	0.333	0.332	0.326	0.327	0.328	0.321	0.324	0.324	0.328	0.005
Spain	2,623	0.330	0.333	0.332	0.329	0.329	0.326	0.326	0.325	0.328	0.329	0.003
Sweden	3,280	0.327	0.324	0.327	0.325	0.323	0.325	0.325	0.325	0.328	0.325	0.002
Switzerland	2							0.284	0.288		0.286	0.003
Thailand	110	0.345	0.350	0.361	0.340	0.347	0.346	0.345	0.339	0.346	0.347	0.006
Turkey	154	0.319	0.323	0.325	0.330	0.323	0.323	0.323	0.322	0.324	0.323	0.003
Ukraine	421	0.333	0.336	0.340	0.334	0.333	0.332	0.322	0.322	0.330	0.331	0.006
United Arab Emirates	9	0.379	0.386	0.398	0.388	0.374	0.371	0.326	0.341	0.360	0.369	0.023
United Kingdom	12,738	0.328	0.326	0.326	0.323	0.323	0.321	0.321	0.320	0.322	0.323	0.003

Uruguay	6	0.289	0.310	0.292	0.297	0.297	0.009	

Table A5. Average estimates of *Profit shifting tax incentive 2* by country-year

This Table reports average estimates of Profit shifting by country-year using *Profit shifting tax incentive 2* (non-parametric) and the number of observations by country. The total number of observations is 82,459.

Country	Obs.	2009	2010	2011	2012	2013	2014	2015	2016	2017	Mean	St. Dev.
Argentina	41	0.670	0.683	0.667		0.872	0.939	1.147	1.122	0.975	0.884	0.197
Australia	3,429	0.332	0.386	0.409	0.513	0.550	0.660	0.761	0.800	0.894	0.590	0.200
Austria	506	0.184	0.463	0.538	0.451	0.517	0.416	0.370	0.400	0.420	0.418	0.103
Bangladesh	2				0.045		0.017				0.031	0.020
Belgium	13,451	0.762	0.753	0.866	0.958	1.035	1.141	1.198	1.244	1.360	1.035	0.217
Bermuda	20	4.676	3.355	3.097	3.482	9.427	5.988	5.380	5.997	6.196	5.289	1.973
Brazil	905	0.808	0.831	0.968	1.122	1.124	1.068	1.076	1.135	1.138	1.030	0.131
Canada	22	0.761	0.409	0.554	0.512	0.419	0.525	0.526	0.771	0.598	0.564	0.129
Canary Islands (Spain)	119	0.186	0.231	0.234	0.276	0.400	0.534	0.327	0.381	0.277	0.316	0.108
Cayman Islands	29	9.643	10.964	8.159	12.273	22.539	19.279	16.250	14.833	16.880	14.536	4.711
Ceuta (Spain)	10	0.003	0.082	0.040	0.094	0.064	0.108				0.065	0.039
Chile	15						0.083	0.815	0.822	1.026	0.687	0.414
China	2,133	0.748	0.689	0.629	0.612	0.461	0.495	0.434	0.429	0.414	0.546	0.125
Colombia	1,842	0.580	0.614	0.697	0.798	0.342	0.319	0.331	0.341	1.404	0.603	0.350
Côte d'Ivoire	22	3.794	5.450	4.142	2.958	4.070	3.077	1.166		0.313	3.121	1.671
Croatia	64	0.646	0.589	0.419	0.358	0.267	0.236	0.268	0.373	0.402	0.395	0.142
Czech Republic	97	0.544	0.625	0.799	0.443	0.233	0.149	0.273	0.183	0.260	0.390	0.225
Denmark	500					0.391	0.321	0.343	0.416	0.310	0.356	0.046
Ecuador	2									0.380	0.380	
Egypt	2				0.020	0.118					0.069	0.069
El Salvador	4								0.589	0.325	0.457	0.187
Estonia	41		0.253	0.314	0.262	0.363	0.346	0.176	0.194	0.301	0.276	0.068
Fiji	2				0.158					0.047	0.102	0.078
Finland	147	0.491	0.698	0.612	0.586	0.292	0.127	0.166	0.224	0.208	0.379	0.218
France	19,968	0.610	0.647	0.712	0.820	0.921	1.008	1.081	1.130	1.280	0.912	0.232
Gabon	7	0.387	0.370	0.495	0.584	0.803	0.941			0.158	0.534	0.268
Germany	3,982	0.429	0.443	0.428	0.494	0.506	0.593	0.644	0.681	0.776	0.555	0.125
Ghana	4						0.039	0.120	0.151	0.271	0.145	0.096

Greece	284	0.416	0.163			0.289	0.289	0.523	0.614	0.664	0.423	0.186
Guadeloupe (France)	3			0.922	0.980	1.037					0.980	0.058
Hungary	36	0.218	0.571	0.578	0.433	0.210	0.234	0.225	0.180		0.331	0.169
Iceland	5			0.097			0.000	0.054	0.229	0.148	0.106	0.088
India	2,165	0.782	0.776	0.653	0.777	1.161	1.267	1.454	1.478	1.683	1.115	0.379
Indonesia	21	0.082	0.190			0.473	0.287	0.115	0.393	0.373	0.274	0.149
Ireland	1			0.623							0.623	
Isle of Man (United Kingdom)	3		0.299	0.033		0.128					0.153	0.135
Israel	31	0.103	0.176	0.096	0.168	0.225	0.375	0.405	0.296	0.311	0.239	0.113
Italy	11,472	0.476	0.471	0.540	0.631	0.712	0.821	0.884	0.936	0.383	0.651	0.199
Jamaica	12	0.930	0.829	0.974	0.982		0.204	0.361	0.454	0.575	0.664	0.305
Japan	604	2.108	1.805	1.973	2.064	1.819	1.487	1.337	0.908	1.010	1.612	0.449
Jersey (United Kingdom)	9	1.361	1.218	1.130	0.791	0.375	0.389	0.174	0.439	0.313	0.688	0.446
Kenya	36	2.077	0.654	0.460	0.497	0.387	0.303	0.220	0.413	0.328	0.593	0.570
Latvia	1		0.010								0.010	
Luxembourg	468	0.312	0.287	0.271	0.254	0.448	0.420	0.548	0.629	0.521	0.410	0.137
Malaysia	127	0.424	0.593	0.555	0.306	0.362	0.327	0.385	0.325	0.341	0.402	0.104
Malta	195	0.986	1.095	1.242	1.157	1.235	1.276	1.408	1.442	1.699	1.282	0.211
Marshall Islands	2							2.948	4.128		3.538	0.834
Martinique (France)	3		0.530	0.620						1.332	0.827	0.439
Mexico	110			0.268	0.484	0.533	0.519	0.676	0.602	0.698	0.540	0.144
Morocco	519	0.215	0.398	0.373	0.418	0.522	0.603	0.658	0.888	0.962	0.560	0.246
Netherlands	1,435	0.373	0.479	0.506	0.422	0.422	0.320	0.382	0.384	0.442	0.415	0.057
New Zealand	851	0.259	0.319	0.420	0.333	0.350	0.482	0.520	0.596	0.660	0.438	0.136
Nigeria	46	0.413	0.185	0.430	0.481	0.507	0.690	0.420	0.457	0.666	0.472	0.149
Norway	2,522	0.564	0.538	0.498	0.354	0.350	0.428	0.481	0.346	0.379	0.438	0.085
Pakistan	141	0.883	0.941	1.050	1.028	1.104	0.906	0.832	0.706	0.769	0.913	0.132
Peru	37	1.622	0.589	0.452	0.483	0.208	0.259	0.178	0.377	0.440	0.512	0.438
Philippines	46	0.679	0.965	0.856	1.024	1.158	1.279	1.010	0.873	0.939	0.976	0.174
Poland	64	0.561	0.372	0.378	0.381	0.637	0.172	0.315	0.214	0.319	0.372	0.149
Portugal	1,404	0.314	0.336	0.392	0.757	0.424	0.202	0.266	0.359	0.445	0.388	0.158
Republic of Korea	698	0.515	0.530	0.600	0.430	0.388	0.358	0.320	0.352	0.297	0.421	0.105

Reunion (France)	6		0.749				2.646	1.863		1.943	1.800	0.784
Romania	31	0.363	0.342	0.284	0.352	0.329	0.323	0.434	0.257	0.189	0.319	0.070
Russian Federation	123	0.152	0.195	0.185	0.250	0.141	0.162	0.192	0.226	0.320	0.203	0.056
Saint Martin (France)	4					0.358	1.172	1.341		1.632	1.126	0.546
Saudi Arabia	1									2.742	2.742	
Senegal	7						0.077	0.119	0.069	0.138	0.101	0.033
Serbia	13					0.313	0.246	0.194	0.307	0.224	0.257	0.052
Singapore	135	1.358	0.874	1.121	1.190	0.829	0.650	0.577	0.447	0.351	0.822	0.348
Slovakia	131	0.505		0.547	0.221	0.378	0.337	0.314	0.404	0.380	0.386	0.104
Slovenia	21	0.238	0.821	0.527	0.545	0.267	0.476	0.613	0.823	0.587	0.544	0.205
South Africa	36	0.624	0.696	0.791	0.927	0.378	0.691	0.304	0.469	1.064	0.660	0.249
Spain	6,074	0.341	0.352	0.350	0.416	0.480	0.582	0.472	0.347	0.413	0.417	0.082
Sri Lanka	8	0.874	0.803							0.048	0.575	0.458
Sweden	805	0.617	0.592	0.642	0.475	0.455	0.435	0.352	0.417	0.322	0.479	0.115
Taiwan	2	0.388									0.388	
Thailand	1,090	0.432	0.476	0.458	0.331	0.204	0.144	0.237	0.194	0.197	0.297	0.129
Turkey	7			0.052				0.040	0.081	0.302	0.119	0.123
Uganda	5			0.015	0.050	0.021	0.091	0.113			0.058	0.043
Ukraine	34	0.380	0.478	0.436	0.102					0.105	0.300	0.183
United Kingdom	2,907	0.507	0.514	0.579	0.410	0.476	0.336	0.250	0.214	0.351	0.404	0.125
United Republic of Tanzania	1									0.115	0.115	
United States of America	136	1.715	1.514	1.448	1.484	1.985	2.077	2.034	1.993	2.085	1.815	0.273
Uruguay	14					0.466	0.553		0.393	0.496	0.477	0.067
Vietnam	139	2.357	1.538	2.001	1.833	1.072	0.905	1.020	0.594	0.707	1.336	0.620
Zambia	8				1.281	1.124	1.033	1.055	0.987	1.220	1.117	0.114
Zimbabwe	4	0.118					0.149		0.484	0.310	0.265	0.168

Table A6. Average estimates of *Profit shifting tax incentive 3* by country-year

This Table reports average estimates of Profit shifting by country-year using *Profit shifting tax incentive 3* (non-parametric using a B-spline as basis function) and the number of observations by country. The total number of observations is 111,268.

Country	Obs.	2009	2010	2011	2012	2013	2014	2015	2016	2017	Mean	St. Dev.
Argentina	9					0.761	0.428	0.893	0.546	0.478	0.621	0.198
Australia	2,628	1.024	1.412	1.561	1.464	1.371	1.262	1.173	1.149	1.024	1.271	0.193
Austria	1,986	0.782	0.755	0.714	0.819	0.985	1.098	1.163	1.339	1.440	1.011	0.266
Bahrain	7			1.257	1.257	1.257	1.257	1.257	1.257	1.257	1.257	0.000
Bangladesh	18	0.715	0.940	1.113	1.571	1.501	0.705	0.914	0.616	1.228	1.034	0.346
Belgium	10,668	1.153	1.147	1.008	0.898	0.790	0.789	0.745	0.729	0.665	0.880	0.182
Bermuda	62	3.768	3.710	2.887	2.736	3.784	2.104	2.265	2.344	1.980	2.842	0.740
Bosnia and Herzegovina	213	1.168	1.462	1.322	1.172	1.021	0.991	0.996	1.038	0.975	1.127	0.170
Brazil	69	0.961	0.788	0.731	0.417	0.347	0.548	0.554	0.801	0.693	0.649	0.198
Bulgaria	1,260	1.390	1.337	1.244	1.032	0.922	0.877	0.868	0.878	0.746	1.033	0.233
Canada	26		1.476	1.245	1.748	1.460	1.492	1.114	1.059	1.373	1.371	0.225
Canary Islands (Spain)	147	1.578	1.606	1.595	1.591	1.464	1.353	1.478	1.366	1.506	1.504	0.097
Cayman Islands	159	3.710	3.555	3.258	3.095	3.342	2.914	2.933	2.700	2.304	3.090	0.436
Ceuta (Spain)	16	2.023	2.023	2.030	2.018	2.028	2.010	1.854	0.761	0.236	1.665	0.676
Chile	40	0.040	0.397	1.808	0.661	1.879	2.023	1.036	0.662	0.665	1.019	0.716
Colombia	13			1.169	1.250	0.870	1.344	1.396	1.552	0.554	1.162	0.342
Croatia	313	0.916	0.647	1.109	1.198	0.962	1.000	0.919	0.814	1.027	0.955	0.161
Czech Republic	1,098	0.717	0.520	0.530	0.684	0.705	0.690	0.632	0.742	0.704	0.658	0.081
Côte d'Ivoire	57	5.032	5.113	5.367	4.337	4.289	4.133	4.057	1.382	1.678	3.932	1.440
Denmark	2,199					1.228	1.249	1.104	1.112	1.279	1.195	0.081
Dominica	1								0.455		0.455	
Ecuador	4								0.917	1.580	1.248	0.469
Egypt	3				2.028	2.004	2.021				2.017	0.012
El Salvador	4								1.207	1.683	1.445	0.337
Estonia	270	0.830	0.579	0.934	0.819	0.945	1.040	0.907	0.986	0.982	0.891	0.137

Faroe Islands (Denmark)	1						0.033				0.033	
Fiji	7	1.921	1.607	0.849	1.175					2.030	1.516	0.499
Finland	1,156	0.918	0.810	0.980	1.002	1.098	0.680	0.803	0.793	0.838	0.880	0.129
France	16,077	1.389	1.351	1.222	1.056	0.937	0.911	0.847	0.817	0.749	1.031	0.237
Gabon	6	1.567	1.598	1.370	1.215	0.858	0.650				1.210	0.385
Germany	4,793	1.514	1.528	1.505	1.471	1.416	1.330	1.250	1.253	1.103	1.374	0.149
Ghana	14	1.068	1.596	1.166	0.760	1.609	1.084	2.002	1.023	0.756	1.229	0.420
Greece	2	0.657	0.039								0.348	0.437
Guadeloupe (France)	3			0.678	0.593	0.519					0.597	0.080
Hong Kong	3							0.366	0.437	0.031	0.278	0.217
Hungary	1,042	0.426	0.422	0.483	0.597	0.659	0.536	0.540	0.777	0.849	0.588	0.149
Iceland	34	0.228	0.061			0.059	0.927	0.419	0.688	0.877	0.465	0.370
India	1,329	1.042	1.025	1.273	1.119	0.708	0.637	0.537	0.546	0.472	0.818	0.298
Indonesia	87	1.027	0.895	1.037	0.837	0.883	1.088	1.479	1.259	1.348	1.095	0.223
Ireland	1,807	0.873	0.865	0.690	0.694	0.647	0.643	0.667	0.706	0.605	0.710	0.095
Isle of Man (United Kingdom)	2						1.927	1.665			1.796	0.185
Israel	47	1.572	1.421	1.598	1.591	1.446	1.841	1.661	1.753	1.724	1.623	0.138
Italy	13,124	1.539	1.499	1.398	1.264	1.150	1.032	0.965	0.919	1.286	1.228	0.227
Jamaica	7		0.454	0.209	0.232	1.917	1.907		1.444	1.230	1.056	0.753
Japan	235	0.550	0.467	1.204	0.552	0.271	0.543	0.582	0.958	0.921	0.672	0.292
Jersey (United Kingdom)	9	0.136	0.305	0.408	0.877	1.589	1.563	1.949	1.471	1.705	1.111	0.686
Jordan	19	1.265			1.265	1.265	1.265	1.265	1.265	1.265	1.265	0.000
Kenya	60	4.057	1.064	1.012	1.229	1.434	1.683	1.699	1.708	1.612	1.722	0.917
Latvia	9	0.188	0.132			0.245	0.125	0.112	0.480	0.473	0.251	0.161
Luxembourg	635	1.284	1.333	1.436	1.444	1.481	1.531	1.373	1.293	1.454	1.403	0.087
Macedonia (Fyrom)	96				0.839	0.865	0.959	1.087	0.944	1.018	0.952	0.093
Malaysia	231	1.064	1.076	1.090	1.340	1.456	1.409	1.275	1.344	1.244	1.255	0.148
Malta	23	1.318	0.926	0.862	1.047	1.359	1.565	1.749	1.602	1.706	1.348	0.337

Marshall Islands	2							5.695	5.963		5.829	0.190
Martinique (France)	3		1.307	1.156						0.170	0.877	0.617
Mexico	6			1.519	1.369	1.691	1.761	1.931		1.977	1.708	0.235
Montenegro	47	2.244	1.610	1.160	0.856	1.409	0.846	0.841	0.917	1.043	1.214	0.472
Morocco	627	1.792	1.591	1.599	1.482	1.462	1.299	1.226	1.040	0.944	1.382	0.277
Netherlands	1,780	0.730	0.730	0.728	0.941	1.128	1.254	1.280	1.309	1.429	1.059	0.281
New Zealand	1,362	1.608	1.569	1.307	1.438	1.467	1.432	1.374	1.274	1.183	1.406	0.137
Nigeria	65	1.472	1.663	1.208	1.299	1.237	1.397	1.146	1.210	1.327	1.329	0.161
Norway	5,010	1.215	1.231	1.368	1.450	1.491	1.441	1.422	1.404	1.387	1.379	0.095
Oman	18	1.570	1.617	1.510	1.385	1.285	1.132	0.911	0.838	0.491	1.193	0.382
Pakistan	130	0.772	0.756	0.581	0.619	0.638	0.821	0.940	1.289	1.247	0.851	0.261
Peru	11					1.909		1.751	1.515	2.026	1.800	0.221
Philippines	39	1.513	1.350	1.179	1.426	1.334	0.962	1.019	0.909	0.933	1.180	0.232
Poland	881	0.432	0.421	0.466	0.753	0.643	0.717	0.664	0.755	0.718	0.619	0.140
Portugal	2,263	0.813	0.810	1.416	1.279	1.163	1.010	1.014	0.984	1.088	1.064	0.200
Republic of Korea	2,600	0.862	0.871	0.779	1.028	1.209	1.300	1.327	1.339	1.235	1.106	0.222
Reunion (France)	3		0.944					0.466		0.278	0.563	0.343
Romania	1,367	0.410	0.435	0.459	0.504	0.472	0.574	0.512	0.595	0.727	0.521	0.098
Senegal	7						2.025	1.965	2.027	1.987	2.001	0.030
Serbia	494	1.304	1.292	1.143	0.911	0.478	0.506	0.552	0.558	0.768	0.835	0.340
Singapore	8	0.400	0.608	0.608	0.608	0.275		1.265	0.971	1.107	0.730	0.348
Slovakia	937	0.565	0.483	0.615	0.739	0.765	0.952	1.069	1.042	1.139	0.819	0.240
Slovenia	214	0.741	0.799	0.994	0.696	0.933	0.917	0.838	1.112	0.995	0.892	0.134
South Africa	61	1.155	1.047	0.913	0.755	1.217	0.520	1.370	0.996	0.670	0.960	0.275
Spain	9,675	1.576	1.596	1.574	1.495	1.424	1.302	1.423	1.330	1.378	1.455	0.110
Sri Lanka	32	0.779	0.892	1.000	1.216	1.504	1.468	1.744	0.210	1.415	1.136	0.469
Sweden	3,619	0.852	0.957	1.143	1.382	0.775	1.030	1.182	1.145	1.240	1.078	0.193
Taiwan	40	1.160	0.239	0.218	0.272	0.620	0.508	0.938	0.888	0.855	0.633	0.346

Thailand	215	1.542	1.329	1.216	0.946	1.031	1.083	1.086	1.065	1.058	1.151	0.184
Tunisia	1									0.043	0.043	
Turkey	28	1.265	0.732	0.865	0.873	0.809	0.733	1.095	1.259	1.442	1.008	0.263
Uganda	8	1.972		2.027	2.030	2.028	2.020	2.007	1.944	1.644	1.959	0.131
Ukraine	157	1.037	1.060	0.882	0.413	0.833	0.638	0.478	0.612	0.711	0.740	0.230
United Arab Emirates	6	3.076	3.037	2.955	2.945	3.104	3.110				3.038	0.073
United Kingdom	17,389	1.187	1.175	1.031	0.879	0.865	0.874	0.874	0.841	0.891	0.957	0.138
United Republic of Tanzania	4					1.835		1.867	1.924	2.005	1.908	0.075
United States of America	7	0.268	0.274			0.121		0.002	0.161	0.055	0.147	0.111
Uruguay	2						0.450	1.133			0.791	0.483
Vietnam	7				2.009		1.265	1.395	0.618		1.322	0.570
Zambia	8				0.230	0.422	0.524	0.496	0.599	0.302	0.429	0.140
Zimbabwe	7	2.003	0.914	0.089	0.181	0.939	1.976				1.017	0.833

Chapter III

Democracy, Institutions, and International Profit-Shifting

Does constitutional democratization affect profit-shifting strategies among firms? Using a global sample of multinational enterprises, we develop a new subsidiary-year measure of profit-shifting and examine how this measure responds to changes in constitutional democracy and the subsequent evolution of the host country's institutions. Our main findings show that a one-standard-deviation increase in the Polity IV democracy index yields an approximately 37% decrease in profit-shifting to other countries. Protection of property rights, contract enforcement, and superior regulatory quality emerge as the key institutional channels that define the decision to keep profits at home. Our results are robust to an instrumental variables approach and a large battery of additional robustness tests.

1. Introduction

Globalization forces countries to compete for capital. By cutting their tax rates, economies attract more capital, which can boost investment and economic growth. Additionally, over the last few decades, corporate tax rates declined dramatically; the global average statutory corporate tax rate fell from 49% in 1985 to 24% in 2018 (Tørsløv et al., 2018). To benefit from corporate tax differences across countries, multinational enterprises (MNEs) "shift" profits from high-tax jurisdictions to low-tax jurisdictions in order to increase net profits. Such strategies erode the government revenue bases of high-tax jurisdictions and pose welfare and fiscal challenges for policymakers and international bodies (e.g., the OECD).

Our study suggests that in deciding to shift profits, MNEs and their subsidiaries not only consider how lucrative the tax-arbitrage is, but also, they examine whether shifted profits are safe and whether tax payments are easy to handle. Constitutional democracy and its qualitative characteristics could be the bedrock, as they provide the environment that allows people and businesses to communicate freely, collaborate, and flourish together. Differently phrased, constitutional democracy is the umbrella that triggers the process of institutional development and provides the first cell for the evolution of institutions that might affect profit shifting. Thus, our first hypothesis suggests that constitutional democracy at home limits MNEs' incentives to shift profit abroad.

The evolution of constitutional democracy sets the pathway for the development of democratic institutions. Such institutions, take the form of property rights, quality of governance, control for corruption, rule of law, etc. Specifically, contract form and enforcement, as well as common commercial codes and availability of information — all of which reduce the costs of transactions, risk, and uncertainty — are important factors in business operations. In this sense, countries' institutional environments may be important determinants of firms' profit-shifting strategies. Therefore, our second hypothesis notes that, following the constitutional democratization process, the evolution of specific institutions also affects profit shifting aggressiveness.

We test our hypotheses using global data on profit-shifting at the subsidiary-year level. To this end, we first build a new subsidiary-year measure of profit-shifting over 2009-2017. Thus far, the literature mainly considers aggregate (country or industry) estimates of profit-shifting (Huizinga and Laeven, 2008; Dharmapala 2014) based on how subsidiaries' logged earnings respond to changes in composite tax rates for the subsidiary and foreign countries.[18] Specifically, a negative subsidiary earnings response to a positive change in the composite tax rate (the difference between the domestic corporate tax rate and the tax rates in all other countries in which an MNE has subsidiaries) shows that subsidiaries engage in profit shifting (Huizinga and Laeven, 2008). Our contribution is to estimate this model nonparametrically, which provides profit-shifting estimates for all observations (subsidiary-years) in the data. Even though profit-shifting is decided at MNE-level, this decision is also based on the democratic conditions in each subsidiary's country. Thus, using a subsidiary-year measure of profit-shifting is important.

Subsequently, we examine the response of profit shifting to changes in democracy. Our sample for this analysis includes only the subsidiary-year observations for which we identify profit-shifting and for which data on all important variables are

[18] There is also the work of De Simone et al. (2019) which offers estimates of firms' relative magnitude of net outbound intercompany payments only for the case of the US.

available (6,590 subsidiaries from 57 countries over 2009-2017). Establishing a causal relation between democratic development and profit-shifting is a key objective of our paper.

The fact that we observe profit-shifting at the subsidiary-year level is a first remedy of the identification problem, because we control for important subsidiary and MNE characteristics as well as country-year variables that affect profit-shifting. A second remedy is the use of country, industry, year, and even subsidiary fixed effects. Fielding country fixed effects, in particular, yields identification from a change (advancement or reversal) in the democracy indicators. To the extent that such a change is not systematically correlated with within-country time-varying unobserved variables, OLS estimates are consistent and unbiased.

To further insulate our analysis from the possibility of endogeneity bias, we additionally use an instrumental variables (IV) approach. Our instrument is drawn from Acemoglu et al. (2019), who uses regional waves of democratizations and reversals. The premise is that regional democratization affects profit-shifting only via its effect on democracy, given controls and fixed effects (thus satisfying the exclusion restriction).

Our findings from several robustness tests and measures of democracy clearly demonstrate that democracy matters. Our benchmark results using the constitutional Polity IV measure of democracy show that a one-standard-deviation increase in democracy in a subsidiary's country reduces profit-shifting to other countries by approximately 37%. The economic significance of this effect is very large, making democratic development one of the most important determinants of profit-shifting.

We next examine the institutional channels through which constitutional democracy affects profit-shifting. We find that the ability of governments to protect property rights and enforce contracts, as well as high-quality policy-making capacity, are important channels that define subsidiaries' decisions to keep profits at home, even if there are lower-tax alternatives elsewhere. By improving institutional conditions instead of focusing on tax competition, governments could not only foster business activity at home but they can also ease future fiscal concerns and improve social welfare. However, we should also note that when loading institutions in the same empirical model with the constitutional democracy variable, the significant effect of constitutional democracy still prevails. This finding is in line with our hypothesis that constitutional democracy is the first cell, the umbrella that matters most.

Although voluminous literature exists on the determinants of profit-shifting with special emphasis on taxation (Dharmapala and Riedel, 2013; Weichenrieder 2009; Klassen et al., 1993), there is a dearth of evidence on how constitutional democracy and institutions affect profit-shifting decisions. The most relevant comes from Sugathan and George (2015), which based on a sample of firms in India during 2001-2010 finds that institutional quality and corporate governance dissuade MNEs to shift their profits.

Our paper relates to and adds to various strands in the literature. In particular, the studies closer to our objectives are those on the determinants of profit-shifting (e.g., Dyreng and Markle, 2016; Markle, 2016; De Simone, 2016). These studies focus on how country characteristics affect profit-shifting (e.g., territorial versus worldwide systems, country-level institutions), as well as how characteristics of a firm's environment affect profit-shifting (e.g., financial reporting pressures, capital constraints, foreign ownership). Our study also relates to a strand of literature that takes a macro perspective to study MNEs' profit-shifting. The majority of this macro literature focuses on U.S. multinationals (Clausing, 2009, 2016; Gravelle, 2009; Zucman, 2014; Guvenen et al., 2019).

Moreover, our study adds to the literature on the estimation of profit-shifting. In a seminal contribution to the identification of profit-shifting, Hines and Rice (1994) examine income shifts between parents and subsidiaries, considering their countries' tax rate differentials. Subsequent studies allow for tax-rate differentials across countries for all subsidiaries in the same group (Huizinga and Laeven, 2008) or take a different perspective in estimating profit-shifting by identifying differences between the locations of firm sales and earnings (Dyreng and Markle, 2016). Dharmapala and Riedel (2013) examine exogenous shocks to multinational parent profits to infer the amount of profit shifted to low-tax subsidiaries. We extend this line of research by constructing a new subsidiary-year measure of international profit-shifting for a large panel of countries around the world.

The remainder of the paper proceeds as follows. Section 2 introduces our theoretical framework on the role of democracy and underlying institutions on profit-shifting. Section 3 discusses the new method to estimate profit-shifting and our empirical model linking profit-shifting to democracy. Section 4 analyzes the empirical results, and section 5 concludes the paper.

2. Theoretical Framework

Thus far, there is no literature on the role of democracy on international profit shifting.[19] The latter, falls into the category of tax-avoidance tactics but differs in the following ways: (i) it requires an international network of affiliates; (ii) it navigates a complex set of laws and regulations that permit firms to reduce their domestic tax bases and allow foreign countries to tax these earnings (Desai and Dharmapala, 2009); and (iii) it is not necessarily illegal. Thus, MNEs exploit loopholes and ambiguities in tax laws of different countries, making it impossible for a single country to confront profit-shifting on its own. Along the same lines, profit-shifting usually is legal and thus bears lower costs, raising MNEs' incentives to engage in more aggressive profit-shifting. These distinguishing elements of profit-shifting, compared to other tax-planning strategies, generate a research question about whether democratic conditions, as an institutional umbrella, play a role on shaping profit-shifting.

i. Constitutional Democracy and Tax-Related Profit-Shifting

Recent theories developed by Acemoglu and Robinson (2000, 2006) argue that political (democratic) reforms can be viewed as strategic decisions by the political elite to prevent widespread social unrest and revolution. Political transition, rather than redistribution under existing political institutions, occurs because current transfers do not ensure future transfers, while the extension of the franchise changes future political equilibria and acts as a commitment to redistribution. More recent works such as those

[19] The literature on democracy and economics largely evolves around the effect of democracy on economic outcomes. As long as democracy has existed, there have been skeptics — from Plato warning of mass rule, to contemporary critics claiming authoritarian regimes can fast-track economic programs. Real-world examples (e.g., China) and academic research (Gerring et al., 2005) suggest that the effect of democracy on economic outcomes is at best ambiguous. On one hand, research that relies on cross-country comparisons questions the relationship between democracy and positive economic outcomes (Sirowy and Inkeles, 1990; Przeworski and Limongi, 1993; Helliwell, 1994; Barro, 1996; Tavares and Wacziarg, 2001). On the other hand, more recent studies that exploit both time series and cross-country variability find that democracy has a sizable effect on prosperity (Rodrik and Wacziarg, 2005; Papaioannou and Siourounis, 2008; Persson and Tabellini, 2009; Acemoglu, et al., 2013).

of Aidt and Jensen (2014) and Aidt and Franck (2015) provide supportive econometric evidence on the link between threat of revolution and democratization. Based on the aforementioned contributions, Besley and Persson (2019) model the drivers of democratic reforms as a dynamic interplay between strategic decisions on violence to affect political turnover and democratic values.

A key takeaway from this line of political economy research is that the first cell of change and what matters most is constitutional democracy, which refers to the set of authority patterns included in countries' constitutions (Eckstein and Gurr, 1975, p.41). Central to the distinction between different authority patterns is the way executives are recruited. Specifically, "executive recruitment involves the ways in which superordinates come to occupy their positions...In current sociological jargon this is a species of 'boundary interchange," a matter of crossing lines between superordinate and subordinate positions" (Eckstein and Gurr 1975).

Moreover, constitutional democracy contains structural characteristics by which chief executives are recruited, namely competitiveness of executive recruitment and openness of executive recruitment. Competitiveness refers to the extent that prevailing modes of advancement give subordinates equal opportunities to become superordinates, whereas openness refers to the extent that all the politically active population has an opportunity, in principle, to attain chief executive position through a regularized process.

A key characteristic of authority patterns is the extent to which the chief executive ruler must take into account the preferences of others when making decisions. An indispensable ingredient of these processes, therefore, is the existence of executive constraints (decision rules) in constitutions that provide basic criteria under which decisions are considered to have been taken. Another general authority trait of polities is participation. The operational question is the extent to which the political system enables non-elites to influence political elites in regular ways. Competitiveness of participation refers to the extent to which alternative preferences for policy and leadership can be pursued in the political arena.

The above constitutional characteristics are the basis and the prerequisites for all institutional changes to happen. Most notably, political transition to constitutional democracy (as a source of redistribution) implies investing in human capital policies, such as education, health, creativity, and labor force participation (Acemoglu et al., 2019), which reduce risk, reduce uncertainty, reduce transaction costs (Coase, 1992), are conducive to private enterprise (Begović, 2013), and ensure the basis of a healthy system for business development and entrepreneurship (Acemoglu et al., 2014).

From an entrepreneur's viewpoint, democratization usually enhances contract enforceability; reduces expropriation, blackmailing, or a sudden eruption of political instability; protects private enterprise; and protects market competition (Begović, 2013; Acemoglu et al., 2014).[20] Thus, constitutional democracies and the underlying democratization process limit the negative externalities of business activities and support a healthy system for business development.

Given these characteristics of constitutional democracies, the democratization process might increase the opportunity and reputation costs of shifting profits abroad. The opportunity costs of profit-shifting especially increase when democratic development leads to reduced country risk for investment, political stability, and

[20] We mostly refer to democratization as opposed to the level of democracy because the dynamic changes are those more likely to generate responses in affect the profit-shifting behavior of firms. This is only essential for empirical identification, where we use country fixed effects to absorb all the cross-sectional (time-invariant) country characteristics.

enhanced property rights. Within an environment of quickly developing constitutional democracy, firms can reinvest profits and grow quicker in the long run compared to nondemocratic countries or even countries with stable democracies. An additional opportunity cost arises because of the lower cost of borrowing in democratic countries compared to nondemocratic ones, which is the result of lower informational asymmetries in democratic countries (Delis et al., 2019). Thus, firms undergoing a democratic transition might reduce profit-shifting because they experience decreasing costs of credit.

Concerning reputation costs, firms that engage in aggressive profit-shifting take the risk of incurring additional charges. In particular, Klassen et al. (2017), using a survey of 219 tax executives, concludes that half of them work to comply primarily with complex tax laws and avoid disputes with various tax authorities. As democracies are constitutionally established, these disputes might be solved more quickly and efficiently, and thus firms might reduce international profit-shifting to foreign countries, especially to those with weaker and stable democratic basis.

There are also theoretical arguments for a positive relationship between democracy and profit-shifting aggressiveness. Democracies might be associated with higher tax rates (partially to finance the more sophisticated democratic institutions), therefore limiting tax incentives and generating electoral benefits from policing tax avoidance by MNEs (Jensen, 2013). However, anecdotal evidence on corporate tax rates suggests that this is not the case. Part of the reason why corporate tax rates are lower among more democratic countries is that they have a greater ability to assess other types of taxes; for example, current individual tax rate rankings suggest that more democratic countries are more heavily reliant on individual income taxes. Further, by being more open economies, democracies tend to compete for capital and engage in tax competition strategies that lower corporate tax rates.

Overall, the theoretical argument that constitutional democratization keeps profits at home seems to outweigh the argument that constitutional democratization increases outbound profit-shifting. We thus formulate our first hypothesis as follows:

Hypothesis 1. Constitutional democratization at home leads to less outbound profit-shifting.

ii. Democratic Institutions and Tax-Related Profit Shifting

Constitutional democracy is an institutional umbrella, but its effects on profit-shifting might be stronger if certain institutions are well-developed.[21] High institutional uncertainty affects the ability of governments to meet their commitments even if governments are benevolent (Brader et al., 2013). It may also mean that politicians find it more efficient to rely on clientelist networks to mobilize support, rather than providing public goods (Keefer, 2007; Keefer & Vlaicu, 2007). Thus, policymakers, civil society groups, and scholars increasingly agree that good governance and efficient implementation of institutional changes matter for reaping the benefits of democratization (e.g., Dreher et al., 2009).[22] For example, poor institutional quality even within democratic regimes — corruption, red tape, weak protection of property

[21] North (1990) offers the following definition: "Institutions are the rules of the game in a society or, more formally, are the humanly devised constraints that shape human interaction."

[22] This growing consensus emerged from a proliferation of empirical measures of institutional quality, governance, and investment climate, and accompanying research shows the strong development impact of good governance (Mauro, 1995; Hall and Jones, 1999; Robinson et al., 2005).

rights, and ineffective rule of law — significantly increase uncertainty and country risk, and they do not provide incentives to realize long-term and risky investments (Olson, 2000).

Prior research shows that democratization improves institutions and better-quality institutions can constrain profit-shifting. Sugathan and George (2015) document how freedom of expression, governmental effectiveness, and political stability affect income shifting. In high-tax countries (the party at loss of tax revenues), the institutions dissuading and limiting negative externalities of business activities are likely to increase the costs of shifting transactions. In particular, they observe that perceptual measures of transparency and public accountability significantly raise the costs of profit shifting activities. Other research has examined how income shifting is affected by features of tax law (Markle 2016), financial accounting quality and comparability (De Simone 2016), intellectual property protection (Griffith et al. 2014), tax reporting requirements (Joshi 2020).

To this end, and besides the main effect of constitutional democratization on profit shifting (over and above any direct effect of institutions) we also consider the institutional channels that transmit this effect. Three are the most important: quality of government, rule of law, and control of corruption. The relevance of these institutional characteristics for firms' profit-shifting decisions comes from their effects on the way firms manage transactions in countries where they pay taxes.

Specifically, quality government regulations provide credible information on government policies and strategies, foster information transparency, and deter profit-shifting. Democracy through better regulatory quality reduces tax inconsistency and can improve tax enforcement efforts (reducing tax audit risk, imposing thin capitalization rules) to constrain outbound income shifting (Beuselinck et al. 2015). Also, democratization encourages countries to adopt regulatory reforms that bring them into line with better governed countries (Mattli and Plumper, 2002) and to join international cooperative organizations that promote regulatory best practices, such as the EU and the OECD (Mansfield and Pevehouse, 2006). Thus, countries adopt the BEPS initiative and use its suggested mechanisms to constrain profit-shifting.

The rule of law secures property rights, as well as enables greater private control and security over firms' earnings. In the absence of a credible rule of law, contracts might not be strictly enforceable and firms may fear expropriation. There is typically no reliable contract enforcement unless there is an impartial court system that can call upon the coercive power of the state to require individuals to honor the contracts they have made. Thus, the only societies where individual rights to property and contract are confidently expected to last across generations are the securely democratic societies (Olson, 1993). When legal institutions are stronger, however, the negative relationship between societal trust and tax evasion is less pronounced (Kanagaretnam et al., 2018).

Finally, in the presence of corruption, firms face risks, fear of blackmailing, or sudden instability, which makes doing business problematic. For example, bribes, unlike taxes, involve unpredictable distortion in the discretionary and uncertain use of government power. This results in additional costs to businesses and allocates resources to unproductive activities, which impose an extra burden on firms and the economy (Cieślik and Goczek, 2018). Democratization improves control of corruption (Hill, 2003). Corruption amplifies profit shifting. Multinationals that have an incentive to shift profits will shift more profits with higher corruption in the tax administration. On average, countries with high levels of corruption face lower tax revenue elasticities with respect to tax rates. Therefore, tax rate increases lead to much smaller tax revenue increases in corrupt countries (Bilicka and Seidel, 2020).

Given these theoretical considerations, we suggest that enhancing these institutions reduces the incentives to shift profits abroad. We thus formulate our second hypothesis as follows:

Hypothesis 2. Improvements in regulatory effectiveness, judicial credibility, and control of corruption are key channels through which constitutional democratization affects outbound profit-shifting.

3. Empirical Model

i. Estimation of Profit-Shifting by Subsidiary Year

To study the relationship between democracy and profit-shifting, we first develop a new measure of profit-shifting estimated at the subsidiary-year level. Thus far, most of the literature offers aggregate profit-shifting estimates globally or by country (Hines and Rice, 1994; Huizinga and Laeven, 2008; Dharmapala and Riedel, 2013),[23] whereas De Simone et al. (2017, 2019) provide a measure of profit shifting at subsidiary and MNE-year level, respectively, but not at subsidiary-year level. Our profit-shifting measure extends Hines and Rice (1994) and Huizinga and Laeven (2008). Hines and Rice (1994) examine the shifted income between a parent firm and its subsidiaries considering their countries' tax rate differentials, whereas Huizinga and Laeven (2008) augment this analysis by allowing for tax-rate differentials across countries of all subsidiaries in the same group.

Following Huizinga and Laeven, the baseline empirical model is of the following form[24]:

$$EBT_{st} = a_1 CT_{st} + u_{st}, \tag{1}$$

The outcome variable EBT_{st} is earnings before taxes (in logs) of the subsidiary *s* at year *t*. The variable CT_{st} is the composite tax variable that summarizes all information about subsidiaries' profit-shifting tax-incentives in year *t*; it is defined as:

$$CT_{st} = \frac{1}{(1-\tau_s)} \frac{\sum_{k \neq i}^{n} (\frac{B_k}{1-\tau_k})(\tau_s - \tau_k)}{\sum_{k=1}^{n} (\frac{B_k}{1-\tau_k})}, \tag{2}$$

where τ_s is the statutory tax rate of the subsidiary country, τ_k is the statutory tax rates of all the affiliated subsidiaries' countries, B_k is subsidiary assets (rather than sales, in case sales data are too distorted by profit-shifting)[25] used to proxy for multinational activities in different locales, and u_{st} is the stochastic disturbance. A positive value for *CT* in equation (1) shows that subsidiary *s* has tax incentives to shift profits out of its country for tax-related reasons.

We are interested in the negative effect of *CT* on *EBT* in equation (1) when *CT* is positive, (i.e., an increase in *CT* via an increase in τ_s leads subsidiaries to send more profits abroad and thus reduces domestic *EBT*). This implies that we disregard cases of

[23] For an analytical exposition of profit shifting measures in the literature, see Dharmapala (2014).
[24] Our model does not include proxies for capital and labor as Huizinga and Laeven (2008) do. However, we control for these in the second stage of our analysis (see equation 3).
[25] We prefer assets, because sales data can be distorted by transfer-pricing policies of MNEs used to exploit specific transfer pricing rules (Behrens et al., 2014). Our results are robust to the use of sales.

positive responses (i.e., the subsidiary does not send profits abroad when tax rates in the host country increase). Also, we do not include observations for which *CT* is negative and there is a negative effect of *CT* on *EBT* in equation (1), even though these observations represent a tax incentive and opportunity to shift income into the subsidiary. We do so, because that is the case for only 73 observations in our sample (if we chose to include them our results remain the same) and our research question is how democracy affects outbound profit-shifting (not inbound for which we require a different theoretical setting).

Given the above, coefficient a_1 is an aggregate estimate of profit-shifting aggressiveness, essentially representing how much profit subsidiaries send abroad. Our contribution is the estimation of profit-shifting by subsidiary-year, which implies estimating $a_{1,st}$. The best way to do this is via nonparametric techniques. In these techniques, the data determine the form of the fitted regression lines, which are fully nonlinear and thus do not rely on assumptions regarding the shape of the relationship between the variables.

The underlying model for local regression is $Y_{it} = \mu(x_{it}) + \varepsilon_{it}$, where x is a predictor variable and Y is the response variable. We estimate the unknown function $\mu(x)$ by fitting a polynomial model within a sliding window (neighborhood of x). Differently phrased, the estimate of μ at x uses all observations whose x_{it} values are closest to x, and each point in this neighborhood is weighted according to its distance from x. Points close to x have large weights, and points far from x have small weights. No strong assumptions are made about μ globally, but locally around x we assume that μ can be well approximated. By using these observation-specific sliding windows, we obtain observation-specific $\hat{a}_{1,st}$.

Two important issues in the estimation are the choice of the kernel (the weighting function) and the optimal bandwidth (the smaller the bandwidth is, the larger the weight assigned to points between x and x_i). We mainly use an Epanechnikov kernel, but we also experiment with Gaussian, triangle, and biweight kernels. In turn, researchers propose many alternatives for deriving the optimal bandwidth (e.g., Greene, 2018); we choose the one that minimizes the integrated mean squared error of the prediction (cross-validation method). We find that our results are not overly sensitive to bandwidth (unless the choice is far off the one chosen by cross-validation).

A third important issue is that this class of models suffers from the so-called curse of dimensionality when the estimation encounters regions with small density in observations.[26] To avoid this problem, we impose that sliding windows must have at least 100 observations; we drop the rest of the observations from our analysis (essentially this is equivalent to dropping outliers).[27] For further details on the construction of our profit-shifting measure, see the Appendix (part A).

We estimate profit-shifting using a sample of 90 countries, where 49,418 subsidiaries reside from 2009 to 2017. The total number of subsidiary-year observations for which we have information to estimate profit-shifting is 254,262, and the financial variables are in U.S. dollars (current prices). For details on sample construction, see Appendix (part A).

Our primary data source is Orbis, which has worldwide coverage of firm-year

[26] This essentially means a small number of observations within the sliding window. As in any parametric regression with a small number of observations, this implies less precise estimates.

[27] We find that increasing the minimum number of observations to 150 or 200 does not affect our results but reduces the number of estimates $\hat{a}_{1,st}$ (and thus the availability of observations for the rest of our empirical analysis).

accounting data, as well as detailed information on firm ownership structures.[28] For the estimation of profit-shifting, we use subsidiaries' earnings before taxes (*EBT*) and assets (B_k). Moreover, we use the statutory tax rate of subsidiaries' countries (τ_s) and the statutory tax rates of all the affiliated subsidiaries' countries (τ_k), obtained from Ernst &Young's Worldwide Corporate Tax Guide.[29] For the theoretical justification on using statutory (as opposed to effective) corporate tax rates, see Deveraux and Mafini (2007) and Huizinga and Laeven (2008).

As discussed, tax-related profit-shifting occurs when $\hat{a}_{1,st}$ is negative and *CT* is positive. This the case for 80,939 observations, corresponding to 18,966 subsidiaries and 72 countries. However, due to several missing data, especially for subsidiary and MNEs characteristics, our main sample is smaller than the sample with profit-shifting estimates; it includes 27,103 observations for 6,590 subsidiaries in 57 countries. In Appendix Table B1, we report average profit-shifting estimates by country and list the countries in our analysis. We find that subsidiaries in United States shift more profit abroad, followed by big countries such as Japan and India, which have high corporate tax rates. We observe the lowest profit-shifting in African and Eastern European countries, which typically have low corporate tax rates. We report average statutory tax rates by country in Appendix Table B2.

ii. Democracy and Profit-Shifting

Given the subsidiary-year estimates of profit-shifting, we examine the relation:

$$Profit\ shifting_{st} = b' + b_1 Democracy_{ct} + b_2 C_{cst} + b_3 C_{cmt} + b_4 F_{st} + b_5 F_{mt} + \varepsilon_{fct}. \quad (3)$$

where, *Profit-shifting* is our measure of profit-shifting obtained in the previous section for subsidiary *s* in year *t*; b' indicates a full set of subsidiary, industry, country, and year fixed effects; $Democracy$ is an index of the quality of democratic institutions in the subsidiary's country; C and F are sets of country and firm controls at the subsidiary (s) and MNE (m) levels, and ε is the stochastic disturbance. We use control variables (country and firm) both at the multinational enterprise group level and at the subsidiary level, as both might affect the profit-shifting decisions. The coefficient of our interest is b_1, which captures the effect of democracy on subsidiaries' profit-shifting to other countries for tax-related purposes. To facilitate our interpretation of how democracy affects profit-shifting in our regression analysis, we multiply our profit-shifting index by -1 so that higher values of *Profit-shifting* actually reflect more aggressive profit-shifting.[30]

[28] Orbis data has the drawback that firms' ownership structure is available for the last reported date only. Therefore, there may be some concerns about misclassification bias as the ownership structure may change during the sample period. However, considering that this bias drives our estimations toward zero (Budd et al., 2005), if anything we underestimate profit-shifting.

[29] https://www.ey.com/gl/en/services/tax/worldwide-corporate-tax-guide---country-list.

[30] An alternative to estimating equations (1) and (3) separately would be a reduced-form model that includes an interaction term of the composite tax variable (CT) and a democracy index. However, that would be only a global estimate and not a subsidiary-year measure of profit-shifting. Further, as Huizinga and Laeven also suggest, both the top statutory tax rate used to calculate CT, and their variable CT might be endogenous. The problem in our setting is that the democracy index might also be endogenous in specifications with subsidiary profits as the outcome variable (i.e., the HL model). Finding instruments

Table 1 provides definitions and data sources for the variables in our empirical analysis. The literature measures democracy using several indices of the quality of political institutions, and such measures tend to be either the result of research by political scientists (e.g., the Polity IV project) or are calculated on the basis of surveys of representative individuals (e.g., the Freedom House dataset).

Our preferred measure of democracy (*Democracy polity*) is the one from the Polity IV Project (termed "Democ" in that database).[31] This is a country-year index that ranges from 0 (lack of institutional democracy) to 10 (institutional democracy of the highest quality). According to the Polity IV Project: Dataset Users' Manual v2018, "Democracy is conceived as three essential, interdependent elements. One is the presence of institutions and procedures through which citizens can express effective preferences about alternative policies and leaders. Second is the existence of institutionalized constraints on the exercise of power by the executive. Third is the guarantee of civil liberties to all citizens in their daily lives and in acts of political participation. Other aspects of plural democracy, such as the rule of law, systems of checks and balances, freedom of the press, and so on are means to, or specific manifestations of, these general principles."

[Please insert Table 1 about here]

An advantage of this measure is that it is institution-based and not perception-based, which allows examining the effect of institutionalized democracy, purified from perceptions that are usually endogenous to political and economic outcomes. Furthermore, based on its definition, *Democracy polity* is separated into four sub-indices (thoroughly defined in Table 1). These reflect the presence of institutions and procedures through which citizens can express effective preferences about alternative policies and leaders (*Competitiveness of executive recruitment*); the existence of equal opportunities to advance in chief executive positions through a regularized process (*Openness of executive recruitment*); the existence of institutionalized constraints on the exercise of power by executives (*Executive constraints*); and the guarantee of civil liberties to all citizens in their daily lives and in acts of political participation (*Competitiveness of participation*).

In robustness tests, we use two more democracy measures. The Freedom House index (*Democracy FH*), is a perception-based measure that ranges from 0 (autocratic country) to 10 (free democratic country) and considers civil and social liberties, the rule of law, and freedom from corruption. Despite its disadvantages compared to *Democracy polity*, examining perception-based democracy dimensions is important because profit-shifting decisions might also be based on perceptions as reflected in civil liberties. Nevertheless, the two indicators have a 96% correlation in our sample (see Appendix Table B3).

Moreover, we use the simpler Boix, Miller, and Rosato (2013) measure (*Democracy BMR*), an institution-based dichotomous variable that goes from 0 to 1 when countries choose their political leaders through fair and free elections and satisfy a threshold value of suffrage.[32] This measure is also highly correlated with *Democracy polity* (87%) and *Democracy FH* (85%).

We also consider quality of governance indicators. We mostly resort to

for numerous (and different) variables is not fruitful and implies the potential for significant bias in our estimates.

[31] https://www.systemicpeace.org/polityproject.html.

[32] https://qog.pol.gu.se/data

information from the World Bank's Worldwide Governance Indicators (WGI) database. These governance indicators are from the aggregation of 340 variables from different sources and grouped into six different dimensions. We use three dimensions most relevant to business practices: (i) regulatory quality; (ii) rule of law; and (iii) control of corruption.

These three aspects of governance quality may influence how democracy affects subsidiaries' profit-shifting decisions: regulatory quality (i.e., policies and regulations that enable and promote private sector development — regulatory burden, tax distortions, business freedom, investment freedom, financial freedom), rule of law (i.e., property rights, government integrity, judicial effectiveness), and control of corruption (i.e., the extent to which public power is exercised for private gain, including both petty and grand forms of corruption, as well as "capture" of the state by elites and private interests). As indicated in Appendix Table B4, we also consider variables from the Fraser Institute and the Heritage Foundation.

Despite the fact that *Democracy polity* is predetermined, identifying democracy's causal effect on profit-shifting is an empirical challenge mostly because any democracy index might capture unobserved country characteristics affecting profit-shifting, thus leading to omitted-variable bias.[33] We proceed with several remedies against this bias. First, to reduce the possibility that the coefficient of democracy captures the effect of other country-year characteristics, in control set *C* we include a large number of relevant controls (altogether more than 50 variables), all of which are listed in Appendix Table B4. The most important ones are a country's economic performance and market size, proxied by output per capita, annual output growth rate, and population, which we use in our baseline specifications.

Further, following the literature **(**Huizinga and Laeven, 2008; Dharmapala and Riedel, 2013; De Simone et al., 2017), set *F* includes controls for firm size measured by the log of total assets, tangibility (the ratio of fixed assets to total assets), leverage (the ratio of total liabilities to total assets), and cost of employees (the log of cost of employees; available only for MNEs).

Second, we include country, industry, subsidiary, and year fixed effects. The country fixed effects control for time-invariant characteristics of a subsidiary country, which implies identification from changes in democracy; this is important, as changes in democracy are unlikely to take place simultaneously with other important events. Even if this the case, democratic developments usually overshadow the effect of other institutional changes because democracy is the general umbrella of institutions (Delis et al., 2019). Industry fixed effects (at the two-digit level) control for time-invariant, industry-specific characteristics that might affect profit-shifting. The subsidiary fixed effects control for time-invariant subsidiary characteristics and render the country and industry fixed effects redundant. The year fixed-effects control for annual unobserved shocks common to all subsidiaries in our sample.

Given all relevant control variables and fixed effects, omitted-variable bias is only possible in the presence of unobserved time-variant characteristics, which correlate with a change in both our profit-shifting and democracy indexes. To insulate our analysis further from omitted-variable bias, we use an instrumental variables (IV) approach. To this end, we closely follow Acemoglu et al. (2019) and Delis et al. (2019). Our instrument is the 10-year lag of regional democratization in the subsidiary country.

[33] One potential concern is that profit-shifting is an estimate and thus measured with error. However, in the estimation of equation (3), this is not as important, because profit-shifting is the outcome variable and measurement error in the dependent variable does not yield inconsistent OLS estimates (e.g., Wooldridge, 2015).

Our exclusion restriction states that regional democratization 10 years ago only affects profit-shifting in the current period via its effect on democracy in the current period.[34] Intuitively, this should hold: in their profit-shifting decisions, subsidiaries consider the current quality of democratic institutions in their countries and not the quality of democratic institutions in the region — especially not the regional quality 10 years ago. Further, Acemoglu's regional democratization instrument is constructed in a way that captures all the past economic and democratic trends[35].

iii. Summary Statistics

Table 2 reports summary statistics for the variables in our analysis, and pairwise correlations are in Table B5 in the Appendix. Most countries in our sample demonstrate democratic principles (Appendix Table B6), but these values are skewed because most subsidiaries are in more democratic countries. A slightly different picture emerges when one considers country-year summary statistics (Appendix Table B7), drawing a more realistic picture of the average *Democracy polity* worldwide. Further, as Appendix Table B6 shows, there are 11 countries where democracy changes 15 times, of which half move to higher democracy levels and half move to lower democracy levels.

The sample for which all important variables are nonmissing is smaller compared to the sample for which we obtain positive profit-shifting estimates. It includes 27,103 observations, corresponding to 6,590 subsidiaries in 57 countries. Our profit-shifting index in this sample has an average of 0.81 and a standard deviation of 0.58, ranging between 0 and 3.12.

The correlation coefficient between *Profit-shifting* and *Democracy polity* is -0.079, statistically significant at conventional levels (Appendix Table B5). Figure 1 shows the development of *Democracy polity* and *Democracy FH* (left axis) and *Profit-shifting* (right axis) over time. There is an approximately 58% increase in profit-shifting during our sample period, whereas democracy decreases by 3% under both indices.

[Please insert Table 2 & Figure 1 about here]

Regarding the quality of specific institutions, in figure 2 the three graphs plot corruption, the rule of law, and regulatory quality against *Democracy polity* over time. Evidently, there is a positive correlation that is not as extremely high (see also the correlation coefficients in Appendix Table B3). Thus, the quality of governance characteristics has some differential information vis-à-vis that of democratic institutions.

[34] In addition to mitigating omitted-variable bias, the instrumental-variable estimation mitigates any possible measurement error in democracy and reverse causality problems (which are more unlikely).

[35] Their approach defines the regional influence to democratize a country. For each country, they examine whether the country was a democracy or nondemocracy in 1960, and the geographic region in which the country lies. These regions are Africa, East Asia and the Pacific, Eastern Europe and Central Asia, Western Europe and other developed countries, Latin America and the Caribbean, the Middle East and the North of Africa, and South Asia. They assume that democracy in a country is influenced by democracy in the set of countries in the same region that also share a similar political history.

4. Empirical Results

i. Democracy and Profit-Shifting: Baseline Results

Table 3 reports OLS estimates from the estimation of equation (3). All specifications include our baseline controls and differ on the fixed effects. The first column includes country fixed effects; the second adds year fixed effects; the third adds industry fixed effects; and the fourth adds subsidiary fixed effects (instead of country and industry fixed effects). We double-cluster the standard errors by subsidiary and MNE country to reduce the effect of correlated errors within these clusters.

The coefficients of *Democracy polity* are negative and statistically significant in all specifications at conventional levels, implying that increasing (decreasing) democracy decreases (increases) profit-shifting. If we focus on the most restrictive specification 4, which *inter alia* includes for subsidiary fixed effects, a one-unit increase in democracy in the subsidiary country decreases profit-shifting to other countries by 0.12 points. For the country with mean profit-shifting, this increase in *Democracy polity* implies a decrease in profit-shifting by approximately 15% (obtained from 0.12/0.81). The equivalent effect from a one-standard-deviation increase in *Democracy polity* (equal to 1.63 in our sample) is 0.196 points or 24%. Thus, in the OLS models, democracy has a negative and economically significant impact on profit shifting.

[Please insert Table 3 about here]

Table 4 presents evidence based on alternative indices of democracy. Specifications 1 to 4 report estimates of the perception-based *Democracy FH*, and specifications 5 to 8 report estimates of the institutional-based *Democracy BMR*. In general, the results are economically even more potent than those in Table 3. Based on specification 4, a one-standard-deviation increase in *Democracy FH* (equal to 1.28) reduces profit-shifting by 0.28 points. Further, moving from 0 to 1 in *Democracy BMR* lowers profit-shifting by 0.33 points, an economically substantial effect given the mean *Profit-shifting* of 0.76 in the sample of 17,217 observations (for which we have information on *Democracy BMR*).

[Please insert Table 4 about here]

Our most important results are those from our IV model (two-stage least squares), which we report in Table 5. The coefficients on *Regional democratization* (our IV) in the first stage are always statistically significant at the 1% level, rejecting any issues of weak instrumentation. The second-stage results are qualitatively similar to those in Table 3, and all previous findings hold. The impact of democracy is somewhat more potent, ranging from approximately 0.14 (column 2) to 0.19 (column 4) points. A one-standard-deviation increase in *Democracy polity* (equal to 1.59 in this sample) reduces profit-shifting to other countries by approximately 37%. Thus, if anything, the economic significance of our OLS results are conservative. Given that there is a statistically significant difference in the coefficient estimates between the OLS and the IV models, we use the IV model in the rest of the robustness tests.[36] We also replicate our analysis removing observations related to worldwide tax systems (Markle,

[36] Table B8 in the Appendix reports IV estimates of alternative democracy measure(s) analogous to Table 4. The estimates of *Democracy FH* are very close to those in Table 4, ranging from 0.19 to 0.26.

2016); the results do not vary significantly. By removing them, we also drop observations for US subsidiaries, in case their Orbis unconsolidated data are not as accurate.

[Please insert Table 5 about here]

Thus far, we show that the subsidiary country's current democracy level matters in firms' decisions to shift profits abroad. However, before shifting profits to another country, firms may consider the longer-term democratic conditions of their countries. We consider this possibility by including annual lags of *Democracy polity* in our IV model and report the estimates in Table 6. Controlling for different numbers of lags in specifications 2 to 5, we find that the first two lags have explanatory power for firms' profit-shifting, and the contemporaneous *Democracy polity* retains its significance. Obviously, a country's early democratic history increases the information set of firms in their decisions to shift (or not shift) profits elsewhere.

[Please insert Table 6 about here]

We use an additional list of more than 50 control variables in various robustness tests. The variables reflect institutional, cultural, geographic, demographic, and economic characteristics of the subsidiary and MNE countries. We list these variables and their sources in Appendix Table B4. Many of these variables are multicollinear (either among themselves or with GDP per capita) and thus we cannot simultaneously include them in the same regression model. We find that our estimates are robust to including these additional variables.

Finally, we show that our results hold in many other robustness tests. In Table B9, we provide some assurance that there is no single country or democratization event that is driving the results. We drop all countries, where democracy changes, with less than 10 observations. We present these estimates against our baseline IV results, to ensure that changing countries with few observations are not driving a global inference. In Table B10, we address outliers by winsorizing our data at levels 1% and 99%. We replicate our four most restrictive specifications (OLS for the first two columns and IV for the last two). Our results do not vary significantly.

ii. Components of Democracy and Profit-Shifting

Next, we delve deeper into examining what component of our democracy index has the largest effect on profit-shifting. *Openness of executive recruitment* has a very small number of changes over time, and thus it drops out when using country fixed effects. Accordingly, we only consider the effect of the other three *Democracy polity* components and report the results in Table 7. We consider the effects in different specifications because these variables are highly correlated (we provide the correlation matrix in Appendix Table B3). All three variables are statistically significant at the 1% level.

The effects of one-standard-deviation increases are 0.33 points (or 41%) for *Competitiveness of participation*, 0.34 points (or 42%) for *Competitiveness of executive recruitment*, and 0.28 points (or 35%) for *Executive constraints*. This is in line with the premise that having established free elections under competitiveness of participation, the other key element of democratic conditions is the guarantee of civil liberties to all citizens in their daily lives and in acts of political participation. Given that this is the

more "qualitative" democratic characteristic of *Democracy polity*, it is also interesting to examine how the purely qualitative components of *Democracy FH* affect profit-shifting.

[Please insert Table 7 about here]

We report these results in Table 8. Consistent with the results in Table 7, we find that all the *Democracy FH* components, reflecting various forms of civil and political liberties, strongly explain profit-shifting. Economically, the largest effects from a one-standard-deviation increase come from personal autonomy, individual rights, and the rule of law.[37] Overall, these findings show that firms' profit-shifting behavior is considerably affected by the quality of property rights and business freedom, citizens' ability to make free political choices, and the quality of the judicial system as a means to protect these liberties.

[Please insert Table 8 about here]

iii. What Institutions are More Conductive to Less Profit-Shifting?

Our analysis on the components of *Democracy polity* and *Democracy FH* already suggests that both constitutional and perception-based indices are important in explaining profit-shifting. An important goal of our empirical analysis is to pinpoint further the key channels through which democracy shapes profit-shifting. To study channels formally, we need to examine which of the institutional components of democracy affect profit-shifting. We include the general democracy indicators in the same model, but they have less significant effects (so the components capture that part of their effect). Unfortunately, *Democracy polity* and *Democracy FH* have very high correlations with their components, so that the results have the usual multicollinearity symptoms. Our remedy is to include the WGI indices, which have lower correlations. In that respect, we also bring in information from a different set of institutional characteristics that are not very highly correlated with our democracy indicators and thus bring in somewhat different information.

Table 9, columns 2 to 4, report the relevant IV estimates against our baseline results, which we replicate in column 1 for convenience. We observe reductions in the coefficient estimates on *Democracy polity*, which are as large as the importance of the effect of the governance variables. Specifically, *Control of corruption* in column 2 is statistically insignificant, and this has a very small effect on the coefficient of *Democracy polity* compared to the baseline.

In contrast, the effect of *Rule of law* (column 3) is negative and highly significant, showing that firms in countries with better protections of property rights, government integrity, and judicial effectiveness are reluctant to move their profits abroad (despite the potential of paying higher taxes). Given the large effect of *Rule of law*, the coefficient on *Democracy polity* in column 3 loses approximately 15% of its power compared to our baseline specification. Together, these findings show that rule of law is an important channel through which democracy affects profit-shifting.

Regulatory quality is also an important channel through which democracy affects profit-shifting. This variable enters specification 4 of Table 9 with a negative and highly significant coefficient, and it lowers the impact of *Democracy polity*

[37] Note that the positive effect of political rights is not counterintuitive, because this variable takes higher values for lower levels of freedom.

compared to our baseline specification by approximately 8%. This finding shows that firms in countries with a significant capacity for national administrators to design and implement quality regulations and policies are also reluctant to shift profits abroad, despite the potentially lower tax burden.

[Please insert Table 9 about here]

Admittedly, this analysis is rougher in terms of identifying causal effects because the governance variables might also be endogenous when entering the profit-shifting equations. However, the fact that these variables are essentially components of democracy and that their addition lowers the coefficient on *Democracy* suggest that this analysis is fruitful even as a direction for future research.

5. Conclusion

In a globalized world, firms face competitive pressures to shift profits from high-tax countries to low-tax countries. The mobility of global businesses and their decisions to pay taxes abroad increase the distributional burden of the tax system among domestic economies, shrink government fiscal budgets, and contract government welfare spending.

Using a global sample of MNEs and their subsidiaries, this paper examines the role of constitutional democracy and institutions on profit-shifting. To this end, we construct a new subsidiary-year measure of profit-shifting, which we use as the outcome variable in our main empirical analysis.

We provide robust evidence that democracy has a negative effect on profit-shifting, implying that increasing democratic institutions in subsidiary countries lowers profit-shifting to other countries. Our baseline results suggest that an increase of one standard deviation in our democracy index reduces profit-shifting by approximately 37%. This estimate is robust to an extensive series of sensitivity tests, including different measures of democracy. We also find that high-quality policy-making and the government's ability to protect property rights and enforce contracts are two key channels increasing democracy's effectiveness in keeping subsidiaries' profits home.

Our results suggest that authorities benefit from taking a closer look at how democracy affects firms' profit-shifting decisions. Our findings point to the need for institutional reforms that improve government regulatory quality and the effectiveness of the rule of law as de facto policies in deterring business and profit-shifting. As the OECD's BEPS and related projects move forward to fulfill their objectives of increased transparency and tax fairness, we provide evidence that focusing on the quality of institutions that relate to profit-shifting plays an important role in the implementation of this initiative.

Tables

Table 1. Variables Definitions and Sources

Variable	Definition	Source
L. Dependent variable		
Profit-shifting	Estimates $\hat{a}_{1,st}$ from the estimation of equation (1) using a fully nonparametric local linear regression. We use an Epanechnikov kernel and select the bandwidth with cross-validation.	Own estimation based on Orbis and EY Tax Guide
Explanatory variables: Firm characteristics		
EBT	Subsidiary's earnings before taxes (log).	Orbis
Firm size	Subsidiary's and MNE's total assets (log).	Orbis
Tangibility	Subsidiary's and MNE's tangibility, defined as fixed assets/ total assets.	Orbis
Leverage	Subsidiary's and MNE's leverage, defined total liabilities/ total assets.	Orbis
Cost of employees	MNE's cost of employees (log).	Orbis
Explanatory variables: Country characteristics		
Democracy polity	Ranges from 0 to 10, with 0 indicating no institutional democracy and 10 indicating a maximum level of institutional democracy.	Polity IV Project (2018)
Democracy FH	A perception-based measure that ranges from 0 (autocratic country) to 10 (free democratic country).	Freedom House
Democracy BMR	Dummy variable equal to 1 if country is a democracy, zero otherwise.	Boix, Miller, and Rosato (2013)
Competitiveness of executive recruitment	Refers to the extent that prevailing modes of advancement give subordinates equal opportunities to become superordinates.	Polity IV Project (2018)
Openness of executive recruitment	Recruitment of the chief executive is "open" to the extent that all the politically active population has an opportunity, in principle, to attain the position through a regularized process.	Polity IV Project (2018)
Executive constraints	Refers to the extent of institutionalized constraints on the decision-making powers of chief executives, whether individuals or collectivities.	Polity IV Project (2018)
Competitiveness of participation	Refers to the extent to which alternative preferences for policy and leadership can be pursued in the political arena.	Polity IV Project (2018)
Personal autonomy and individual rights	Evaluates the extent of state control over travel, choice of residence, employment or institution of higher education; the right of citizens to own property and establish private businesses; the private business' freedom from undue influence by government officials, security forces, political parties or organized crime; gender equality, freedom of choice of marriage partners and size of family; equality of opportunity and absence of economic exploitation. Countries are graded between 0 (worst) and 16 (best).	Freedom House

Political pluralism and participation	Encompasses an examination of the right of the people to organize freely in political parties; the existence of an opposition with a realistic possibility to increase its support; the ability of the people to make political choices free from domination by the military, totalitarian parties, or other powerful groups; and the existence of full political rights for all minorities. Countries are graded between 0 (worst) and 16 (best).	Freedom House
Political rights	Political rights enable people to participate freely in the political process, including the right to vote freely for distinct alternatives in legitimate elections, compete for public office, join political parties and organizations, and elect representatives who have a decisive impact on public policies and are accountable to the electorate. The specific list of rights considered varies over the years. Countries are graded between 1 (most free) and 7 (least free).	Freedom House
Rule of law FH	Measures the independence of the judiciary; the extent to which rule of law prevails in civil and criminal matters; the existence of direct civil control over the police; the protection from political terror, unjustified imprisonment, exile, and torture; absence of war and insurgencies; and the extent to which laws, policies, and practices guarantee equal treatment of various segments of the population. Countries are graded between 0 (worst) and 16 (best).	Freedom House
GDP per capita	GDP per capita in constant prices.	WDI
GDP growth	Annual GDP growth rate.	WDI
Population	Country's population.	WDI
Control of corruption	Captures perceptions of the extent to which public power is exercised for private gain, including both petty and grand forms of corruption, as well as "capture" of the state by elites and private interests.	Worldwide Governance Indicators
Regulatory quality	Captures perceptions of the ability of the government to formulate and implement sound policies and regulations that permit and promote private-sector development.	Worldwide Governance Indicators
Rule of law	Captures perceptions of the extent to which agents have confidence in and abide by the rules of society, and in particular the quality of contract enforcement, property rights, the police, and the courts, as well as the likelihood of crime and violence.	Worldwide Governance Indicators
Explanatory variables: Firm and country characteristics		
Composite tax variable	Summarizes all information about subsidiaries' profit-shifting tax-incentives in a given year.	Huizinga and Laeven (2008)
Instrumental variables		
Regional democratization	Regional waves of democratization and reversals in democracy, excluding information in a subsidiary's country.	Acemoglu et al. (2019)

Table 2. Summary Statistics (57 countries, period: 2009-2017)

The table reports the number of observations as well as the mean, standard deviation, minimum, maximum, and median of the main variables used in the empirical analysis. The variables are defined in Table 1.

	Obs.	Mean	Std. Dev.	Min.	Max.	Median
Profit-shifting	27,103	0.81	0.58	0	3.12	0.72
Democracy polity	27,103	8.89	1.63	0	10	9
Democracy polity (IV)	27,154	9.45	1.59	-1.64	12.64	9.53
Competitiveness of executive recruitment	27,154	2.97	0.29	1.04	3.66	2.97
Executive constraints	27,154	6.76	0.72	1.95	8.70	6.78
Competitiveness of participation	27,154	4.71	0.60	0.43	5.29	4.79
Democracy FH	27,177	9.44	1.28	1.17	10	9.75
Personal autonomy and individual rights	27,154	14.59	1.21	5.83	14.84	14.51
Political pluralism and participation	27,154	15.22	1.95	1.10	15.64	15.03
Political rights	27,154	1.20	0.78	1.03	6.88	1.20
Rule of law FH	27,154	13.87	1.87	0.31	14.26	13.84
Democracy BMR	17,217	0.98	0.14	0	1	1
Control of corruption	27,154	1.19	0.76	-1.27	2.40	1.47
Rule of law	27,154	1.22	0.62	-1.18	2.10	1.43
Regulatory quality	27,154	1.13	0.50	-0.95	2.26	1.16
Firm size (subsidiary)	27,103	9.86	2.17	0.54	18.24	9.77
Firm size (MNE)	27,103	15.98	1.82	7.46	19.83	16.10
Leverage (subsidiary)	27,103	0.56	0.28	0	1.43	0.58
Leverage (MNE)	27,103	0.62	0.17	0.01	2.14	0.62
Tangibility (subsidiary)	27,103	0.26	0.29	0	1	0.15
Tangibility (MNE)	27,103	0.58	0.16	0	1	0.59
Cost of employees (MNE)	27,103	13.52	2.30	2.52	17.39	13.78
GDP per capita (subsidiary)	27,103	10.47	0.73	6.44	11.60	10.64
GDP per capita (MNE)	27,103	10.70	0.48	7.20	11.60	10.73
GDP growth (subsidiary)	27,103	0.26	0.98	-4.26	2.72	0.41
GDP growth (MNE)	27,103	0.65	0.75	-4.26	3.24	0.66
Population (subsidiary)	27,103	17.35	1.20	13.14	21.05	17.90
Population (MNE)	27,103	17.77	1.41	12.71	21.02	18.00
Composite tax variable	27,103	0.10	0.05	0.03	0.48	0.09

Table 3. Democracy and Profit-Shifting: OLS estimates

The table reports coefficients and *t*-statistics (in brackets). The dependent variable is *Profit-shifting*. We define all variables in Table 1. Estimation method is OLS with standard errors clustered by both subsidiary's and MNE's country. The lower part of the table denotes the type of fixed effects used in each specification. The *, **, and *** marks denote statistical significance at the 10%, 5%, and 1% level, respectively.

	(1)	(2)	(3)	(4)
Democracy polity	-0.169***	-0.103***	-0.104***	-0.121**
	[-3.114]	[-2.808]	[-2.720]	[-2.662]
Firm size (subsidiary)	-0.012**	-0.012**	-0.006	-0.000
	[-2.287]	[-2.372]	[-1.460]	[-0.037]
Firm size (MNE)	-0.009	-0.009	-0.013***	-0.021
	[-1.131]	[-1.205]	[-3.235]	[-1.409]
Leverage (subsidiary)	0.024	0.026	0.015	-0.007
	[0.676]	[0.730]	[0.536]	[-0.216]
Leverage (MNE)	-0.111	-0.114	-0.133*	0.019
	[-1.260]	[-1.277]	[-1.852]	[0.187]
Tangibility (subsidiary)	-0.038***	-0.037**	-0.010	-0.012
	[-2.769]	[-2.461]	[-0.663]	[-0.538]
Tangibility (MNE)	0.078	0.074	0.102	0.048
	[0.761]	[0.726]	[1.143]	[0.433]
Cost of employees (MNE)	-0.027***	-0.026***	-0.029***	0.004
	[-4.753]	[-4.497]	[-6.478]	[0.319]
GDP per capita (subsidiary)	-0.252	-0.434	-0.490	-0.706
	[-0.380]	[-0.626]	[-0.708]	[-1.165]
GDP per capita (MNE)	0.012	0.005	-0.001	0.366***
	[0.584]	[0.261]	[-0.035]	[4.773]
GDP growth (subsidiary)	0.010**	-0.025***	-0.025**	-0.031***
	[2.041]	[-2.971]	[-2.426]	[-3.320]
GDP growth (MNE)	0.029**	0.027**	0.023**	-0.017
	[2.674]	[2.227]	[2.256]	[-1.119]
Population (subsidiary)	6.221**	1.148	1.354	3.093
	[2.469]	[0.671]	[0.771]	[1.265]
Population (MNE)	0.043***	0.040***	0.034***	-1.136
	[5.226]	[5.210]	[4.540]	[-0.904]
Constant	-103.274**	-13.810	-16.576	-27.840
	[-2.603]	[-0.484]	[-0.564]	[-0.614]
Observations	29,242	29,242	29,241	27,103
Adjusted R-squared	0.266	0.273	0.313	0.776
Year effects	N	Y	Y	Y
Subsidiary effects	N	N	N	Y
Sub. country effects	Y	Y	Y	N
Sub. industry effects	N	N	Y	N
Clustered standard errors	country	country	country	country

Table 4. Democracy and Profit-Shifting (Alternative Indices of Democracy): OLS Estimates

The table reports coefficients and *t*-statistics (in brackets). The dependent variable is *Profit-shifting*. We define all variables in Table 1. Estimation method is OLS with standard errors clustered by both subsidiary's and MNE's country. The lower part of the table denotes the type of fixed effects. The *, **, and *** marks denote statistical significance at the 10%, 5%, and 1% level, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Democracy FH	-0.274**	-0.217***	-0.228***	-0.217*				
	[-2.029]	[-2.999]	[-3.112]	[-1.880]				
Democracy BMR					-0.517***	-0.323***	-0.349***	-0.327***
					[-3.772]	[-5.192]	[-5.332]	[-4.840]
Firm size (subsidiary)	-0.013**	-0.013**	-0.006	-0.002	-0.013**	-0.013**	-0.007	0.004
	[-2.441]	[-2.356]	[-1.312]	[-0.246]	[-2.169]	[-2.209]	[-1.528]	[0.451]
Firm size (MNE)	-0.008	-0.008	-0.013**	-0.024*	-0.009	-0.009	-0.015**	-0.065***
	[-0.999]	[-0.883]	[-2.485]	[-1.958]	[-0.947]	[-1.081]	[-2.347]	[-3.070]
Leverage (subsidiary)	0.020	0.022	0.012	-0.005	-0.023	-0.021	-0.029	-0.068**
	[0.486]	[0.330]	[0.190]	[-0.123]	[-0.561]	[-0.511]	[-0.920]	[-2.336]
Leverage (MNE)	-0.107	-0.109	-0.130*	0.023	-0.089	-0.087	-0.102	-0.029
	[-1.193]	[-1.201]	[-1.804]	[0.225]	[-0.923]	[-0.906]	[-1.224]	[-0.257]
Tangibility (subsidiary)	-0.037*	-0.036	-0.009	-0.017	-0.029*	-0.029	-0.006	-0.042
	[-1.808]	[-1.146]	[-0.219]	[-0.722]	[-1.768]	[-1.658]	[-0.335]	[-1.303]
Tangibility (MNE)	0.084	0.079	0.112	0.072	0.086	0.084	0.130	0.233
	[0.817]	[0.587]	[0.868]	[0.632]	[0.777]	[0.800]	[1.171]	[1.551]
Cost of employees (MNE)	-0.028***	-0.027***	-0.030***	0.003	-0.024***	-0.023***	-0.024***	0.002
	[-4.614]	[-3.587]	[-6.289]	[0.253]	[-3.922]	[-3.671]	[-4.665]	[0.091]
GDP per capita (subsidiary)	-0.339	-0.422	-0.482	-0.659	-1.149	-0.877	-0.946	-0.943**
	[-0.461]	[-0.621]	[-0.711]	[-1.124]	[-1.487]	[-1.354]	[-1.478]	[-2.288]
GDP per capita (MNE)	0.011	0.004	-0.002	0.331***	0.002	-0.003	-0.003	0.477**
	[0.517]	[0.190]	[-0.094]	[3.404]	[0.124]	[-0.144]	[-0.216]	[2.128]
GDP growth (subsidiary)	0.001	-0.029**	-0.029**	-0.035***	0.003	-0.014	-0.015	-0.018*
	[0.215]	[-2.381]	[-2.343]	[-3.590]	[0.454]	[-1.470]	[-1.364]	[-1.826]
GDP growth (MNE)	0.031**	0.027*	0.024	-0.016	0.024**	0.023**	0.021*	-0.018
	[2.258]	[1.880]	[1.558]	[-0.800]	[2.265]	[2.100]	[1.965]	[-1.052]
Population (subsidiary)	5.976**	1.311	1.512	3.320	5.933**	0.692	0.870	2.455
	[2.394]	[0.826]	[0.937]	[1.443]	[2.036]	[0.578]	[0.727]	[1.488]
Population (MNE)	0.042***	0.040***	0.033***	-1.214	0.039***	0.036***	0.031***	-0.589
	[4.729]	[4.106]	[3.813]	[-0.973]	[4.747]	[4.458]	[4.653]	[-0.444]
Constant	-96.957**	-15.605	-18.139	-29.444	-89.554*	-1.768	-3.963	-25.256
	[-2.508]	[-0.619]	[-0.705]	[-0.654]	[-1.924]	[-0.081]	[-0.180]	[-0.697]
Observations	29,317	29,317	29,317	27,177	19,357	19,357	19,357	17,217
Adjusted R-squared	0.269	0.275	0.315	0.778	0.224	0.230	0.275	0.821
Year effects	N	Y	Y	Y	N	Y	Y	Y
Subsidiary effects	N	N	N	Y	N	N	N	Y
Sub. country effects	Y	Y	Y	N	Y	Y	Y	N
Sub. industry effects	N	N	Y	N	N	N	Y	N
Clustered standard errors	country	country	country	country	country	country	country	country

Table 5. Democracy and Profit-Shifting: IV estimates

The table reports coefficients and *t*-statistics (in brackets). The dependent variable is *Profit-shifting*. We define all variables in Table 1. Estimation method is IV with standard errors clustered by both subsidiary's and MNE's country. The intermediate part of the table shows the main first-stage results (common across all regressions). The lower part of the table denotes the type of fixed effects used in each specification. The *, **, and *** marks denote statistical significance at the 10%, 5%, and 1% level, respectively.

	(1)	(2)	(3)	(4)
Democracy polity	-0.153**	-0.137**	-0.144**	-0.190***
	[-2.285]	[-2.021]	[-2.088]	[-2.732]
Firm size (subsidiary)	-0.013**	-0.013**	-0.006	-0.001
	[-2.408]	[-2.492]	[-1.496]	[-0.061]
Firm size (MNE)	-0.008	-0.008	-0.013***	-0.020
	[-1.036]	[-1.102]	[-3.269]	[-1.408]
Leverage (subsidiary)	0.020	0.022	0.013	-0.009
	[0.563]	[0.625]	[0.469]	[-0.237]
Leverage (MNE)	-0.108	-0.111	-0.131*	0.019
	[-1.237]	[-1.252]	[-1.838]	[0.191]
Tangibility (subsidiary)	-0.037***	-0.036**	-0.009	-0.010
	[-2.755]	[-2.549]	[-0.583]	[-0.448]
Tangibility (MNE)	0.085	0.080	0.113	0.063
	[0.805]	[0.773]	[1.249]	[0.542]
Cost of employees (MNE)	-0.028***	-0.027***	-0.030***	0.002
	[-4.887]	[-4.649]	[-6.546]	[0.180]
GDP per capita (subsidiary)	-0.386	-0.504	-0.570	-0.833
	[-0.540]	[-0.687]	[-0.772]	[-1.241]
GDP per capita (MNE)	0.011	0.004	-0.001	0.379***
	[0.518]	[0.211]	[-0.070]	[5.581]
GDP growth (subsidiary)	-0.004	-0.035***	-0.035***	-0.044***
	[-0.638]	[-3.214]	[-3.010]	[-4.819]
GDP growth (MNE)	0.029**	0.026**	0.023*	-0.018
	[2.503]	[2.024]	[1.967]	[-1.131]
Population (subsidiary)	5.851**	1.037	1.217	3.160
	[2.307]	[0.614]	[0.700]	[1.303]
Population (MNE)	0.042***	0.040***	0.034***	-0.932
	[4.886]	[4.919]	[4.435]	[-0.758]
Constant	-95.448**	-10.753	-12.918	-30.688
	[-2.351]	[-0.380]	[-0.443]	[-0.685]
First stage results				
Regional democratization	11.883***			
	[3.92]			
Observations	29,294	29,294	29,294	27,154
Adjusted R-squared	0.268	0.275	0.315	0.779
Year effects	N	Y	Y	Y
Subsidiary effects	N	N	N	Y
Sub. country effects	Y	Y	Y	N
Sub. industry effects	N	N	Y	N
Clustered standard errors	country	country	country	country

Table 6. Medium and Longer-Term Effects of Democratic Development

The table reports coefficients and *t*-statistics (in brackets). The dependent variable is *Profit-shifting*, and most variables are defined in Table 1. Estimation method is our baseline IV procedure with standard errors clustered by both subsidiary's and MNE's country. The lower part of the table denotes the type of fixed effects used in each specification. The *, **, and *** marks denote statistical significance at the 10%, 5%, and 1% level, respectively.

	(1)	(2)	(3)	(4)	(5)
Democracy polity	-0.190***	-0.261***	-0.271***	-0.319**	-0.448**
	[-2.732]	[-3.507]	[-2.705]	[-2.195]	[-2.140]
Democracy polity (t-1)		0.029	-0.093**	-0.131**	-0.151**
		[0.479]	[-2.059]	[-2.326]	[-2.642]
Democracy polity (t-2)			0.177	-0.059	-0.150*
			[0.870]	[-1.029]	[-2.034]
Democracy polity (t-3)				0.003	0.049
				[0.048]	[0.435]
Democracy polity (t-4)					-0.106
					[-0.810]
Firm size (subsidiary)	-0.001	0.002	0.000	0.014	0.004
	[-0.061]	[0.230]	[0.008]	[1.063]	[0.360]
Firm size (MNE)	-0.020	-0.032	-0.042**	-0.054	-0.039**
	[-1.408]	[-1.507]	[-2.077]	[-1.602]	[-2.066]
Leverage (subsidiary)	-0.009	0.000	-0.002	-0.027	0.010
	[-0.237]	[0.002]	[-0.040]	[-0.995]	[0.480]
Leverage (MNE)	0.019	0.052	0.081	0.122*	0.133**
	[0.191]	[0.459]	[1.001]	[1.901]	[2.146]
Tangibility (subsidiary)	-0.010	-0.009	-0.003	-0.044*	-0.072**
	[-0.448]	[-0.522]	[-0.168]	[-1.875]	[-2.180]
Tangibility (MNE)	0.063	-0.001	0.017	0.083	-0.027
	[0.542]	[-0.011]	[0.214]	[0.769]	[-0.336]
Cost of employees (MNE)	0.002	0.005	0.011*	0.020**	0.026*
	[0.180]	[0.503]	[1.746]	[2.637]	[1.729]
GDP per capita (subsidiary)	-0.833	-0.600	0.317	0.359	0.797
	[-1.241]	[-0.754]	[0.374]	[0.421]	[0.925]
GDP per capita (MNE)	0.379***	0.334***	0.152**	0.139**	0.137*
	[5.581]	[3.332]	[2.365]	[2.351]	[1.824]
GDP growth (subsidiary)	-0.044***	-0.003	0.034	0.032	0.064
	[-4.819]	[-0.097]	[0.856]	[0.805]	[0.797]
GDP growth (MNE)	-0.018	-0.013	-0.001	-0.010	-0.007
	[-1.131]	[-1.279]	[-0.051]	[-0.546]	[-0.340]
Population (subsidiary)	3.160	3.333	4.055	2.091	1.745
	[1.303]	[1.247]	[1.543]	[0.734]	[0.908]
Population (MNE)	-0.932	-0.794	-0.723	-1.468	-2.647
	[-0.758]	[-0.570]	[-0.512]	[-1.121]	[-1.437]
Constant	-30.688	-37.427	-58.937	-9.101	15.768
	[-0.685]	[-0.747]	[-1.283]	[-0.189]	[0.358]
Observations	27,154	21,215	15,761	11,888	8,952
Adjusted R-squared	0.779	0.801	0.837	0.884	0.900
Year effects	Y	Y	Y	Y	Y
Subsidiary effects	Y	Y	Y	Y	Y
Sub. country effects	N	N	N	N	N
Sub. industry effects	N	N	N	N	N
Clustered standard errors	country	country	country	country	country

Table 7. Components of the Democracy (Polity IV) Index: IV Estimates

The table reports coefficients and *t*-statistics (in brackets). The dependent variable is *Profit-shifting* and the main independent variables are the components of the Polity IV index denoted in lines 2 to 4 of the table. We define all variables in Table 1. The estimation method is IV, with standard errors clustered by both subsidiary and MNE country. The lower part of the table denotes the type of fixed effects. The *, **, and *** marks denote statistical significance at the 10%, 5%, and 1% level, respectively.

	(1)	(2)	(3)
Competitiveness of executive recruitment	-1.179***		
	[-2.729]		
Executive constraints		-0.388***	
		[-2.728]	
Competitiveness of participation			-0.554***
			[-2.731]
Firm size (subsidiary)	-0.001	-0.001	-0.001
	[-0.061]	[-0.061]	[-0.061]
Firm size (MNE)	-0.020	-0.020	-0.020
	[-1.409]	[-1.410]	[-1.408]
Leverage (subsidiary)	-0.009	-0.009	-0.009
	[-0.237]	[-0.237]	[-0.237]
Leverage (MNE)	0.019	0.019	0.019
	[0.191]	[0.191]	[0.191]
Tangibility (subsidiary)	-0.010	-0.010	-0.010
	[-0.449]	[-0.448]	[-0.448]
Tangibility (MNE)	0.063	0.063	0.063
	[0.542]	[0.542]	[0.542]
Cost of employees (MNE)	0.002	0.002	0.002
	[0.181]	[0.181]	[0.181]
GDP per capita (subsidiary)	-0.818	-0.931	-0.706
	[-1.225]	[-1.346]	[-1.093]
GDP per capita (MNE)	0.379***	0.379***	0.379***
	[5.550]	[5.548]	[5.564]
GDP growth (subsidiary)	-0.076***	-0.032***	-0.049***
	[-4.417]	[-3.693]	[-4.943]
GDP growth (MNE)	-0.018	-0.018	-0.018
	[-1.131]	[-1.131]	[-1.131]
Population (subsidiary)	3.111	3.139	3.210
	[1.286]	[1.295]	[1.320]
Population (MNE)	-0.932	-0.932	-0.932
	[-0.758]	[-0.758]	[-0.758]
Constant	-28.276	-28.461	-32.074
	[-0.634]	[-0.638]	[-0.714]
Observations	27,154	27,154	27,154
Adjusted R-squared	0.779	0.779	0.779
Year effects	Y	Y	Y
Subsidiary effects	Y	Y	Y
Sub. country effects	N	N	N
Sub. industry effects	N	N	N
Clustered standard errors	country	country	country

Table 8. Components of the Democracy (Freedom House) Index: IV Estimates

The table reports coefficients and *t*-statistics (in brackets). The dependent variable is *Profit-shifting* and the main independent variables are the components of the Freedom House index denoted in lines 2 to 5 of the table. We define all variables in Table 1. The estimation method is IV, with standard errors clustered by both subsidiary and MNE country. The lower part of the table denotes the type of fixed effects. The *, **, and *** marks denote statistical significance at the 10%, 5%, and 1% level, respectively.

	(1)	(2)	(3)	(4)
Personal autonomy and individual rights	-0.358***			
	[-2.732]			
Political pluralism and participation		-0.163***		
		[-2.732]		
Political rights			0.425***	
			[2.733]	
Rule of law FH				-0.195***
				[-2.733]
Firm size (subsidiary)	-0.001	-0.001	-0.001	-0.001
	[-0.061]	[-0.061]	[-0.060]	[-0.060]
Firm size (MNE)	-0.020	-0.020	-0.020	-0.020
	[-1.407]	[-1.408]	[-1.404]	[-1.407]
Leverage (subsidiary)	-0.009	-0.009	-0.009	-0.009
	[-0.237]	[-0.237]	[-0.236]	[-0.237]
Leverage (MNE)	0.019	0.019	0.019	0.019
	[0.191]	[0.191]	[0.191]	[0.191]
Tangibility (subsidiary)	-0.010	-0.010	-0.010	-0.010
	[-0.448]	[-0.448]	[-0.448]	[-0.448]
Tangibility (MNE)	0.063	0.063	0.063	0.063
	[0.542]	[0.542]	[0.541]	[0.542]
Cost of employees (MNE)	0.002	0.002	0.002	0.002
	[0.180]	[0.180]	[0.180]	[0.180]
GDP per capita (subsidiary)	-0.321	-0.717	-0.674	-0.536
	[-0.548]	[-1.107]	[-1.053]	[-0.870]
GDP per capita (MNE)	0.379***	0.379***	0.379***	0.379***
	[5.576]	[5.581]	[5.636]	[5.586]
GDP growth (subsidiary)	-0.056***	-0.056***	-0.083***	-0.044***
	[-4.909]	[-4.898]	[-4.289]	[-4.841]
GDP growth (MNE)	-0.018	-0.018	-0.018	-0.018
	[-1.131]	[-1.131]	[-1.131]	[-1.131]
Population (subsidiary)	3.084	3.107	3.116	3.134
	[1.276]	[1.284]	[1.288]	[1.294]
Population (MNE)	-0.932	-0.932	-0.932	-0.932
	[-0.758]	[-0.758]	[-0.758]	[-0.758]
Constant	-31.339	-30.300	-33.889	-32.450
	[-0.698]	[-0.677]	[-0.751]	[-0.722]
Observations	27,154	27,154	27,154	27,154
Adjusted R-squared	0.779	0.779	0.779	0.779
Year effects	Y	Y	Y	Y
Subsidiary effects	Y	Y	Y	Y
Sub. country effects	N	N	N	N
Sub. industry effects	N	N	N	N
Clustered standard errors	country	country	country	country

Table 9. Profit-Shifting and Macroeconomic Institutions: IV Estimates

The table reports coefficients and *t*-statistics (in brackets). The dependent variable is *Profit-shifting*. We define all variables in Table 1. Estimation method is IV with standard errors clustered by both subsidiary's and MNE's country. The lower part of the table denotes the type of fixed effects. The *, **, and *** marks denote statistical significance at the 10%, 5%, and 1% level, respectively.

	(1)	(2)	(3)	(4)
Democracy polity	-0.190***	-0.183**	-0.161**	-0.175***
	[-2.732]	[-2.675]	[-2.439]	[-2.737]
Control of corruption		-0.294		
		[-0.714]		
Rule of law			-0.646***	
			[-3.078]	
Regulatory quality				-0.483**
				[-2.558]
Firm size (subsidiary)	-0.001	0.000	0.000	0.001
	[-0.061]	[0.034]	[0.046]	[0.097]
Firm size (MNE)	-0.020	-0.021	-0.020	-0.018
	[-1.408]	[-1.299]	[-1.290]	[-1.366]
Leverage (subsidiary)	-0.009	-0.011	-0.014	0.000
	[-0.237]	[-0.281]	[-0.364]	[0.007]
Leverage (MNE)	0.019	0.022	0.017	0.013
	[0.191]	[0.230]	[0.167]	[0.122]
Tangibility (subsidiary)	-0.010	-0.015	-0.011	-0.019
	[-0.448]	[-0.568]	[-0.458]	[-0.775]
Tangibility (MNE)	0.063	0.061	0.052	0.064
	[0.542]	[0.511]	[0.447]	[0.560]
Cost of employees (MNE)	0.002	0.002	0.001	0.001
	[0.180]	[0.153]	[0.049]	[0.042]
GDP per capita (subsidiary)	-0.833	-0.576	-0.206	-0.472
	[-1.241]	[-0.666]	[-0.326]	[-0.826]
GDP per capita (MNE)	0.379***	0.370***	0.377***	0.375***
	[5.581]	[5.158]	[5.722]	[4.822]
GDP growth (subsidiary)	-0.044***	-0.054***	-0.057***	-0.049***
	[-4.819]	[-4.244]	[-4.960]	[-5.747]
GDP growth (MNE)	-0.018	-0.018	-0.019	-0.019
	[-1.131]	[-1.198]	[-1.147]	[-1.220]
Population (subsidiary)	3.160	3.308	2.660	3.406
	[1.303]	[1.396]	[1.328]	[1.469]
Population (MNE)	-0.932	-0.958	-0.883	-0.842
	[-0.758]	[-0.778]	[-0.739]	[-0.703]
Constant	-30.688	-35.083	-28.902	-39.897
	[-0.685]	[-0.771]	[-0.736]	[-0.881]
Observations	27,154	27,154	27,154	27,154
Adjusted R-squared	0.779	0.780	0.782	0.782
Year effects	Y	Y	Y	Y
Subsidiary effects	Y	Y	Y	Y
Sub. country effects	N	N	N	N
Sub. industry effects	N	N	N	N
Clustered standard errors	country	country	country	country

Figures

Figure 1. Democracy and Profit-Shifting

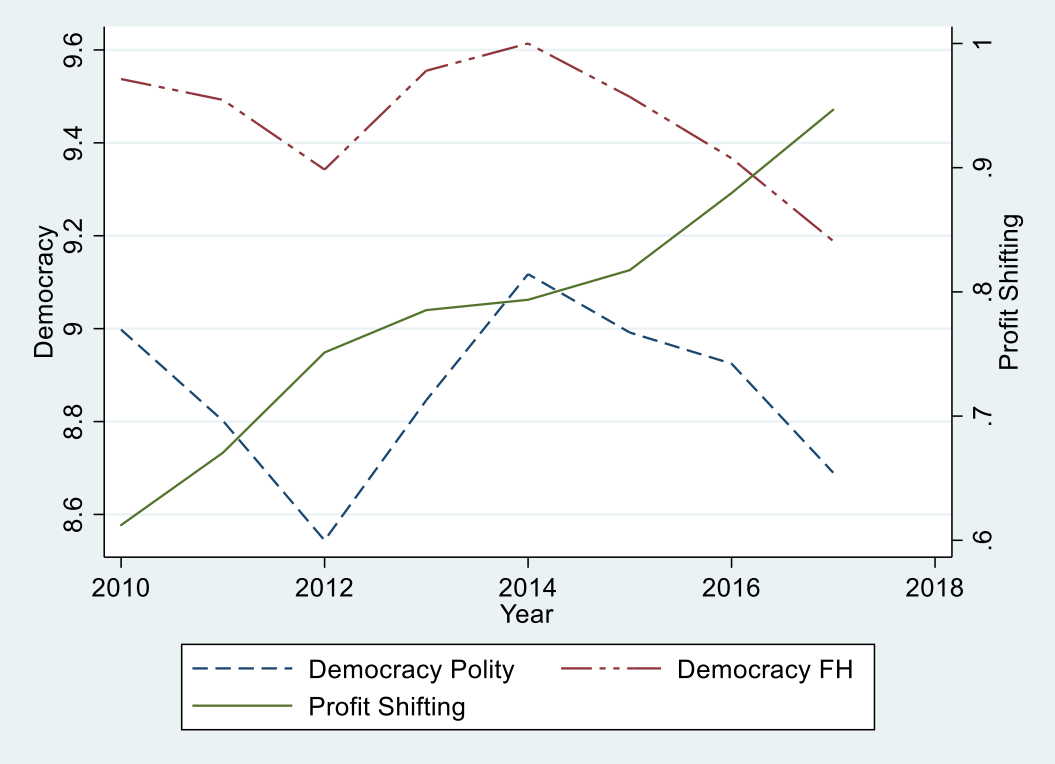
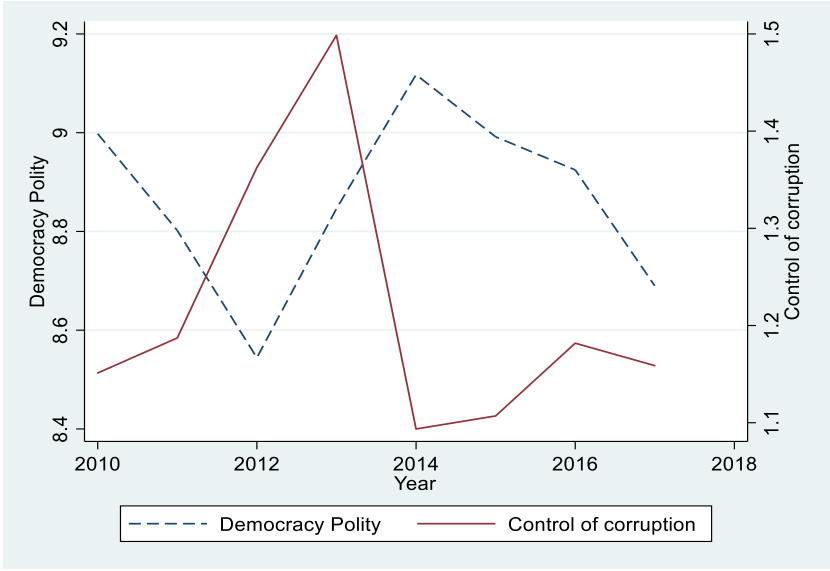
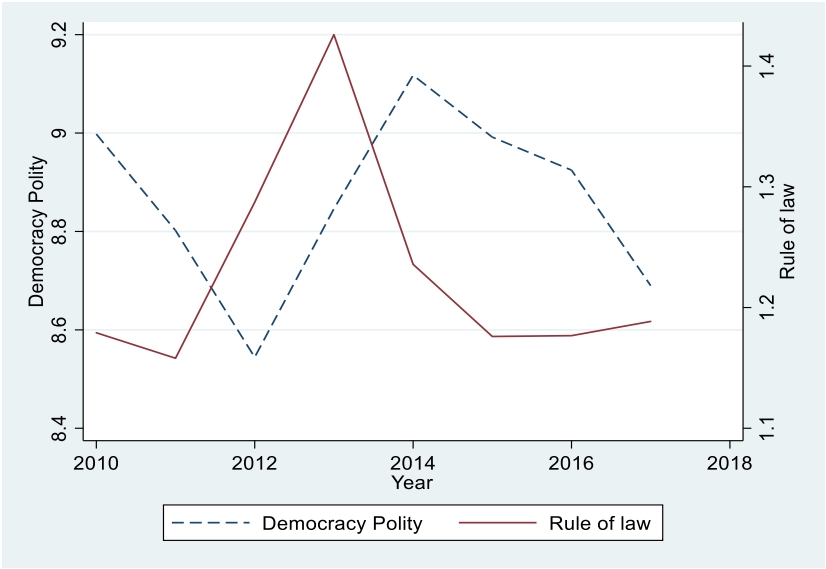
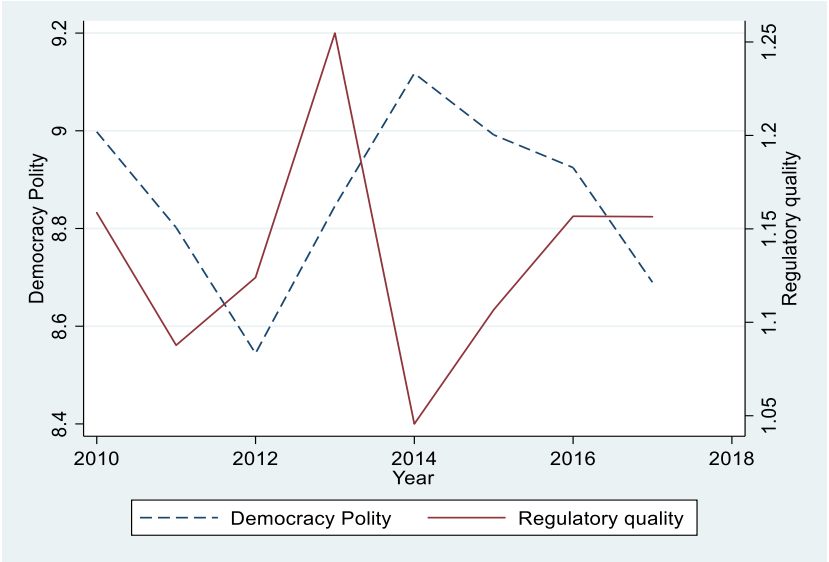


Figure 2. Democracy Polity and Institutions







Appendix

i. Sample Construction

We begin with the full worldwide set of subsidiaries with listed global ultimate owners (GUOs) in Orbis.[38] This search strategy provides detailed accounting data for the subsidiaries (and not for the GUO). Next, we create a data set for GUO, for which we search for shareholders with foreign subsidiaries anywhere in the world (excluding firms for which the country is not listed). For subsidiaries, we rely on unconsolidated statements; for GUOs we rely on consolidated statements (there are very few unconsolidated statements for GUOs). Consolidated data, which net out potential profit-shifting movements among affiliates of a multinational group, help us control for GUO characteristics potentially affecting the profit-shifting behaviors in equation (3) of our empirical analysis. We then merge the data sets by GUO and year. Both the subsidiaries and their GUO are of one of the following types: (i) very large or large companies, active, with recent detailed financials, (ii) medium-size companies, active, with recent detailed financials, (iii) small companies, active, with recent detailed financials. We exclude public authorities.

Our criterion for specifying a subsidiary is the existence of a GUO that owns at least 25.01% of the subsidiary. Note also that the minimum percentage of 25.01% includes both the ultimate owner's direct and indirect holdings, in case there are chains of ownership among the related firms of a specific group. Unlike previous studies, we relax the restriction that GUOs own at least 51% of their foreign subsidiaries, as one might expect that even lower but still strong ownership could provide an incentive for profit-shifting. However, all of our results are robust to majority ownership, which is important to avoid results due to "tunneling" (i.e., the phenomenon of individual or family shareholders who control a group of firms shifting income from firms in which they own a relatively small stake to firms in which they own a relatively large stake).

To construct our composite tax variable for estimating equation (1), we collect statutory tax rates from Ernst & Young's Worldwide Corporate Tax Guide. Deveraux and Mafini (2007) and many others henceforth use statutory (as opposed to effective) tax rates and justify this as follows. Multinationals shift profits among affiliates they already operate. Thus, they exploit tax allowances, which depend on differences in statutory (and not effective) tax rates. If multinationals were to decide where to produce (country, location) or measure an investment's value via the margin, effective average tax rate is preferred.

From this initial sample, we exclude subsidiaries in the same countries as their GUOs in order to capture the propagation of earnings among related subsidiaries in different countries due to tax differences. This yields a sample of 49,418 subsidiaries in 90 countries from 2009 to 2017. The total number of subsidiary-year observations is 254,262.

As discussed, we are interested in the negative responses of *EBT* to *CT* in equation (1) when *CT* is positive (i.e., an increase in *CT* via an increase in τ_s leads subsidiaries to send more profits abroad and thus reduces domestic *EBT*). This the case for 80,939 observations for 18,966 subsidiaries in 72 countries, for which we obtain our profit-shifting measure.

We merge this sample of subsidiaries with the variables needed to estimate

[38] Following Orbis, we use the more technical term *GUO*; however, this is exactly the same as our description of an MNE.

equation (3). To determine how democracy affects profit-shifting in our regression analysis, we multiply our profit-shifting index by -1. We have several missing data, especially for subsidiary and MNEs characteristics. The sample with nonmissing important variables is thus smaller than the sample with profit-shifting estimates; it includes 27,103 observations for 6,590 subsidiaries in 57 countries.

ii. Tables

Table B1. Country List and Rank According to Their Profit-Shifting

This table reports average profit-shifting estimates by country and lists the 57 countries in our analysis.

Country	Profit-Shifting	Country	Profit-Shifting
US	1.983	Kenya	0.352
Japan	1.236	Croatia	0.349
India	1.196	Mexico	0.324
Philippines	1.187	Estonia	0.303
Zambia	1.101	Poland	0.302
Brazil	1.062	Israel	0.279
Belgium	1.049	Romania	0.278
Argentina	1.029	Peru	0.272
France	0.931	Czech Republic	0.252
Finland	0.827	Hungary	0.252
Pakistan	0.810	Indonesia	0.220
Colombia	0.783	Russia	0.216
Italy	0.762	Serbia	0.193
Australia	0.706	Portugal	0.180
Morocco	0.688	Ghana	0.145
Greece	0.647	Uganda	0.058
Vietnam	0.620	Turkey	0.046
Uruguay	0.610	Bangladesh	0.031
Germany	0.599		
South Africa	0.567		
Gabon	0.559		
New Zealand	0.541		
Singapore	0.531		
United Kingdom	0.520		
Luxembourg	0.489		
Spain	0.471		
Sweden	0.465		
South Korea	0.445		
Denmark	0.441		
Malaysia	0.431		
Netherlands	0.419		
China	0.410		
Norway	0.400		
Canada	0.388		
Nigeria	0.373		
Austria	0.369		
Ukraine	0.367		
Slovakia	0.362		
Sri Lanka	0.361		

Table B2. Country Ranking According to Their Statutory Tax Rate

This table reports average statutory tax rates by country for the 57 countries in our analysis.

Country	Mean	Std. Dev.	Country	Mean	Std. Dev.
Japan	0.354	0.038	United Kingdom	0.226	0.032
Argentina	0.350	0	Finland	0.224	0.033
US	0.350	0	Portugal	0.222	0.018
Zambia	0.350	0	South Korea	0.220	0
Gabon	0.342	0.020	Slovakia	0.215	0.014
Brazil	0.340	0	Estonia	0.206	0.005
Belgium	0.340	0	Croatia	0.200	0
India	0.338	0.009	Russia	0.200	0
Pakistan	0.338	0.016	Turkey	0.200	0
France	0.333	0	Czech Republic	0.190	0
South Africa	0.329	0.033	Hungary	0.190	0
Sri Lanka	0.315	0.049	Poland	0.190	0
Morocco	0.303	0.005	Singapore	0.170	0
Italy	0.302	0.030	Romania	0.160	0
Australia	0.300	0	Serbia	0.150	0
Kenya	0.300	0	**Total**	0.271	0.054
Mexico	0.300	0			
Nigeria	0.300	0			
Philippines	0.300	0			
Uganda	0.300	0			
Germany	0.296	0.001			
Peru	0.294	0.009			
Colombia	0.291	0.044			
Luxembourg	0.288	0.008			
New Zealand	0.283	0.007			
Spain	0.276	0.025			
Bangladesh	0.275	0			
Greece	0.275	0.021			
Norway	0.269	0.016			
Canada	0.265	0			
Israel	0.251	0.010			
Netherlands	0.251	0.002			
Austria	0.250	0			
China	0.250	0			
Ghana	0.250	0			
Indonesia	0.250	0			
Ukraine	0.250	0			
Uruguay	0.250	0			
Malaysia	0.246	0.005			
Denmark	0.234	0.014			
Sweden	0.232	0.021			
Vietnam	0.227	0.023			

Table B3. Correlation Matrix of Main Variables by Country-Year

	1	2	3	4	5	6	7	8	9	10
1. Democracy polity	1									
2. Competitiveness of executive recruitment	0.888*	1								
3. Openness of executive recruitment	0.448*	0.641*	1							
4. Executive constraints	0.950*	0.808*	0.405*	1						
5. Competitiveness of participation	0.891*	0.703*	0.223*	0.761*	1					
6. Democracy FH	0.963*	0.836*	0.356*	0.927*	0.853*	1				
7. Democracy BMR	0.873*	0.776*	0.403*	0.887*	0.736*	0.853*	1			
8. Control of corruption	0.499*	0.379*	0.212*	0.449*	0.539*	0.604*	0.381*	1		
9. Rule of law	0.524*	0.390*	0.176*	0.472*	0.573*	0.636*	0.396*	0.973*	1	
10. Regulatory quality	0.539*	0.413*	0.195*	0.500*	0.559*	0.646*	0.414*	0.938*	0.952*	1

Table B4. List of Additional Country-Year Control Variables

The table provides a list of more than 50 control variables we use in additional regressions. We do not report the results from these regressions, but the effect of *Democracy polity* is similar to that in our baseline regressions. In some respects, we use more than one variable (i.e., from a different source) for the same country-year characteristic (e.g., *Corruption*). FH: Freedom House; WB: World Bank (either World Development Indicators or Quality of Governance indices); HF: Heritage Foundation; FI: Fraser Institute; V-Dem: Varieties of Democracy Measures. Many variables are % of GDP. We acknowledge the Quality of Government Institute for their data-collection process.

Variable	Source	Variable	Source
Corruption	WB, V-Dem	HH market concentration index	WB
Rule of law	FH, WB	Fixed broadband subscriptions	WB
Government effectiveness	WB	Business density	WB
Population density	WB	Renewable electricity	WB
Population growth	WB	Various electricity production ratios	WB
Urban population	WB	Depth of the food deficit	WB
Military expenditure	WB	Voice and accountability	WB
Government education expenditure	WB	Various school enrollment ratios	WB
Age dependency (% of labor)	WB	Literacy rate	WB
Birth rate (per 1,000 people)	WB	Individuals using internet	WB
CO2 emissions	WB	Interest payments	WB
Death rate (per 1,00 people)	WB	Various income share held ratios	WB
Electric power consumption	WB	International migrant stock	WB
Various employment ratios	WB	Internally displaced persons	WB
Foreign direct investment inflows	WB	Intentional homicides	WB
Fertility rate	WB	Trade freedom	HF, FI
Forest area	WB	Freedom from government	HF
Real interest rate	WB	Government integrity	HF
Life expectancy at birth	WB	Business freedom	HF
Mobile subscriptions	WB	Labor freedom	HF
Infant mortality	WB	Monetary freedom	HF
Exports of goods and services	WB	Investment freedom	HF
Consumer prices	WB	Financial freedom	HF
Access to sound money	FI	Tax burden	HF
Government expenditures	FI	Health expenditure	WB
Political stability	WB	Central government debt	WB

Table B5. Correlation Matrix

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1.Profit-shifting	1														
2.Democracy polity	-0.079*	1													
3.Firm size (subsidiary)	-0.057*	-0.006	1												
4.Firm size (MNE)	-0.071*	-0.035*	0.301*	1											
5.Leverage (subsidiary)	-0.034*	0.058*	-0.029*	-0.007	1										
6.Leverage (MNE)	-0.051*	-0.005	0.068*	0.298*	0.058*	1									
7.Tangibility (subsidiary)	-0.035*	0.014	0.386*	0.105*	-0.183*	0.024*	1								
8.Tangibility (MNE)	0.028*	-0.021*	0.108*	0.309*	-0.119*	-0.011	0.182*	1							
9.Cost of employees (MNE)	-0.120*	-0.047*	0.189*	0.711*	0.072*	0.370*	0.057*	0.097*	1						
10.GDP per capita (subsidiary)	-0.029*	0.468*	-0.027*	-0.094*	0.082*	-0.009	-0.034*	-0.041*	-0.060*	1					
11.GDP per capita (MNE)	0.012	0.006	0.061*	0.044*	-0.019*	-0.033*	0.006	-0.003	-0.001	0.034*	1				
12.GDP growth (subsidiary)	-0.049*	-0.195*	0.044*	-0.018*	-0.080*	-0.014	0.041*	-0.001	-0.041*	-0.302*	0.006	1			
13.GDP growth (MNE)	0.036*	0.047*	-0.022*	-0.084*	-0.011	-0.063*	-0.034*	-0.038*	-0.138*	0.023*	-0.077*	0.173*	1		
14.Population (subsidiary)	0.060*	-0.092*	0.111*	0.035*	-0.029*	-0.031*	0.048*	0.008	-0.026*	-0.589*	0.035*	0.077*	0.025*	1	
15.Population (MNE)	0.097*	0.020*	-0.027*	0.065*	-0.001	0.068*	-0.053*	-0.026*	-0.176*	-0.047*	-0.336*	0.019*	-0.033*	0.049*	1

Table B6. Changes in Democracy Polity by Country

This table reports the number of observations, as well as the mean, standard deviation, and number of changes (if there is a change, positive or negative) in democracy by country. The total number of observations is 27,103, and the number of countries that experience a change in democracy is 11.

Country	Observations	Mean	Std. Dev.	Democratizations	Reversals
Argentina	9	8.889	0.333	1	
Australia	1,144	10	0		
Austria	203	10	0		
Bangladesh	2	4.5	2.121		1
Belgium	6,211	8	0		
Brazil	113	8	0		
Canada	4	10	0		
China	303	0	0		
Colombia	603	7	0		
Croatia	16	9	0		
Czech Republic	35	9	0		
Denmark	177	10	0		
Estonia	16	9	0		
Finland	15	10	0		
France	6,996	9	0		
Gabon	6	4	0		
Germany	1,467	10	0		
Ghana	4	8	0		
Greece	22	10	0		
Hungary	14	10	0		
India	625	9	0		
Indonesia	4	8.75	0.5	1	
Israel	27	7	0		
Italy	3,326	10	0		
Japan	180	10	0		
Kenya	20	8.65	0.489	1	
Luxembourg	229	10	0		
Malaysia	44	6	0		
Mexico	22	8	0		
Morocco	295	0.993	0.082	1	
Netherlands	385	10	0		
New Zealand	300	10	0		
Nigeria	24	5.333	1.926	1	
Norway	1,181	10	0		
Pakistan	44	6.545	0.504	2	
Peru	19	9	0		
Philippines	8	8	0		
Poland	34	10	0		
Portugal	143	10	0		
South Korea	137	8	0		

Romania	11	9	0		
Russia	17	5	0		
Serbia	4	9	0		
Singapore	79	2	0		
Slovakia	57	10	0		
South Africa	15	9	0		
Spain	1,642	10	0		
Sri Lanka	2	5.5	2.121	1	1
Sweden	260	10	0		
Turkey	2	6.5	3.536		2
Uganda	5	1	0		
Ukraine	8	6	0		
United Kingdom	499	10	0		
US	49	9.469	0.892		2
Uruguay	6	10	0		
Vietnam	32	0	0		
Zambia	8	6.625	0.518		1
Total	27,103	8.893	1.630	8	7

Table B7. Summary Statistics of Main Variables by Country-Year

The table reports the number of observations, mean, standard deviation, minimum, and maximum from collapsing the subsidiary-level sample by country and year.

	Obs.	Mean	Std.Dev.	Min	Max
Democracy polity	340	7.835	2.891	0	10
Competitiveness of executive recruitment	340	2.697	0.660	0	3
Openness of executive recruitment	340	3.894	0.565	0	4
Executive constraints	340	6.171	1.292	3	7
Competitiveness of participation	340	3.962	1.188	0	5
Democracy FH	340	8.180	2.357	1.167	10
Democracy BMR	238	0.790	0.408	0	1
Control of corruption	340	0.566	1.112	-1.275	2.405
Rule of law	340	0.645	0.986	-1.182	2.096
Regulatory quality	340	0.717	0.874	-0.951	2.261

Table B8. Democracy and Profit-Shifting (Alternative Indices of Democracy): IV Estimates

The table reports coefficients and *t*-statistics (in brackets). The dependent variable is *Profit-shifting*. We define all variables in Table 1. The estimation method is IV with standard errors clustered by both subsidiary and MNE country. The lower part of the table denotes the type of fixed effects. The *, **, and *** marks denote statistical significance at the 10%, 5%, and 1% level, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Democracy FH	-0.206**	-0.185**	-0.194**	-0.257***				
	[-2.285]	[-2.021]	[-2.088]	[-2.732]				
Democracy BMR					-1.335**	-1.201**	-1.258**	-1.664***
					[-2.285]	[-2.021]	[-2.088]	[-2.732]
Firm size (subsidiary)	-0.013**	-0.013**	-0.006	-0.001	-0.013**	-0.013**	-0.006	-0.001
	[-2.408]	[-2.492]	[-1.496]	[-0.061]	[-2.408]	[-2.492]	[-1.496]	[-0.061]
Firm size (MNE)	-0.008	-0.008	-0.013***	-0.020	-0.008	-0.008	-0.013***	-0.020
	[-1.035]	[-1.102]	[-3.267]	[-1.408]	[-1.036]	[-1.102]	[-3.268]	[-1.408]
Leverage (subsidiary)	0.020	0.022	0.013	-0.009	0.020	0.022	0.013	-0.009
	[0.563]	[0.625]	[0.469]	[-0.237]	[0.563]	[0.625]	[0.469]	[-0.237]
Leverage (MNE)	-0.108	-0.111	-0.131*	0.019	-0.108	-0.111	-0.131*	0.019
	[-1.237]	[-1.252]	[-1.838]	[0.191]	[-1.237]	[-1.252]	[-1.838]	[0.191]
Tangibility (subsidiary)	-0.037***	-0.036**	-0.009	-0.010	-0.037***	-0.036**	-0.009	-0.010
	[-2.755]	[-2.549]	[-0.583]	[-0.448]	[-2.755]	[-2.549]	[-0.583]	[-0.448]
Tangibility (MNE)	0.085	0.080	0.113	0.063	0.085	0.080	0.113	0.063
	[0.805]	[0.773]	[1.249]	[0.542]	[0.805]	[0.773]	[1.249]	[0.542]
Cost of employees (MNE)	-0.028***	-0.027***	-0.030***	0.002	-0.028***	-0.027***	-0.030***	0.002
	[-4.887]	[-4.650]	[-6.551]	[0.180]	[-4.887]	[-4.649]	[-6.548]	[0.180]
GDP per capita (subsidiary)	-0.329	-0.453	-0.517	-0.762	-0.438	-0.550	-0.619	-0.897
	[-0.467]	[-0.627]	[-0.711]	[-1.161]	[-0.604]	[-0.739]	[-0.825]	[-1.311]
GDP per capita (MNE)	0.011	0.004	-0.001	0.379***	0.011	0.004	-0.001	0.379***
	[0.518]	[0.211]	[-0.070]	[5.575]	[0.518]	[0.211]	[-0.070]	[5.583]
GDP growth (subsidiary)	-0.027*	-0.055***	-0.057***	-0.073***	-0.016	-0.046***	-0.047***	-0.059***
	[-1.735]	[-2.866]	[-2.861]	[-4.513]	[-1.462]	[-3.038]	[-2.974]	[-4.852]
GDP growth (MNE)	0.029**	0.026**	0.023*	-0.018	0.029**	0.026**	0.023*	-0.018
	[2.504]	[2.024]	[1.967]	[-1.131]	[2.503]	[2.025]	[1.967]	[-1.131]
Population (subsidiary)	5.829**	1.017	1.197	3.133	5.849**	1.035	1.215	3.157
	[2.298]	[0.602]	[0.689]	[1.293]	[2.306]	[0.613]	[0.699]	[1.302]
Population (MNE)	0.042***	0.040***	0.034***	-0.932	0.042***	0.040***	0.034***	-0.932
	[4.884]	[4.917]	[4.434]	[-0.758]	[4.887]	[4.919]	[4.435]	[-0.758]
Constant	-95.107**	-10.446	-12.596	-30.263	-95.005**	-10.354	-12.500	-30.135
	[-2.341]	[-0.369]	[-0.432]	[-0.676]	[-2.338]	[-0.366]	[-0.428]	[-0.673]
Observations	29,294	29,294	29,294	27,154	29,294	29,294	29,294	27,154
Adjusted R-squared	0.268	0.275	0.315	0.779	0.268	0.275	0.315	0.779
Year effects	N	Y	Y	Y	N	Y	Y	Y
Subsidiary effects	N	N	N	Y	N	N	N	Y
Sub. country effects	Y	Y	Y	N	Y	Y	Y	N
Sub. industry effects	N	N	Y	N	N	N	Y	N
Clustered standard errors	country	country	country	country	country	country	country	country

Table B9. Excluding Countries, where Democracy changes, with less than 10 observations

The table reports coefficients and *t*-statistics (in brackets). Columns 2 to 8, report IV estimates after dropping all countries, where democracy changes, with less than 10 observations. We drop Argentina, Bangladesh, Indonesia, Sri Lanka, Turkey, Zambia and US, respectively. We present these estimates against our baseline results, which we replicate in column 1 for convenience. The dependent variable is *Profit-shifting*, and all variables are defined in Table 1. Estimation method is IV with standard errors clustered by both subsidiary's and MNE's country. The lower part of the table denotes the type of fixed effects used in each specification. The *, **, and *** marks denote statistical significance at the 10%, 5%, and 1% level, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Democracy polity	-0.190***	-0.190***	-0.191***	-0.191***	-0.191***	-0.191***	-0.191***	-0.191***
	[-2.732]	[-2.728]	[-2.727]	[-2.731]	[-2.735]	[-2.737]	[-2.743]	[-2.741]
Firm size (subsidiary)	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001
	[-0.061]	[-0.062]	[-0.060]	[-0.061]	[-0.059]	[-0.058]	[-0.074]	[-0.058]
Firm size (MNE)	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020
	[-1.408]	[-1.412]	[-1.412]	[-1.419]	[-1.431]	[-1.429]	[-1.420]	[-1.509]
Leverage (subsidiary)	-0.009	-0.009	-0.009	-0.009	-0.009	-0.009	-0.008	-0.010
	[-0.237]	[-0.234]	[-0.236]	[-0.237]	[-0.233]	[-0.233]	[-0.206]	[-0.262]
Leverage (MNE)	0.019	0.019	0.019	0.019	0.020	0.019	0.019	0.019
	[0.191]	[0.190]	[0.191]	[0.189]	[0.193]	[0.192]	[0.188]	[0.192]
Tangibility (subsidiary)	-0.010	-0.010	-0.010	-0.010	-0.010	-0.010	-0.009	-0.011
	[-0.448]	[-0.447]	[-0.448]	[-0.443]	[-0.433]	[-0.434]	[-0.418]	[-0.476]
Tangibility (MNE)	0.063	0.063	0.063	0.063	0.064	0.063	0.063	0.065
	[0.542]	[0.539]	[0.540]	[0.541]	[0.548]	[0.546]	[0.540]	[0.553]
Cost of employees (MNE)	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002
	[0.180]	[0.183]	[0.183]	[0.188]	[0.184]	[0.184]	[0.175]	[0.179]
GDP per capita (subsidiary)	-0.833	-0.834	-0.836	-0.832	-0.823	-0.821	-0.829	-0.829
	[-1.241]	[-1.242]	[-1.243]	[-1.237]	[-1.223]	[-1.220]	[-1.232]	[-1.230]
GDP per capita (MNE)	0.379***	0.378***	0.378***	0.379***	0.378***	0.379***	0.378***	0.380***
	[5.581]	[5.535]	[5.534]	[5.569]	[5.486]	[5.530]	[5.532]	[5.592]
GDP growth (subsidiary)	-0.044***	-0.044***	-0.044***	-0.044***	-0.044***	-0.044***	-0.044***	-0.044***
	[-4.819]	[-4.820]	[-4.823]	[-4.817]	[-4.817]	[-4.810]	[-4.781]	[-4.782]
GDP growth (MNE)	-0.018	-0.018	-0.018	-0.018	-0.018	-0.018	-0.018	-0.018
	[-1.131]	[-1.120]	[-1.120]	[-1.123]	[-1.122]	[-1.123]	[-1.133]	[-1.136]
Population (subsidiary)	3.160	3.164	3.165	3.169	3.165	3.169	3.243	3.236
	[1.303]	[1.304]	[1.305]	[1.306]	[1.304]	[1.305]	[1.324]	[1.322]
Population (MNE)	-0.932	-0.938	-0.937	-0.941	-0.929	-0.927	-0.911	-0.908
	[-0.758]	[-0.763]	[-0.763]	[-0.766]	[-0.753]	[-0.751]	[-0.740]	[-0.739]
Constant	-30.688	-30.631	-30.635	-30.676	-30.916	-31.049	-32.515	-32.445
	[-0.685]	[-0.683]	[-0.684]	[-0.684]	[-0.688]	[-0.691]	[-0.718]	[-0.717]
Observations	27,154	27,145	27,143	27,139	27,137	27,135	27,127	27,078
Adjusted R-squared	0.779	0.779	0.779	0.779	0.779	0.779	0.780	0.778
Year effects	Y	Y	Y	Y	Y	Y	Y	Y
Subsidiary effects	Y	Y	Y	Y	Y	Y	Y	Y
Sub.Country effects	N	N	N	N	N	N	N	N
Sub.Industry effects	N	N	N	N	N	N	N	N
Clustered standard errors	country	country	country	country	country	country	country	country

Table B10. Winsorizing data

The table reports coefficients and *t*-statistics (in brackets). The dependent variable is *Profit-shifting*, and all variables are defined in Table 1. Estimation method is OLS for the first two columns and IV for columns (3) and (4), with standard errors clustered by both subsidiary's and MNE's country. The lower part of the table denotes the type of fixed effects used in each specification. The *, **, and *** marks denote statistical significance at the 10%, 5%, and 1% level, respectively.

	(1)	(2)	(3)	(4)
Democracy polity	-0.114**	-0.134**		
	[-2.646]	[-2.470]		
Democracy polity (IV)			-0.141*	-0.183**
			[-1.949]	[-2.561]
Firm size (subsidiary)	-0.005	0.002	-0.006	0.002
	[-1.448]	[0.265]	[-1.509]	[0.195]
Firm size (MNE)	-0.013***	-0.017	-0.012***	-0.014
	[-2.944]	[-1.242]	[-2.983]	[-0.993]
Leverage (subsidiary)	0.016	-0.006	0.015	-0.009
	[0.599]	[-0.209]	[0.530]	[-0.254]
Leverage (MNE)	-0.140**	-0.001	-0.137*	0.005
	[-2.011]	[-0.007]	[-1.989]	[0.040]
Tangibility (subsidiary)	-0.009	-0.011	-0.008	-0.010
	[-0.679]	[-0.530]	[-0.630]	[-0.478]
Tangibility (MNE)	0.100	0.062	0.111	0.074
	[1.129]	[0.529]	[1.244]	[0.633]
Cost of employees (MNE)	-0.029***	0.004	-0.029***	0.002
	[-5.446]	[0.321]	[-5.518]	[0.169]
GDP per capita (subsidiary)	-0.724	-0.797	-0.787	-0.875
	[-1.113]	[-1.289]	[-1.135]	[-1.272]
GDP per capita (MNE)	0.001	0.327***	-0.000	0.327***
	[0.035]	[3.627]	[-0.006]	[4.390]
GDP growth (subsidiary)	-0.028**	-0.032**	-0.040***	-0.047***
	[-2.248]	[-2.540]	[-2.937]	[-3.732]
GDP growth (MNE)	0.029*	-0.023	0.029	-0.023
	[1.721]	[-0.970]	[1.620]	[-0.987]
Population (subsidiary)	1.886	3.878	1.590	3.455
	[0.955]	[1.471]	[0.845]	[1.362]
Population (MNE)	0.036***	-1.741	0.036***	-1.417
	[4.791]	[-1.196]	[4.647]	[-1.001]
Constant	-23.362	-29.331	-17.214	-26.399
	[-0.700]	[-0.588]	[-0.529]	[-0.547]
Observations	29,241	27,103	29,294	27,154
Adjusted R-squared	0.316	0.777	0.318	0.780
Year effects	Y	Y	Y	Y
Subsidiary effects	N	Y	N	Y
Sub.Country effects	Y	N	Y	N
Sub.Industry effects	Y	N	Y	N
Clustered standard errors	country	country	country	country

Chapter IV

Global Evidence on Profit Shifting: The Role of Intangible Assets

We study global variations in profit shifting and the role played therein by firms' intangible assets. Employing nonparametric estimation techniques within a mainstay model of profit shifting, we construct a global database, with subsidiary–year estimates of profit shifting from 95 countries for the period 2009–17. A key determinant of profit shifting is the subsidiaries' ratio of intangible assets, and this channel is stronger in countries with weaker institutions. Both our new database and our novel findings open important avenues to analyze the sources and effects of profit shifting.

1. Introduction

Tax-motivated profit shifting refers to the tax planning strategies of multinational enterprises (MNEs) and their "shifting" of profits from a parent or subsidiaries located in high-tax jurisdictions to subsidiaries in low-tax jurisdictions with the aim of increasing their net income. The practice has attracted considerable interest in recent years from academics and policy makers. Alongside decreased tax fairness due to the consequent erosion of government revenue bases, profit shifting poses welfare and fiscal challenges. This has triggered efforts and policies from governments and international organizations to contain the practice. The most prominent of these efforts are the OECD's Base Erosion and Profit Shifting (BEPS) initiative and the June 2021 agreement among G7 finance ministers to seek a global minimum corporate tax rate of at least 15 percent (Rappeport, 2021).

Given the importance of the problem, a substantial empirical literature in economics, finance, and accounting has focused on understanding the potential sources and outcomes of profit shifting.[39] Although this literature has produced many relevant insights, especially regarding how to generally identify the degree of profit shifting, it has not produced a comprehensive global data set of firms' profit shifting intensity. This paper introduces such a data set—henceforth referred to as the "global profit shifting database"—obtained from estimating profit shifting at the subsidiary–year level.

While our analysis can be motivated by several research and policy questions regarding profit shifting, we focus on the recent rise in intangibles, alongside the growth of the information and communications technology sectors. Intangible assets include goodwill, brands, an intellectual property, such as patents, royalties and licenses, trademarks and copyrights. Unlike tangible fixed assets, intangible assets are not physical in nature, making it straightforward to locate them abroad in foreign subsidiaries, either by relocating research and development units and patents or simply by setting up trademark holding companies in low-tax destinations. Moreover, existing accounting standards leave much room for the determination and valuation of intangible assets, as market values are often missing, making it straightforward to shift profits by overstating the internal transfer price of intangibles such as royalty payments (Desai, Foley, and Hines, 2006). Anecdotal evidence strongly suggests that companies with lots of intangibles have engaged in profit shifting with the most success in recent years.[40] Our analysis shows that subsidiaries' intangible assets are a key driver of profit shifting intensity.

Theoretically, it is not necessarily obvious that firm intangibility per se will lead to more profit shifting. Intangibles are hard to price and their location cannot be easily tied to a production location (Lev, 2004). This lack of transparency creates opportunities to shift profits by (re-)locating intangibles in low-tax environments in an opaque and not easily verifiable manner. But then it is also true that in the case of tangible assets internal transfer pricing by altering input prices (especially of half-finished and not directly marketable products) may be fairly straightforward, especially when the production process involves multiple stages, the location of which can be

[39] A non-exhaustive list includes Huizinga and Laeven (2008), Overesch (2009), Dharmapala (2014), Sugathan and George (2015), Dyreng and Markle (2016), Clausing (2016), Markle (2016), De Simone (2016), Torslov et al. (2018), Koethenbuerger et al. (2019), and Guvenen et al. (2019).

[40] For example, on May 4, 2021, the *Guardian* (international edition) revealed that Amazon generated €44 billion in sales revenue across Europe in 2020, but paid almost no taxes on it in Luxembourg, where it chose to file.

fairly freely chosen. Therefore, our main testable hypothesis is that differences in the corporate tax rates between countries in which an MNE's subsidiaries are located, triggers profit shifting that is higher for subsidiaries with higher ratios of intangible assets.

Relatedly, we explore the heterogeneous effects of firms' intangibility on profit shifting due to country–year characteristics in the subsidiaries' countries. We focus on the role of institutional quality. A large literature has shown that countries with a higher quality of government and political institutions are less corrupt and have a higher capacity to collect taxes (e.g., Shleifer and Vishny, 1993; Besley and Persson, 2009). In line with this literature, we hypothesize that institutional quality reduces intangibility's encouragement of profit shifting because of the superior checks and balances introduced by quality institutions and the associated higher compliance with international guidelines and practices.

The empirical models that identify the degree of profit shifting examine the effect of differential tax rates among countries on subsidiaries' before-tax profits. We build on the work of Hines and Rice (1994) and Huizinga and Laeven (2008) on differential taxation between parents and subsidiaries that reside in different countries. Huizinga and Laeven identify profit shifting from the response of subsidiary profits to tax incentives that are in turn a function of tax differences in the affiliates' (parents and subsidiaries) countries. The assumption of their model is that an increase in tax rate differences incentivizes subsidiaries to send more profit to the low tax jurisdiction; it identifies the presence of profit shifting via a single (constant) parameter estimate.

A key novelty of our approach is to identify profit shifting by subsidiary–year, and to this end we estimate the Huizinga and Laeven (2008) model using nonparametric techniques. The simplest of these techniques are those based on nonparametric kernel regression, which mimics parametric ordinary least squares (OLS). The key difference is that the nonparametric regression makes no assumptions regarding the slope of the regression in the full sample because estimation is carried out for local samples within "sliding windows" of observations.[41]

Depending on data availability, our global profit shifting database covers a maximum of 95 countries for the period 2009–17 (a maximum of 26,593 subsidiaries). The maximum number of subsidiary–year observations for which we estimate profit shifting is 106,301. Consistent with expectations, we find that subsidiaries in the Cayman Islands, United Arab Emirates, Bermuda, and Oman engage in more aggressive profit shifting, especially in the initial years of our sample, while Bosnia and Herzegovina and Montenegro emerge as important profit shifting jurisdictions in the last few years of our sample. Among the developed economies, profit shifting in the Republic of Ireland is the most prominent when considering the top 5 percent of profit shifting firms.

Averaging our measure across countries and years, we observe a gradual decline in the intensity of profit shifting from 2011 to 2016, consistent with the BEPS initiative and the emergence of more stringent policies to fight profit shifting. However, we observe the opposite trend if we average on firms across industries with the highest

[41] For example, for an estimate on observation x_i (in our case reflecting the corporate tax differential between subsidiaries and parents), we use the observations closest to it (sliding window around x_i). In this way, we obtain an estimate on x_i for the observations in the corresponding window. Then, we move to the closest to x_i observation, x_j, and do the same analysis for x_j (estimation using the observations in the window around x_j). Thus, estimation is carried out for each value of x using overlapping sliding windows, from which we obtain estimates equal to the number of observations (as long as we have dense observations around each x).

intangibles ratios, particularly firms in the education, financial, and information and communications technology sectors.

Our formal empirical analysis shows that a one standard deviation increase in the ratio of intangible assets to total assets increases profit shifting by approximately 3 percent. This makes the intangibles ratio the firm–year characteristic with the largest impact on profit shifting (per standard deviation of change in the characteristic). To identify a causal effect, we exploit (i) corporate events (mainly M&As) that substantially affect the MNEs' intangibles ratio, and (ii) corporate tax increases in specific states in the US where the MNEs are headquartered (unrelated to the corporate tax rates used to construct the subsidiary–year profit shifting indices). The results from these two empirical tests show that the effect of the intangibles ratio on profit shifting is substantially higher in years with such corporate events or in the year–state pairs with tax increases (for the former, the marginal effect is 4.4 percent; for the latter it increases to 9 percent).

Moreover, consistent with our hypotheses on the heterogenous effect of firms' intangibility on profit shifting, we find stronger results in countries with weaker institutions, especially when these are as measured by citizens' ability to participate in free elections and associations, and when the country has a "free" media (variable "Voice and accountability" from the World Governance Indicators). Our results show that a movement from an average value on the index of institutional quality to its third quartile indicating higher institutional quality almost eliminates the effect of firms' intangibility on profit shifting.

Our paper builds on key studies on the measurement of profit shifting (Hines and Rice, 1994; Huizinga and Laeven, 2008; Dharmapala and Riedel, 2013) and on studies of the responses of multinationals to international taxation, ranging from location decisions to capital structure choices (e.g., Desai, Foley, and Hines, 2004, 2006; Huizinga, Laeven and Nicodème, 2008; Dharmapala, Foley, and Forbes, 2011; Barrios et al. 2012; Hasan et al. 2014). We contribute to this literature by studying a global sample (as opposed to US or European sample) of firms and by employing nonparametric estimation techniques.

Our paper also relates to studies on the role of asset intangibility, including research on the drivers of the recent rise in intangibles, and its implications for corporate financing and economic growth (e.g., Acemoglu and Restrepo, 2018; Haskel and Westlake, 2018; and Hochberg et al. 2018). A closely related paper is De Simone et al. (2019), who develop a firm–year measure for US MNEs to study net intercompany payments to controlled foreign corporations. Their approach includes intangible assets and intellectual property as means of facilitating income shifting. Karkinsky and Riedel (2012), meanwhile, show that MNEs have incentives to locate their patents, especially those with opaque royalty payments, in low-tax affiliates to minimize the corporate tax burden. Beer and Loeprick (2015) use the tax differential between parents and subsidiaries and show that both the intangible asset endowment of subsidiaries and the supply-chain complexity of MNEs explain aggregate profit shifting trends. Grubert (2003) evaluates the extent to which the correlation between profitability and local tax rates depends on the presence of the parent's intangible assets, and finds that R&D-intensive companies engage in a greater volume of intercompany transactions.

Our paper also naturally relates to the large literature on other determinants of profit shifting (see Dharmapala (2014) for a helpful overview). Sugathan and George (2015) show the importance of governance infrastructure and corporate governance in limiting profit shifting. Dyreng and Markle (2016) study the role of financial constraints on profit shifting, and Markle (2016) shows the importance of territorial

versus worldwide tax systems. De Simone (2016) reveals a significant change in reported book pre-tax profits following affiliate IFRS adoption, relative to pre-adoption and non-adopter affiliate–years. Tørsløv, Wier and Zucman (2018) create a country–year index of profit shifting and estimate that close to 40 percent of multinationals' profits are shifted to tax havens globally. They also show that profits would increase by around 15 percent in high-tax European Union countries and by 10 percent in the United States, while they would fall by 60 percent in today's tax havens.

Our analysis is different from both literatures in two dimensions. First, our paper is the first to create a firm–year global profit shifting database, estimated using nonparametric techniques. In that sense, our database can be used to analyze the sources or effects of profit shifting using firm-level data and can inform policy decisions at the micro level. Second, our paper is the first to analyze the causal effect of firms' intangibility on profit shifting, to establish its importance, and to reflect upon the important role of institutional quality in this nexus.

The remainder of the paper is structured as follows. Section 2 discusses the empirical model used to identify profit shifting and its nonparametric estimation. Section 3 presents the estimates on the global profit shifting database. Section 4 discusses the empirical model that identifies the effect of firms' intangibility on profit shifting and presents the empirical results. Section 5 concludes and provides directions for future research.

2. Modelling profit shifting

i. Empirical model

The original model for identifying profit shifting was constructed by Hines and Rice (1994). At the core of their model is that the observed pre-tax income of an MNE's subsidiary that is located in a low-tax jurisdiction represents the sum of "true" and of "shifted" income (where the latter can be either positive or negative). A subsidiary's true income originates from production, which is approximated by a typical Cobb–Douglas production function including capital and labor as inputs. Shifted income is driven by the tax incentive to move income in or out of the subsidiary, in consideration of the differential tax rate between the parent's and the subsidiary's countries.

Huizinga and Laeven (2008) extend this tax motive by allowing for tax-rate differentials across countries of all subsidiaries of the same MNE. Profit reported by a low-tax subsidiary and that cannot be accounted for by that subsidiary's own labor and capital is attributed to profit shifting. Moreover, Huizinga and Laeven exploit panel data techniques to control for unobservable time-invariant determinants of corporate profits.

The empirical model is the following:

$$log\,\pi_{it} = a_1 CT_{it} + a_2\, log\, K_{it} + a_3 log L_{it} + \gamma\, C_{it} + \mu_i + \delta_t + \varepsilon_{it}. \qquad (1)$$

In equation 1, π_{it} represents the observed pre-tax income of subsidiary *i* in year *t*; K_{it} represents the subsidiary's capital (measured by fixed tangible assets); L_{it} is labor (measured by employment compensation); C_{it} is a vector of subsidiary-level controls; μ_i represents subsidiary fixed effects (which control for time-invariant unobserved characteristics of subsidiary *i*); δ_t represents year fixed effects (which control for time-

varying unobserved common changes in the profitability of all subsidiaries); and ε_{it} is the error term. Using natural logarithms excludes subsidiaries with negative profits.[42]

The tax incentive variable CT_{it} is defined as:

$$CT_{it} = \frac{1}{(1-\tau_i)} \frac{\sum_{k\neq i}^{n} (\frac{B_k}{1-\tau_k})(\tau_i - \tau_k)}{\sum_{k=1}^{n} (\frac{B_k}{1-\tau_k})}, \quad (2)$$

where τ_i is the statutory tax rate of the subsidiary's country; τ_k the statutory tax rates of all the affiliated subsidiaries' countries; and B_k are subsidiaries' sales (or assets in the case where sales data are too distorted by profit shifting), used to proxy for an MNE's scale of activities in different locales.

Changes in the tax rate differential between subsidiary *i* and other subsidiaries of the same MNE are typically generated by tax reforms in either subsidiary *i*'s country or in the countries of the MNE's other subsidiaries. Thus, they are unlikely to be attributed directly to the subsidiary's own behavior or choices. The related literature distinguishes between effective and statutory tax rates when calculating the tax rate differential CT_{it}. Several tax deductions offered by different national tax systems tend to differentiate effective tax rates from statutory ones. Given that effective tax rates relate to endogenous corporate choices (e.g., use of depreciation, amortization, debt, or other deductible expenses), we prefer statutory tax rates. Moreover, MNEs shift profits among affiliates across countries in which they already operate. Thus, they exploit tax allowances, which depend on differences in the statutory (and not the effective) tax rate (Deveraux and Mafini, 2007; Huizinga and Laeven, 2008).

The coefficient of main interest in equation 1, a_1, reflects the extent to which the MNEs' subsidiaries shift profits into or out of subsidiary *i* due to a marginal change in tax rates, ceteris paribus. A negative a_1 in equation 1 implies that an increase (decrease) in τ_i leads to an increase (decrease) in CT_{it}, which leads subsidiaries to send more profit abroad (receive more profit from abroad) and thus reduces (increases) π_{it}, the pre-tax income of subsidiary *i* in year *t*.

To further clarify, consider the example in Figure 1. Affiliate 1 shifts profits to its low-tax subsidiaries of the same MNE (IP Holdco and the Service Centre). In the estimation approach, a change in the tax rate differential CT_{it} between Affiliate 1 and the other subsidiaries of the same MNE via an increase in Germany's statutory tax rate leads Affiliate 1 to send more profit abroad and thus reduces its *Subsidiaries' earnings before taxes* (π_{it}). This response is captured by $a_1 < 0$. Related to this example, but also more generally, our model captures profit shifting between subsidiaries. It does not capture profit shifting from parent to subsidiaries. This is a limitation driven by data availability because unconsolidated data on parent firms are not available.

[Please insert Figure 1 about here]

It is important to note that the coefficient a_1 is an aggregate estimate (given that it is a point estimate) and thus cannot be used as a firm–year index of profit shifting. Its importance lies in the identification and the potency of profit shifting for a given sample of firms (for which the coefficients in equation 1 are estimated).

[42] Excluding loss-making subsidiaries may obscure the profit shifting that occurs when real losses exceed the shifted income from affiliates (De Simone et al., 2017).

ii. Estimation of profit shifting by subsidiary–year

To estimate profit shifting by subsidiary–year, we estimate subsidiary–year responses $a_{1,it}$ in equation 1. We do so by using nonparametric models, also called varying coefficient models because they allow coefficients to vary by observation (for an introduction, see, e.g., Loader (1999)). These models do not require the specification of functional forms for the estimation; the data itself informs the resulting model.

For example, ordinary least squares (OLS) estimate the unknown parameters in a regression equation between an outcome variable *y* and a predictor variable *x*. In graphical form, OLS estimation fits a regression line with a unique slope through the full sample (i.e., globally). In equation 1, this naturally implies constant estimates for a_1. In contrast, the nonparametric models make no assumption that the slope is the same for the full sample, but rather that the slope has a locally specific value around each observation. Although nonparametric regression is a way of obtaining varying estimates that are robust to functional form misspecification, this robustness comes at a cost. We need many observations and more time to compute the estimates; this is referred to as the curse of dimensionality. However, given the large number of available observations on subsidiaries, the curse of dimensionality is not a problem in our study.

In general form, the regression model of outcome *y* is:

$$y_i = v_i\beta + g(x_i) + \varepsilon_i. \quad (3)$$

The $v_i\beta$ part is the usual parametric regression for explanatory variables *v*, the function g is unknown (obtains its shape from the data), x_i equals CT_{it} in equation 1, and ε is the error term. We estimate equation 3 using nonparametric kernel regression, which estimates a regression for a subset of observations for each point in our data (Fan and Gijbels, 1996).

To clarify, let us provide an example with the help of a graph (Figure 2) that plots the observations for a sample in the *y*-*x* space. Now, consider estimating the mean of *y* given that *x* = A when *x* is continuous and A is a value observed for *x*. Because *x* is continuous, the probability of any observed value being exactly equal to A is 0. Therefore, we cannot compute an average for the values of *y* for which *x* is equal to a given value A. We use the average of *y* for the observations in which *x* is close to A to estimate the mean of *y* given that *x* = A. Specifically, we use the observations for which $|x - A| < h$, where h is small. The parameter h is the bandwidth. In a nonparametric kernel regression, a bandwidth determines the amount of information we use to estimate the conditional mean at each point A. The circles in Figure 2 delimit the values of *x* around A for which we are computing the mean of *y*. The square is our estimate of the conditional mean using the observations inside the first circle. Then we move to the next observation. To avoid complicating the figure by taking the observation closest to A, we focus on another observation we label B. The estimation is carried out again for the observations in the window around B.

[Please insert Figure 2 about here]

Doing this estimation for each point in our data produces a nonparametric estimate of the mean for a given value of the covariates. This process is repeated several times for each of the observations (fitting points) in this example, each time solving the minimization problem for the nonparametric part, given by:

$$\sum_{i=1}^{n} W\left(\frac{x_i - x}{h}\right)(y_i - \left(a_0 + a_{1,i}(x_i - x)\right))^2. \quad (4)$$

The constant a_0 in equation 4 is the conditional mean at a specified point *x*. The slope parameter $a_{1,i}$ is the derivative of the mean function with respect to *x*. The size of the bandwidth, *h*, determines the shape and smoothness of the estimated conditional mean function because the bandwidth defines how many observations around each point are used. A too-large bandwidth includes too many observations, so the estimate is biased but it has a low variance. A too-small bandwidth includes too few observations, so the estimate has little bias, but the variance is large. In other words, the optimal bandwidth trades off bias and variance. Many alternatives have been proposed for the derivation of the optimal bandwidth (e.g., Greene, 2018; Li and Racine, 2004), and we choose the one that minimizes the integrated mean squared error of the prediction (cross-validation method). We find that our results are not overly sensitive to the bandwidth that is employed (unless the choice we make is far from the one chosen by cross validation). *W* is the kernel function that assigns weights to observations x_i based on how much they differ from *x* and based on the bandwidth, *h*. The smaller *h* is, the larger the weight assigned to points between x_i and *x*.[43]

Estimation of equation 1 using this method yields subsidiary–year estimates of profit shifting $a_{1,it}$ (from this point onward referred to as *Profit shifting*).

3. Global estimates of profit shifting

i. Data and variables

We provide the full step-by-step details of our data collection and management process in the appendix. We use an initial firm–year panel of 58,805 subsidiaries and 4,758 parents from across 110 countries, for the period 2009–17. The total number of subsidiary–year observations is 375,958 and all monetary variables are expressed in US dollars (USD). We list the countries and the country-specific observations in appendix Table A1.

Our main data source is Orbis, which has worldwide coverage of firm–year accounting data as well as detailed information on firms' ownership structure.[44] We measure π_{it} in equation 1 using subsidiaries' observed earnings before taxes in logs (*Subsidiaries' earnings before taxes*). We further use *Subsidiaries' assets* (B_k) in equation 2. For the calculations in equation 2, we use the statutory tax rate of the subsidiary's country (τ_i) and the statutory tax rates of all the affiliated subsidiaries' countries (τ_k). We obtain these tax rates from Ernst &Young's Worldwide Corporate Tax Guides.[45] Explicit definitions of all variables and data sources can be found in Table 1 and the summary statistics are in Table 2.

[43] We use an Epanechnikov weight; results are robust to using other weight functions (e.g., Gaussian weights). As we show later, results are also robust to using spline-based nonparametric estimation instead of kernel-based.

[44] Orbis data has the drawback that firms' ownership structure is only available for the last reported date. There may therefore be some concerns about misclassification bias as the ownership structure may have been modified during the sample period. Nevertheless, in consonance with previous papers, this would downward bias our estimates, so that if anything the identified profit shifting will be less potent (Budd et al., 2005).

[45] https://www.ey.com/gl/en/services/tax/worldwide-corporate-tax-guide---country-list.

[Please insert Tables 1 and 2 about here]

As discussed above, for the estimation of tax incentive *Profit shifting*, we expect a negative effect of CT_{it} on *Subsidiaries' earnings before taxes* (π_{it})—that is, the estimates of $a_{1,it}$ are expected to be negative in equation 1. This is the case for 106,301 observations, corresponding to 26,593 subsidiaries across 95 countries. We end up with this number of observations because the other responses are positive, which implies that we are dealing with subsidiaries that do not send profits abroad (receive profits from abroad) when tax rates in the host country increase (decrease). Thus, for these observations there is no tax-motivated profit shifting (Dharmapala and Riedel, 2013; Huizinga and Laeven, 2008). Further, we drop all the missing observations of the composite tax variable CT_{it}. Such is the case for all the subsidiaries of our sample that do not have affiliated subsidiaries in the same multinational group.

Estimating profit shifting at the subsidiary level is not free of limitations (Tørsløv et al., 2018). Importantly, even though Orbis provides accurate information about the global consolidated profits of most of the world's multinationals (Cobham and Loretz, 2014), multinational companies are generally not required to publish their profits country by country (or subsidiary by subsidiary). Tørsløv et al. (2018) give the example of Apple, which reports large profits (billions) at the consolidated level even though summing the subsidiary profits yields a just few millions. This discrepancy arises because Orbis has limited coverage for some countries. To address this limitation of the data, we compare our baseline results with those of a robustness test in which we also control for differences between profits at the consolidated level and the aggregated profits of subsidiaries; the resulting profit shifting index (*Profit shifting 2*) does not vary significantly from our first index (*Profit shifting*). Importantly, we examine the correlation between MNEs' consolidated assets and the sum of the assets of subsidiaries in the same MNE group. The two variables have a very high correlation coefficient of 86 percent.

Our main explanatory variable of interest, the *Subsidiary's intangibles ratio*, is defined as the ratio of intangible assets over total assets. Intangible assets include goodwill, brand recognition, and intellectual property, such as patents, royalties and licenses, trademarks and copyrights. We do information on the book value of all intangible assets. We do not have information on the breakdown across different categories of intangible assets. As profit shifting incentives may vary across different types of intangible assets, if anything our estimates of the sensitivity of profit shifting to intangible assets can be regarded as a lower bound. There is much variation in the data in the *Subsidiary's intangibles ratio*. On average, intangible assets constitute 5% of total assets, but this varies from a low of 0% to a high of 99%, with a standard deviation of 11% (Table 2).

ii. Profit shifting estimates

In the first specification of Table 3, we estimate a standard OLS regression to compare our results with those of Huizinga and Laeven (2008). The second specification reports mean coefficient estimates (mean of $a_{1,it}$) and standard errors from the estimation of equation 1, given the assumptions about the model type, the method for bandwidth selection, and observation density. We only retain the negative observations (the ones theoretically suggesting tax motivation as in our discussion of equation 1). At the lower end of each column, we also report the total of observations (the total number of observations we use in the regressions).

[Please insert Table 3 about here]

In our baseline specification (specification 2), we estimate a semi-parametric model with an Epanechnikov kernel and cross validation for optimal bandwidth selection. In line with our expectations, the composite tax variable CT_{it} is negative and statistically significant at the 1 percent level, showing that profit shifting by a subsidiary is negatively related to a weighted average of international tax rate differences between this country and all other countries in which the multinational is active. The mean estimates reported in column 2 closely resemble the estimate of column 1, validating our mean estimates against those of the standard Huizinga and Laeven (2008) model.

In addition to reporting summary statistics for the variables used in our analysis, Table 2 also reports the summary statistics of *Profit shifting*. We multiply *Profit shifting* by -1 so that higher values reflect more aggressive profit shifting. We consider the estimated values to be indices that track firms' profit shifting in a standardized way (i.e., they do not have a monetary interpretation such as a dollar value). The results show substantial heterogeneity across the firms in our sample. Concerning *Profit shifting*, we report an average of 1.46 and a range between 0 and 36.40.

iii. Country and time variation of profit shifting

In Table A2 of the appendix, we report average profit shifting estimates by country–year using *Profit shifting*. The index ranges from 0.12 in Hong Kong in 2012 to 14.61 in Oman in 2012. Notably, we find that subsidiaries in the Cayman Islands, United Arab Emirates, Bermuda, Oman, and some Balkan countries (Bosnia and Herzegovina, Montenegro, and Bulgaria) engage in more aggressive profit shifting. These countries were often singled out as notable tax havens during our sample period, hence the fact they obtain higher estimated values validates our index.[46] Specifically, the OECD's April 2009 progress report identifies jurisdictions under the heading "Jurisdictions that have committed to the internationally agreed tax standard, but have not yet substantially implemented." The Cayman Islands and Bermuda are categorized as tax havens. While the United Arab Emirates is listed in the OECD's April 2009 report as "substantially implementing the internationally agreed tax standard," subsequent reviews (from 2011 onward) identify significant deficiencies in its legal and regulatory framework. Bulgaria is widely considered a European offshore jurisdiction, while Montenegro and Bosnia are appealing to many entrepreneurs and businesses because of their low corporate tax rates.[47] Other countries on these lists also display notable profit shifting in our index.

To illustrate differences between countries' levels of in-country profit shifting, we also report the standard deviation of *Profit shifting* for each country. We find that subsidiaries in the United Arab Emirates, Bermuda, Oman, and Montenegro—which lead the way in terms of aggressive profit shifting behavior—also report the largest in-country variation in profit shifting.

To illustrate the international picture, we construct a global map for *Profit shifting* (Map 1). For expositional brevity, we map a ranking of countries (as opposed to the mean profit shifting values), which creates a clearer differentiation. The countries

[46] The EU removed the Cayman Islands and Oman from its "non-cooperative jurisdictions for tax purposes" list in 2020 after these countries implemented several reforms to improve their tax-policy frameworks.

[47] See the Study entitled "*European initiatives on eliminating tax havens and offshore financial transactions*" by the *Policy Department Budgetary Affairs of the Directorate-General for Internal Policies of the Union (European Parliament)* which was published *in 2013*.

with high profit shifting have a dark, purple color and those with low profit shifting a light, green color. The map shows that subsidiaries in Bulgaria, the United Arab Emirates, Bosnia and Herzegovina, Fiji, and Oman are engaged in more aggressive profit shifting. The Cayman Islands, Bermuda, and the Isle of Man also have most profit shifting, but are not observable on the map due to their small size.

[Please insert Map 1 about here]

In Table A3 of the appendix, we report average estimates of *Profit shifting* by country using only the most aggressive profit shifting subsidiaries (top 5 percent). These firms shift profit to 61 countries. Repeatedly, we find that subsidiaries in the Cayman Islands, United Arab Emirates, Bermuda, Oman, and some Balkan countries (Bosnia and Herzegovina, Montenegro, North Macedonia, and Bulgaria) are engaged in more aggressive profit shifting. A notable addition is the Republic of Ireland, which is the only high-income country in this group.[48] This is in line with anecdotal evidence that very aggressive profit shifters favor the Republic due to its low corporate tax rate but also its stable institutions and high level of economic development. To better visualize these results, we construct a second global map for *Profit shifting* (Map 2) for these 61 countries. Once again, we map a ranking of countries as opposed to the mean profit shifting values. The countries with high profit shifting have a dark, purple color and those with low profit shifting a light, green color. This map clearly demonstrates the tax haven status of the Republic of Ireland, along with that of the other usual suspects. The Cayman Islands and Bermuda also have a high level of profit shifting, but are not observable on the map due to their small size.

[Please insert Map 2 about here]

Profit shifting varies considerably not only across countries and geographical areas but also across different sectors, and this has important welfare and policy implications. Sectors with more profit shifting lower their average cost of capital and are thus able to attract more investment, potentially overperforming compared to sectors less able to dodge taxes. To the extent that multinationals compete over market share and input factors, this heterogeneity translates into profit shifting acting as a subsidy to specific industries.

In Table A4 of the appendix, we report the average values of *Profit shifting* by industry.[49] The results show that mining and quarrying firms engage aggressively in profit shifting activities. These firms are engaged in the mining of coal and lignite, the extraction of crude petroleum and natural gas, the mining of metal ores, and other mining and quarrying activities. The mining industry has two specific characteristics that favor profit shifting. First, it has many foreign-owned companies because reserves (fossil fuel and other reserves) and refineries are usually in different locations than the parent. Second, in most major mining countries firms are not obliged to disclose the financial accounts of their subsidiaries.

In Figure 3 we show the annual average of *Profit shifting*, as well as equivalent regional averages. The trend for the full sample is negative from 2011 onward, but this

[48] This finding concurs with Torslov et al. (2018), who designate the Republic as the number one profit shifting destination among a group of mostly developed countries for the year 2015. Following the June 2021 agreement among G7 finance ministers, the Republic of Ireland has come out reluctantly in favor of a global minimum corporate tax rate of at least 15 percent.

[49] Average values of our profit shifting index by industry-year are available on request.

is only driven by Western European and other developed countries, possibly reflecting the increased stringency of taxation policies in these countries (Buettner et al., 2018) and the introduction of the OECD's Base Erosion and Profit Shifting (BEPS) initiative in 2013.[50] In contrast, profit shifting increases in Eastern European/central Asian countries as well as in East Asian and Pacific countries.

[Please insert Figure 3 about here]

iv. Additional robustness tests

We examine several different indices—based on different assumptions when estimating the nonparametric regressions. Specifically, we use a Gaussian kernel (instead of the Epanechnikov), and we select the bandwidth using the Akaike information criterion (AIC) (instead of cross validation). Using different methods to select the optimal bandwidth, or different kernel functions, provides very similar indices (very high correlations with our baseline indices). We also experiment with different splines and with different assumptions within the spline-based methods. Finally, we experiment with computationally more involved, fully nonparametric methods (all explanatory variables enter the regression nonparametrically); we do not favor a fully nonparametric model only because it adds considerable estimation time without a gain in our inferences. In general, all of the above robustness tests yield very similar inferences.

4. Intangible assets and profit shifting

i. Empirical model and data

Given the subsidiary–year estimates of profit shifting (*Profit shifting*), in this section we empirically establish that intangible assets are a key determinant. We estimate the following equation:

$$Profit\ shifting_{it} = b' + b_1 Subsidiaries'\ intangible\ ratio_{it} + b_2 C_{ct} + b_3 F_{it} + \varepsilon_{ict}, \quad (5)$$

where *Profit shifting* is as estimated in the previous section; *Subsidiaries' intangibles ratio* is the ratio of intangible assets to total assets; C and F are sets of country and firm controls, respectively; and ε is the stochastic disturbance. Our focus is on coefficient b_1, which captures the effect of intangible assets on subsidiaries' profit shifting.[51]

Table 1 thoroughly defines all variables used in equation 5 and Table 2 provides summary statistics. Concerning the country–year controls, *C*, we include in our baseline specifications a country's *GDP growth*, *Population*, and *Voice and accountability*. We subsequently include additional country control capturing the country's level of institutional and economic development, obtained from the QOG data set of Teorell et

[50] See OECD (2013).

[51] An alternative to estimating equations (1) and (5) separately would be to estimate a reduced-form model of subsidiaries' profits on an interaction term of the composite tax variable (CT) and subsidiaries' intangibles ratio (plus main terms and controls). However, this would deliver only a global estimate and not a subsidiary-year measure of profit-shifting which is the main focus and contribution of this paper. We do show below that our main results are generally robust to such variation in specifications.

al. (2021).

Further, following the literature (e.g., Huizinga and Laeven, 2008; Dharmapala and Riedel, 2013), the vector *F* includes controls for firm size measured by the log of total assets, leverage (the ratio of total liabilities to total assets), and cost of employees (the ratio of subsidiaries' cost of employees to subsidiaries' earnings before taxes). Again, we use several additional firm–year controls (obtained from Orbis), which we find to have a residual role in explaining profit shifting and do not affect the estimate on b_1.

Moreover, the vector b' indicates subsidiary, year, and (in some specifications) country–year fixed effects. The subsidiary fixed effects control for time-invariant subsidiary characteristics (e.g., corporate culture, corporate governance, production technology, industry characteristics, and time-varying country characteristics). The year and country–year fixed effects control for unobserved annual or annually varying country unobserved shocks (e.g., crises, country-specific policies, etc.).

The subsidiaries' intangibles ratio has a relatively low average value of 0.05, but also has a maximum value of almost 1. As shown in Table A5 of the appendix, the ratio varies considerably by industry. As expected, we observe that firms in services—such as education, water supply and waste management, financial and insurance activities, information and communication technologies, and the arts, entertainment, and recreation—invest more in intangible assets.[52]

In Figure 4, we show the time trend in the annual averages of *Subsidiaries' intangibles ratio* and *Subsidiaries' intangibles ratio 1*. *Subsidiaries' intangibles ratio 1* includes the annual average for only the first six industries in Table A5 of the appendix (those with the highest average values of *Subsidiaries' intangibles ratio* by industry). For *Subsidiaries' intangibles ratio* the trend is negative, with the only exception being 2011–12, when it reverses. However, the line for *Subsidiaries' intangibles ratio 1* shows that there is an upward trend in intangibles, driven by some sectors (mainly service industries). This relation is more explicit in Figure 5, which shows a positively sloped line from the bivariate regression between the industry averages of *Profit shifting* and *Subsidiaries' intangibles ratio*.[53] Thus, these figures provide clear visual evidence that despite an overall decreasing trend in profit shifting, firms with high levels of intangible assets conduct more profit shifting. In the next section, we aim to establish a causal effect.

[Please insert Figures 4 & 5 about here]

ii. The effect of intangible assets on profit shifting

Table 4 reports our baseline results from the estimation of equation 5.[54] We begin in the first specification with OLS estimates with standard errors clustered by subsidiary

[52] The highest value is observed for the "Public administration and defense; compulsory social security" industry. There are only 100 observations in this industry, and, from these, five companies display high values. All these companies are non-government owned multinationals in the aerospace and intelligence industries.

[53] We use the NACE two-digit numerical code.

[54] Being an estimate, profit shifting has a measurement error. Using profit shifting as the dependent variable implies that OLS estimates still satisfy the Gauss–Markov assumptions so that the coefficients on the variables are consistent (but the constant term may be biased). The measurement error in the dependent variable only results in larger error variance, which if anything produces slightly higher p-values.

and without including any fixed effects. In columns 2 to 4, we sequentially add subsidiary, year, and subsidiary country × year fixed effects.

[Please insert Table 4 about here]

The results show that asset intangibility is a key firm–year determinant of profit shifting. Economically, based on the results of column 4, a one standard deviation increase in *Subsidiaries' intangibles ratio* (equal to 0.11) increases profit shifting by approximately 3.1 percent (= 0.11 × 0.282). The results on the firm-specific controls are intuitive. Large firms conduct more profit shifting, consistent with the premise that large firms achieve economies of scale in tax planning (Rice, 1992; Rego, 2003).[55] Also, firms with aggressive profit shifting have a higher cost-to-earnings ratio, consistent with the premise that these firms pay higher salaries.

In columns 5 to 8, we keep the firm and year fixed effects and sequentially include country–year controls that the literature has proposed as being potentially important determinants of profit shifting (definitions in Table 1 and summary statistics in Table 2). This analysis serves as a validation of our profit shifting index, but also informs the subsequent analysis on potential heterogeneity in the effect of intangible assets on profit shifting due to specific country–year characteristics. We find more profit shifting in countries with higher growth rates and worse institutions, as measured by *Voice and accountability*, *Democratic conditions*, and *Government effectiveness*. These results are consistent with Sugathan and George (2015), who analyze how freedom of expression, governmental effectiveness, and political stability affect income shifting. Specifically, in high-tax countries, institutions dissuading and limiting negative externalities of business activities are likely to increase the costs of shifting transactions and thus reduce profit shifting. We also find that the effect of the intangibles ratio is not affected by the addition of these variables.

We provide additional robustness tests in the appendix. Specifically, in Table A6 we use *Profit shifting 2* as the dependent variable and find results very similar to those of Table 4. Thus, we infer that controlling, in the estimation of profit shifting, for the difference between profits at the consolidated level and the aggregated profits of subsidiaries does not affect the relation between asset intangibility and profit shifting. We also obtain similar results when using profit shifting estimates from models with different bandwidths, splines, or fully nonparametric methods. Moreover, in Table A7, we cluster standard errors by subsidiary country, industry, or subsidiary country and year. Our inferences are again very similar.

An alternative modelling approach to identifying the role of intangible assets in profit shifting would be a variant of equation 1 that includes the interaction term between *CT* and *Subsidiaries' intangible ratio*. This model can be directly estimated with the usual parametric techniques but does not provide firm-year estimates of profit shifting. Appendix Table A8 reports the results, showing that the interaction term is positive and statistically significant at the 5% level across different specifications that include different fixed effects or control variables. These findings are consistent with those in our analysis so far, indicating more profit sifting for firms with higher intangible assets ratios.

It is possible that small absolute values of *CT* might not provide a full scale of incentives to shift profit because profit shifting carries costly risks related to

[55] This is in contrast to early evidence by Zimmerman (1983) suggesting that large firms avoid tax avoidance strategies because they face greater political costs.

reputational and regulatory issues. If this were the case, then we would expect that the relation between intangible assets and profit shifting is stronger for larger values of *CT*. In Table A9, we show that omitting the smallest 5% (column 1) or 10% (column 2) of the *CT* values, indeed increases the economic impact of intangible assets on profit shifting compared to our baseline specifications (in column 2 this increase is large as 13%). This holds linearly across higher values of *CT*, as is evident from the relevant marginal effects.

iii. Inference from instrumental variables and events

In Table 5, we strengthen our causal inferences on our main variable of interest, the *Subsidiaries' intangibles ratio*, using two alternative approaches. In the first specification, we estimate a two-stage least squares (2SLS) regression, using *Industry cost* as the instrument, defined as the industry-year median of the cost of employees scaled by total assets. This instrument is directly obtained from the literature (Garmaise, 2008; Campello and Giambona, 2013). The relevance assumption for the validity of the instrumental variable (IV) suggests that industries with higher labor costs also have higher intangible assets levels due to the personnel expertise needed to handle intangible assets (e.g., handling research and development as opposed to handling physical capital). The exclusion restriction states that *Industry cost* affects profit shifting only via *Subsidiaries' intangibles ratio* (Campello and Giambona, 2013). This assumption is intuitive, especially because any direct effects of industry-specific labor costs should be controlled for by the firm-specific *Subsidiaries' cost ratio*, leaving the industry effects to be exogenous shocks correlated to asset tangibility.

[Please insert Table 5 about here]

The first-stage results include a highly significant coefficient on *Industry cost*, associated with weak-identification and under-identification tests with very small p-values. The second-stage results still show a positive and statistically significant coefficient on *Subsidiaries' intangibles ratio*. Both the estimate and the standard error are higher, pointing to some bias associated with the IV model. Given the strong identification tests, this bias is most probably due to observations of the endogenous variable being at the firm–year level while observations of the instrument are at the industry-year level.

In column 2, we exploit important corporate events to infer the effect of the intangibles ratio on profit shifting. These events, mostly vertical M&As, produce abrupt changes in intangible assets and create an experiment from which we can infer causal inference for the effect of intangible assets on profit shifting. Using such events would be invalid if the corporate events are endogenous to profit shifting (i.e., MNEs acquire firms to expand their profit shifting network). However, we have two reasons to believe that such concerns are unwarranted. First, using vertical M&As limits this possibility because vertical M&As, in contrast to horizontal M&As, take place between companies in different industries and at different stages of production, making it less straightforward to shift profits. Moreover, when we model the probability of observing a corporate event as a function of profit shifting and the intangible ratio (adding our controls and fixed effects), we find that profit shifting enters with a statistically insignificant coefficient (with a high p-value of 0.754). Thus, it is highly unlikely that these events occur due to profit-shifting reasons.

We use a binary variable named *Corporate events* that is equal to 1 in the firm–

year observations in which these events occur. We use specifications without year fixed effects (column 2) and with year fixed effects (column 3), and we keep the controls of specification 7 of Table 4. The interaction term *Corporate events* × *Subsidiaries' intangibles ratio* is positive and statistically significant at the 1 percent level.[56] In the years of these events, the marginal effect of *Subsidiaries' intangibles ratio* equals 0.398 (= 0.223+0.175), considerably larger than the effect identified in specification 6 of Table 4 (equal to 0.292) and equal to a 4.4 percent increase in profit shifting. Thus, sharp increases in intangible assets following relevant corporate events trigger significantly higher profit shifting intensity. We maintain this identification approach based on corporate events for estimations in our subsequent analysis.

Differences in top marginal corporate tax rates across the Unites States and changes introduced by some US states in specific years also create a setting via which to study the relation between intangible assets and profit shifting. These events are suitable because they represent changes in the corporate taxes on MNEs that do not directly enter into equations 1 and 2. These equations include subsidiaries' tax rates and not the taxation of the parent company. Of particular importance are tax increases that increase the incentives of US- based parent firms to shift profit into foreign jurisdictions. We identify five such events during our sample period, in Connecticut (2009), North Carolina (2009), Illinois (2011), Connecticut (2012), and Oregon (2009). The information comes from Heider and Ljungqvist (2015) but we also cross-check for other events during the most recent years of our sample. We use a binary variable (named *State tax increases*) that is equal to 1 in the years of these events, matching the MNEs' headquarters with the states.

In specifications 4 and 5 of Table 5, the interaction term *State tax rises* × *Subsidiaries' intangibles ratio* is positive and statistically significant, showing that tax increases in the state of the parent company induce larger effects of the intangibles ratio on profit shifting. The marginal effect of the intangibles ratio when there is an increase in state corporate taxes equals a sizeable 0.802, which constitutes a 9 percent increase in profit shifting for a one standard deviation increase in the *Subsidiaries' intangibles ratio*.

Figure 6 provides an illustrative validation of our events-based analyses. Specifically, we graph the predicted values of *Profit shifting* as a function of *Subsidiaries' intangibles ratio* for each value of *Corporate events* and *State tax rises* (columns 3 and 5 of Table 5 for the two graphs, respectively). Both graphs show very similar effects of *Subsidiaries' intangibles ratio* on *Profit shifting* for low values on the *Subsidiaries' intangibles ratio*, and considerable variation for the treated and untreated observations as this ratio increases. Thus, for both the treated and untreated groups there is a positive relation between the level of intangible assets and profit shifting, but this relation is significantly stronger for the treated groups in the two graphs.

[Please insert Figure 6 about here]

iv. The role of institutional quality in subsidiaries' countries

In this section, we examine the role of institutional quality of the host country in the relation between intangible assets and profit shifting. To this end, we build on the model including the double interaction term *Subsidiaries' intangibles ratio* × *Corporate*

[56] Adding the interaction term *Corporate events* × *Subsidiaries' assets* to control for general firm size effects of the event does not affect our inferences. This is also the case when adding interaction terms between *Corporate events* and the rest of the firm–year controls.

events (specification 3 of Table 5) and add triple terms with several variables reflecting institutional quality. We expect that the relation between intangible assets and profit shifting is weaker in countries with stronger institutional quality, ceteris paribus.

Column 1 of Table 6 shows that the triple term including *Voice and accountability* is negative and significant at the 1 percent level. The marginal effect of the specification with respect to *Voice and accountability* equals -0.47, at the mean value of *Subsidiaries' intangibles ratio* and setting *Corporate events* equal to 1. Most importantly, by setting the derivative of the specification with respect to *Subsidiaries' intangibles ratio* equal to zero and *Corporate events* equal to 1, we find that the positive effect of *Subsidiaries' intangibles ratio* × *Corporate events* is eliminated for values on the *Voice and accountability* index equal to 1.42 or higher. That value is a bit higher than the third quartile of the index (see summary statistics in Table 2).

[Please insert Table 6 about here]

In specifications 2 to 4 of Table 6, we return very similar results when using *Control of corruption*, *Government effectiveness*, and *Rule of law*, instead of *Voice and accountability*. We abstain from using all these variables in the same specification due to multicollinearity concerns (the correlation across these variables is at least 80 percent). We find that the effect of intangible assets is eliminated for substantially high values on all these three, institutional-quality reflecting indicators. Given that institutional development goes hand-in-hand with economic development, in the last specification of Table 6 we include the natural logarithm of GDP per capita in the triple interaction term. As in the case of institutional development, we find that the effect of asset intangibility on profit shifting is less potent in more economically developed countries. Horseracing institutional development with economic development is not possible because the institutional characteristics are more than 80 percent correlated with economic development and the results show clear signs of multicollinearity.

These findings are consistent with a large literature in institutional economics and political science showing that tax avoidance is lower in countries with higher institutional quality (e.g., Kanagaretnam et al., 2018; Bilicka and Seidel, 2020; Olson, 2000), but these findings are novel concerning the nexus between asset tangibility and profit shifting. Our findings that this relationship is prevalent in countries with weaker institutions suggests that institutional quality and enforcement mitigate the ability of MNEs with large shares of intangible assets to shift profits for tax-related purposes.

5. Conclusions and directions for future research

This paper constructs a global profit shifting database with subsidiary–year measures of profit shifting across a maximum of 95 countries for the period 2009 to 2017. This new database shows that (i) the countries in which subsidiaries receive the largest amounts of profit shifting are the usual suspects (tax havens); (ii) the profit shifting average gradually declines after 2011, but not for firms with intangible assets, which display an increase in profit shifting.

This latter observation sets our pathway to a formal empirical analysis, which shows that the ratio of intangible assets to total assets is the most important predictor of profit shifting. Our most favored specification and rather conservative estimate shows a 4.4 percent increase in profit shifting following a one standard deviation increase in the intangible assets to total assets ratio. We also show that this effect is

significantly stronger in countries with lower institutional quality. In fact, the effect of firms' intangibility on profit shifting is almost eliminated when moving from average values of institutional quality to its third quartile reflecting higher institutional quality.

These findings are only a first step to uncovering the potential of this database for analyzing profit shifting at the firm or aggregate level. The global profit shifting database and its updates, which we aim to provide, can be used by researchers to analyze either the factors causally affecting profit shifting or the causal effects of profit shifting on firm-specific or country-specific characteristics. We show that intangible assets are a key determinant of profit shifting at the firm level, while institutional quality is a very promising country-specific determinant of profit shifting is institutional quality. We also find a strong correlation between the presence of fossil fuel activity and profit shifting, which establishes a pathway to a thorough examination of the link between environmental economics and profit shifting.

Our analysis reveals a need for substantial new research into questions pertaining to the determinants of profit shifting over and above cross-country tax differences, as well as into the industry profiles of firms that shift profit, and their capital structure, corporate governance, and investment decisions. Naturally, future research might also be interested in the macroeconomic outcomes of profit shifting, especially with regard to the labor market, investment, innovation, climate change, and economic growth.

Tables

Table 1. Variable definitions and sources

Variable	Definition	Source
A. Profit-shifting indices		
Profit shifting	The estimates $a_{1,it}$ from the estimation of equation 1 using the semiparametric local linear regression. We use an Epanechnikov kernel and select the bandwidth with cross-validation. The control variables include *Subsidiaries' assets* and *Subsidiaries' cost of employees*.	Own estimations
Profit shifting 2	The estimates $a_{1,it}$ from the estimation of equation 1 using the semiparametric local linear regression. We use an Epanechnikov kernel and select the bandwidth with cross-validation. The control variables include *Subsidiaries' assets, Subsidiaries' cost of employees* and the differences in profits at the consolidated level with the aggregated profits of subsidiaries.	Own estimations
Dependent variables		
Subsidiaries' earnings before taxes	Subsidiary's observed earnings before taxes (log).	Orbis
Explanatory variables: Firm characteristics		
Composite tax variable	Composite tax variable that summarizes all information about subsidiaries' profit-shifting tax-incentives in year t.	Orbis, EY Tax Guide
Subsidiaries' assets	Subsidiary's total assets (log).	Orbis
Subsidiaries' cost of employees	Subsidiary's cost of employees (log).	Orbis
Subsidiaries' cost ratio	The ratio subsidiaries' cost of employees / subsidiaries' earnings before taxes.	Orbis
Subsidiaries' leverage	Subsidiary's leverage, defined as total debt/ total assets.	Orbis
Subsidiaries' intangibles ratio	Subsidiary's intangibles ratio, defined as intangible assets/ total assets. Intangible assets include goodwill, brand recognition and intellectual property, such as patents, trademarks, and copyrights. Intangible assets exist in opposition to tangible assets, which include land, vehicles, equipment, and inventory.	Orbis
Corporate events	Dummy variable equal to 1 if the MNE reports large company size increases via M&As (sometimes involving spinoffs, MBOs, and LBOs).	Thomson One Banker
Explanatory variables: Country characteristics		
Statutory tax rates	Statutory tax rate of the subsidiary's country.	EY Tax Guide
	Statutory tax rates of all the subsidiaries' countries in the same group.	EY Tax Guide
GDP per capita	GDP per capita in constant prices.	WDI
GDP growth	Annual GDP growth rate.	WDI
Population	Subsidiary country's population in logs.	WDI

State tax rises	Dummy variable equal to one if a state in the United States in which the MNE has its headquarters increased the top marginal corporate income tax rate in a specific year during the period 2009-2017. These states are Connecticut-2009, North Carolina-2009, Illinois-2011, Connecticut-2012, Oregon-2009.	Heider and Ljungqvist (2015)
Democratic conditions (Polity)	Ranges from 0 to 10, with 0 indicating no institutional democracy and 10 indicating a maximum level of institutional democracy.	Polity IV Project (2018)
Voice and accountability	Perceptions of the extent to which a country's citizens are able to participate in selecting their government, as well as freedom of expression, freedom of association, and a free media. Estimate gives the country's score on the aggregate indicator, in units of a standard normal distribution, i.e. ranging from approximately -2.5 to 2.5.	Worldwide Governance Indicators
Government effectiveness	Combines into a single grouping response on the quality of public service provision, the quality of the bureaucracy, the competence of civil servants, the independence of the civil service from political pressures, and the credibility of the government's commitment to policies. The main focus of this index is on" inputs" required for the government to be able to produce and implement good policies and deliver public goods.	Worldwide Governance Indicators
Control of corruption	Captures perceptions of the extent to which public power is exercised for private gain, including both petty and grand forms of corruption, as well as "capture" of the state by elites and private interests.	Worldwide Governance Indicators
Rule of law	Captures perceptions of the extent to which agents have confidence in and abide by the rules of society, and in particular the quality of contract enforcement, property rights, the police, and the courts, as well as the likelihood of crime and violence.	Worldwide Governance Indicators

Table 2. Summary statistics of key variables

The table reports the number of observations, the mean, standard deviation, minimum, maximum, first quartile, third quartile, and median of the variables used to estimate our profit-shifting index and the variables used in our baseline OLS specification (6) in Table 4 (plus the additional variables used in Tables 4 to 6). The variables are defined in Table 1 and the sample period is 2009-2017.

	Obs.	Mean	St. Dev.	Min.	Max.	Q1	Q3	Median
Profit shifting	106,301	1.46	1.01	0	36.40	0.90	1.80	1.44
Subsidiaries' earnings before taxes	106,301	7.24	2.17	-9.63	17.58	5.87	8.63	7.25
Composite tax variable	106,301	0.03	0.08	-0.39	0.60	0	0.07	0.03
Subsidiaries' assets	106,301	9.83	2.07	-6.61	18.38	8.45	11.18	9.76
Statutory tax rates	106,301	0.27	0.06	0	0.40	0.24	0.31	0.28
Subsidiaries' cost of employees	106,301	8.21	1.85	-6.70	15.90	7.06	9.39	8.21
Profit shifting	49,999	1.43	0.86	0.00	17.68	0.91	1.77	1.43
Subsidiaries' intangibles ratio	49,999	0.05	0.11	0.00	0.99	0	0.04	0.01
Subsidiaries' assets	49,999	10.25	1.89	1.82	18.12	8.97	11.48	10.17
Subsidiaries' leverage	49,999	0.58	0.43	-0.44	58.72	0.37	0.77	0.58
Subsidiaries' cost ratio	49,999	0.00	0.02	0.00	3.46	0	0	0
GDP growth	49,999	1.37	2.01	-14.80	25.56	0.58	2.26	1.50
Population	49,999	17.27	1.08	12.67	21.02	16.23	17.99	17.89
GDP per capita	49,999	10.45	0.59	7.20	11.60	10.36	10.70	10.60
Voice and accountability	49,999	1.14	0.33	-1.05	1.74	1	1.35	1.17
Democratic conditions (Polity)	49,986	9.46	1.06	0	10	9	10	10
Government effectiveness	49,999	1.17	0.55	-0.83	2.24	0.67	1.57	1.35
Control of corruption	49,999	1.08	0.77	-1.13	2.40	0.27	1.67	1.31
Rule of law	49,999	1.18	0.60	-0.86	2.10	0.62	1.65	1.41
Corporate events	49,999	0.29	0.45	0	1	0	1	0
State tax rises	49,999	0.01	0.09	0	1	0	0	0
Profit shifting 2	49,873	1.45	0.89	0	17.50	0.92	1.78	1.44

Table 3: Estimation of profit shifting from equation 1

The table reports coefficient estimates and standard errors (in parentheses) from the estimation of equation 1. Dependent variable is *Subsidiaries' earnings before taxes* and all variables are defined in Table 1. The first specification is estimated with OLS. The second specification is estimated with the semiparametric local linear regression and produces *Profit shifting*. We report White's (1980) heteroskedasticity-consistent standard errors in parentheses for specification 1. For specification (2), the standard errors are from bootstrapping. Total observations refer to the total number of observations we use in the regressions. Negative profit shifting is the number of observations for which our profit shifting estimates (the subsidiary–year coefficients on the *Composite tax variable*) are negative. The ***, **, and * marks denote statistical significance at the 1%, 5%, and 10% level, respectively.

	(1) OLS estimation	(2) Profit shifting
Composite tax variable	-0.660***	-0.646***
	(0.033)	(0.030)
Subsidiaries' assets	0.763***	0.763***
	(0.003)	(0.002)
Subsidiaries' cost of employees	0.165***	0.164***
	(0.003)	(0.002)
Total observations	166,979	166,979
Negative profit shifting		106,301

Table 4. Intangible assets and profit shifting

The table reports coefficients and standard errors (in parentheses). The dependent variable is *Profit shifting*. We define all variables in Table 1. Estimation method is OLS with standard errors clustered by subsidiary. The lower part of the table denotes the type of fixed effects. The *, **, and *** marks denote statistical significance at the 10%, 5%, and 1% level, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Subsidiaries' intangibles ratio	0.253***	0.352***	0.299***	0.282***	0.297***	0.292***	0.294***	0.295***
	(0.050)	(0.093)	(0.093)	(0.090)	(0.093)	(0.093)	(0.093)	(0.093)
Subsidiaries' assets	-0.010***	0.033*	0.033*	0.030*	0.032*	0.033*	0.033*	0.033*
	(0.003)	(0.018)	(0.018)	(0.017)	(0.018)	(0.018)	(0.018)	(0.018)
Subsidiaries' leverage	0.009	0.022*	0.005	0.003	0.007	0.003	0.003	0.003
	(0.011)	(0.013)	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)
Subsidiaries' cost ratio	0.050***	0.123***	0.069***	0.056***	0.062***	0.061***	0.062***	0.067***
	(0.007)	(0.003)	(0.005)	(0.012)	(0.005)	(0.005)	(0.005)	(0.006)
GDP growth					0.009**	0.011***	0.010***	0.010***
					(0.004)	(0.004)	(0.004)	(0.004)
Population					-1.261*	-0.997	-1.175*	-1.375*
					(0.706)	(0.675)	(0.707)	(0.712)
Voice and accountability						-0.368***		
						(0.133)		
Democratic conditions (Polity)							-0.086**	
							(0.043)	
Government effectiveness								-0.112**
								(0.055)
Observations	54,531	50,218	50,218	50,182	50,074	49,999	49,986	49,999
Adjusted R-squared	0.002	0.422	0.430	0.455	0.428	0.426	0.426	0.426
Subsidiary effects	N	Y	Y	Y	Y	Y	Y	Y
Year effects	N	N	Y	Y	Y	Y	Y	Y
Sub.country–year effects	N	N	N	Y	N	N	N	N
Clustered standard errors	subsidiary	subsidiary	subsidiary	subsidiary	subsidiary	subsidiary	subsidiary	subsidiary

Table 5. Evidence from instrumental variables and shocks

The table reports coefficients and standard errors (in parentheses). The dependent variable is *Profit shifting*. We define all variables in Table 1. Estimation method is 2SLS for the first specification and OLS for the other four specifications with standard errors clustered by subsidiary. The lower part of the table denotes the type of fixed effects. The *, **, and *** marks denote statistical significance at the 10%, 5%, and 1% level, respectively.

	(1)	(2)	(3)	(4)	(5)
Subsidiaries' intangibles ratio	1.092**	0.244**	0.223**	0.298***	0.285***
	(0.541)	(0.095)	(0.094)	(0.094)	(0.093)
Subsidiaries' assets	-0.008**	0.031	0.035*	0.041**	0.033*
	(0.004)	(0.019)	(0.019)	(0.018)	(0.018)
Subsidiaries' leverage	-0.006	0.009	0.003	0.010	0.003
	(0.008)	(0.010)	(0.010)	(0.010)	(0.010)
Subsidiaries' cost ratio	0.020**	0.085***	0.063***	0.089***	0.061***
	(0.010)	(0.005)	(0.005)	(0.005)	(0.005)
GDP growth	-0.001	0.008***	0.011***	0.007***	0.011***
	(0.004)	(0.002)	(0.004)	(0.002)	(0.004)
Population	-0.028**	-3.014***	-1.000	-3.103***	-0.989
	(0.011)	(0.340)	(0.678)	(0.338)	(0.675)
Voice and accountability	-0.078**	-0.373***	-0.370***	-0.365***	-0.369***
	(0.033)	(0.129)	(0.133)	(0.129)	(0.133)
Corporate events		0.023**	-0.014		
		(0.010)	(0.011)		
Corporate events × Subsidiaries' intangibles ratio		0.162**	0.175**		
		(0.079)	(0.079)		
State tax rises				0.017	-0.003
				(0.032)	(0.033)
State tax rises × Subsidiaries' intangibles ratio				0.492**	0.517**
				(0.223)	(0.228)
First stage					
Industry cost	0.073***				
	(0.007)				
Observations	55,873	49,999	49,999	49,999	49,999
Adjusted R-squared	-	0.421	0.426	0.421	0.426
Subsidiary effects	N	Y	Y	Y	Y
Year effects	Y	N	Y	N	Y
Clustered standard errors	subsidiary	subsidiary	subsidiary	subsidiary	subsidiary

Table 6. The role of institutions

The table reports coefficients and standard errors (in parentheses). The dependent variable is *Profit shifting*. We define all variables in Table 1. Estimation method is OLS with standard errors clustered by subsidiary. All specifications include *Subsidiaries' assets*, *Subsidiaries' leverage*, *Subsidiaries' cost ratio*, *GDP growth* and *Population* as control variables. The lower part of the table denotes the type of fixed effects. The *, **, and *** marks denote statistical significance at the 10%, 5%, and 1% level, respectively.

	(1)	(2)	(3)	(4)	(5)
Subsidiaries' intangibles ratio	0.629	0.243	0.331	0.361	4.917
	(0.849)	(0.245)	(0.345)	(0.356)	(4.172)
Corporate events	-0.054	-0.016	-0.009	-0.011	-0.351*
	(0.043)	(0.019)	(0.026)	(0.025)	(0.200)
Corporate events × Subsidiaries' intangibles ratio	1.713***	0.573**	0.839**	0.745**	8.621**
	(0.631)	(0.224)	(0.338)	(0.323)	(3.451)
Voice and accountability	-0.426***	-0.437***	-0.433***	-0.467***	-0.426***
	(0.138)	(0.150)	(0.138)	(0.145)	(0.136)
Voice and accountability × Subsidiaries' intangibles ratio	-0.328				
	(0.665)				
Corporate events × Voice and accountability	0.036				
	(0.034)				
Voice and accountability × Subsidiaries' intangibles ratio × Corporate events	-1.280***				
	(0.496)				
Control of corruption		-0.009			
		(0.053)			
Control of corruption × Subsidiaries' intangibles ratio		-0.020			
		(0.156)			
Corporate events × Control of corruption		0.003			
		(0.013)			
Control of corruption × Subsidiaries' intangibles ratio × Corporate events		-0.313**			
		(0.144)			
Government effectiveness			-0.052		
			(0.056)		
Government effectiveness × Subsidiaries' intangibles ratio			-0.087		
			(0.235)		
Corporate events × Government effectiveness			-0.003		
			(0.019)		
Government effectiveness × Subsidiaries' intangibles ratio × Corporate events			-0.521**		
			(0.236)		
Rule of law				0.081	
				(0.071)	
Rule of law × Subsidiaries' intangibles ratio				-0.108	
				(0.234)	
Corporate events × Rule of law				-0.001	
				(0.017)	
Rule of law × Subsidiaries' intangibles ratio × Corporate events				-0.429**	
				(0.217)	
GDP per capita					0.350
					(0.256)
GDP per capita × Subsidiaries' intangibles ratio					-0.443
					(0.391)
Corporate events × GDP per capita					0.033*
					(0.019)
GDP per capita × Subsidiaries' intangibles ratio × Corporate events					-0.803**
					(0.325)

Observations	49,999	49,999	49,999	49,999	49,999
Adjusted R-squared	0.429	0.429	0.429	0.429	0.430
Subsidiary effects	Y	Y	Y	Y	Y
Year effects	Y	Y	Y	Y	Y
Clustered standard errors	subsidiary	subsidiary	subsidiary	subsidiary	subsidiary

Figures

Figure 1: Profit shifting flows based on equation 1

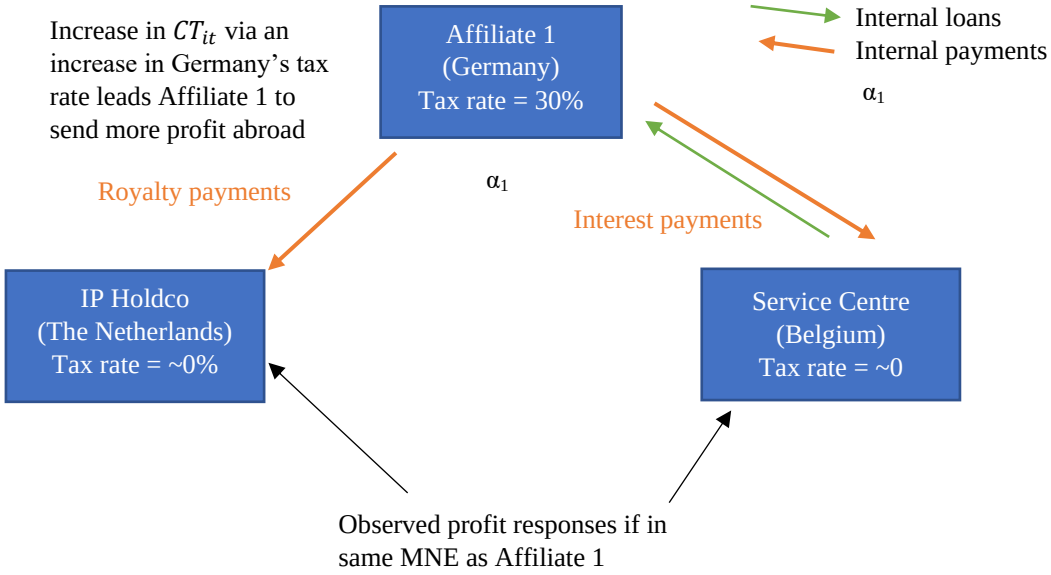


Figure 2: Nonparametric estimates at two points

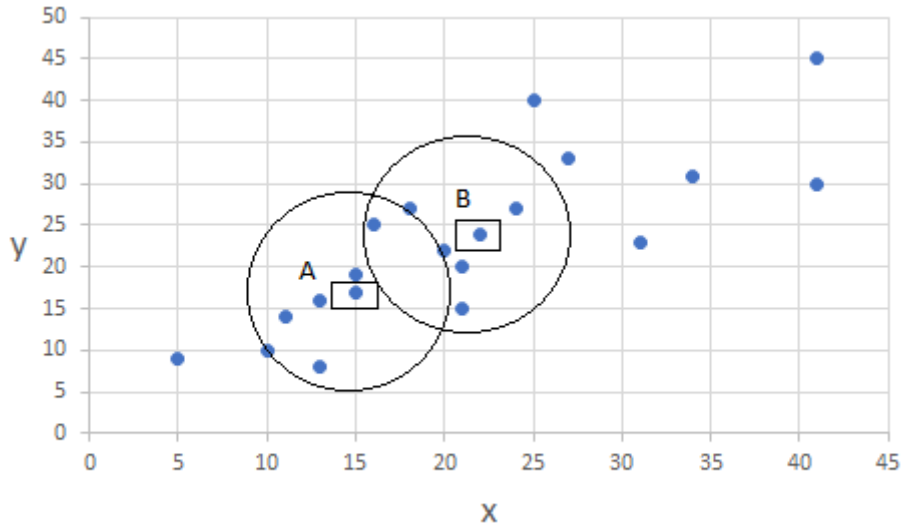


Figure 3: Annual averages of profit shifting

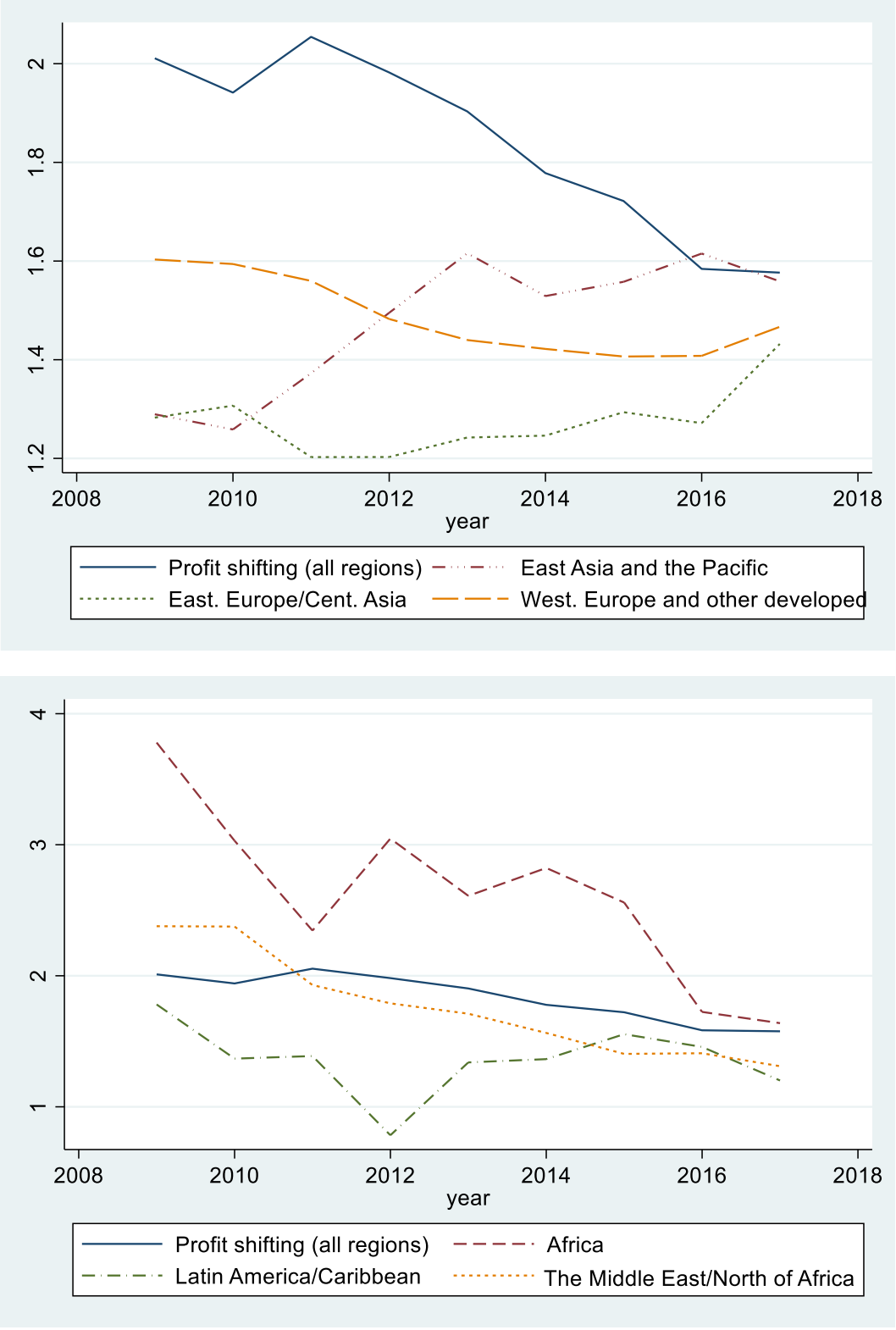


Figure 4: Annual averages of the subsidiaries' intangibles ratio

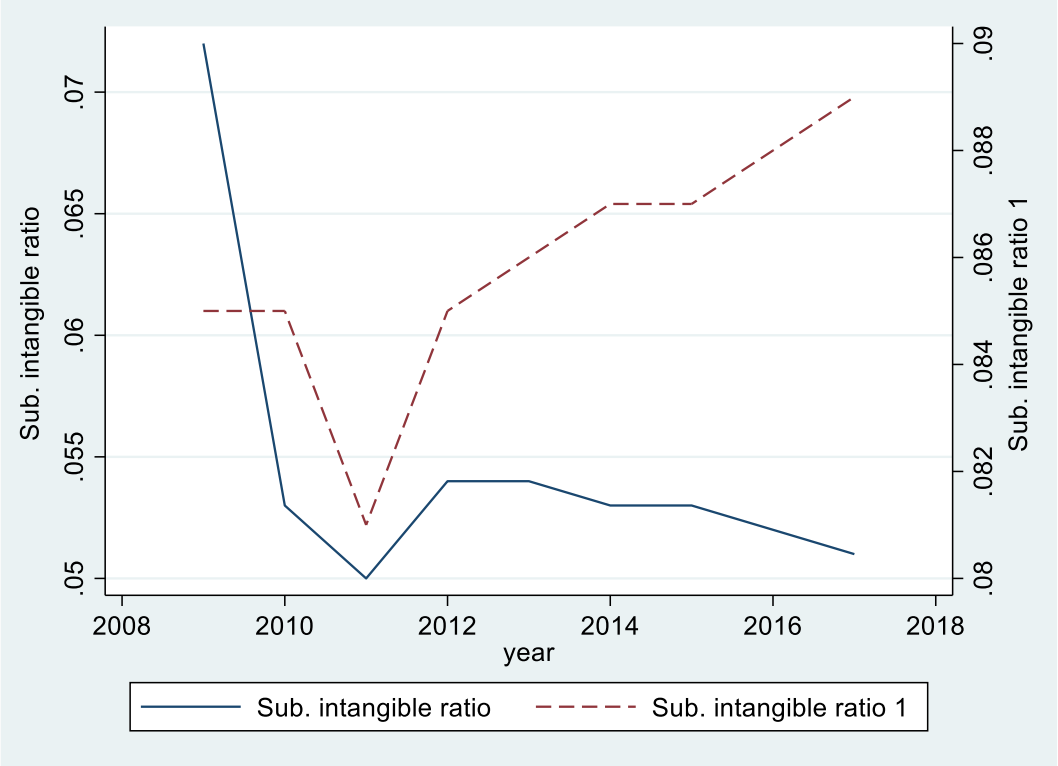


Figure 5: Profit shifting and subsidiaries' intangibles ratio across industries

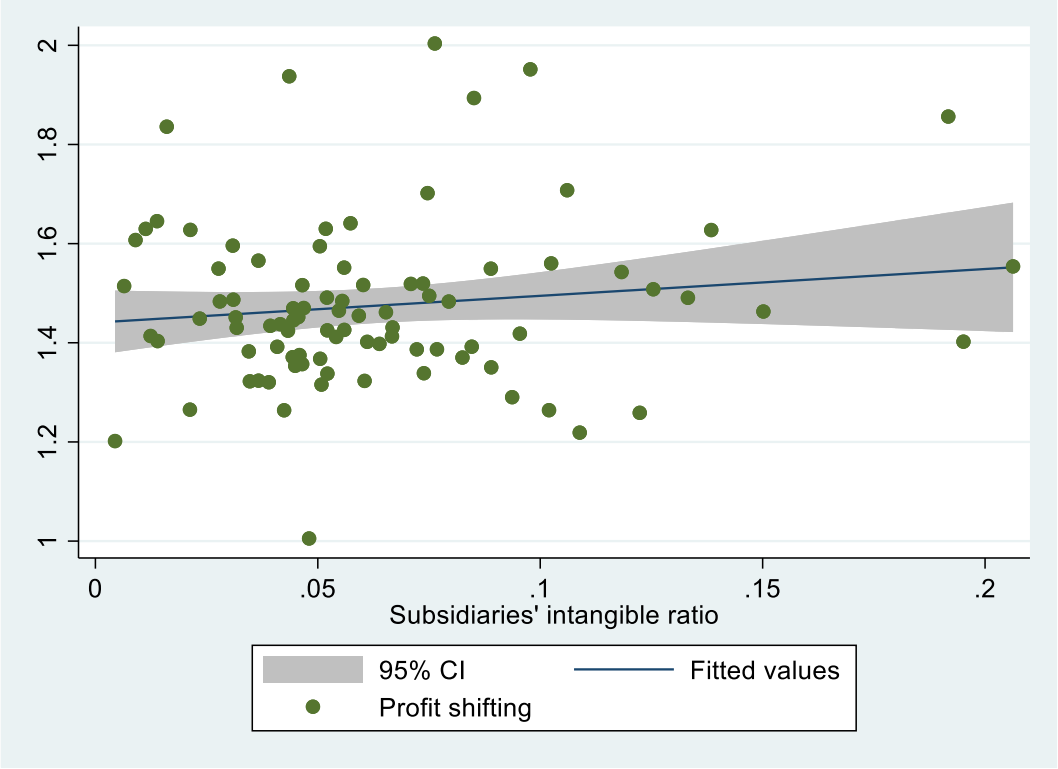
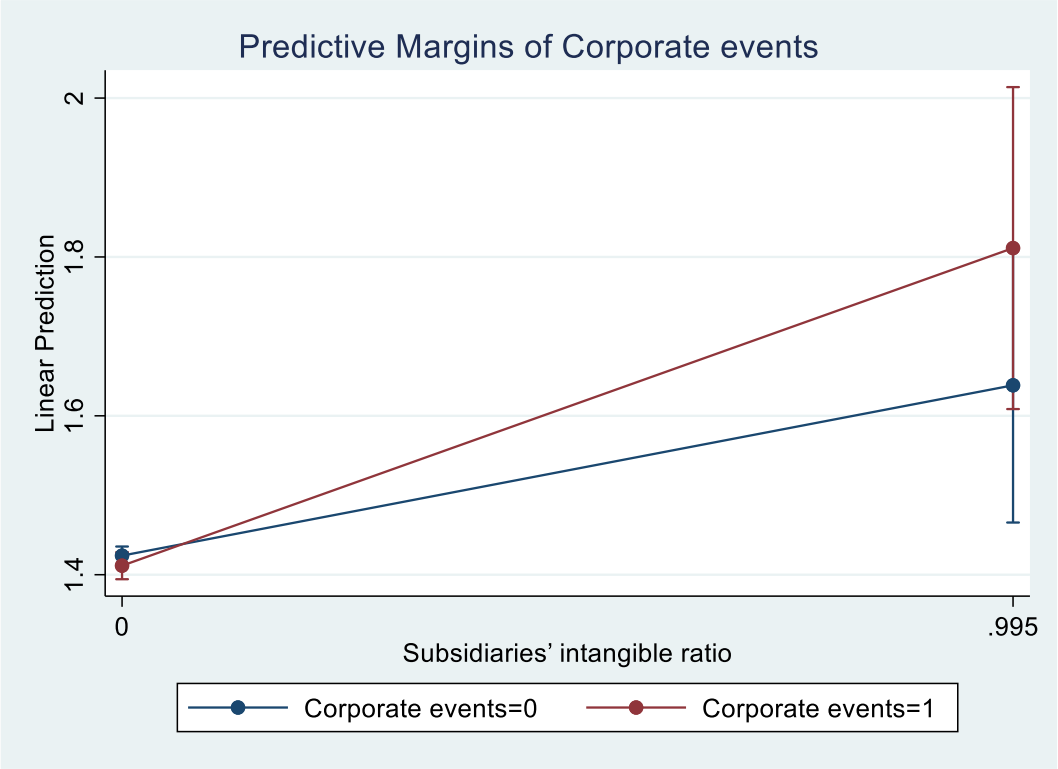
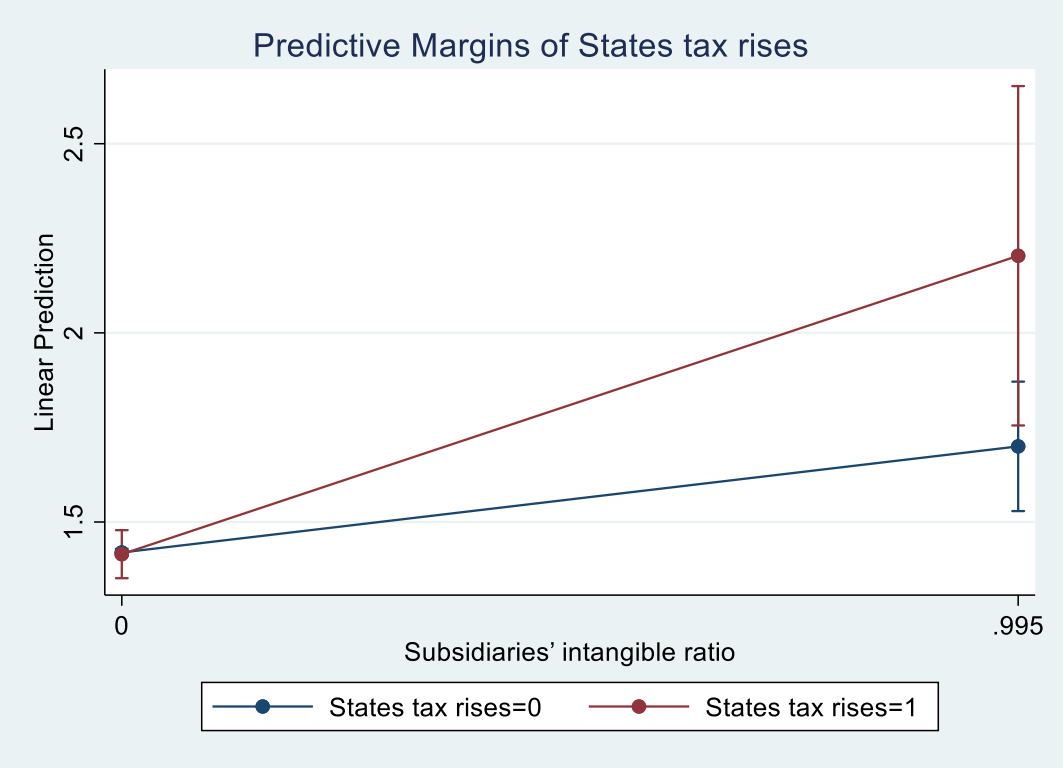
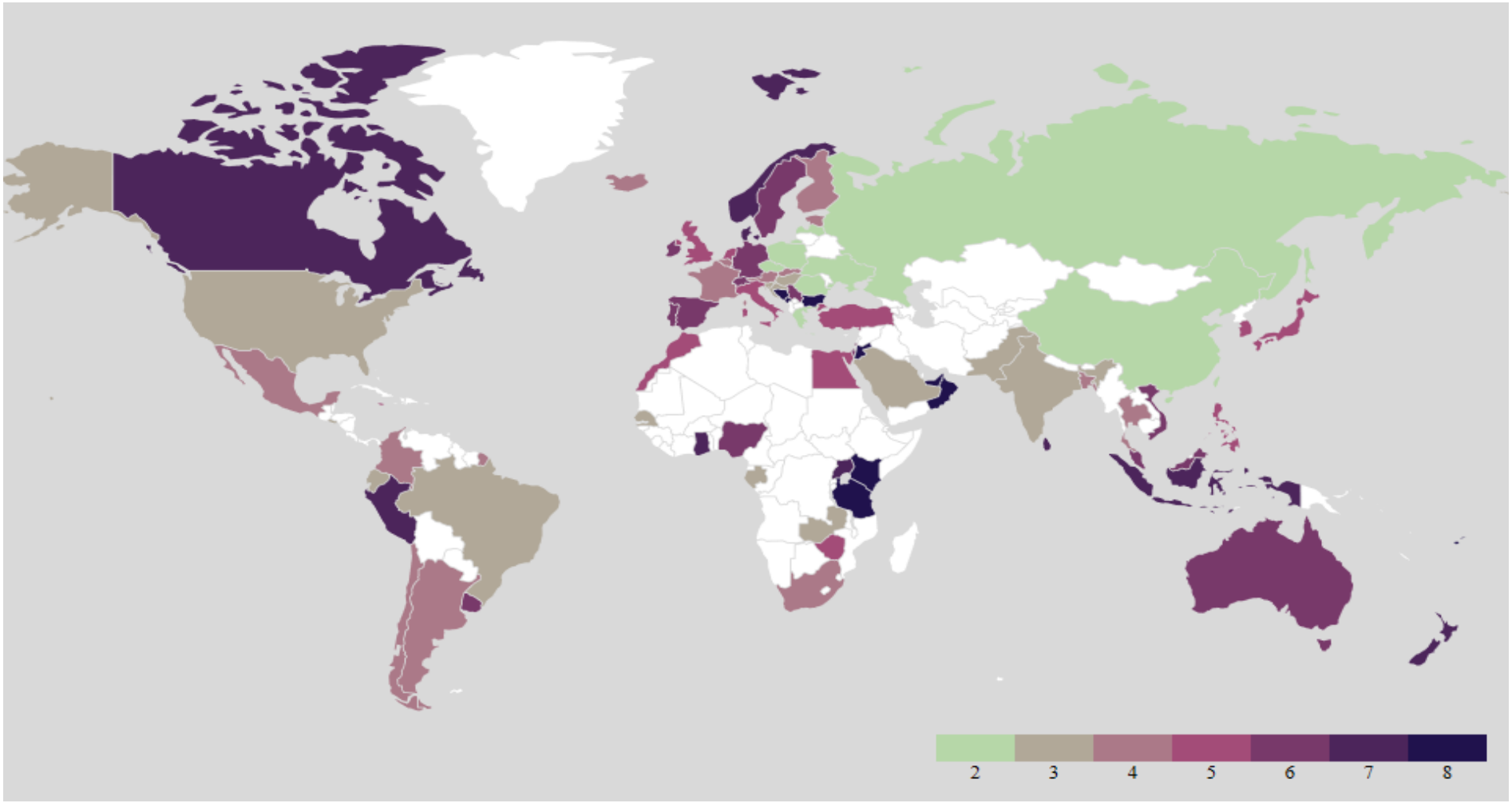


Figure 6: Predictive margins of corporate events and states tax rises



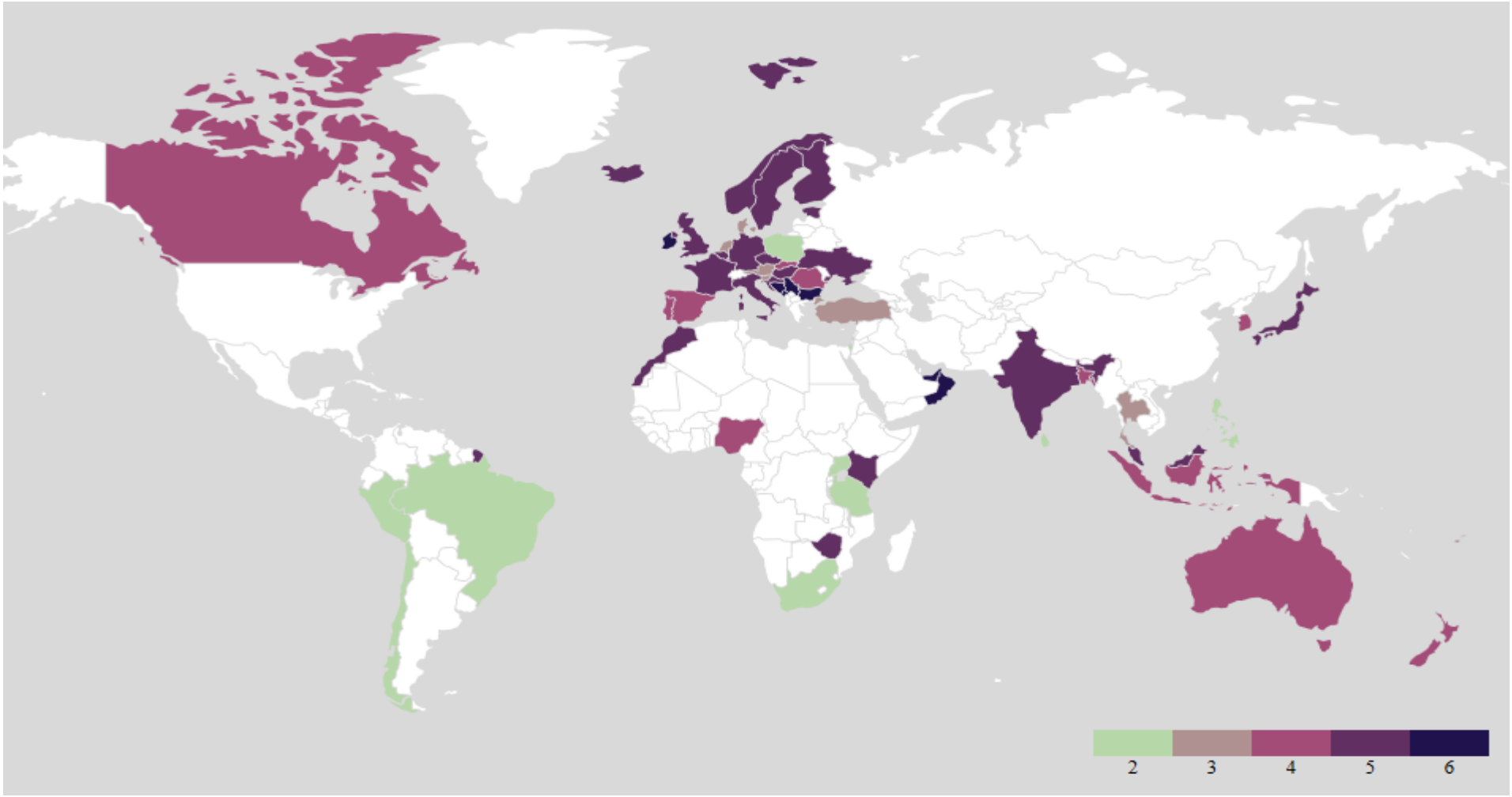


.Map 1. Country averages of *Profit shifting*



*Cayman Islands, Bermuda and Isle of Man take the highest value but are not visually depicted on the map due to their small size.

Map 2. Country averages of *Profit shifting* using the top 5% of profit-shifting firms



*Cayman Islands and Bermuda take the highest value but are not observable on the map due to their small size.

Appendix

Global Evidence on Profit Shifting. The Role of Intangible Assets

This appendix, intended for online use only, includes more information on our sample construction, the average values of our profit-shifting index by country–year and by industry, the average estimates of profit shifting by country using the top 5% of subsidiaries according to their profit-shifting estimates, the average values of intangible assets by industry, and additional robustness tests.

i. Sample construction

We begin with the full worldwide set of subsidiaries with listed global ultimate owners (GUOs) in Orbis.[57] This search strategy provides detailed accounting data for the subsidiaries (and not for the GUO). Next, we create a data set for GUO, for which we search for shareholders with foreign subsidiaries anywhere in the world (excluding firms for which the country is not listed). For subsidiaries, we rely on unconsolidated statements; for GUOs we rely on consolidated statements (there are very few unconsolidated statements for GUOs). Consolidated data net out potential profit-shifting movements among affiliates of a multinational group. We then merge the data sets by GUO and year. Both the subsidiaries and their GUO are of one of the following types: (i) Very large or large companies, active, with recent detailed financials, (ii) medium-sized companies, active, with recent detailed financials, (iii) small companies, active, with recent detailed financials. We exclude public authorities.

Our criterion for specifying a subsidiary is the existence of a GUO that owns at least 25.01% of the subsidiary. Note also that the minimum percentage of 25.01% includes both the ultimate owner's direct and indirect holdings, in case there are chains of ownership among the related firms of a specific group. Unlike previous studies, we relax the restriction that GUOs owning at least 51% of their foreign subsidiaries, as one might expect that even lower but still strong ownership could provide an incentive for profit shifting. Relaxing this restriction allows wider coverage. However, all of our results are robust to majority ownership, which might important to avoid results due to "tunneling" (i.e., the phenomenon of individual or family shareholders who control a group of firms shifting income from firms in which they own a relatively small stake to firms in which they own a relatively large stake).

To construct our composite tax variable (equation 2), we collect statutory tax rates from Ernst & Young's Worldwide Corporate Tax Guide. Deveraux and Mafini (2007) and many others henceforth use statutory (as opposed to effective) tax rates and justify this as follows. Multinationals shift profits among affiliates they already operate. Thus, they exploit tax allowances, which depend on differences in statutory (and not effective) tax rates. If multinationals were to decide where to produce (country, location) or measure an investment's value via the margin, effective average tax rate is preferred.

From this initial sample, we exclude subsidiaries in the same countries as their GUOs in order to capture the propagation of earnings among related subsidiaries in different countries due to tax differences. As discussed for the estimation of *Profit shifting*, we are interested in the negative responses of *Subsidiaries' earnings before taxes* (π_{it}) to CT_{it} in equation (1). This yields a sample of 26,593 subsidiaries in 95 countries from 2009 to 2017. The total number of subsidiary–year observations is 106,301. We disregard cases of positive responses, i.e., responses when the subsidiary does not send profits abroad (receive profits from abroad) when tax rates in the host country increase (decrease). By using logs, we drop all earnings before taxes of unprofitable subsidiaries, because they deal with zero tax rates, so they have no incentive for profit shifting activities if the local tax authorities do not authorize loss offsets. Further, we drop all the missing observations of the composite tax variable CT_{it}. That is the case for all the subsidiaries of our sample that do not have affiliated subsidiaries in the same multinational group.

[57] Following Orbis, we use the more technical term *GUO*; however, this is exactly the same as our description of an MNE.

ii. Tables

Table A1. Country list

This Table reports the number of observations by country in our initial subsidiary–year level dataset. The total number of observations is 375,958.

Country	Observations	Country	Observations	Country	Observations
Albania	22	Hungary	5,618	Saint Martin	16
Argentina	68	Iceland	365	Saudi Arabia	9
Australia	6,523	India	3,268	Senegal	16
Austria	4,890	Indonesia	181	Serbia	1,667
Bahrain	7	Ireland	9,012	Singapore	18,106
Bangladesh	45	Isle of Man	9	Slovakia	4,392
Belgium	20,204	Israel	84	Slovenia	1,472
Bermuda	151	Italy	22,003	South Africa	92
Bolivia	1	Jamaica	18	Spain	17,073
Bosnia and Herzegovina	441	Japan	798	Sri Lanka	36
Botswana	9	Jersey	18	Sweden	13,744
Brazil	1,499	Jordan	63	Switzerland	34
Bulgaria	2,783	Kazakhstan	74	Taiwan	176
Canada	212	Kenya	77	Thailand	10,381
Canary Islands	265	Kosovo	10	Trinidad and Tobago	4
Cayman Islands	319	Latvia	1,609	Tunisia	9
Ceuta	20	Lithuania	694	Turkey	637
Chile	148	Luxembourg	1,392	Uganda	9
China	13,239	Macedonia	224	Ukraine	1,619
Colombia	4,379	Malaysia	915	UAE	17
Croatia	1,844	Malta	390	United Kingdom	71,037
Cyprus	19	Marshall Islands	8	Tanzania	4
Czech Republic	7,813	Martinique	3	USA	368
Côte d'Ivoire	79	Mauritius	4	Uruguay	63
Denmark	6,111	Mexico	198	Vietnam	1,696
Dominica	2	Montenegro	87	Virgin Islands	22
Ecuador	14	Morocco	1,136	Zambia	11
Egypt	18	Netherlands	14,267	Zimbabwe	27
El Salvador	4	New Zealand	2,080		
Estonia	1,758	Nigeria	96		
Faroe Islands	9	Norway	10,343		
Fiji	18	Oman	22		
Finland	4,539	Pakistan	176		
France	32,603	Peru	95		
Gabon	9	Philippines	58		
Georgia	3	Poland	9,378		
Germany	7,526	Portugal	7,793		
Ghana	54	South Korea	6,262		
Greece	1,290	Reunion	6		
Guadeloupe	7	Romania	6,857		
Hong Kong	21	Russia	8,564		

Table A2. Average estimates of *Profit shifting* by country–year

This Table reports average estimates of Profit shifting by country–year using *Profit shifting* (semi-parametric) and the number of observations by country. The total number of observations is 106,301.

Country	Obs.	2009	2010	2011	2012	2013	2014	2015	2016	2017	Mean	St. Dev.
Argentina	7					1.428		1.816	1.054	1.040	1.334	0.368
Australia	2,430	1.595	1.757	1.863	1.497	1.458	1.440	1.340	1.412	1.319	1.520	0.185
Austria	1,744	0.634	1.212	1.275	1.441	1.419	1.479	1.502	1.672	1.812	1.383	0.335
Bahrain	7			0.133	0.133	0.133	0.133	0.133	0.133	0.133	0.133	0.000
Bangladesh	16	0.646	1.165	2.214	1.443	1.470	1.943	1.109	0.398	1.878	1.363	0.601
Belgium	9,449	1.468	1.447	1.429	1.331	1.319	1.280	1.252	1.213	1.233	1.330	0.096
Bermuda	41	4.310	4.569	5.617	7.644	8.439	4.710	4.602	6.180	3.190	5.474	1.686
Bosnia and Herzegovina	145	2.439	2.432	2.676	2.639	3.960	3.586	4.169	4.027	3.360	3.254	0.716
Brazil	53	1.781	1.368	1.425	0.949	0.937	1.312	0.967	1.302	1.374	1.268	0.277
Bulgaria	865	2.249	2.546	2.817	2.209	2.176	2.565	2.386	2.424	1.653	2.336	0.327
Canada	27	1.568	2.493	1.721	2.254	1.909	1.182	0.994	1.167	1.721	1.668	0.505
Canary Islands (Spain)	143	1.487	1.503	1.337	1.295	1.302	1.596	1.580	1.620	2.116	1.537	0.251
Cayman Islands	113	7.720	7.989	8.831	8.718	9.497	8.853	8.835	9.026	8.482	8.661	0.536
Ceuta (Spain)	14	1.506	1.321	1.344	1.340	1.312	1.375	2.747	0.761		1.463	0.564
Chile	33			1.687	0.514	1.459	1.122	2.002	1.619	0.925	1.333	0.509
China	2						1.236	0.650			0.943	0.414
Colombia	12			1.038	0.790	1.012	2.148	1.516	1.579	1.124	1.315	0.463
Croatia	478	1.215	1.046	1.294	1.175	1.224	1.217	1.261	1.196	1.228	1.206	0.069
Czech Republic	2,246	1.064	1.164	0.993	1.014	1.035	0.992	1.037	1.050	1.134	1.054	0.060
Côte d'Ivoire	35	9.458	13.080	13.349	9.142	7.958	9.304	9.097	2.251	1.822	8.384	4.041
Denmark	2019					1.668	1.639	1.578	1.649	1.794	1.666	0.079
Dominica	1								1.638		1.638	
Ecuador	4								1.116	1.083	1.099	0.023
Egypt	3				1.415	1.403	1.534				1.451	0.072

El Salvador	4								0.904	1.314	1.109	0.290
Estonia	383	1.205	1.137	1.109	1.163	1.397	1.712	1.460	1.404	1.412	1.333	0.197
Fiji	6	2.474	2.777	2.843	1.520			0.598		1.329	1.923	0.911
Finland	1,056	1.462	1.444	1.503	1.455	1.692	1.178	1.195	1.168	1.439	1.393	0.177
France	14,764	1.502	1.466	1.495	1.356	1.276	1.307	1.312	1.246	1.200	1.351	0.112
Gabon	6	1.054	1.124	0.715	0.881	1.806	1.625				1.201	0.427
Germany	4,494	1.643	1.722	1.596	1.572	1.518	1.423	1.381	1.417	1.303	1.508	0.137
Ghana	14	1.419	2.107	1.238	1.995	2.780	1.347	1.409	1.502	1.512	1.701	0.499
Greece	2	0.504		0.160							0.332	0.243
Guadeloupe (France)	3			1.677	1.405	0.781					1.288	0.459
Hong Kong	12	0.196	0.181	0.193	0.123	0.265	0.503	0.960	1.229	1.347	0.555	0.490
Hungary	1,577	1.087	1.171	0.967	0.974	1.018	1.006	1.049	1.068	2.118	1.162	0.364
Iceland	19	1.654		1.214	1.307		1.066	0.944	1.286	1.844	1.331	0.317
India	1,391	1.382	1.324	1.329	1.309	1.070	1.036	1.214	1.076	1.373	1.235	0.139
Indonesia	65	1.616	1.373	1.738	1.640	1.745	1.544	2.119	2.004	1.416	1.688	0.248
Ireland	1,365	1.718	1.715	1.623	1.705	1.544	1.715	1.541	1.516	1.172	1.583	0.175
Isle of Man (United Kingdom)	2						2.436	2.856			2.646	0.297
Israel	43	1.654	1.821	1.507	1.696	1.574	1.681	1.393	1.571	1.559	1.606	0.123
Italy	12,177	1.526	1.489	1.406	1.442	1.393	1.335	1.301	1.247	1.598	1.415	0.112
Jamaica	4					2.495	1.599		0.806	0.838	1.434	0.796
Japan	264	2.196	1.021	2.236	1.300	1.458	0.859	1.131	1.453	1.414	1.452	0.479
Jersey (United Kingdom)	7	0.636			1.813	1.103	1.044	1.559	0.853	1.363	1.196	0.409
Jordan	19	1.938			1.938	1.938	1.938	1.938	1.938	1.938	1.938	0.000
Kenya	51	5.221	1.316	1.497	1.704	1.549	1.602	1.412	1.840	1.709	1.983	1.225
Latvia	35	0.856				0.697	1.186	0.959	1.065	1.194	0.993	0.195
Luxembourg	580	1.751	1.742	1.644	1.712	1.511	1.523	1.549	1.640	1.505	1.620	0.101
Macedonia (Fyrom)	67				1.306	1.101	1.817	2.297	2.137	1.910	1.762	0.468
Malaysia	211	1.586	1.572	1.673	1.787	1.574	1.535	1.603	1.686	1.625	1.627	0.077

Malta	24	1.272	1.220	1.894	1.799	2.255	2.139	1.912	1.132	1.565	1.687	0.410
Martinique (France)	3		0.712	1.091						0.425	0.742	0.334
Mexico	6			0.949	0.714	1.333	1.470	1.582		2.056	1.351	0.476
Montenegro	35	7.790	1.313		1.364	5.652	1.890	2.398	1.488	2.965	3.108	2.369
Morocco	587	1.191	1.906	1.738	1.561	1.551	1.465	1.413	1.392	1.273	1.499	0.222
Netherlands	1,540	1.108	1.197	1.296	1.446	1.557	1.518	1.543	1.637	1.803	1.456	0.220
New Zealand	1,270	1.903	1.827	1.812	1.660	1.653	1.665	1.612	1.537	1.551	1.691	0.128
Nigeria	57	1.826	1.668	1.575	1.807	1.238	1.529	1.255	1.443	1.519	1.540	0.210
Norway	4,621	1.779	1.744	1.858	1.688	1.637	1.646	1.640	1.623	1.689	1.701	0.079
Oman	15	5.955	4.452	12.854	14.609	5.348	1.991	0.798	0.671	0.519	5.244	5.248
Pakistan	113	1.202	1.143	1.289	1.063	0.976	1.179	1.377	1.433	1.483	1.238	0.171
Peru	10					1.598		1.899	2.199	1.316	1.753	0.381
Philippines	40	1.420	1.256	1.115	1.951	1.720	1.509	1.334	1.518	1.187	1.446	0.266
Poland	2,183	1.057	0.989	0.959	1.046	1.093	1.102	1.153	0.983	1.105	1.054	0.066
Portugal	2,146	1.558	1.382	1.789	1.483	1.793	1.550	1.275	1.270	1.544	1.516	0.191
Republic of Korea	2,538	1.180	1.239	1.206	1.490	1.674	1.611	1.615	1.687	1.632	1.481	0.213
Reunion (France)	5		1.792				2.334	1.224		2.334	1.921	0.530
Romania	1,363	1.029	1.050	1.061	0.975	1.136	1.048	0.914	1.051	1.148	1.046	0.072
Russian Federation	6					0.424	1.186	1.347	1.026	0.726	0.942	0.369
Saudi Arabia	1									1.270	1.270	
Senegal	8			0.525			1.316	1.490	1.315	1.465	1.222	0.398
Serbia	399	2.698	2.466	2.337	1.832	0.866	0.994	1.141	1.053	1.119	1.612	0.724
Singapore	14	1.582	0.496	0.638	1.142			1.627	1.191	1.306	1.140	0.434
Slovakia	1,191	1.108	1.170	1.038	1.104	1.296	1.216	1.645	1.572	1.574	1.302	0.233
Slovenia	527	0.958	1.025	1.124	1.200	1.249	1.296	1.259	1.398	1.396	1.212	0.153
South Africa	51	1.305	1.457	1.164	1.021	1.303	0.907	1.412	1.684	1.516	1.307	0.245
Spain	9,172	1.801	1.832	1.666	1.544	1.487	1.427	1.558	1.653	1.653	1.625	0.135
Sri Lanka	26	1.272	1.323	1.680	2.182	2.230	2.306	2.824	0.950	2.022	1.865	0.601

Sweden	3,307	1.530	1.719	1.776	1.973	1.207	1.432	1.643	1.649	1.739	1.630	0.220
Switzerland	1								1.512		1.512	
Taiwan	47	1.364	0.720	0.989	1.081	0.839	1.056	1.189	1.226	1.198	1.073	0.201
Thailand	268	1.624	1.308	1.425	1.410	1.241	1.385	1.386	1.290	1.341	1.379	0.110
Turkey	37	1.232	1.021	1.158	1.031	1.155	2.038	1.432	1.708	2.004	1.420	0.402
Uganda	8	2.100		1.437	1.323	1.411	1.334	1.387	2.325	2.831	1.769	0.576
Ukraine	216	1.236	1.275	1.224	0.401	1.147	1.311	1.032	1.061	0.927	1.068	0.280
United Arab Emirates	6	8.164	9.178	11.170	11.394	7.420	7.257				9.097	1.825
United Kingdom	15,921	1.676	1.673	1.563	1.366	1.364	1.397	1.296	1.304	1.285	1.436	0.159
United Republic of Tanzania	4					2.795		2.709	2.453	1.395	2.338	0.645
United States of America	9					0.521	1.601		1.163	1.362	1.162	0.463
Uruguay	1							1.602			1.602	
Vietnam	8				1.708		1.938	2.275	1.426	0.186	1.506	0.801
Zambia	4					1.505	0.838	0.508	1.749		1.150	0.576
Zimbabwe	5	1.403	1.110		0.269	2.883	1.497				1.433	0.944

Table A3. Average estimates of *Profit shifting* by country using the top 5% of profit-shifting firms

This table reports average estimates of *Profit shifting* by country using the top 5% of the subsidiaries according to their profit-shifting estimates. These firms shift profit to 61 countries.

Country	Profit shifting	Country	Profit shifting
Cayman Islands	11.736	Denmark	2.853
Bosnia and Herzegovina	11.082	Austria	2.852
Macedonia (Fyrom)	11.023	Netherlands	2.851
Oman	10.293	Turkey	2.843
Ireland	10.237	Fiji	2.843
Bulgaria	9.188	Canary Islands (Spain)	2.842
United Arab Emirates	9.097	South Africa	2.841
Bermuda	9.076	Poland	2.839
Montenegro	8.416	Chile	2.837
Serbia	8.162	Sri Lanka	2.832
Japan	6.957	Uganda	2.831
Hungary	6.740	Israel	2.828
India	5.798	Philippines	2.826
Kenya	4.919	Brazil	2.811
France	3.743	United Republic of Tanzania	2.795
Belgium	3.602	Peru	2.789
Czech Republic	3.079		
Italy	3.067		
United Kingdom	2.936		
Germany	2.899		
Iceland	2.896		
Zimbabwe	2.883		
Croatia	2.871		
Morocco	2.869		
Sweden	2.866		
Norway	2.862		
Estonia	2.862		
Ukraine	2.862		
Malaysia	2.861		
Finland	2.860		
Republic of Korea	2.859		
Bangladesh	2.859		
Luxembourg	2.859		
Australia	2.859		
Spain	2.858		
Indonesia	2.857		
Slovakia	2.856		
Canada	2.856		
New Zealand	2.856		
Isle of Man (United Kingdom)	2.856		
Nigeria	2.855		
Portugal	2.854		
Romania	2.854		
Thailand	2.854		
Slovenia	2.853		

Table A4. Average estimates of profit shifting by industry using *Profit shifting*

Industry	Profit shifting
Mining and quarrying	2.054
Water supply; sewerage, waste management and remediation activities	1.719
Agriculture, forestry and fishing	1.642
Arts, entertainment and recreation	1.621
Human health and social work activities	1.537
Transportation and storage	1.535
Construction	1.531
Accommodation and food service activities	1.521
Manufacturing	1.498
Wholesale and retail trade; repair of motor vehicles and motorcycles	1.490
Education	1.474
Real estate activities	1.465
Administrative and support service activities	1.458
Information and communication	1.457
Professional, scientific and technical activities	1.452
Financial and insurance activities	1.424
Other service activities	1.384
Electricity, gas, steam and air conditioning supply	1.347
Public administration and defense; compulsory social security	0.878

Table A5. Average estimates of *Subsidiaries' intangibles ratio* by industry

Industry	Subsidiaries' intangibles ratio
Public administration and defense; compulsory social security	0.195
Education	0.106
Water supply; sewerage, waste management and remediation activities	0.098
Financial and insurance activities	0.097
Information and communication	0.083
Arts, entertainment and recreation	0.080
Mining and quarrying	0.074
Human health and social work activities	0.073
Other service activities	0.071
Agriculture, forestry and fishing	0.070
Administrative and support service activities	0.067
Transportation and storage	0.061
Professional, scientific and technical activities	0.057
Real estate activities	0.052
Manufacturing	0.045
Wholesale and retail trade; repair of motor vehicles and motorcycles	0.044
Accommodation and food service activities	0.043
Construction	0.040
Electricity, gas, steam and air conditioning supply	0.034

Table A6. Alternative measures of profit shifting

The table reports coefficients and standard errors (in parentheses). The dependent variable is *Profit shifting 2*. We define all variables in Table 1. Estimation method is OLS with standard errors clustered by subsidiary. The lower part of the table denotes the type of fixed effects. The *, **, and *** marks denote statistical significance at the 10%, 5%, and 1% level, respectively.

	(1)	(2)	(3)	(4)
Subsidiaries' intangibles ratio	0.251***	0.307***	0.293***	0.282***
	(0.053)	(0.097)	(0.095)	(0.092)
Subsidiaries' assets	-0.009**	0.038**	0.030	0.029
	(0.003)	(0.018)	(0.019)	(0.018)
Subsidiaries' leverage	0.007	0.015	0.007	0.003
	(0.010)	(0.011)	(0.011)	(0.010)
Subsidiaries' cost ratio	0.049***	0.092***	0.062***	0.053***
	(0.007)	(0.005)	(0.005)	(0.010)
GDP growth	-0.009***	0.007***	0.011***	
	(0.003)	(0.002)	(0.004)	
Population	-0.048***	-3.394***	-1.232*	
	(0.010)	(0.344)	(0.703)	
Voice and accountability	0.038	-0.410***	-0.410***	
	(0.043)	(0.136)	(0.141)	
Observations	54,074	49,767	49,767	49,873
Adjusted R-squared	0.006	0.444	0.449	0.477
Subsidiary effects	N	Y	Y	Y
Year effects	N	N	Y	Y
Sub.country–year effects	N	N	N	Y
Clustered standard errors	subsidiary	subsidiary	subsidiary	subsidiary

Table A7. Sensitivity to the type of clustering of standard errors

The table reports coefficients and standard errors (in parentheses). The dependent variable is *Profit shifting*. We define all variables in Table 1. Estimation method is OLS. The lower part of the table denotes the type of fixed effects and clustering used in each specification. The *, **, and *** marks denote statistical significance at the 10%, 5%, and 1% level, respectively.

	(1)	(2)	(3)	(4)
Subsidiaries' intangibles ratio	0.292***	0.292***	0.292***	0.292***
	(0.093)	(0.073)	(0.097)	(0.086)
Subsidiaries' assets	0.033*	0.033*	0.033	0.033*
	(0.018)	(0.019)	(0.021)	(0.018)
Subsidiaries' leverage	0.003	0.003	0.003	0.003
	(0.010)	(0.009)	(0.010)	(0.010)
Subsidiaries' cost ratio	0.061***	0.061***	0.061***	0.061
	(0.005)	(0.016)	(0.006)	(0.058)
GDP growth	0.011***	0.011	0.011*	0.011
	(0.004)	(0.009)	(0.006)	(0.008)
Population	-0.997	-0.997	-0.997	-0.997
	(0.675)	(1.501)	(0.886)	(1.214)
Voice and accountability	-0.368***	-0.368	-0.368**	-0.368
	(0.133)	(0.459)	(0.151)	(0.417)
Observations	49,999	49,999	49,999	49,999
Adjusted R-squared	0.426	0.426	0.426	0.426
Subsidiary effects	Y	Y	Y	Y
Year effects	Y	Y	Y	Y
Clustered standard errors	subsidiary	Sub. country	Sub.industry	Sub.country–year

Table A8. Interaction terms in equation 1

The table reports coefficient estimates and standard errors (in parentheses) from adding interaction terms in equation 1. Dependent variable is *Subsidiaries' earnings before taxes* and all variables are defined in Table 1. Estimation method is OLS with standard errors clustered by subsidiary. The lower part of the table denotes the type of fixed effects. The *, **, and *** marks denote statistical significance at the 10%, 5%, and 1% level, respectively.

	(1)	(3)	(4)	(5)	(6)	(7)
Composite tax variable	-0.613***	-0.411**	-0.322**	-0.306**	-0.278*	-0.274*
	(0.137)	(0.199)	(0.143)	(0.144)	(0.144)	(0.144)
Subsidiaries' intangibles ratio	-0.781***	-0.756***	-0.765***	-0.764***	-0.763***	-0.767***
	(0.093)	(0.093)	(0.092)	(0.092)	(0.092)	(0.092)
Composite tax variable × Subsidiaries' intangibles ratio	1.837**	1.927**	1.817**	1.846**	1.826**	1.838**
	(0.914)	(0.930)	(0.917)	(0.917)	(0.916)	(0.918)
Subsidiaries' assets	0.778***	0.763***	0.771***	0.771***	0.772***	0.771***
	(0.015)	(0.016)	(0.016)	(0.016)	(0.016)	(0.016)
Subsidiaries' leverage	-0.210*	-0.200*	-0.203*	-0.203*	-0.202*	-0.203*
	(0.117)	(0.113)	(0.114)	(0.114)	(0.114)	(0.114)
Subsidiaries' cost ratio	-4.368***	-4.395***	-4.397***	-4.396***	-4.397***	-4.406***
	(0.402)	(0.399)	(0.400)	(0.400)	(0.400)	(0.400)
GDP growth			0.013***	0.013***	0.013***	0.013***
			(0.003)	(0.003)	(0.003)	(0.003)
Population			-1.883***	-1.987***	-2.122***	-1.568***
			(0.411)	(0.413)	(0.418)	(0.417)
Voice and accountability				0.146**		
				(0.071)		
Democratic conditions (Polity)					0.091***	
					(0.028)	
Government effectiveness						0.195***
						(0.047)
Observations	79,176	79,131	78,976	78,976	78,976	78,976
Adjusted R-squared	0.842	0.843	0.843	0.843	0.843	0.843
Subsidiary effects	Y	Y	Y	Y	Y	Y
Year effects	N	Y	Y	Y	Y	Y
Sub.country × year effects	N	Y	N	N	N	N
Clustered standard errors	subsidiary	subsidiary	subsidiary	subsidiary	subsidiary	subsidiary

Table A9. Dropping small values of CT

This table changes our main specification of Table 4 by dropping 5% and 10% of the smallest absolute values of the Composite tax variable, respectively. The table reports coefficients and standard errors (in parentheses). The dependent variable is *Profit shifting*. We define all variables in Table 1. Estimation method is OLS with standard errors clustered by subsidiary. The lower part of the table denotes the type of fixed effects. The *, **, and *** marks denote statistical significance at the 10%, 5%, and 1% level, respectively.

	(1)	(2)
Subsidiaries' intangibles ratio	0.301***	0.331***
	(0.102)	(0.108)
Subsidiaries' assets	0.038*	0.038*
	(0.020)	(0.021)
Subsidiaries' leverage	0.008	0.005
	(0.011)	(0.011)
Subsidiaries' cost ratio	0.059***	0.057***
	(0.005)	(0.006)
GDP growth	0.012***	0.014***
	(0.004)	(0.004)
Population	-1.063	-1.062
	(0.718)	(0.777)
Voice and accountability	-0.375***	-0.405***
	(0.139)	(0.146)
Observations	47,372	44,586
Adjusted R-squared	0.430	0.434
Subsidiary effects	Y	Y
Year effects	Y	Y
Clustered standard errors	subsidiary	subsidiary

Chapter V

Corporate Governance and Profit Shifting: The Important Role of the Audit Committee

We examine tax-motivated profit shifting as the outcome of corporate governance characteristics in multinational enterprises (MNEs). We propose a novel subsidiary-year measure of profit shifting, estimated from the responses of subsidiary profits to exogenous parent earnings shocks. Subsequently, we hypothesize that audit committee size and experience, as well as CEO duality are key factors affecting profit shifting. Our baseline results show that increasing audit committee size by one standard deviation increases profit shifting by an economically significant 7.8%. We also find that this positive effect reverses for MNEs with higher numbers of audit committee members who have audit expertise and for MNEs without CEO duality.

1. Introduction

For multinational enterprises (MNEs), tax-motivated profit shifting involves moving profits from high-tax jurisdictions to low-tax jurisdictions in order to increase after-tax income. Economic globalization intensifies this practice, triggering governments and international organizations to contain it via increased efforts and policies (mostly the OECD/G20 Inclusive Framework on Base Erosion and Profit Shifting, or BEPS; OECD, 2019). Extant research focuses on external and country-specific factors affecting MNE profit shifting, but we know little about the intrafirm decision processes that lead to more aggressive profit shifting.[58] In this study, we look at how corporate governance affects profit shifting. We consider a full range of corporate governance characteristics but focus on those that have clear theoretical underpinnings and yield significant empirical results. We find that the firm's audit committee size and experience, and CEO duality are key drivers of profit shifting. These findings inform policymakers about the corporate governance of MNEs' profit-shifting behavior.

Profit shifting and the corporate governance of MNEs have independently been the focus of researchers for more than two decades. The agency theory of the firm and the relevant problems that arise due to intrafirm conflicts of interest affect the trade-off between the benefits and costs of profit shifting. The benefits mainly are reduced tax payments from exploiting tax-rate differences across affiliate countries. Administrative, opportunity, and reputation costs related to profit shifting exist, however. Differences in corporate governance can result in differences in profit-shifting aggressiveness because of potential differences in the way CEOs and directors approach and value the relevant benefits and costs.

We focus on corporate governance characteristics that are theoretically more closely related to profit-shifting decisions and have clear empirical implications. We build three testable hypotheses. First is that the audit committee's role in influencing an MNE's optimal tax-planning strategies and monitoring compliance with international tax law and regulation is of key importance in profit shifting. By regulation, audit committees are composed almost entirely of independent nonexecutive directors (INEDs) with a view to improve accounting quality, legal compliance and risk management. By synthesizing the views and expertise of many INEDs, a large audit committee can better monitor profit-shifting strategies, especially in large MNEs with many subsidiaries in different countries. If these effects prevail, MNEs with large audit committees will conduct less profit shifting.

However, established literature links large audit committees to inefficient governance (e.g., Vafeas, 1999; Aldamen et al., 2012). There are three key reasons. First, large audit committees might be the result of agency problems between the audit committee and the rest of the MNEs top executives. Specifically, MNEs might appoint many audit committee members precisely to refrain from screening their output quality and drop the hot potato on these committees. Second, and related, large audit committees might face agency problems within its members, given that large committees are linked to capture by those members with relevant expertise or free-riding by those without expertise. Finally, more audit committee members with unique knowledge of the subsidiaries' tax jurisdictions may support more aggressive income shifting. These dynamics can exacerbate principal-agent problems, which can lead to

[58] See, for example, Klassen and Laplante (2012a, b), Klassen et al. (2014), Beuselinck et al. (2015), Dyreng et al. (2016), Dyreng and Markle (2016), Markle (2016), De Simone (2016), De Simone et al. (2021), Blouin et al. (2018), and Delis et al. (2020).

more profit shifting, especially the kind considered more aggressive (e.g., what the OECD refers to as base erosion). We expect that the forces driving a positive relation between audit committee size and profit shifting outweigh those driving a negative relation; we thus hypothesize that reducing the size of the audit committee reduces tax-motivated profit shifting.

A second key characteristic of an audit committee is the functional expertise of its members. Noting that experienced auditors are fully aware of the increased international stringency among regulators toward profit shifting, they might place more weight on their own reputational costs. This dynamic especially holds if more profit shifting implies that a company's practices are very aggressive. For example, Dyreng et al. (2016) find reputational losses due to aggressive profit shifting, irrespective of whether the practices are illegal (Starbucks is a well-known case). Members of the audit committee who have deeper knowledge of profit-shifting practices at other MNEs and awareness of the increasing number of relevant legal cases might also be more risk-averse. This would be especially true given that auditors are independent directors and thus more immune to control by CEOs or other directors. Based on these considerations, we hypothesize that when the number of MNE audit committee members with audit experience increases, MNEs either directly limit profit shifting or moderate the positive effect of audit committee size.

The third key corporate governance characteristic that potentially affects profit shifting is board independence in general and CEO duality in particular. CEO duality (i.e., the CEO is also the chairman of the board) is considered by several studies as a key element blurring sound corporate governance and board independence (e.g., Jensen and Meckling, 1976), and it heavily contributes to many renowned accounting scandals (e.g., Enron). The CEO, by being the firm's ultimate decision maker and with augmented roles as board chair, might champion profit-shifting strategies with an ultimate goal of higher after-tax profit. Thus, our third hypothesis notes that CEO duality might overcome the "hurdles" of an independent and experienced audit committee, thus increasing profit shifting.

We test these hypotheses using Orbis and BoardEx data for MNEs with parent companies in the United States over the period 2008-2017. Orbis provides accounting data for firms worldwide, detailed information on their ownership structure, and the links between parent companies and subsidiaries. BoardEx collects biographical information on executives and board members of public companies, including relevant information on audit committees and CEO duality.

We conduct our empirical analysis in two stages. We first estimate the level of profit shifting at the subsidiary-year level, building on the differences-in-differences (DID) model in Dharmapala and Riedel (2013). This model makes profit shifting exogenous to firm corporate governance by exploiting external earnings shocks at firms that are comparable to the parent firm. It examines the propagation of these shocks toward the parent's subsidiaries. The premise is that using this instrumental variables' approach, an exogenous increase in a parent's profits implies partial profit shifting to subsidiaries in low-tax countries. To improve the shocks' exogeneity, we restrict the empirical analysis to subsidiaries in different industries (and of course countries) than their parent companies.

Our contribution is to estimate this model semiparametrically (or nonparametrically), which allows deriving coefficient estimates (slopes) on the DID component by subsidiary and year. For these estimations, we use firm-level data from all available countries (not only for the U.S.-based MNEs), which is important for two reasons. First, we eliminate the curse of dimensionality, a problem related to not having

dense observations when estimating nonparametric models. Second, using only U.S. multinational firms results in using firms whose parents almost always have higher tax rates than their subsidiaries and this imposes a strong (and unwanted) restriction on our results.

The estimates from this exercise are our subsidiary-year measure of profit shifting. To our knowledge, this is the first subsidiary-year measure of profit shifting in the literature. Further, given that the earnings shocks are independent of the specific parent firms' managerial processes (they are instrumented by shocks to firms other than the parent), our profit shifting measure is also independent of the well-known selection problem in corporate governance (i.e., firm profitability and other characteristics jointly lead to the measure of profit shifting and board characteristics, or firm profits results in specific corporate governance characteristics).

In the second stage, we examine how parents' corporate governance characteristics affect firm-year profit shifting. Our preferred model (the one with the most stringent set of controls and fixed effects) predicts that the key variable directly affecting profit shifting is audit committee size. We find that decreasing audit committee size by one standard deviation (having 1.1 fewer directors) yields a decrease in profit shifting of an economically significant 7.8%. This result is robust to different controls, fixed effects, and assumptions in the profit-shifting estimations. This result is also robust to an instrumental variables (IV) model, using the number of retirements or deaths in audit committees as an exogenous instrument.

Importantly, we find that audit committee experience moderates the positive effect of audit committee size on profit shifting. In our sample, only about 20% of the average MNE's directors have functional audit experience. According to our estimates, raising this number lowers the positive effect of audit committee size on profit shifting, and an approximately 50% ratio eliminates this effect. Moreover, by conducting separate estimations on subsamples of MNEs with high ratios of directors with audit expertise (the top quartile) and those with lower such ratios (the remainder three quartiles), we find that the effect of audit committee size is positive and significant only in the latter subsample.

Similar findings prevail when examining the heterogeneous effect of audit committee size on profit shifting due to CEO duality. We note that the positive effect of audit committee size prevails only for MNEs with CEO duality (approximately 67% of our sample). For that subsample, a one-standard-deviation decrease in audit committee size decreases profit shifting by 9.75%. In contrast, the effect of audit committee size on profit shifting for MNEs without duality is statistically insignificant.

Besides profit shifting for tax-related reasons, the underlying principal-agent problem can lead to nontax transfer pricing agency issues (e.g., budget allocations, intra-group trade, risk shifting, and, ultimately, investment efficiency). Most notably, MNEs' corporate governance might aim for policies that mitigates double marginalization problems and optimally incentivizes divisional managers (Baldenius and Reichelstein, 2006; Hiemann and Reichelstein, 2012). Thus, minimizing the global tax bill is an additional constraint for governance mechanisms when choosing the optimal transfer pricing policy (Baldenius et al., 2004) and, in principle, corporate governance should also affect the nontax outcomes of transfer pricing.

We note that transfer pricing of physical goods, the subject of this literature is only one method of profit shifting. The strategic use of internal debt, royalty payments for intangible assets, and head office cost allocations are three common methods of income shifting that do not rely of physical goods flows, though royalty payments would be commonly considered to be part of transfer pricing. For example, Auerbach

(2016) provides an inside look at the profit shifting of IKEA. He shows that IKEA is able to maintain a worldwide effective tax rate of approximately 3% by shifting profit to a Netherlands affiliate using a gross profit charge for the use of the IKEA brand name, and by using an internal bank in Belgium that loans capital to the operating affiliates. Thus, the role of governance in overseeing profit shifting may not be closely tied to the incentive aspects of transfer pricing in this literature.

Our analysis recognizes that corporate governance potentially affects both the tax-related and the nontax-related profit shifting and aims to distinguish between the two effects. Empirically, our key premise is that changes in nontax profit shifting apply to both high-tax affiliates and low-tax affiliates. Thus, we aim to first identify tax-related profit shifting from the heterogeneous responses of parents' earnings to exogenous earnings shocks for low-tax subsidiaries vs. high-tax subsidiaries. This is an important reason to use a two-stage analysis in which we first estimate tax-related profit shifting at the firm-year level and then we use these estimates as a function of corporate governance characteristics.[59]

Our study contributes to the profit-shifting literature by looking, for the first time, into the role of corporate governance, and in particular, the audit committee characteristics. The studies closer to our objectives are those on the determinants of profit shifting (e.g., Klassen and Laplante, 2012a, 2012b; Sugathan and George, 2015; Dyreng and Markle, 2016; Markle, 2016; De Simone, 2016). These studies focus on country characteristics (e.g., regulatory costs, territorial versus worldwide systems, and country-level institutions) or characteristics of the firm's environment (e.g., financial reporting pressures, capital constraints, and foreign ownership).

Our research also contributes to the literature examining the role of corporate governance in firms' general tax-planning strategies (e.g., Minnick and Noga, 2010; Brown, 2011; Brown and Drake, 2014; Armstrong et al., 2015; Li et al., 2017; Beasley et al., 2020). Studying how corporate governance affects international profit shifting has important differences compared to related studies of domestic tax planning or using a very broad measure of tax outcomes (Wilson and Wilde, 2018). In particular, the geographic footprint of MNE operations requires compliance with tax law in multiple countries, and transactions across borders are subject to different tax laws and country agreements. This also implies that intrafirm accounting and corporate governance strategies to manage profit shifting are more complex compared to domestic tax planning and might require specialized knowledge. Additionally, the costs, benefits and risks of tax-motivated profit shifting are not as straightforward (Desai and Dharmapala, 2009) as those of other potentially aggressive tax-planning strategies, especially because profit shifting typically involves legally exploiting gaps in different countries' tax laws that may still create public relations problems for the firm. These special characteristics of profit shifting have implications for audit committee structure and experience, especially given that tax laws evolve in different countries.

Moreover, due to the large flows of funds internationally and the blurred concepts of aggressive profit shifting and fully tax-compliant profit shifting, disputes with tax authorities may arise even when a firm is not trying to reduce taxes strategically

[59] Recent studies offer new theoretical findings regarding tax and non-tax aspects of transfer pricing. For example, Reineke and Weiskirchner-Merten (2020) using a partial equilibrium theoretical framework, examine the relocation of intangibles with respect to tax minimization (e.g., tax aspects) and with respect to the efficiency of spillover internalization (non-tax aspects). The diff-in-diff research design, the various controls, and the multiple fixed effects we utilize as well as an adequately high adjusted R-squared can significantly mitigate concerns for alternative explanations, but as with any empirical strategy, we cannot fully rule out them.

(Klassen et al., 2017). Thus, although corporate boards may preclude management from engaging in tax shelters due to potential negative impacts on firm value (Wilson, 2009; Chow et al., 2016) or on their own reputations (Graham et al., 2014; Dyreng, et al., 2016; Austin and Wilson, 2017), decisions around international tax compliance are much less stark and impossible to prohibit outright. In that case, the role of board structure, especially using specialized and experienced audit committee members, is likely more fundamental compared to the usual cases of tax planning.

Our findings benefit policy makers as they attempt to contain excessive profit shifting by proposing changes in these characteristics. For example, Deloitte places corporate governance at the core of its analysis of corporate taxation (Deloitte, 2015). In turn, the OECD, within its base erosion and profit-shifting (BEPS) initiative, directly (but only theoretically) links corporate governance with tax management (e.g., Centre for Tax Policy and Administration, 2009; OECD, 2015; Lambe, 2015). Governments have already begun related processes. For example, the U.K. and Canadian tax authorities undertake governance reviews in conjunction with tax audits, and Australia has an extensive guide to corporate responsibilities for tax oversight, including at the board level (Misutka and MacEachern, 2013). Our evidence lends an additional support to those who argue for stronger corporate governance measures.

2. Hypothesis development

i. The unique characteristics of profit shifting and related literature

The costs and benefits of tax planning for MNEs have been the subject of voluminous research (e.g., De Simone et al., 2021; Wilde and Wilson, 2018). Like many corporate strategic decisions, some level of tax planning enhances firm value, but too much can destroy value, especially if the practice is illegal. This results in a firm-specific optimum (Slemrod, 2004; Armstrong et al., 2015; Cook et al., 2017). Excessive tax aggressiveness reduces value in specific settings, such as accounting fraud (Lennox et al., 2013), debt costs (Hasan et al., 2014), and stock price crash risk (Kim et al., 2011). Because the main objective of tax planning is to lower the present value of tax payments to governments, tax planning increases cash flows and sometimes reported income. However, at least as far back as Enron's tax-planning activities came to light in 2001, it is also clear that when tax planning becomes too aggressive, firm value eventually suffers because of the legal and reputational costs (Oppel, 2001).

International profit shifting is a specific but complicated tax planning strategy. We use the word *complicated* because, unlike most other tax-planning strategies, profit shifting requires an international network of affiliates navigating complex laws and regulations in order to reduce tax bases in countries with high tax rates and have those earnings taxed in countries with low tax rates (Desai and Dharmapala, 2009). Moreover, international profit shifting increasingly withstands scrutiny from high-tax-rate countries (Mescall and Klassen, 2018). The enactment and implementation of BEPS under the OECD/G20 framework shows that large countries have been taking considerable steps to reduce tax avoidance.

In the same line, unlike other aggressive tax-planning strategies, profit shifting falls more heavily into the grey area of tax compliance because the taxation is based on concepts (such as the arm's length principal) that are subject to broad interpretation. If this holds for a particular profit shifting strategy, tax reductions might bear lower expected costs than other forms of aggressive tax reductions, raising MNEs' incentives

to conduct more aggressive profit shifting. These features also suggest that a firm's position on profit shifting may be more nuanced than other, more general positions on tax-planning aggressiveness. These distinguishing elements of profit shifting generate research questions on which specific corporate governance characteristics causally affect the practice.

Several studies are related to ours. Sugathan and George (2015), for example, examine how the quality of country-level institutions and foreign ownership affect profit shifting. Using data from foreign subsidiaries operating in India, they show that general country governance indicators, property rights, and the presence of foreign institutional investors crucially affect profit shifting. In fact, Sugathan and George (2015) call for more research on how firm-specific corporate governance affects profit shifting. Further, Klassen et al. (2017) survey 219 tax executives about their transfer-pricing practices, which are key aspects of international profit shifting. They interpret the executives' responses to suggest that approximately equal numbers of MNEs focus their transfer-pricing efforts on reducing global taxes, while the other half work to comply primarily with complex tax laws and avoid disputes with the various tax authorities.

Two more studies focus on managers and MNE tax-planning activities. Ting and Gray (2019) illustrate that MNEs' tax-avoidance can motivate managers to locate profits in low-tax jurisdictions without affecting the locations of their real operations. Akamah et al. (2018) highlight managers' active roles in activities related to tax avoidance. Thus, this recent literature places agency theory at the core of MNEs' (as opposed to other firms') tax-planning activities, as well as the associated benefits and costs.

Finally, several studies explore the features of the board of directors and broad measures of tax-planning aggressiveness. For example, Lanis and Richardson (2011) and Richardson et al. (2013) explore the role of the board of directors in Australian firms' tax-planning activities. They find that having more independent directors is associated with less tax aggressiveness. However, Moore et al. (2017) find the opposite for U.S. firms. Minnick and Noga (2010) fail to show any association for U.S. firms. Armstrong et al. (2015) study the impact of corporate governance on tax avoidance. Using quantile regressions to examine the extreme tails of the tax avoidance distribution, they find that board financial expertise and independence have a positive (negative) relation with tax avoidance for low (high) levels of tax avoidance. Notably, Armstrong et al. (2015) control for the size of foreign operations, consistent with common approaches to broad studies of tax avoidance. Our interest is in the interaction of foreign operational activities and corporate governance on the choices made around income shifting aggressiveness.[60] International income shifting in particular provides a strong setting to explore one aspect of tax planning that has gained considerable public attention (e.g., Starbucks in the UK; Barford and Holt, 2013). This conjecture further

[60] While income shifting and overall Cash ETR are correlated, they are not as highly correlated as one might expect. For example, Chen et al. (2018) and De Simone et al. (2021) develop different firm-specific proxies of income shifting. They include these proxies in standard Cash ETR regressions and show a coefficient between -0.01 and -0.03 on their income shifting proxies. While statistically significant, the correlation is not large. For Chen et al., the inter-quartile range of these proxies are 0.29 and 0.31 for the average and instrumental versions, respectively. Thus, multiplying these two reveals that the average effect on Cash ETR from an interquartile range change in the income shifting proxy is at best 1% reduction in Cash ETR. De Simone et al. use an indicator and find a similar magnitude. Thus, while correlated, we would assert that the two measures are capturing different aspects of corporate tax activities.

motivates our analysis, also given the important theoretical differences between general tax avoidance and profit shifting, described above.

Within this framework, we focus on the relation between core corporate governance characteristics that also have a policy flavor, and MNEs' profit-shifting behavior. To our knowledge, our study is the first to conduct such an analysis.

ii. The audit committee

Audit committee's size and composition are important factors that affect financial reporting quality (e.g., Carcello and Neal, 2000; Chen and Zhou, 2007; Pomeroy and Thornton, 2008; Habib and Bhuiyan, 2016). Several studies suggest that the audit committees' composition, in terms of legal expertise (Krishnan et al., 2011), industry expertise (Cohen et al., 2014), and financial expertise (McDaniel et al., 2002; Kusnadi et al., 2016), has a significant impact on the financial reporting quality. Ghosh et al. (2010) and Chen and Zhou (2007) note that firms with smaller boards and audit committees monitor their financial reporting more efficiently.

More aligned with our objectives, Richardson et al. (2013) show that if a firm has a more independent internal audit committee, it is less likely to be tax aggressive, mainly because of their better assessment of the accounting policies used and reputation-related concerns. On the same line, Robinson et al. (2012) report evidence that audit committee financial expertise is generally positively associated with tax planning, in line with the hypothesis that employing experienced audit committee members maximizes after tax returns. However, for very risky levels of tax planning this association becomes negative mainly because of reputational concerns. Our paper seeks to extend the literature to the effect of audit committee characteristics on MNEs' profit shifting.

Profit shifting transactions are inherently risky and complex due to international tax laws, different market regulations, and multiple countries' bilateral tax agreements. Because the audit committee has a responsibility to monitor the risk profile of the company's activities and has financial experts on it, well-informed audit committees and their specific characteristics such as independence, size, and their members' expertise play a central role in influencing the level of profit shifting (Brown et al., 2009; McGuire et al., 2012; Robinson et al., 2012; Deslandes et al. 2019). Moreover, BEPS action 13 and relevant legislation in several countries require larger companies to provide exceptionally detailed data about their global operations, including the location of employees, tangible assets, earned income, and tax payments. An efficient audit committee is usually aware of the international tax landscape (which is in a constant state of flux), oversees internal controls, and promptly shares the necessary data with their own MNEs, while assessing trends in the tax authorities, and the public (to reduce information asymmetries and other agency problems). These practices suggest a balance between a firm's desire to increase profit and shareholder value (the advisory role of the board), and the dangers and associated costs of aggressive or borderline-legal profit shifting (the monitoring role of the board). Thus, it is optimal for audit committees to stay aware of reputational dangers and be ready to answer questions about profit shifting if/when it emerges.[61]

[61] Audit committee members who do not adequately examine aggressive practices would experience difficulty justifying their effectiveness, both to the rest of the audit committee or to the board of directors. Thus, these audit committee members might be more concerned (because their self-concept is threatened) with tax decisions that support aggressive practices and they would reduce this discomfort by investigating these decisions thoroughly with probing questions. On the same line, audit committee

Based on these considerations, we hypothesize that the audit committee and its characteristics are important corporate governance mechanisms that affect the level of profit-shifting. We assert that the key audit committee characteristics are size and experience.

A large audit committee might improve monitoring and synthesize the viewpoints and expertise of more qualified members. These dynamics might be especially true for large MNEs with many subsidiaries in different countries that have different tax laws and regulations. Further, the literature closely links audit committee size with the number of audit committee meetings (Raghunandan and Rama, 2007), potentially yielding improved accounting, monitoring, and overall practices. If these effects prevail, we expect that MNEs with large audit committees conduct less profit shifting to subsidiaries abroad.

However, most of the literature notes a dark side of large audit committees. The literature suggests that communication and decision making of larger boards are less effective in representing shareholders' interests compared to smaller boards (e.g., Yermack, 1996; Van den Berghe and Levrau, 2004). Moreover, large audit committees are linked to inefficient governance because of communication problems and all-too-frequent meetings (e.g., Vafeas, 1999). These characteristics yield monitoring inefficiencies and reduced oversight. Similar to our perspective, Aldamen et al. (2012) also conclude that smaller audit committees with more experience and financial expertise are positively associated with firm performance.

On the basis of these theoretical considerations, there are three arguments explicitly linking large audit committees to profit shifting. To conduct profit shifting effectively, MNEs with subsidiaries in many countries must turn to many audit committee members with unique knowledge of the tax, financial, and macroeconomic environments in subsidiary countries. Adding more members on these specific environments can thus be based on the MNEs' expectation that when opportunity arises, large audit committees increase profit shifting to maximize MNE profit.

Second, large audit committees might exacerbate agency problems. Large audit committees imply principal-agent problems between audit committees (on one hand) and management and control (on the other hand). Specifically, MNEs appointing many audit committee members might refrain from checking the output quality of these committees (precisely because they appoint many members to do so), and this lack of scrutiny and control can yield more borderline legal or aggressive profit shifting.

Third, large audit committees might increase within-audit committee problems, such as capture by those with relevant expertise or free-riding by those without expertise. The essence of this mechanism is that a small audit committee reduces aggressive profit shifting mainly because of the underlying larger per auditor reputational costs incurred by a smaller number of audit committee members (as opposed to diffusion of these costs to more audit committee members).

Given the above, we formulate our first hypothesis as follows:

Hypothesis 1. MNEs with large audit committees engage in more tax-motivated profit shifting.

Given that audit committees are mostly independent by regulation, the second key characteristic distinguishing audit committees is INEDs' experience. With the term

members with audit experience might be less comfortable with accounting and tax decisions compared to members with less audit experience when outcomes are aggressive (Pomeroy, 2010).

experience, we measure whether audit committee independent directors have previous experience with an important role (functional expertise).

Dechow et al. (1996), McMullen (1996), and Beasley et al. (2000) find that a more independent audit committee reduces organizational risk (e.g., fraud) and earnings management. More generally, empirical evidence suggests that a higher number of INEDs on the board reduces financial fraud (Beasley, 1996; Chen et al., 2006), transfer-pricing manipulation (Lo et al., 2010), and the propensity for opportunistic earnings management (Peasnell et al., 2005). Deslandes et al. (2019) find that financial expertise of an audit committee plays an important role in constraining tax aggressiveness. Thus, bringing together the roles of independent board members with experienced auditors, a natural question is whether having more experienced INEDs on audit committees reduces profit shifting, especially by moderating the positive effect of audit committee size (i.e., moderating the effect underlined in hypothesis 1).

We note again that the characteristics of profit shifting and the relevance of having more independent auditors are somewhat different compared to other tax-planning strategies. Given the additional complexity due to the rapid digitalization of the economy, the continued evolution of new business models, and the accelerated internationalization (OECD, 2015), more experienced independent audit committee members with deeper knowledge of relevant practices are expected to fulfil better their monitoring and consulting responsibilities toward profit-shifting practices.

There are two interrelated issues behind this question; one concerns the nature of independent directors and the other concerns the nature of experience. First, the audit committee members are independent in order to improve accounting quality. The regulatory framework toward profit shifting is becoming increasingly stringent (e.g., enactment of BEPS, country-specific laws, and continuous monitoring using IT methods) and the reputational costs of independent members is larger if profit-shifting practices are excessively aggressive. Second, given the complex nature of profit shifting, audit committee members, with high level of accounting and finance expertise, can identify, understand, and explain better to the board potential financial repercussions or opportunities associated with such international tax planning activities (Robinson et al., 2012; McGuire et al., 2012; Hsu et al., 2018). On this line, a deeper knowledge of the profit-shifting practices at other MNEs and awareness of the details and outcomes of important relevant legal cases suggest that experience might make independent auditors more risk-averse. Thus, the combination of independence and experience (as opposed to only independence) can induce aversion to profit shifting, especially regarding aggressive practices.[62]

Given the above, we hypothesize that including more experienced, independent audit committee members either directly reduces profit shifting or moderates the positive effects of a large audit committee. We formulate our next hypotheses as follows:

> *Hypothesis 2a. MNEs with experienced independent audit committee members engage in less tax-motivated profit shifting.*

[62] The profit-shifting effect of having more INEDs with functional expertise on the audit committee might also be positive. If INEDs fall into agency capture, their expertise can reduce profit-shifting uncertainty, handle more complicated types of profit shifting, and generate important relevant networks and social capital (Brown and Drake, 2014).

Hypothesis 2b. The number of experienced, independent members on MNE audit committees moderates the positive effect that large audit committees have on tax-motivated profit shifting.

CEO duality is one of the most important reasons behind agency problems (Jensen and Meckling, 1976; Fama and Jensen, 1983; Jensen, 1993) because CEO duality reduces board monitoring effectiveness and increases the likelihood of fraud in firm operations (e.g., Chen et al., 2006).[63] The costs and benefits associated with profit shifting are linked to CEO duality. CEO duality creates better coordination across the complex mechanics needed to shift profits to subsidiaries abroad and allows for the creation of an audit committee that is more profit-shifting friendly (and less independent or less experienced). A board with CEO as chairperson might also more easily overcome the conflicts of interest and private information needed to take the risks associated with costly profit shifting. Note that such behavior is not necessarily against shareholders' interests, as profit shifting can be value enhancing for MNEs.

Based on these theoretical considerations, we formulate the following hypotheses regarding the effect of CEO duality on profit shifting:

Hypothesis 3a. CEO duality results in greater amounts of tax-motivated profit shifting.

Hypothesis 3b. CEO duality exacerbates the positive effect that large audit committees have on tax-motivated profit shifting.

3. Estimation of profit shifting

i. Empirical model

The complicated nature of profit shifting and the private information about MNE activities mean that profit shifting is difficult to measure. Most existing methods identify whether profit shifting exists at the aggregate country or industry level. They model how subsidiary profits respond to tax differences between the parent and subsidiaries (e.g., Hines and Rice, 1994) or among subsidiaries (e.g., Huizinga and Laeven, 2008). An appealing feature of Huizinga and Laeven (2008) is that they identify profit shifting from the response of subsidiary profits to a composite tax variable, reflecting all bilateral differences in the subsidiary countries' tax rates. In line with existing literature (e.g., Markle, 2016; De Simone, 2016), to use the Huizinga-Laeven model in our setting requires identification from interaction terms between that composite tax variable and several corporate governance characteristics. The issue is that, as Huizinga and Leaven also suggest, both the top statutory tax rate used to calculate the composite tax index and the composite tax index might be endogenous. Thus, in using this model, we would have to deal with two endogenous tax variables and several endogenous corporate governance variables. Given that our aim is to look inside the black box of individual firms and examine the role of corporate governance, it is ideal to estimate tax-motivated profit shifting at the subsidiary-year level.[64]

[63] For example, duality has been offered as an important explanation for the failures of Enron and WorldCom.

[64] De Simone et al. (2021) estimate a firm-level rolling average (not a subsidiary-year) measure using the firm fixed effects from the estimation of a model similar to Huizinga and Laeven (2008). In our

A second important identification problem is selection bias. In our case, selection comes from the potential choice of specific corporate governance characteristics (e.g., large audit committees) with the aim of conducting more profit shifting. Another challenge is that corporate governance is a general notion with several underlying characteristics, and identifying exogenous variations for one characteristic (e.g., through a change in relevant regulation) does not guarantee the same for other characteristics. Thus, we need an approach that simultaneously identifies causal effects of more than one corporate governance characteristic.

Our approach is to estimate *exogenous* variations in profit shifting at the subsidiary-year level. To this end, we conduct an empirical analysis in two stages. First, we build on the differences-in-differences (DID) model of Dharmapala and Riedel (2013). This model identifies how an exogenous shock at time *t* to parent *p* pretax and pre-shifting profit $\tilde{\pi}_{pt}$ affects subsidiary *i* profits π_{it} in a low-tax country, relative to subsidiary *j* profits π_{jt} in a high-tax country. The low-tax subsidiaries form a treatment group, and we compare them to subsidiaries in high-tax countries. In the presence of tax-motivated profit-shifting, an exogenous increase in the parent pretax and pre-shifting profits (a positive earnings shock) lead disproportionately to increases in the pretax profits of a low-tax subsidiary relative to a high-tax subsidiary.

The empirical model takes the form:

$$log\pi_{it} = \beta_0 + \beta_1 log a_{it} + \beta_2 log\tilde{\pi}_{pt} + \beta_3\big(Low\text{-}tax\ subsidiary_{it} \cdot log\tilde{\pi}_{pt}\big) + \beta_4 Low\text{-}tax\ subsidiary_{it} + \beta_5 Leverage_{it} + e_{it} \quad (1)$$

The dummy variable *Low-tax subsidiary* is the DID identifier. It equals 1 if the subsidiary faces a lower corporate tax rate than the parent firm; it equals 0 otherwise. In line with Dharmapala and Riedel (2013), we also control for the subsidiary i's size a_{it}, measured by the natural logarithm of total assets, as well as its exposure to debt (*Leverage*). The term *e* is the stochastic disturbance.[65]

The economic parent profits (i.e., before profit shifting) are unobserved. To construct $\tilde{\pi}_{pt}$, we follow Bertrand et al. (2002) and Sugathan and George (2015) and use the system of equations:

$$\tilde{\pi}_{pt} = \widetilde{ROA}_{pt} * \alpha_{pt}, \quad (2)$$

$$\widetilde{ROA}_{pt} = \sum_j \frac{\alpha_{jt}}{\sum_j \alpha_{jt}} \cdot ROA_{jt}, p \neq j, \ \forall\, t \in \{1, \dots, T\}. \quad (3)$$

In equations (2) and (3), α_{pt} denotes the total assets of parent firm *p* (the global ultimate owner). For parents, we consolidate data and avoid double-counting the assets of subsidiary *i* in the parent's consolidated financial statements by subtracting each subsidiary's total assets from consolidated total assets. In turn, α_{jt} in equation (3) equals

framework, it is important to identify how profit shifting responds to changes in corporate governance as a remedy against selection bias.

[65] Based on our theoretical analysis leading to the estimation of equation (1), the tax difference is what creates the motivation for profit shifting. The tax difference is between the corporate tax rate faced by each parent and the equivalent rates faced by each subsidiary separately. Thus, we improve the heterogeneity of our sample by analyzing the effects of corporate governance on profit shifting observed by subsidiary-year. This heterogeneity is further enhanced by using affiliate fixed effects that cause the coefficients to capture changes in profit shifting from changes in the tax difference. We also show, however, that our results are robust to analyzing profit shifting at the MNE-year level, described below.

the total assets of *comparable* parent firms j in year t, and $ROA_{jt} = \pi_{jt}/\alpha_{jt}$ is the comparable parent's pretax profit over total assets. The product of the average industry profitability ratio $\widetilde{ROA}_{pt}$ and parent total assets α_{pt} (minus the total assets of each subsidiary) gives our measure of parent earnings, $\tilde{\pi}_{pt}$.

We define a firm as comparable if it is in the same industry (four-digit NACE) and country each year as specific parent firm p. To construct the set of comparable firms, we use all the national and multinational firms in Orbis for which data on profits and total assets are available.[66] As in Dharmapala and Riedel (2013), we keep only the subsidiary-year combinations in our sample if (i) the set of comparable firms includes at least 10 firms and (ii) the subsidiaries operate in four-digit NACE industries different from their parent companies. The first requirement increases the accuracy of our measure by providing sufficient data for each industry within a country. The second requirement enhances the shock's exogeneity by preventing industry shocks to directly affect the reported pretax profits of each subsidiary.

Using $\tilde{\pi}_{pt}$ in equation (1) introduces exogenous shocks to parents' earnings by assuming that $\widetilde{ROA}_{pt}$ is a function of comparable firms' *ROA* and the observed subsidiaries operate in a different industry. This process mitigates potential selection bias between the profit-shifting shocks and virtually all the corporate governance characteristics of parent firms. The reason is quite simple: given that the profitability shock to the parent firm is exogenous to the internal firm processes, the firm could not have adjusted (selected) its corporate governance characteristics to change its profit shifting in the same period. This is a key advantage of the Dharmapala and Riedel (2013) model in our framework.

If tax-motivated profit shifting occurs, then we expect $\hat{\beta}_3$ to be positive and statistically significant. This implies that a parent-firm earnings shock, $\tilde{\pi}_{pt}$, will propagate asymmetrically toward low-tax subsidiaries compared to high-tax subsidiaries. The parameter $\hat{\beta}_2$ is also important because it controls for nontax-related profit shifting (e.g., budget and capital allocations, intra-group trade, risk shifting). Thus, in line with our theoretical considerations, we distinguish between tax-related profit shifting ($\hat{\beta}_3$ from the heterogeneous responses of parents' earnings to exogenous earnings shocks for low-tax subsidiaries vs. high-tax subsidiaries) and nontax-related profit shifting (general response of π_{it} to $\tilde{\pi}_{pt}$). The issue of course is that the slope $\hat{\beta}_3$ is a constant and does not change by firm-year. In the following section, we estimate equation (1) by uncovering firm year estimates (slopes) for $\hat{\beta}_3$.

ii. Estimation and results

To estimate equation (1), we resort to nonparametric regressions, mainly the semiparametric local linear model (e.g., Fan, 1992; Fan and Zhang, 1999; Mamuneas et al., 2006). We only outline the estimation here and leave the technical details for the Appendix. The key merit of a nonparametric approach for our purposes is that, unlike a parametric regression (e.g., ordinary least squares, OLS), the nonparametric method

[66] To avoid the correlation (and the endogeneity) that arises if we include a firm in the calculation of its industry profitability, we exclude the firm from the set of comparable firms. One drawback to the data we obtain from Orbis is that ownership structure is only available for the last reported year (2017 in our sample). As with previous studies, this is not a key concern, because the potential misclassification of parent-subsidiary links would, if anything, bias our results toward zero (e.g., Budd et al. 2005). However, this is a potential limitation of our analysis.

allows estimating $\hat{\beta}_3$ for each individual observation (by subsidiary-year) to obtain $\hat{\beta}_{3,it}$. This is our estimate of *Profit shifting*, which is the dependent variable in the second stage of our analysis.[67] The assumption of the semiparametric model is that only the DID term enters nonparametrically, whereas the rest of the terms enter parametrically.[68] We provide the technical estimation details in the Appendix.

To clarify our profit shifting measure, consider the example in Figure 1. The example is an abstraction from the IKEA structure documented in Auerbach (2016) and Ortmann and Schindler (2020). In our example, the parent firm shifts profits to its low-tax subsidiaries (IP Holdco, Op Affil 2, and the Service Centre). We assume the operating affiliates, Op Affil 1 and Op Affil 2 are not in the same industry as Parent. In the estimation technique, a profit shock in the parent's country, industry and year instruments a shock to the parent's profits. The estimation then uses observed profits in the three non-financial affiliates that are in different industries from the parent. To the extent that the parent's instrumented profit shock shows up to a greater degree in low tax-rate affiliates than in the high tax-rate affiliate (Op Affil 1), captured by $\hat{\beta}_3 > 0$, we conclude that there is profit shifting.

(Please insert Figure 1 about here)

We use data from Orbis. Orbis is the largest database of firm-level accounts of registered companies worldwide. It includes information on public and private firms' balance sheets and income statements. Importantly, it also includes the ownership structure.[69] At this stage, we use firm-level data from all available countries (not only for the U.S.-based MNEs), which is important for two reasons. First, we eliminate the curse of dimensionality, the problem related to not having dense observations when estimating nonparametric models. This substantially improves econometric efficiency. Second, using only U.S. multinational firms results in using firms whose parents almost always have higher tax rates than their subsidiaries and this imposes a strong (and unwanted) restriction on our results.[70] This significantly helps with the heterogeneity of the control group in *Low-tax subsidiary* (otherwise this variable will mostly equal 1 because U.S. parent firms have higher tax rates than their subsidiaries). Our sample spans the period 2008-2017. We define all the variables of our empirical analysis in Table 1 and report summary statistics in Table 2. After dropping missing observations for our main variables, we have a sample of 52,228 subsidiary-year observations from 6,596 subsidiaries and 940 parents for the period 2008-2017. This sample includes subsidiaries from 59 countries. Further, 76.3% of the subsidiaries in our sample face

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[67] As in Dharmapala and Riedel (2013), profit shifting is only derived from $\hat{\beta}_3$ and not from the total effect of $\tilde{\pi}_{pt}$. In other words, the coefficient $\hat{\beta}_2$ does not reflect shifted income to a subsidiary; it reflects a comovement between parent shocks and subsidiary profits. This comovement can be due to, for example, productivity linkages between parent and subsidiary profits.

[68] We also experiment with a fully nonparametric model and note that this model yields very similar results; we do not favor the fully nonparametric model only because it adds considerable estimation time without gain in our inferences. As these estimation approaches are now standard in several statistical software packages, we only provide our estimation details here. For more information, see Loader (1999).

[69] For a significant number of firms there is only very basic data, such as the name and address. However, Orbis still has data for the largest number of firms worldwide (given that it includes both private and public firms). Cobham and Loretz (2014) document that Orbis has an excellent coverage of European subsidiaries, but this is not the case for subsidiaries outside Europe. Dowd et al. (2017) highlight the lack of tax-haven coverage. In our context, this means that, if anything, our estimations of profit shifting are expected to be more conservative.

[70] In the analysis of profit shifting into corporate governance determinants, we use only U.S. parent companies to keep the macroeconomic, institutional, and regulatory environment constant. At that analysis, we also use many fixed effects (firm, year, industry, country, etc.).

lower statutory corporate tax rates than their parents. In the appendix Table A1, we provide statistics for the distribution of parent firms and their foreign subsidiaries by country as well as for the mean profit shifting in each country.

(Please insert Tables 1 and 2 here)

For subsidiaries, we use unconsolidated statements; for parents, we rely on consolidated statements. Consolidated parent profits can shift to low-tax subsidiaries and should be included in the analysis (as opposed to only including unconsolidated profits). Using consolidated data also creates a measure that is immune from profit shifting because any shifting is netted out upon consolidation. Further, because the construction of the average industry profitability index ($\widetilde{ROA}_{pt}$) uses data for comparable firms, the possible concern that the profits of subsidiary *i* are included is already addressed. Another advantage of consolidated data is that the requirement for separate parent data is not necessary. This allows retaining, for example, U.S. parents whose separate financial statements are not publicly available.

We measure subsidiary *i*'s profits at time *t* using the log of pretax earnings (*EBT*), subsidiary size using the log of subsidiary total assets, and financial leverage using the ratio of total debt to total assets. We use the variables in logs due to their high skewness, and this limits our sample to subsidiaries with positive earnings before interest and taxes. We obtain data on the statutory corporate tax rates from OECD and KPMG. For the theoretical justification for using statutory (as opposed to effective) corporate tax rates, see Devereux and Mafini (2007) and Huizinga and Laeven (2008). In unreported tests, we also use the statutory corporate tax-rate differences (e.g., Sugathan and George, 2015) or the statutory tax rate in the parent or the subsidiary countries instead of an indicator that separates low-tax and high-tax subsidiaries. The results are similar and are available on request.

Table 3 reports mean coefficient estimates (mean of the $\hat{\beta}_{3,it}$) and standard errors (obtained from bootstrapping and 200 replications) from the estimating equation (1). The different specifications produce a different number of estimates $\hat{\beta}_{3,it}$ given the assumptions about the kernel type, the method for bandwidth selection, and observation density.[71] We only retain the positive observations (the ones theoretically suggesting tax motivation as in our discussion of equation 1). At the lower end of each column, we report the total observations (the total number of observations we use in the regressions) and the observations with positive profit shifting in the United States (the ones we use in the second-stage analysis on the profit-shifting determinants).

(Please insert Table 3 here)

In the first column we report results from the semiparametric model with an Epanechnikov kernel and select the optimal bandwidth with cross-validation. This estimation method produces a larger number of estimates, $\hat{\beta}_{3,it}$, given the restrictions we place on bandwidth selection and observation density. In the second column we use a Gaussian kernel (instead of the Epanechnikov), and in the third we select the bandwidth using the Akaike information criterion (AIC) (instead of cross-validation). In the fourth column, we assume a fully nonparametric model (all explanatory variables

[71] Essentially, estimates are dropped when the regression encounters regions with scarce data (sliding windows with less than 100 observations). The number of observations dropped differs for different model assumptions and use of more control variables.

enter the regression nonparametrically). In column (5), we remove the main terms of the DID term (as the nonparametric model should by itself take care of the underlying nonlinearity). Finally, in column (6) we add the corporate governance variables as controls to prevent our profit shifting estimates from capturing any effects of corporate governance variables on subsidiaries' pre-tax profits.

The results are very similar across the different specifications. In line with our expectations, the DID term (*Low-tax subsidiary × Estimated parent profits*) is positive and statistically significant at the 1% level. According to our baseline model in column 1, a 10% increase in parent earnings implies that low-tax subsidiaries receive 0.29% more profit than high-tax subsidiaries. Our results show that for every $100 profits that exogenously flow into the parent, approximately $3 more go to each low tax-rate subsidiary, relative to high tax-rate subsidiaries. Our profit-shifting results are very similar to Dharmapala and Riedel (2013), who find an equivalent of $1 to $4 of profit shifting depending on the fixed effects used.

Concerning the profit-shifting estimates, we report summary statistics in Table 2. A more informative picture appears in histograms and kernel densities for the full set of effective observations (both positive and negative $\hat{\beta}_{3,it}$) in Figure 2. The different estimation approaches produce similar results, with one mode at zero profit shifting (or slightly above zero) and another mode at around 0.25. This is consistent with expectations suggesting that some MNEs do not conduct profit shifting, but most MNEs should have similar profit-shifting strategies and thus similar levels of profit shifting. A third small mode on the right-hand side of the histograms reflects firms with more aggressive profit shifting.

4. Corporate governance and profit shifting

i. Identifying the effect of corporate governance on profit shifting

To examine whether corporate governance characteristics affect profit shifting we estimate the model:

$$Profit\ shifting_{it} = c_0 + c_1 g_{it} + c_2 f_{it} + \rho' + u_{it}, \quad (4)$$

Where *Profit shifting* is any of our measures of *Profit shifting 1* to *Profit shifting 5*, g is the vector of governance characteristics, f is the vector of subsidiary-year and/or parent-year control variables, ρ' is a vector of fixed effects, and u is the stochastic disturbance. We define all variables in Table 1 and provide summary statistics in Table 2.

In this section, we use only data from U.S.-based MNEs. The main reason is that we aim to keep the MNEs' macroeconomic, institutional, and especially regulatory environment constant, as different countries have different regulations in place for corporate governance (and these differences might affect our results). Further, the accounting and ownership documentation in Orbis and the corporate governance documentation in BoardEx are uniform when considering the United States. The dataset includes 18,862 observations for 3,316 subsidiaries in 25 countries (again spanning the period 2008-2017).

Information for the corporate governance variables is from BoardEx. This information is at the director level and, thus, we calculate averages by parent (the global ultimate owner) and year. BoardEx contains data on college education, graduate education, past employment history, current employment status, social activities, and

committees' composition. Since the data from BoardEx do not share a common unique identifier with Orbis, to match BoardEx and Orbis, we first use the International Security Identification Number (ISIN) that is common in both databases. Then, to avoid losing observations, we apply a "fuzzy merge" using a bigram string comparator score of the company name as it appears in each database. This bigram string comparator computes the consecutive character matches between two string variables.[72] To ensure that the matching is correct, we review manually all matches one by one.

In line with our theoretical considerations and hypotheses, we use three key corporate governance measures. First, we use *Audit committee size*, measured by the natural logarithm of the number of directors on the audit committee. According to hypothesis 1, we expect *Audit committee size* to have a positive effect on *Profit shifting*. Second, we use four alternative measures of audit committee member experience, defined as *INEDs with audit experience* (see Table 1 for precise definitions). In line with hypothesis 2, we expect that these measures either negatively affect profit shifting or moderate the positive effect of *Audit committee size*. Third, we use a CEO duality dummy variable (*Duality*) and, consistent with hypothesis 3, we expect that this variable positively affects profit shifting (directly or via the effect of *Audit committee size*).

The mean *Audit committee size* is approximately 4.2 directors and ranges from 1 to 8 directors. Surprisingly, the ratio of INEDs with functional audit experience to the total number of members (*INEDs with audit experience 1*) takes a mean value of 0.2, suggesting that most members do not have functional audit expertise. Further, 67% of the parent firms in our sample have CEO/chairman duality, also making the potential effect of this variable particularly interesting. After merging Orbis with BoardEx, these statistics are in line with other studies that merge BoardEx with Compustat (e.g., Anderson et al., 2004; Ghosh et al., 2010; Karavitis et al., 2021). Indicatively, these studies report an audit committee size between 3.71 and 4.2, and a board size between 9.29 and 12.1.

In Table A3 we provide additional information on our sample, differentiating between small-sized, medium-sized and large audit committees. Very few sample firms have small-sized audit committees. We observe that, compared to firms with medium-sized audit committees, firms with large audit committees report more profits, are bigger, and engage in higher levels of profit shifting. Moreover, Figure 3 shows a positive correlation between audit committee size and profit shifting. In our empirical analysis that controls for these correlations among the many firm characteristics and other sources of endogeneity, we show that this relation translates to differences in audit committee size leading to systematic differences in profit shifting.

To further safeguard the causal effect of corporate governance on profit shifting. As noted in section 3, the effect of corporate governance variables on profit shifting in equation (4) is free of selection bias: parent firms do not have the time to choose strategically their future corporate governance characteristics following exogenous earnings shocks at year *t*. These shocks are derived from profits of comparable firms (and not the profits of their own parent firms) operating in different industries than the subsidiaries. Thus, it is highly unlikely that our estimates suffer from selection bias.

Our approach also mitigates omitted-variable bias in equation (4). The Dharmapala and Riedel approach essentially separates the cross section of parents into those that face an exogenous earnings shock and those that do not. This implies that

[72] We implement this fuzzy merge using the Stata ado file reclink (e.g., Babenko et al., 2020; Biswas et al., 2017). For each potential fuzzy match, Stata provides a similarity score; a higher score implies a greater degree of similarity between the matched terms, with 1 indicating a perfect match. To ensure accuracy we select the 95% as the similarity threshold for the matching.

profit shifting (the response of subsidiary profits to the territorial tax difference) of the former following this shock must be larger than that of the latter. There is no reason why time-varying firm-specific omitted variables will drive this effect, given that this effect comes from industry earnings shocks to comparable firms. The fact that our results remain remarkably stable when adding control variables (especially corporate governance controls) and – quite importantly – subsidiary fixed effects is further indication for the validity of our approach (Angrist and Pischke, 2008).[73]

The vector of controls includes several corporate governance variables of the parent firm (the global ultimate owner). In appendix Table A4, we show that the control variables do not have very high correlations with our three main variables (correlations do not exceed 0.5). First, we control for board size (*Board size*) to avoid *Audit committee size* capturing the potential effect of total board size. Similarly, we control for other dimensions of experience (other than audit experience) using the mean directors' board tenure (*Tenure*), the number of multiple directorships directors hold (*Number of directorships*), and the directors' network size (*Network size*). Further, we use the share of female directors in the board. Female directors are believed to hold stricter attitudes toward law compliance, produce more conservative financial reporting (Francis et al., 2015), and exert higher audit effort (Gul et al., 2008). Next, we control for the directors' mean age because several studies suggest that conservatism increases with age (Wu et al., 2005). We note that using these controls has a very small impact on the coefficients of main interest, which is evidence against omitted-variable bias.[74]

At the parent-year level, we control for financial characteristics that might affect MNEs' propensity to shift profit. Specifically, we use firm size, liquidity, total number of shares outstanding, book value, and profitability (see Table 1 for exact variable definitions). In robustness tests, we also use subsidiary characteristics. In general, we find that the subsidiary characteristics do not affect profit shifting significantly; this is expected, given that profit-shifting decisions should be made at the MNE level.

Importantly, we use several types of fixed effects. We begin with subsidiary and year fixed effects to control for time-invariant subsidiary characteristics and time-varying characteristics common to all subsidiaries, respectively. The subsidiary fixed effects further mitigate the possibility of simultaneity and omitted-variable bias because we obtain identification from firms with *changes* in *Audit committee size*, *INEDs with audit experience*, and *Duality*. Thus, given the exogeneity of earnings shocks and conditional on control variables, it is unlikely that changes in unobserved variables are correlated with both changes in our variables of main interest (*Audit committee size*, *INEDs with audit experience*, and *Duality*) and the stochastic term in equation (4).

Moving on to more stringent specifications, we use subsidiary and/or parent industry fixed effects, which further reduce the possibility that industry characteristics drive our key results. In the most stringent specifications, we saturate our model from the effects of time-varying country characteristics in the parent and subsidiary countries (subsidiary country × year and parent country × year fixed effects). These fixed effects control for the full gamut of macroeconomic, institutional, and societal characteristics

[73] Of course, *Profit shifting* is measured with error, as it is estimated from equation (1). It is well known, however, that measurement error in the dependent variable does not lead to inconsistent OLS estimates (e.g., Pischke, 2007).

[74] We take two steps to safeguard our analysis from multicollinearity issues (we report correlation coefficients in Panel A of Table A4). First, we run a variable inflation factors (VIF) multicollinearity test (Panel B of Table A4). Second, we sequentially add and exclude control variables (results available on request). Both these exercises show that multicollinearity problems in our estimations are insignificant.

in the parent and subsidiary countries that might correlate with both profit shifting and MNEs' corporate governance.

To further specification check our analysis for the possibility of endogeneity bias, we estimate an IV model. As an exogenous instrument, we use the number of deaths or illnesses that cause involuntary reduction in audit committee size (*Audit committee deaths & illnesses*). We observe 192 such cases in our sample. A recent corporate governance literature uses similar instruments (e.g., Fracassi and Tate, 2012). The exclusion restriction suggests that the event of an audit committee reduction due to deaths or illnesses affects profit shifting only via the audit committee size, conditional on controls for other corporate governance characteristics (e.g., director expertise, network, etc.) and firm characteristics. Given that our panel is heavily unbalanced, we find that using GMM (instead of two-stage least squares) considerably improves the weak identification and overidentification tests (also GMM is more efficient than 2SLS in the presence of heteroskedasticity).[75]

ii. Baseline empirical results

Table 4 reports our baseline results from the estimation of equation (4) using *Profit shifting 1* as the outcome variable. We cluster standard errors by parent because this is the level at which we observe corporate governance variables.[76] We begin with models including only subsidiary and year fixed effects. Given the exogeneity assumptions established in section 3, we expect that the estimates remain stable to the inclusion of control variables. This is indeed the case as we add controls in specifications 2 (corporate governance controls) and 3 (financial controls). In terms of our three hypotheses, only the effect of *Audit committee size* enters with a statistically significant coefficient, but *INEDs with audit experience* and *Duality* enter with insignificant coefficients.

We find that a 10% increase in *Audit committee size* increases profit shifting by approximately 3%. This is economically a large effect, considering that *Audit committee size* takes values between 1 and 8, and that its mean value is 4.2 and its standard deviation is 1.1. Thus, a one-standard-deviation increase in *Audit committee size* that is initially at its mean (going from 4.2 to 5.3, equivalent to a 26% increase) yields a 7.8% increase in profit shifting. These effects are fairly stable across the three specifications of Table 4.

(Please insert Table 4 about here)

Simply using subsidiary and year fixed effects raises the adjusted R-squared to approximately 0.67. From the rest of the corporate governance controls, the only significant one is *Network size*, which consistently enters with a negative and statistically significant coefficient. This is an important finding, suggesting that large MNEs with directors who have large networks conduct less profit shifting. Detected profit shifting can cause large reputational losses that can be exacerbated for renowned directors with large networks. Thus, these directors might be overly cautious in complying with aggressive profit shifting, especially because profit shifting is one of

[75] This is not to be confused with GMM for dynamic panels, which is very sensitive to the inclusion as instruments of lagged values of the dependent and control variables. We note, however, that our results are robust when using GMM for dynamic panels.

[76] As expected, clustering by subsidiary inflates our *t*-statistics (lowers standard errors) because all the subsidiaries share the parent's corporate governance characteristics.

the most important tax-planning strategies that capture international interests and associated policies to contain it.[77]

The effect of the parent-year controls largely follows our expectations. MNE size and liquidity positively relate to profit shifting, in line with expectations that larger MNEs with more subsidiaries and MNEs with higher cash-flow ratios conduct more aggressive profit shifting. We also expect a negative effect of *Parent ROA*, as parent firms that shift profits will show lower profitability ratios (profit is shifted to the subsidiaries).

In Table 5 we add several additional fixed effects. These fixed effects saturate our model from the effect of common shocks in industry-specific profit shifting (subsidiary or parent industries) and time-varying subsidiary country-specific shocks (subsidiary country × year fixed effects). The latter render the need for subsidiary country-year control variables redundant. The results confirm the results of Table 4, without significantly increasing the adjusted R-squared. This substantiates our identification assumptions on causal effects: adding more explanatory variables and fixed effects does not affect our baseline estimates, in line with assumptions of the usual DID model (e.g., Angrist and Pischke, 2008). Nevertheless, as specification 5 of Table 5 is the most stringent specification and controls for a full set of fixed effects, we treat it as our baseline specification for the rest of the robustness tests.

(Please insert Table 5 about here)

We conduct several sensitivity tests on the baseline results. First, we use the different profit-shifting measures, as specified in section 3 (*Profit shifting 2* to *Profit shifting 6*). We report the results in Table A5. Despite the significant variation in available observations, our key results remain largely unaffected: *Audit committee size* is the key variable affecting profit shifting. For the first two specifications, the estimated effect of *Audit committee size* is somewhat lower economically compared to our baseline; for the last two specifications the effect is equivalent to our baseline or slightly larger.[78]

In Table 6, we re-estimate our baseline specifications using the MNE-year mean of our profit shifting estimates as the outcome variable. This analysis ensures that we are not picking up spurious effects, whereby the same MNE (with the same corporate governance characteristics) has some subsidiaries with high profit shifting and some with low profit shifting. The results in Table 6 are very similar to those analyzing subsidiary-year profit shifting.

(Please insert Table 6 about here)

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[77] The general literature on tax-planning offers similar arguments. For example, Coram et al. (2016) suggest that CEOs with large networks perceive accrual earnings management (the strong form of earning management) as ethically questionable, and Griffin et al. (2017) provide similar evidence. In contrast, other studies show that larger networks contribute to tax-planning strategies, especially when considering milder forms of earnings management such as real activities earnings management (Griffin et al., 2017; references therein). The reason we do not place this variable in the core of our analysis is that it is not as relevant from a policy perspective. Indeed, it is difficult to think of a policy suggesting that MNEs hire directors with larger networks.

[78] For the robustness of our estimation method, in untabulated tests we also use the unweighted tax difference instead of the low-tax subsidiaries, to examine the effect of *Audit committee size* on profit shifting. The findings are in line with our baseline results in tables 4 and 5. The reason we do not prefer such a research design is that it suffers from severe multicollinearity problems. This test is available upon request.

Next, we consider scaling issues in audit committee size and, instead of the logarithm of the number of audit committee members, we use the ratio of audit committee size to the total number of directors (*Audit size to board size*). In appendix Tables A6 and A7, we replicate the results of Tables 4 to 6. In Table 7, in addition to controlling for firm size, board size, and firm fixed effects in our main analysis, we also explore the robustness of our results to the possibility that audit committee size captures scale effects by replacing the audit committee size with the ratio of audit committee size to total assets. The results are similar to our baseline. We again find that audit committee size is the key corporate governance variable yielding more aggressive profit shifting.

(Please insert Table 7 about here)

Table 8 replicates Table 5 for the GMM regressions. The Cragg-Donald and Kleibergen-Paap F-statistics easily pass the Stock-Yogo weak instrument critical values and the Hansen test is in the optimal region of overidentification (reference). The estimates on *Audit committee size* remain statistically significant. Despite the strength of the first-stage results (the instrument is not weak), the actual estimates are larger than the OLS ones. Thus, we prefer to base our inferences on the more conservative OLS estimates. The estimates on the corporate governance control variables are also in line with the OLS estimates, except from *INEDs with audit experience*, which turns out positive and statistically significant in the GMM, and *Network size*, which is negative and significant.

(Please insert Table 8 about here)

We report the results from six more robustness tests in appendix Table A8. In the first specification, we add controls reflecting subsidiary financial characteristics. We do not expect that these characteristics play an important role in the decision to shift profit, as parent companies make this decision. Indeed, we find that the included subsidiary controls enter with statistically insignificant coefficients. As these variables are insignificant and we lose observations when using them, we do not include them in our baseline specifications.[79] In the second specification, we add parent fixed effects. In general, we find that adding parent fixed effects while using clustering at the parent level does not affect our results (if anything, the estimate on *Audit committee size* becomes slightly more potent). In the third and fourth specifications, we consider clustering standard errors by parent and year (two-way clustering) and by parent and year and subsidiary country (three-way clustering). Our results remain approximately the same with our baseline. In the last two specifications, we control for the number of foreign subsidiaries and the number of countries where an MNE operates. Once again, our results are similar to our baseline.

Our results are in line with hypothesis 1, indicating the positive effect of audit committee size on profit shifting. In contrast, our results fail to reject the null forms of hypothesis 2a and hypothesis 3a on the direct effects of *INEDs with audit experience* and *Duality* on profit shifting.

[79] We experiment with many other subsidiary controls (reflecting sales, other measures of liquidity, labor, and capital, etc.). These results are available on request.

iii. The roles of audit committee member experience and CEO duality

In this section, we examine how audit committee member experience and CEO duality affect the relation between audit committee size and profit shifting (hypotheses 2b and 3b). Table 9 reports the results from specifications that examine the heterogeneous effect of *Audit committee size* due to members' functional experience (as captured by *INEDs with audit experience 1* to *4*).

(Please insert Table 9 about here)

We begin with two regressions, splitting our sample for values of the dummy variable *INEDs with audit experience 2* equal to 1 and 0, respectively. These regressions differentiate the effect of *Audit committee size* for high values of *INEDs with audit experience* (in the top quartile) and the rest. Our results show that in the first specification (observations for which *INEDs with audit experience 2* equals 1), the effect of *Audit committee size* is statistically insignificant; it retains its significance in specification 2 (observations for which *INEDs with audit experience 2* equals 0). Thus, we find that our baseline results hold only for MNEs with a relatively low number of audit committee members with functional expertise.

Splitting the sample implies different slopes for all the explanatory variables, but it also has the disadvantage of smaller samples. In specifications 3 to 6 of Table 9, we instead infer parameter heterogeneity using interaction terms between *Audit committee size* and *INEDs with audit experience 1* to *4*. The results are consistent with those in the first two columns, with the interaction terms entering with a negative and significant coefficient. Using the derivative of specification 3 with respect to *Audit committee size* and setting equal to 0, we find that when *INEDs with audit experience 1* approximately equals 0.5, the positive effect of *Audit committee size* on profit shifting is eliminated (and turns negative from that point and higher). We obtain very similar estimates when using *INEDs with audit experience 3*, while the two dummies also draw the same picture. The marginal effects of the equations of Table 9 with respect to *Audit committee size*, calculated at the mean value of *INEDs with audit experience*, show that the positive effect of the audit committee size on profit shifting remains.

These results are robust to a full gamut of sensitivity tests, as with those in section 4.2. We report these results in appendix Tables A9 to A11. Specifically, in Table A9 we employ different combinations of fixed effects in a similar way to Table 5, and in Table A10 we use the different versions of our profit-shifting estimates. Panels A to D in both tables show the results from the four different versions of *INEDs with audit experience*. Finally, in Table A11 we experiment with different standard error clustering. Clearly, throughout all the specifications in Tables A9 to A11, the results are in line with those of Table 9.

In Table 10, we report equivalent results for CEO duality. In the first two columns, we split the sample into boards with and without CEO duality and find that the effect of *Audit committee size* remains positive only for MNEs with CEO duality. In fact, for these MNEs, a one-standard-deviation increase in *Audit committee size* (this again equals 1.1 as in the full sample) implies a 9.75% increase in profit shifting (the equivalent in our baseline results is 7.8%). The picture is similar when using the relevant interaction term in column 3. The main term on *Audit committee size* loses its

statistical significance, which is absorbed by the interaction term.[80] This again suggests that the positive effect of audit committee size on profit shifting is only prevalent for MNEs with CEO duality. In appendix Tables A12 and A13, we provide the robustness tests on these results. In Table A12 we check the sensitivity of our findings using combinations of fixed effects and different clustering of standard errors. In Table A13 we use the different versions of our profit shifting estimates.

In summary, our results in this section are in line with hypotheses 2b and 3b, suggesting that the positive effect of audit committee size on profit shifting is lower (or completely eliminated) for MNEs with more INEDs with audit experience and without CEO duality. [81]

5. Conclusions and policy implications

We hypothesize and empirically examine whether specific corporate governance characteristics affect tax-motivated profit shifting. Our empirical strategy first identifies profit shifting from exogenous earnings shocks to parent firms in industries different than the subsidiaries' industries. Subsequently, we examine the role of corporate governance characteristics as explanatory variables of the estimated profit shifting.

Our baseline results suggest that an increase of one standard deviation in the audit committee size (approximately equal to adding 1.1 directors to the audit committee) increases profit shifting by an economically significant 7.8%. This estimate is robust to an extensive series of sensitivity tests, including different measures of audit committee size and profit shifting. Importantly, we find that increasing the ratio of INEDs with functional audit experience on audit committees and abolishing CEO duality can substantially reduce or even eliminate the positive effect of audit committee size on profit shifting.

Our results suggest that tax authorities would benefit from looking at MNEs' corporate governance more closely, especially with regard to audit committee size, members' experience, and CEO duality. Our findings point to the need for policy initiatives ranging from guidelines to regulation. As the OECD's BEPS and related projects move forward to fulfill their objectives for increased transparency and tax fairness, we provide evidence that redesigning the audit committees could hold an important role in the implementation of this initiative. Essentially, we suggest that MNEs' audit committees must mostly include INEDs with functional audit experience, and those INEDs must be fully liable for profit-shifting misconduct.

This study opens a window for future research. Looking inside the specific aspects of experience that cause less aggressive profit-shifting behavior (e.g., education, source of experience, experience specific to profit shifting, experience specific to subsidiary countries, etc.) is an important extension of our analysis if relevant data are available. Further, more detailed examinations of the effects of the remuneration committee on profit shifting, distinguishing between transfer pricing and debt shifting, and looking at

[80] The coefficient on the main term on *Duality* does not have a straightforward interpretation because the interaction term includes a continuous variable (*Audit committee size*). As it stands, the coefficient shows the effect of *Duality* when *Audit committee size* equals zero, which of course is irrelevant. At the mean value of *Audit committee size*, the effect of *Duality* becomes insignificant (as in the previous tables).

[81] We further check the robustness of our results by restricting our sample to only U.S. foreign subsidiaries located in European Union and rerunning our baseline specifications. The results are very similar qualitatively and quantitatively. Available upon request, these untabulated tests mitigate concerns for measurement error in our estimates.

networks (at the country, firm, or CEO and director level) between parents and subsidiaries are potentially fruitful avenues for future research.

Figures

Figure 1: Profit shifting flows

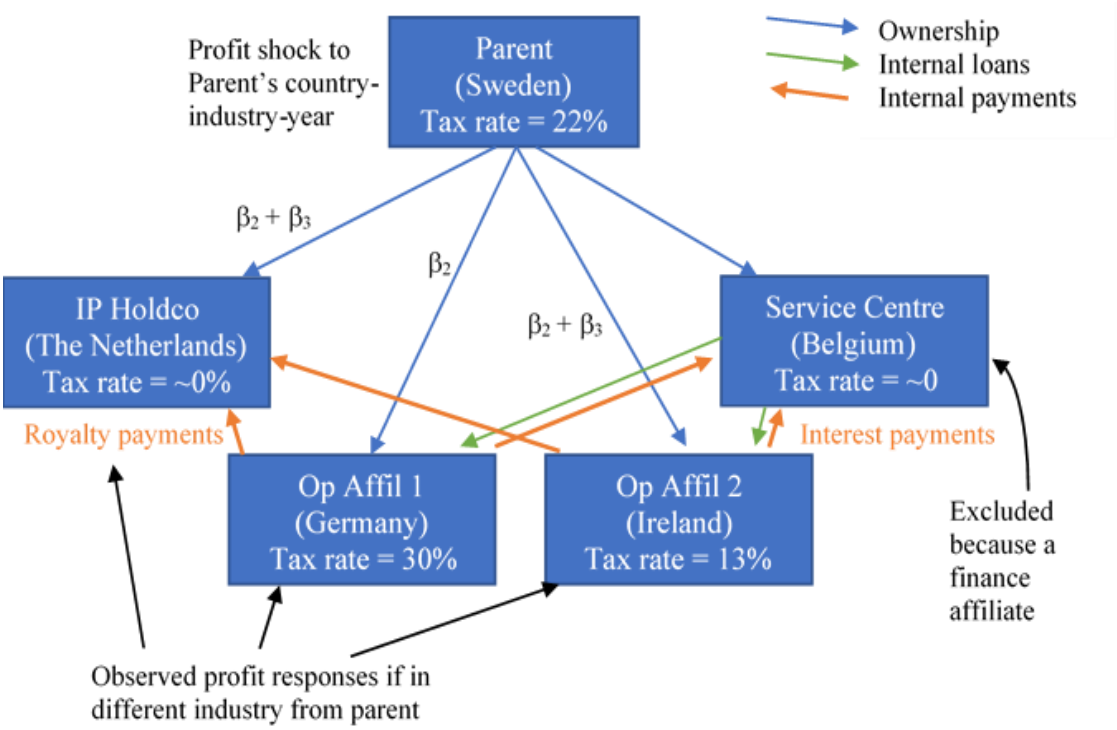


Figure 2: Densities of profit shifting measures

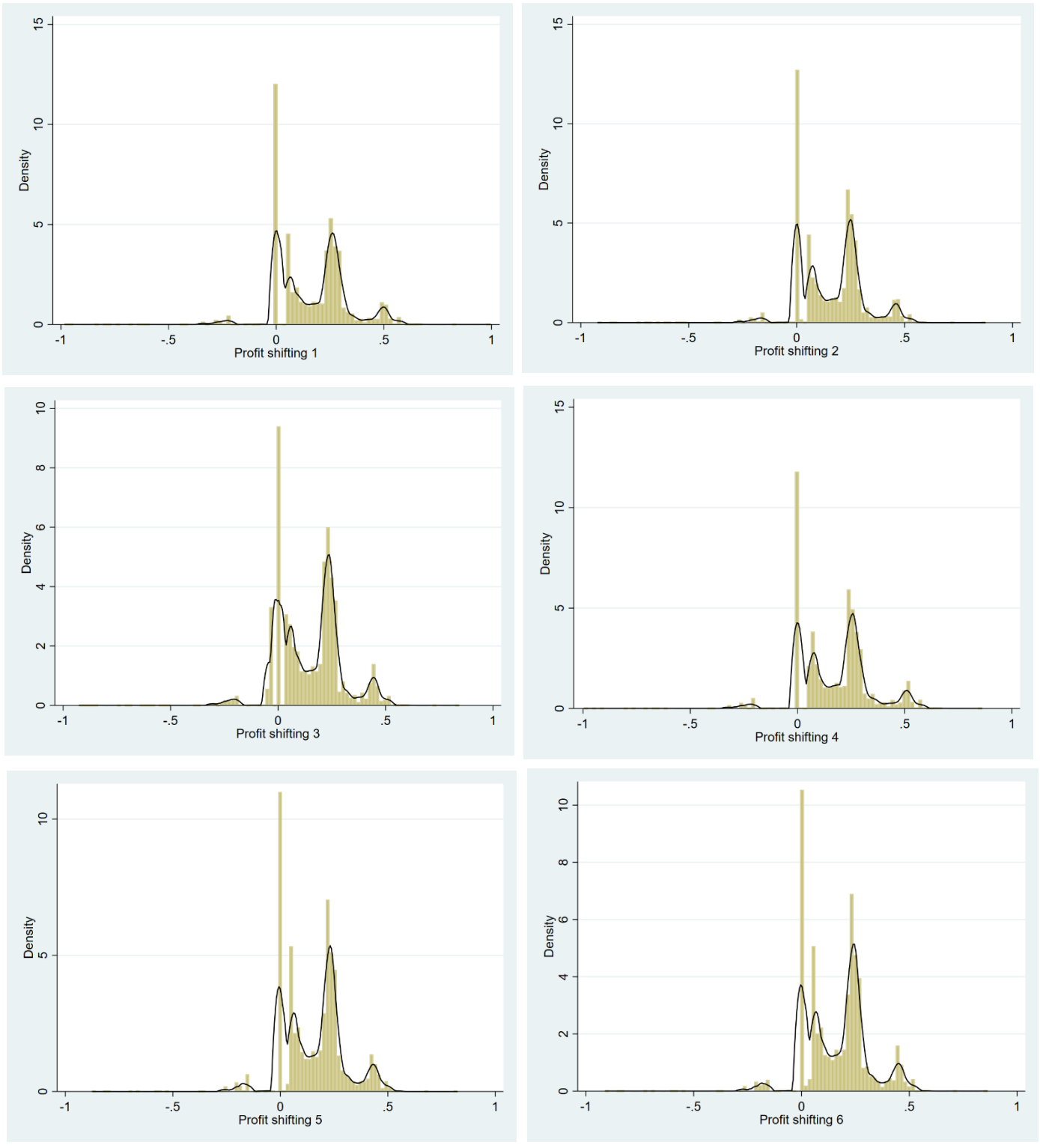
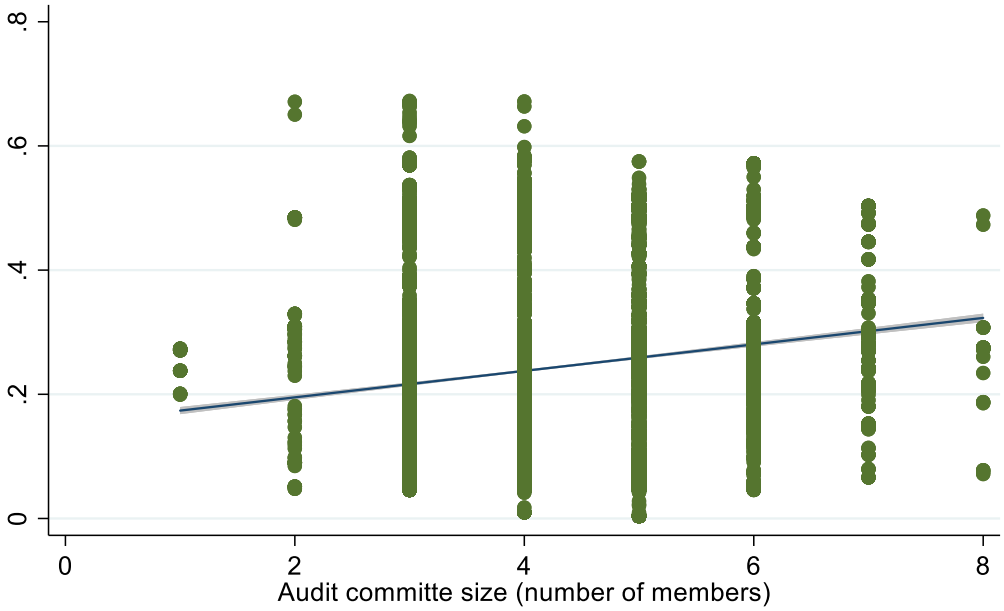


Figure 3: Audit committee size and profit shifting



Tables

Table 1: Variable definitions and sources

Name	Description	Data source
EBT	Subsidiary's pre-tax profits (log).	Orbis
Low-tax subsidiary	Dummy variable equal to one if the corporate tax rate in the subsidiary's country is lower than the one in the parent's country and zero otherwise.	OECD, KPMG
Estimated parent profits	$\tilde{\pi}_{it} = \tilde{p}_{jt}\alpha_{it}$, where $\tilde{\pi}_{it}$ denotes the parent's pre-tax & pre-shifting profit. It is constructed as the product of the asset-weighted average profitability of all firms in the same 4-digit NACE industry in the same country and the parent's total asset stock (i.e., $\tilde{p}_j = \sum_j \frac{\alpha_j}{\sum_j \alpha_j} p_j \, , i \neq j$ and $p_j = \frac{\pi_j}{\alpha_j}$).	Orbis, OECD, KPMG
Subsidiary total assets	Subsidiary's total assets (log).	Orbis
Subsidiary leverage	Subsidiary's leverage, defined as total debt/ total assets.	Orbis
Profit shifting 1	The estimates $\hat{\beta}_{3,it}$ from the estimation of equation (1) using semiparametric local linear regression. We use an Epanechnikov kernel and select the bandwidth with cross validation. The control variables include *Subsidiary total assets* and *Subsidiary leverage*.	Own estimation based on Orbis data
Profit shifting 2	The estimates $\hat{\beta}_{3,it}$ (log) from the estimation of equation (1) using semiparametric local linear regression. We use a Gaussian kernel and select the bandwidth with cross validation. The control variables include *Subsidiary total assets* and *Subsidiary leverage*.	Own estimation based on Orbis data
Profit shifting 3	The estimates $\hat{\beta}_{3,it}$ (log) from the estimation of equation (1) using semiparametric local linear regression. We use an Epanechnikov kernel and select the bandwidth with the Akaike information criterion. The control variables include *Subsidiary total assets* and *Subsidiary leverage*.	Own estimation based on Orbis data
Profit shifting 4	The estimates $\hat{\beta}_{3,it}$ (log) from the estimation of equation (1) using a fully nonparametric local linear regression. We use an Epanechnikov kernel and select the bandwidth with cross validation. The control variables include *Subsidiary total assets* and *Subsidiary leverage*.	Own estimation based on Orbis data
Profit shifting 5	The estimates $\hat{\beta}_{3,it}$ (log) from the estimation of equation (1) using semiparametric local linear regression. We use an Epanechnikov kernel and select the bandwidth with cross-validation. The model includes only the interaction term (no main terms). The control variables include *Subsidiary total assets* and *Subsidiary leverage*.	Own estimation based on Orbis data
Profit shifting 6	The estimates $\hat{\beta}_{3,it}$ (log) from the estimation of equation (1) using semiparametric local linear regression. We use an Epanechnikov kernel and select the bandwidth with cross validation. The control variables include *Subsidiary total assets*, *Subsidiary leverage*, and all the corporate governance controls included in this table.	Own estimation based on Orbis data
Audit committee size	The number of directors in the audit committee (log).	BoardEx
Audit size to board size	Audit committee size to the total number of directors.	BoardEx
INEDs with audit experience 1	The ratio of independent nonexecutive directors (INEDs) with audit experience to audit committee size.	BoardEx
INEDs with audit experience 2	Dummy variable equal to 1 if the ratio of independent nonexecutive directors (INEDs) with audit experience is in the top quartile of our sample, and zero otherwise.	BoardEx
INEDs with audit experience 3	The ratio of independent nonexecutive directors (INEDs) with audit experience to total of independent nonexecutive directors in the audit committee.	BoardEx
INEDs with audit experience 4	Dummy variable equal to 1 if the ratio of independent nonexecutive directors (INEDs) with audit experience to independent nonexecutive	BoardEx

	directors in the audit committee is in the top quartile of our sample and zero otherwise.	
Duality	Dummy variable equal to 1 if the CEO is also the chairman of the board.	BoardEx
Board size	The number of board directors.	BoardEx
Tenure	The average tenure of the board's directors.	BoardEx
Number of directorships	The total current number of directorships of the board's directors (quoted boards).	BoardEx
Network size	The average network size of the board's directors (log).	BoardEx
Board age	The average age of the board's directors.	BoardEx
Board female members	The ratio of female directors to total directors.	BoardEx
Parent total assets	Parent's total assets (log).	Orbis
Parent liquidity	Parent's cash to operating revenue.	Orbis
Parent shares	Parent's total number of shares (log).	Orbis
Parent book value	Parent's book value per share.	Orbis
Parent ROA	Parent's return on assets.	Orbis
Subsidiary labor cost	Subsidiary's cost of labor (log).	Orbis
Subsidiary intangible assets	Subsidiary's intangible assets (log).	Orbis
Subsidiary liquidity	Subsidiary's cash to operating revenue.	Orbis
Number of subsidiaries	The number of foreign subsidiaries per parent firm.	Orbis
Number of countries with foreign subsidiaries	The number of countries that parent countries own foreign subsidiaries.	Orbis

Table 2: Summary statistics

The table reports the number of observations as well as the mean, standard deviation, minimum, and maximum of the main variables used in the empirical analysis. The variables are defined in Table 1.

	N	Mean	S.d.	Min.	Max.
EBT (log)	52,228	7.833	1.864	-13.45	16.47
Low-tax subsidiary	52,228	0.763	0.425	0.000	1.000
Estimated parent profits (log)	52,228	13.30	1.961	1.251	18.56
Subsidiary total assets (log)	52,228	10.34	1.658	-6.701	17.78
Subsidiary leverage	52,228	0.876	3.113	0.000	631.9
Profit shifting 1	18,862	0.240	0.131	0.004	0.672
Profit shifting 2	18,094	0.236	0.117	0.030	0.599
Profit shifting 3	18,089	0.214	0.117	-0.006	0.607
Profit shifting 4	15,240	0.242	0.131	0.005	0.666
Profit shifting 5	12,143	0.218	0.113	0.032	0.568
Profit shifting 6	12,143	0.224	0.117	0.029	0.591
Audit committee size	18,862	4.176	1.065	1.000	8.000
Audit size to board size	18,862	0.004	0.001	0.001	0.010
INEDs with audit experience 1	18,862	0.202	0.192	0.000	1.000
INEDs with audit experience 2	18,862	0.315	0.465	0.000	1.000
INEDs with audit experience 3	18,861	0.202	0.192	0.000	1.000
INEDs with audit experience 4	18,862	0.316	0.465	0.000	1.000
Duality	18,862	0.670	0.470	0.000	1.000
Board size	18,862	10.59	2.290	5.000	22.00
Tenure	18,862	10.07	4.033	0.000	28.13
Number of directorships	18,862	22.22	8.651	3.000	74.00
Network size (log)	18,862	7.819	0.587	4.075	9.110
Board age	18,862	62.18	3.431	44.29	76.40
Board female members	18,862	0.170	0.095	0.000	0.556
Parent total assets (log)	18,862	16.17	1.723	10.30	20.02
Parent liquidity	18,862	15.25	10.83	-95.99	92.72
Parent shares (log)	18,862	12.61	1.560	6.418	16.13
Parent book value	18,862	2.821	2.825	-20.96	55.95
Parent ROA	18,862	9.086	8.198	-73.43	71.31
Subsidiary labor cost (log)	16,048	9.204	1.227	-0.057	14.70
Subsidiary intangible assets (log)	10,886	5.598	3.172	-10.04	14.87
Subsidiary liquidity	15,462	9.529	11.23	-94.36	99.72
Number of subsidiaries	18,862	14.18	22.44	1.000	256.0
Number of countries with foreign subsidiaries	18,862	6.120	10.09	1.000	110.0

Table 3: Estimation of profit shifting

The table reports coefficient estimates and standard errors (in parentheses) from the estimation of equation 1. Dependent variable is EBT and all variables are defined in Table 1. All specifications are estimated with semiparametric local linear regression, except from specification (4), which is estimated with nonparametric local linear regression. The standard errors are from a bootstrapping procedure with 200 replications. Table 1 also specifies the differences between each specification in the definitions of *Profit shifting 1* to *Profit shifting 6*. Specifically, specification 1 uses the Epanechnikov kernel and cross-validation for the bandwidth. Specification 2 uses the Gaussian kernel and cross-validation for the bandwidth. Specification 3 uses the Epanechnikov kernel and AIC for the bandwidth. Specification 4 replicates specification 1 but allows all variables to be nonparametrically estimated (as opposed to only the DID term). Specification 5 includes only the DID term, and specification 6 includes all controls, as well as the corporate governance variables. *Total observations* is the total number of observations we use in the regressions. *Effective observations* is the number of observations that survive after using the minimum of 100 observations within the sliding windows. *Positive profit shifting* is the number of observations for which our profit shifting estimates (the firm-year coefficients on the DID term) are positive. The ***, **, and * marks denote statistical significance at the 1%, 5%, and 10% level, respectively.

	(1) Profit shifting 1	(2) Profit shifting 2	(3) Profit shifting 3	(4) Profit shifting 4	(5) Profit shifting 5	(6) Profit shifting 6
Low-tax subsidiary ×	0.0286***	0.0289***	0.0321***	0.0291***	0.00347***	0.0270***
Estimated parent profits	(0.00681)	(0.00681)	(0.00682)	(0.00694)	(0.000876)	(0.00694)
Low-tax subsidiary	-0.327***	-0.334***	-0.397***	-0.256***		-0.292***
	(0.0890)	(0.0890)	(0.0892)	(0.0921)		(0.0906)
Estimated parent profits	-0.0111*	-0.0119**	-0.0128**	-0.00715		-0.0148**
	(0.00600)	(0.00599)	(0.00603)	(0.00623)		(0.00654)
Subsidiary total assets	0.871***	0.872***	0.864***	0.867***		0.869***
	(0.00365)	(0.00365)	(0.00384)	(0.00387)		(0.00370)
Subsidiary leverage	-0.0363***	-0.0367***	-0.0312***	-0.0291***		-0.0337***
	(0.00573)	(0.00573)	(0.00570)	(0.00570)		(0.00573)
Audit committee size						-0.00294
						(0.0241)
Duality						-0.142***
						(0.0126)
Board size						-0.00503**
						(0.00236)
Tenure						0.0166***
						(0.00169)
Number of directorships						0.00222**
						(0.000961)
Network size						0.0579***
						(0.00840)
Mean age of the board						-0.00838***
						(0.00183)
Ratio of female members						-0.189***
						(0.0528)
Total observations	52,228	52,228	52,228	52,228	52,228	51,246
Positive profit shifting U.S.	29,994	28,793	28,607	24,313	29,994	19,549

Table 4: Baseline results

The table reports coefficient estimates and *t*-statistics (in brackets) for all explanatory variables. The observational units are multinational subsidiaries with a foreign parent firm. All variables are defined in Table 1. The dependent variable is *Profit shifting 1*. For expositional brevity, the variable *Parent earnings per share* is divided by 100. The lower part of the table indicates the type of fixed effects used in each regression. The ***, **, and * marks denote statistical significance at the 1%, 5%, and 10% level, respectively.

	(1)	(2)	(3)
Audit committee size	0.293**	0.269**	0.303***
	[2.536]	[2.323]	[2.661]
INEDs with audit experience 1	0.210	0.184	0.171
	[1.442]	[1.231]	[1.138]
Duality	-0.053	-0.049	-0.057
	[-1.102]	[-0.998]	[-1.239]
Board size		0.012	0.004
		[0.787]	[0.246]
Tenure		-0.020	-0.021
		[-1.492]	[-1.642]
Number of directorships		0.001	0.001
		[0.068]	[0.105]
Network size		-0.316*	-0.313**
		[-1.792]	[-2.022]
Board age		-0.004	-0.005
		[-0.258]	[-0.415]
Board female members		0.167	0.142
		[0.607]	[0.515]
Parent total assets			0.194***
			[2.666]
Parent liquidity			0.008*
			[1.846]
Parent shares			-0.224**
			[-2.113]
Parent book value			-0.008
			[-0.156]
Parent ROA			-0.007**
			[-2.085]
Observations	18,862	18,862	18,862
Adjusted R-squared	0.661	0.667	0.674
S.E. clustering	Parent	Parent	Parent
Subsidiary effects	√	√	√
Year effects	√	√	√

Table 5: Additional fixed effects

The table reports coefficient estimates and *t*-statistics (in brackets) for all explanatory variables. The observational units are multinational subsidiaries with a foreign parent firm. All variables are defined in Table 1. The dependent variable is *Profit shifting 1*. For expositional brevity, the variable *Parent earnings per share* is divided by 100. The lower part of the table indicates the type of fixed effects used in each regression. The industry fixed effects are at the two-digit NACE level. The ***, **, and * marks denote statistical significance at the 1%, 5%, and 10% level, respectively.

	(1)	(2)	(3)	(4)	(6)
Audit committee size	0.302***	0.303***	0.302***	0.306***	0.306***
	[2.636]	[2.658]	[2.633]	[2.721]	[2.695]
INEDs with audit experience 1	0.167	0.171	0.167	0.166	0.162
	[1.098]	[1.137]	[1.097]	[1.122]	[1.082]
Duality	-0.056	-0.057	-0.056	-0.054	-0.053
	[-1.198]	[-1.238]	[-1.197]	[-1.209]	[-1.165]
Board size	0.005	0.004	0.005	0.003	0.004
	[0.316]	[0.246]	[0.316]	[0.189]	[0.260]
Tenure	-0.021	-0.021	-0.021	-0.020	-0.020
	[-1.635]	[-1.640]	[-1.633]	[-1.640]	[-1.630]
Number of directorships	0.001	0.001	0.001	0.002	0.001
	[0.086]	[0.104]	[0.086]	[0.195]	[0.174]
Network size	-0.317**	-0.313**	-0.317**	-0.313**	-0.316**
	[-2.034]	[-2.020]	[-2.032]	[-2.052]	[-2.063]
Board age	-0.005	-0.005	-0.005	-0.005	-0.005
	[-0.428]	[-0.415]	[-0.428]	[-0.420]	[-0.434]
Board female members	0.143	0.142	0.143	0.143	0.144
	[0.516]	[0.514]	[0.515]	[0.525]	[0.526]
Parent total assets	0.192***	0.194***	0.192***	0.198***	0.196***
	[2.612]	[2.663]	[2.609]	[2.739]	[2.681]
Parent liquidity	0.008*	0.008*	0.008*	0.008*	0.008*
	[1.835]	[1.844]	[1.833]	[1.872]	[1.858]
Parent shares	-0.221**	-0.224**	-0.221**	-0.221**	-0.218**
	[-2.070]	[-2.111]	[-2.068]	[-2.121]	[-2.076]
Parent book value	-0.006	-0.008	-0.006	-0.009	-0.008
	[-0.126]	[-0.155]	[-0.126]	[-0.189]	[-0.163]
Parent ROA	-0.007**	-0.007**	-0.007**	-0.006**	-0.006**
	[-2.080]	[-2.083]	[-2.078]	[-2.088]	[-2.080]
Observations	18,714	18,862	18,714	18,861	18,713
Adjusted R-squared	0.672	0.673	0.671	0.675	0.672
S.E. clustering	Parent	Parent	Parent	Parent	Parent
Subsidiary effects	√	√	√	√	√
Year effects	√	√	√	-	-
Sub. industry effects	√	-	√	-	√
Parent industry effects	-	√	√	-	√
Sub. country-year effects	-	-	-	√	√

Table 6: Additional fixed effects (MNE-year mean profit shifting)

The table reports coefficient estimates and *t*-statistics (in brackets) for all explanatory variables. The observational units are multinational subsidiaries with a foreign parent firm. All variables are defined in Table 1. The dependent variable is the *MNE-year* mean *Profit shifting*. For expositional brevity, the variable *Parent earnings per share* is divided by 100. The lower part of the table indicates the type of fixed effects used in each regression. The industry fixed effects are at the two-digit NACE level. The ***, **, and * marks denote statistical significance at the 1%, 5%, and 10% level, respectively.

	(1)	(2)	(3)	(4)	(5)
Audit committee size	0.303***	0.304***	0.303***	0.307***	0.307***
	[2.695]	[2.719]	[2.692]	[2.788]	[2.761]
INEDs with audit experience 1	0.130	0.127	0.130	0.122	0.125
	[0.948]	[0.949]	[0.946]	[0.925]	[0.924]
Duality	-0.048	-0.048	-0.048	-0.045	-0.045
	[-1.066]	[-1.076]	[-1.065]	[-1.038]	[-1.026]
Board size	0.004	0.003	0.004	0.002	0.003
	[0.298]	[0.215]	[0.298]	[0.157]	[0.241]
Tenure	-0.021*	-0.021*	-0.021*	-0.021*	-0.021*
	[-1.729]	[-1.748]	[-1.727]	[-1.757]	[-1.731]
Number of directorships	0.001	0.001	0.001	0.002	0.001
	[0.106]	[0.132]	[0.106]	[0.222]	[0.193]
Network size	-0.305**	-0.301**	-0.305**	-0.300**	-0.304**
	[-2.041]	[-2.027]	[-2.039]	[-2.058]	[-2.069]
Board age	-0.004	-0.004	-0.004	-0.004	-0.004
	[-0.318]	[-0.290]	[-0.318]	[-0.293]	[-0.324]
Board female members	0.121	0.117	0.121	0.116	0.120
	[0.448]	[0.436]	[0.447]	[0.438]	[0.449]
Parent total assets	0.209***	0.213***	0.209***	0.217***	0.213***
	[2.842]	[2.924]	[2.839]	[3.002]	[2.912]
Parent liquidity	0.008*	0.008*	0.008*	0.008*	0.008*
	[1.844]	[1.848]	[1.842]	[1.878]	[1.869]
Parent shares	-0.160*	-0.150	-0.160*	-0.146	-0.156*
	[-1.681]	[-1.607]	[-1.679]	[-1.584]	[-1.662]
Parent book value	-0.004	-0.005	-0.004	-0.007	-0.006
	[-0.082]	[-0.114]	[-0.082]	[-0.152]	[-0.124]
Parent ROA	-0.006**	-0.006**	-0.006**	-0.006**	-0.006**
	[-2.078]	[-2.077]	[-2.076]	[-2.078]	[-2.072]
Observations	18,714	18,862	18,714	18,861	18,713
Adjusted R-squared	0.678	0.680	0.678	0.681	0.678
S.E. clustering	Parent	Parent	Parent	Parent	Parent
Subsidiary effects	√	√	√	√	√
Year effects	√	√	√	-	-
Sub. industry effects	√	-	√	-	√
Parent industry effects	-	√	√	-	√
Sub. country-year effects	-	-	-	√	√

Table 7: Replication of baseline (with standardized audit committee size)

The table reports coefficient estimates and *t*-statistics (in brackets) for all explanatory variables. The observational units are multinational subsidiaries with a foreign parent firm. All variables are defined in Table 1. The dependent variable is *Profit shifting 1*. For expositional brevity, the variable *Parent earnings per share* is divided by 100. The lower part of the table indicates the type of fixed effects used in each regression. The industry fixed effects are at the two-digit NACE level. The ***, **, and * marks denote statistical significance at the 1%, 5%, and 10% level, respectively.

	(1)
Audit committee size/ Parent total assets	15.832**
	[2.171]
INEDs with audit experience 1	0.118
	[0.884]
Duality	-0.045
	[-0.944]
Board size	0.025*
	[1.841]
Tenure	-0.021
	[-1.560]
Number of directorships	0.000
	[0.065]
Network size	-0.276*
	[-1.750]
Board age	-0.002
	[-0.193]
Board female members	0.151
	[0.551]
Parent liquidity	0.008*
	[1.930]
Parent shares	0.111
	[0.785]
Parent book value	0.100*
	[1.883]
Parent ROA	-0.008***
	[-2.924]
Observations	18,713
Adjusted R-squared	0.669
Subsidiary effects	√
Sub. industry effects	√
Parent industry effects	√
Sub. country-year effects	√

Table 8: GMM regressions

The table reports coefficient estimates and *t*-statistics (in brackets) for all explanatory variables. The observational units are multinational subsidiaries with a foreign parent firm. All variables are defined in Table 1. The dependent variable is *Profit shifting 1*. Panel A reports the first-stage results on the instrumental variable and Panel B reports the second-stage results. The lower part of the table reports the Cragg-Donald and Kleibergen-Paap F-statistics for weak identification, as well as the Stock-Yogo critical value, which equals 16.85. It also reports the Hansen test for overidentifying restrictions (p-value). The lower part of the table indicates the type of fixed effects used in each regression. For expositional brevity, the variable *Parent earnings per share* is divided by 100. The ***, **, and * marks denote statistical significance at the 1%, 5%, and 10% level, respectively.

	(1)	(2)	(3)
	Panel A: First stage results		
Audit committee deaths & illnesses	-0.167***	-0.167***	-0.166***
	[-9.13]	[-9.07]	[-9.34]
	Panel B: Second stage results		
Audit committee size	1.052**	1.045**	1.078**
	(2.404)	(2.376)	(2.433)
INEDs with audit experience 1	0.408**	0.405**	0.405**
	(2.192)	(2.168)	(2.181)
Duality	0.007	0.011	0.010
	(0.147)	(0.219)	(0.208)
Board size	-0.060*	-0.059	-0.061*
	(-1.663)	(-1.622)	(-1.687)
Tenure	-0.024*	-0.024*	-0.024*
	(-1.894)	(-1.872)	(-1.929)
Number of directorships	0.006	0.005	0.006
	(0.668)	(0.636)	(0.752)
Network size	-0.265**	-0.268**	-0.274**
	(-2.146)	(-2.167)	(-2.212)
Board age	0.004	0.004	0.003
	(0.303)	(0.290)	(0.259)
Board female members	-0.379	-0.378	-0.408
	(-1.021)	(-1.013)	(-1.099)
Parent total assets	0.351***	0.347***	0.350***
	(3.160)	(3.110)	(3.172)
Parent liquidity	0.006	0.006	0.006*
	(1.587)	(1.569)	(1.679)
Parent shares	-0.223	-0.211	-0.211
	(-1.304)	(-1.232)	(-1.236)
Parent book value	0.059	0.062	0.062
	(0.941)	(0.992)	(0.975)
Parent ROA	-0.007*	-0.007*	-0.007*
	(-1.823)	(-1.813)	(-1.961)
Observations	14,273	14,165	14,124
Cragg-Donald	182.2	180.1	175.0
Kleibergen-Paap	25.6	25.3	26.6
Hansen (-p-value)	0.66	0.66	0.64
Subsidiary effects	√	√	√
Year effects	√	√	-
Sub. industry effects	-	√	√
Parent industry effects	-	√	√
Sub. country-year effects	-	-	√
Parent country-year effects	-	-	√

Table 9: Heterogeneity of the effect of audit committee size due to experience in audit committees

The table reports coefficient estimates and *t*-statistics (in brackets) for all explanatory variables. The observational units are multinational subsidiaries with a foreign parent firm. All variables are defined in Table 1. The dependent variable is *Profit shifting 1* and all specifications include the controls in Table 5. In specification 1, we limit our sample to that with *INEDs with audit experience 2* equal to 1. In specification 2, we limit our sample to that with *INEDs with audit experience 2* equal to 0. Specifications 3 to 6 use *INEDs with audit experience 1* to *INEDs with audit experience 4*, respectively. The lower part of the table indicates the type of fixed effects used in each regression. The industry fixed effects are at the two-digit NACE level. The ***, **, and * marks denote statistical significance at the 1%, 5%, and 10% level, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
Audit committee size	-0.063	0.500***	0.483***	0.436***	0.483***	0.436***
	[-0.438]	[3.013]	[2.955]	[2.995]	[2.954]	[2.992]
INEDs with audit experience			1.344***	0.552**	1.344***	0.550**
			[2.672]	[2.564]	[2.676]	[2.555]
Audit committee size × INEDs			-0.934**	-0.416***	-0.933**	-0.414***
with audit experience			[-2.395]	[-2.619]	[-2.399]	[-2.607]
Duality	-0.046	-0.090	-0.053	-0.058	-0.053	-0.058
	[-0.822]	[-1.572]	[-1.199]	[-1.281]	[-1.206]	[-1.280]
Network size	-0.306***	-0.416*	-0.324**	-0.313**	-0.324**	-0.313**
	[-2.961]	[-1.751]	[-2.110]	[-2.068]	[-2.108]	[-2.068]
Marginal effect at mean of			0.294***	0.305***	0.294***	0.305***
INEDs with audit experience			(2.644)	(2.692)	(2.645)	(2.696)
Observations	5,538	12,578	18,713	18,713	18,712	18,713
Adjusted R-squared	0.761	0.663	0.673	0.673	0.673	0.673
S.E. clustering	Parent	Parent	Parent	Parent	Parent	Parent
Subsidiary effects	√	√	√	√	√	√
Sub. industry effects	√	√	√	√	√	√
Parent industry effects	√	√	√	√	√	√
Sub. country-year effects	√	√	√	√	√	√

Table 10: Heterogeneity of the effect of audit committee size due to CEO duality

The table reports coefficient estimates and *t*-statistics (in brackets) for all explanatory variables. The observational units are multinational subsidiaries with a foreign parent firm. All variables are defined in Table 1. The dependent variable is *Profit shifting 1* and all specifications include the controls in Table 5. In specification 1, we limit our sample to that with *Duality* equal to 1. In specification 2, we limit our sample to that with *Duality* equal to 0. The lower part of the table indicates the type of fixed effects used in each regression. The industry fixed effects are at the two-digit NACE level. The ***, **, and * marks denote statistical significance at the 1%, 5%, and 10% level, respectively.

	(1)	(2)	(3)
Audit committee size	0.366**	0.082	0.147
	[2.272]	[0.701]	[1.353]
Duality			-0.398**
			[-2.067]
Audit committee size × Duality			0.245*
			[1.847]
INEDs with audit experience 1	0.039	-0.041	0.156
	[0.183]	[-0.319]	[1.053]
Network size	-0.585**	-0.049	-0.310**
	[-2.050]	[-0.574]	[-2.044]
Observations	12,374	5,898	18,713
Adjusted R-squared	0.667	0.721	0.673
S.E. clustering	Parent	Parent	Parent
Subsidiary effects	√	√	√
Sub. industry effects	√	√	√
Parent industry effects	√	√	√
Sub. country-year effects	√	√	√

Appendix

Corporate Governance and Profit Shifting: The Important Role of the Audit Committee

This appendix, intended for online use only, includes more information on our sample and additional robustness tests. The first two tables include information for the countries included in the two-stages of our analysis (i.e., estimation of profit shifting and analysis of profit shifting into its determinants). Table A3 provides further descriptive statistics. Table A4 is a correlations matrix for the main explanatory variables of the second-stage analysis. Tables A5 onward provide robustness tests on the effect of corporate governance variables on profit shifting.

i. Technical details for the nonparametric estimation

We estimate equation (1) using semiparametric or nonparametric local linear regression. The local linear regression is a moving average regression that builds on classical OLS but estimates the regression line within localized subsets of the data (sliding windows). Consider the local linear model as $Y_{it} = \mu(x_{it}) + \varepsilon_{it}$, where *x* are predictor variables and *Y* is the response variable. We estimate the unknown function $\mu(x)$ by fitting a polynomial model within a sliding window (neighborhood of *x*). Differently phrased, the estimate of μ at *x* uses all observations whose x_{it} values are closest to *x*. Each point in this neighborhood is weighted according to its distance from *x*. Points close to *x* have large weights, and points far from *x* have small weights. The next sliding window is the one around *x'* (the observation closest to *x*), which includes *x* along with other observations in the equivalent neighborhood of *x'* but leaves out the most distant observation to *x'* (that is included in the equivalent window of *x*) and so on. The number of windows equals the number of observations.

Within the sliding windows the estimation assumptions are the same with OLS (errors independent and identically distributed with zero mean and finite variance, etc.). We make no strong assumptions about μ globally, but locally around *x* we assume that μ can be well approximated. By using these observation-specific sliding windows, we obtain observation-specific $\hat{\beta}_{3,it}$.

Formally, for the observation *x*, define a bandwidth *h*(*x*) and the sliding window (*x*-*h*(*x*), *x*+*h*(*x*)). The observations are weighted using $w_i(x) = W(^{x_i - x}/_{h(x)})$, where W is a weight function that assigns the larger weight for observations close to *x*.

Given the weight function, two important issues in the estimation are the choice of the kernel (the shape of the weighting function) and the optimal bandwidth (the smaller the bandwidth is, the larger the weight assigned to points between *x* and x_i). We mainly use an Epanechnikov kernel (where $W(x) = 1 - x^2, |x| < 1$), but we also experiment with Gaussian, triangle, and biweight kernels (the results do not change significantly).

In turn, there are many alternatives for the derivation of optimal bandwidth (e.g., Loader, 1999), and we choose the one that minimizes the integrated mean squared error of the prediction (cross-validation method). We find that our results are not sensitive to different methods of bandwidth selection (e.g., the nearest neighbor bandwidth).

A third important issue is that this class of models suffers from the so-called curse of dimensionality when the estimation encounters regions with small density in observations.[82] To avoid this problem, we impose that sliding windows must have at least 100 observations; we drop the rest of the observations from our analysis (essentially this is equivalent to dropping outliers).[83]

[82] This essentially means a small number of observations within the sliding window. As in any parametric regression with a small number of observations, this implies less precise estimates.

[83] We find that increasing the minimum number of observations to 150 or 200 does not affect our results but reduces the number of estimates $\hat{\beta}_{3,it}$ (and thus the availability of observations for the rest of our empirical analysis).

ii. Tables

Table A1: Country-specific information by parent and subsidiary country

The table includes two panels. Panel A reports the number of parent firms by parent country, the percentage of each country's parent firms to the total number of parents, and the mean profit shifting by parent country (i.e., *Profit Shifting 1*). Panel B reports the number of foreign subsidiaries by subsidiary country, the percentage of each country's foreign subsidiaries to the total foreign subsidiaries, and the mean profit shifting by subsidiary country (i.e., *Profit Shifting 1*).

Panel A: 18 Parent countries

Country	Parents	Parents %	Profit shifting	Country	Parents	Parents %	Profit shifting
China	5	0.53%	0.032	Luxembourg	2	0.21%	0.067
Denmark	10	1.06%	0.033	Netherlands	23	2.45%	0.069
Finland	20	2.13%	0.067	Norway	16	1.70%	0.121
France	67	7.13%	0.205	Poland	15	1.60%	0.032
Germany	57	6.06%	0.134	Spain	24	2.55%	0.135
Greece	4	0.43%	0.113	Sweden	48	5.11%	0.071
Ireland	5	0.53%	0	Turkey	1	0.11%	0.072
Israel	5	0.53%	0.235	United Kingdom	177	18.83%	0.057
Italy	11	1.17%	0.162	United States	444	47.23%	0.219
					940	**100.00%**	

Panel B: 59 Subsidiary countries

Country	Subsidiaries	Subsidiaries %	Profit shifting	Country	Subsidiaries	Subsidiaries %	Profit shifting
Albania	2	0.03%	0.333	Latvia	35	0.53%	0.245
Australia	213	3.23%	0.131	Lithuania	14	0.21%	0.239
Austria	68	1.03%	0.166	Luxembourg	33	0.50%	0.136
Bangladesh	1	0.02%	0.064	Macedonia(F.)	1	0.02%	0.120
Belgium	416	6.31%	0.099	Malaysia	19	0.29%	0.230
Bosnia&Herzeg.	1	0.02%	0.502	Malta	9	0.14%	0.113
Botswana	1	0.02%	0.090	Mexico	7	0.11%	0.010
Brazil	17	0.26%	0.030	Netherlands	74	1.12%	0.165
Bulgaria	50	0.76%	0.271	Nigeria	4	0.06%	0.000
Canada	1	0.02%	0.133	Norway	161	2.44%	0.093
Chile	4	0.06%	0.365	Pakistan	3	0.05%	0.040
China	396	6.00%	0.171	Panama	1	0.02%	0.367
Colombia	9	0.14%	0.198	Poland	229	3.47%	0.218
Croatia	27	0.41%	0.235	Portugal	121	1.83%	0.206
Czech Republic	231	3.50%	0.227	Korea (Rep)	102	1.55%	0.189
Denmark	104	1.58%	0.134	Romania	98	1.49%	0.257
Estonia	27	0.41%	0.158	Russian Feder.	249	3.78%	0.195
Finland	60	0.91%	0.179	Serbia	24	0.36%	0.284
France	686	10.40%	0.131	Slovakia	75	1.14%	0.220
Germany	861	13.05%	0.154	Slovenia	16	0.24%	0.280
Ghana	1	0.02%	0.125	South Africa	1	0.02%	0.000
Greece	58	0.88%	0.225	Spain	359	5.44%	0.147
Hungary	83	1.26%	0.198	Sweden	211	3.20%	0.159
Iceland	7	0.11%	0.197	Turkey	5	0.08%	0.196
India	13	0.20%	0.031	Ukraine	23	0.35%	0.245
Indonesia	1	0.02%	0.092	U.K.	806	12.22%	0.192
Ireland	114	1.73%	0.215	United States	7	0.11%	0.000
Italy	415	6.29%	0.133	Uruguay	1	0.02%	0.503
Japan	28	0.42%	0.121	Vietnam	12	0.18%	0.152
Kenya	1	0.02%	0.000	**Total:**	**6,596**	**100.00%**	

Table A2: Information on the location of U.S. subsidiaries in our sample

The table reports the number of unique U.S. subsidiaries by country, as well as the ratio of the number of subsidiaries in a country to the total number of subsidiaries by U.S. parents (e.g., Italy has 174/3,316=5.25% of the U.S. subsidiaries of our sample).

Country	Number	Percentage	Country	Number	Percentage
Australia	102	3.08%	Japan	20	0.60%
Austria	62	1.87%	Netherlands	178	5.37%
Belgium	148	4.46%	Norway	43	1.30%
China	219	6.60%	Poland	73	2.20%
Czech Republic	79	2.38%	Portugal	39	1.18%
Denmark	53	1.60%	Republic of Korea	56	1.69%
Finland	25	0.75%	Romania	50	1.51%
France	372	11.22%	Russian Federation	85	2.56%
Germany	409	12.33%	Slovakia	24	0.72%
Greece	25	0.75%	Spain	156	4.70%
Hungary	41	1.24%	Sweden	93	2.80%
Ireland	91	2.74%	United Kingdom	699	21.08%
Italy	174	5.25%	**Total**	**3,316**	**100.00%**

Table A3: Summary statistics by audit committee group size

The table reports the number of observations, the mean of small (1-2 members), medium (3-5 members) and large (6-8 members) audit committees as well as the t-test for the differences of the main variables used in the empirical analysis. The variables are defined in Table 1.

	Small size: Audit committees with 1-2 members		Medium size: Audit committees with 3-5 members		Large size: Audit committees with 6-8 members		Differences Medium - Small		Differences Large - Medium	
	N	Mean	N	Mean	N	Mean	Mean	Signif.	Mean	Signif.
EBT (log)	129	8.262	16,450	7.965	2,283	8.088	-0.297	**	0.123	***
Estimated parent profits (log)	129	13.34	16,450	13.37	2,283	14.29	0.031		0.918	***
Subsidiary total assets (log)	129	10.64	16,429	10.49	2,279	10.61	-0.153		0.126	***
Subsidiary leverage	102	0.740	12,901	0.929	1,880	0.837	0.189		-0.092	***
Profit shifting 1	129	0.266	16,450	0.234	2,283	0.278	-0.032	***	0.044	***
Profit shifting 2	122	0.261	15,788	0.231	2,184	0.272	-0.029	***	0.041	***
Profit shifting 3	127	0.240	15,771	0.209	2,191	0.249	-0.032	***	0.041	***
Profit shifting 4	111	0.267	13,268	0.236	1,861	0.279	-0.031	***	0.043	***
Profit shifting 5	92	0.235	10,543	0.212	1,508	0.261	-0.023	**	0.049	***
Profit shifting 6	92	0.244	10,543	0.218	1,508	0.267	-0.025	**	0.049	***
Audit committee size	129	1.806	16,450	3.915	2,283	6.194	2.109	***	2.279	***
Audit size to board size	129	0.003	16,450	0.004	2,283	0.005	0.001	***	0.001	***
INEDs with audit experience 1	129	0.128	16,450	0.201	2,283	0.214	0.073	***	0.013	***
INEDs with audit experience 2	129	0.256	16,450	0.322	2,283	0.270	0.066	*	-0.052	***
INEDs with audit experience 3	129	0.128	16,450	0.201	2,282	0.215	0.073	***	0.013	***
INEDs with audit experience 4	129	0.256	16,450	0.322	2,283	0.270	0.067	*	-0.052	***
Duality	129	0.364	16,450	0.647	2,283	0.851	0.282	***	0.204	***
Board size	129	7.202	16,450	10.33	2,283	12.64	3.130	***	2.313	***
Tenure	129	7.785	16,450	10.21	2,283	9.177	2.422	***	-1.030	***
Number of directorships	129	14.53	16,450	21.47	2,283	28.07	6.942	***	6.603	***
Network size (log)	129	6.810	16,450	7.797	2,283	8.037	0.987	***	0.240	***
Board age	129	59.59	16,450	62.03	2,283	63.37	2.444	***	1.337	***
Board female members	129	0.119	16,450	0.164	2,283	0.215	0.045	***	0.051	***
Parent total assets (log)	129	16.15	16,450	16.02	2,283	17.22	-0.128		1.202	***
Parent liquidity	129	18.89	16,450	15.43	2,283	13.78	-3.461	***	-1.646	***
Parent shares (log)	129	12.89	16,450	12.53	2,283	13.17	-0.366	***	0.642	***
Parent book value	129	1.830	16,450	2.617	2,283	4.349	0.787	***	1.732	***
Parent ROA	129	9.626	16,450	8.978	2,283	9.835	-0.647		0.857	***

Subsidiary labor cost (log)	111	9.411	13,996	9.206	1,941	9.180	-0.205	**	-0.026	
Subsidiary intangible assets	53	5.840	9,417	5.563	1,416	5.827	-0.278		0.265	***
Subsidiary liquidity	112	10.50	13,475	9.384	1,875	10.51	-1.118		1.131	***

Table A4: Variables' bilateral relationships

Panel A: Correlation Matrix

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1. Profit shifting 1	1.000															
2. Audit committee size	0.179*	1.000														
3. INEDs audit exper.1	0.017	-0.092*	1.000													
4. Duality	0.147*	0.199*	-0.212*	1.000												
5. Board size	0.276*	0.531*	-0.039*	0.279*	1.000											
6. Tenure	-0.031*	-0.082*	-0.137*	0.123*	-0.017	1.000										
7. # of directorships	0.299*	0.427*	-0.097*	0.210*	0.698*	-0.123*	1.000									
8. Network size	0.387*	0.234*	0.028*	0.119*	0.466*	-0.159*	0.552*	1.000								
9. Board age	0.055*	0.211*	-0.254*	0.201*	0.146*	0.389*	0.094*	-0.050*	1.000							
10. Board females	0.246*	0.273*	0.013	0.159*	0.343*	-0.046*	0.423*	0.388*	0.006	1.000						
11. Parent total assets	0.487*	0.352*	-0.006	0.238*	0.647*	0.015	0.645*	0.713*	0.139*	0.428*	1.000					
12. Par. earnings/share	0.183*	0.233*	0.030*	0.113*	0.251*	0.075*	0.235*	0.215*	0.191*	0.169*	0.355*	1.000				
13. Parent liquidity	0.354*	0.002	0.037*	0.023*	0.176*	0.076*	0.164*	0.310*	0.032*	0.145*	0.394*	0.305*	1.000			
14. Parent shares	0.493*	0.252*	0.026*	0.196*	0.564*	0.020*	0.548*	0.722*	0.054*	0.356*	0.895*	0.133*	0.479*	1.000		
15. Parent book value	0.099*	0.122*	-0.032*	0.064*	0.168*	0.076*	0.170*	0.044*	0.101*	0.137*	0.271*	0.447*	0.070*	-0.075*	1.000	
16. Parent ROA	0.097*	0.087*	0.043*	0.082*	0.078*	0.188*	0.007	0.112*	0.071*	0.029*	0.138*	0.478*	0.504*	0.212*	-0.023*	1.000

Panel B: VIF test for multicollinearity among the corporate governance

Variable	VIF
Board size	2.65
Number of directorships	2.54
Network size	2.36
Audit committee size	1.56
Board age	1.41
Tenure	1.36
Board female members	1.33
Duality	1.19
INEDs with audit experience 1	1.13
Mean VIF	1.73

Table A5: Alternative measures of profit shifting

The table reports coefficient estimates and *t*-statistics (in brackets) for all explanatory variables. The observational units are multinational subsidiaries with a foreign parent firm. All variables are defined in Table 1. The dependent variable is shown in the first line of the table, with the different profit-shifting measure. For expositional brevity, the variable *Parent earnings per share* is divided by 100. The lower part of the table indicates the type of fixed effects used in each regression. The industry fixed effects are at the two-digit NACE level. The ***, **, and * marks denote statistical significance at the 1%, 5%, and 10% level, respectively.

	(1)	(2)	(3)	(4)	(5)
	Profit shifting 2	Profit shifting 3	Profit shifting 4	Profit shifting 5	Profit shifting 6
Audit committee size	0.221***	0.269***	0.289**	0.322***	0.314***
	[2.715]	[2.799]	[2.550]	[3.428]	[3.247]
INEDs with audit experience 1	0.146	0.193	0.152	0.173	0.173
	[1.178]	[1.343]	[1.035]	[1.253]	[1.235]
Duality	-0.040	-0.045	-0.042	-0.040	-0.040
	[-1.096]	[-0.995]	[-1.037]	[-0.998]	[-0.986]
Board size	0.003	0.004	-0.000	0.000	0.000
	[0.246]	[0.291]	[-0.005]	[0.027]	[0.008]
Tenure	-0.014	-0.017	-0.017	-0.012	-0.013
	[-1.544]	[-1.608]	[-1.380]	[-1.245]	[-1.270]
Number of directorships	-0.001	-0.002	0.002	0.000	0.001
	[-0.144]	[-0.304]	[0.281]	[0.082]	[0.113]
Network size	-0.219**	-0.253**	-0.308**	-0.218**	-0.227**
	[-2.419]	[-2.458]	[-2.125]	[-2.396]	[-2.364]
Board age	-0.002	0.001	-0.007	-0.003	-0.003
	[-0.197]	[0.052]	[-0.619]	[-0.305]	[-0.322]
Board female members	0.147	0.211	0.123	0.208	0.211
	[0.663]	[0.801]	[0.474]	[0.870]	[0.862]
Parent total assets	0.204***	0.230***	0.201***	0.209***	0.210***
	[3.811]	[3.601]	[2.944]	[3.366]	[3.300]
Parent liquidity	0.006**	0.006**	0.008**	0.005**	0.006**
	[2.363]	[2.292]	[2.017]	[2.373]	[2.324]
Parent shares	-0.174**	-0.228**	-0.208**	-0.227**	-0.230**
	[-2.001]	[-1.998]	[-2.216]	[-2.192]	[-2.189]
Parent book value	-0.016	-0.016	-0.014	-0.015	-0.015
	[-0.391]	[-0.327]	[-0.286]	[-0.316]	[-0.306]
Parent ROA	-0.004**	-0.005**	-0.006**	-0.005**	-0.005**
	[-2.048]	[-2.075]	[-2.129]	[-2.330]	[-2.329]
Observations	17,791	17,691	14,971	11,880	11,880
Adjusted R-squared	0.705	0.683	0.677	0.709	0.705
S.E. clustering	Parent	Parent	Parent	Parent	Parent
Subsidiary effects	√	√	√	√	√
Sub. industry effects	√	√	√	√	√
Parent industry effects	√	√	√	√	√
Sub. country-year effects	√	√	√	√	√

Table A6: Replacing *Audit committee size* with *Audit to board size*

This table replicates Table 4 for *Audit to board size* instead of *Audit committee size*. The table reports coefficient estimates and *t*-statistics (in brackets) for all explanatory variables. The observational units are multinational subsidiaries with a foreign parent firm. All variables are defined in Table 1. The dependent variable is *Profit shifting 1*. For expositional brevity, the variable *Parent earnings per share* is divided by 100. The lower part of the table indicates the type of fixed effects used in each regression. The ***, **, and * marks denote statistical significance at the 1%, 5%, and 10% level, respectively.

	(1)	(2)	(3)
Audit size to board size	44.259*	64.012**	71.036**
	[1.819]	[2.177]	[2.457]
INEDs with audit experience 1	0.201	0.165	0.152
	[1.334]	[1.067]	[0.981]
Duality	-0.052	-0.045	-0.054
	[-1.076]	[-0.910]	[-1.162]
Board size		0.035**	0.030**
		[2.426]	[1.995]
Tenure		-0.021	-0.022*
		[-1.546]	[-1.691]
Number of directorships		0.001	0.001
		[0.102]	[0.122]
Network size		-0.323*	-0.317*
		[-1.736]	[-1.947]
Board age		-0.003	-0.005
		[-0.237]	[-0.390]
Board female members		0.174	0.139
		[0.624]	[0.494]
Parent total assets			0.206***
			[2.815]
Parent liquidity			0.008*
			[1.824]
Parent shares			-0.234**
			[-2.164]
Parent book value			-0.018
			[-0.368]
Parent ROA			-0.006**
			[-2.028]
Observations	18,719	18,719	18,719
Adjusted R-squared	0.659	0.667	0.674
S.E. clustering	Parent	Parent	Parent
Subsidiary effects	√	√	√
Year effects	√	√	√

Table A7: Replacing *Audit committee size* with *Audit to board size*: Additional results

The first five columns of this table replicate Table 5 for *Audit to board size* instead of *Audit committee size*. Similarly, the last five columns replicate Table A5. We omit the results on control variables. The table reports coefficient estimates and *t*-statistics (in brackets) for all explanatory variables. The observational units are multinational subsidiaries with a foreign parent firm. All variables are defined in Table 1. The dependent variable is shown in the first line of the table, with the different profit-shifting measure. The lower part of the table indicates the type of fixed effects used in each regression. The industry fixed effects are at the two-digit NACE level. The ***, **, and * marks denote statistical significance at the 1%, 5%, and 10% level, respectively.

	(1) Profit shifting 1	(2) Profit shifting 1	(3) Profit shifting 1	(4) Profit shifting 1	(5) Profit shifting 1	(6) Profit shifting 2	(7) Profit shifting 3	(8) Profit shifting 4	(9) Profit shifting 5	(10) Profit shifting 6
Audit size to board size	70.996**	71.036**	70.996**	71.875**	71.909**	51.021**	62.358***	67.706**	75.672***	73.688***
	[2.436]	[2.454]	[2.433]	[2.531]	[2.510]	[2.556]	[2.625]	[2.467]	[3.248]	[3.071]
INEDs with audit experience 1	0.148	0.152	0.148	0.146	0.142	0.140	0.186	0.145	0.166	0.167
	[0.943]	[0.980]	[0.942]	[0.956]	[0.918]	[1.132]	[1.296]	[0.983]	[1.208]	[1.191]
Duality	-0.053	-0.054	-0.053	-0.051	-0.050	-0.041	-0.046	-0.042	-0.041	-0.041
	[-1.119]	[-1.161]	[-1.118]	[-1.131]	[-1.085]	[-1.105]	[-1.006]	[-1.055]	[-1.019]	[-1.006]
Network size	-0.321*	-0.317*	-0.321*	-0.318**	-0.322**	-0.215**	-0.247**	-0.302**	-0.213**	-0.221**
	[-1.960]	[-1.945]	[-1.958]	[-1.979]	[-1.991]	[-2.397]	[-2.433]	[-2.111]	[-2.368]	[-2.339]
Observations	18,571	18,719	18,571	18,718	18,570	17,791	17,691	14,971	11,880	11,880
Adjusted R-squared	0.672	0.673	0.671	0.675	0.672	0.705	0.683	0.677	0.709	0.705
S.E. clustering	Parent	Parent	Parent	Parent	Parent	Parent	Parent	Parent	Parent	Parent
Subsidiary effects	√	√	√	√	√	√	√	√	√	√
Year effects	√	√	√	-	-	-	-	-	-	-
Sub. industry effects	√	-	√	-	√	√	√	√	√	√
Parent industry effects	-	√	√	-	√	√	√	√	√	√
Sub. country-year effects	-	-	-	√	√	√	√	√	√	√

Table A8: Sensitivity to subsidiary controls, parent fixed effects, and standard error clustering

The table reports coefficient estimates and *t*-statistics (in brackets) for all explanatory variables. The observational units are multinational subsidiaries with a foreign parent firm. All variables are defined in Table 1. The dependent variable is *Profit shifting 1*. For expositional brevity, the variable *Parent earnings per share* is divided by 100. The lower part of the table indicates the type of fixed effects used in each regression. The ***, **, and * mark denote statistical significance at the 1%, 5%, and 10% level, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
Audit committee size	0.317***	0.310***	0.310**	0.310**	0.311**	0.304***
	[2.763]	[2.645]	[2.826]	[3.048]	[2.192]	[2.657]
INEDs with audit experience 1	0.155	0.150	0.150	0.150	0.085	0.161
	[0.998]	[0.972]	[0.994]	[1.010]	[0.781]	[1.072]
Duality	-0.063	-0.049	-0.049	-0.049	0.033	-0.052
	[-1.377]	[-1.075]	[-1.113]	[-1.170]	[0.645]	[-1.138]
Board size	0.001	0.003	0.003	0.003	-0.030	0.004
	[0.086]	[0.234]	[0.221]	[0.226]	[-1.498]	[0.279]
Tenure	-0.019	-0.022*	-0.022	-0.022	0.000	-0.021*
	[-1.553]	[-1.698]	[-1.557]	[-1.611]	[0.016]	[-1.662]
Number of directorships	0.001	0.001	0.001	0.001	-0.000	0.001
	[0.157]	[0.175]	[0.163]	[0.166]	[-0.066]	[0.173]
Network size	-0.326**	-0.328**	-0.328*	-0.328*	0.032	-0.315**
	[-2.257]	[-2.008]	[-1.921]	[-1.985]	[0.494]	[-2.044]
Board age	-0.005	-0.005	-0.005	-0.005	0.007	-0.005
	[-0.397]	[-0.373]	[-0.397]	[-0.397]	[0.770]	[-0.431]
Board female members	0.228	0.127	0.127	0.127	0.128	0.140
	[0.791]	[0.456]	[0.396]	[0.397]	[0.483]	[0.514]
Subsidiary total assets	-0.000					
	[-0.023]					
Subsidiary leverage	-0.003					
	[-0.953]					
Subsidiary liquidity	-0.000					
	[-0.137]					
Subsidiary intangible fixed assets	-0.000					
	[-0.135]					
Parent total assets	0.234***	0.211***	0.211**	0.211**	0.096	0.197***
	[3.197]	[2.861]	[3.002]	[3.156]	[1.573]	[2.687]
Parent liquidity	0.007*	0.008*	0.008	0.008	0.008**	0.008*
	[1.776]	[1.859]	[1.777]	[1.791]	[2.140]	[1.839]
Parent shares	-0.252**	-0.228**	-0.228***	-0.228**	0.118	-0.221**
	[-2.277]	[-2.128]	[-3.250]	[-3.095]	[1.646]	[-2.103]
Parent book value	-0.018	-0.019	-0.019	-0.019	0.087	-0.010
	[-0.323]	[-0.384]	[-0.340]	[-0.350]	[1.607]	[-0.188]
Parent ROA	-0.004	-0.006**	-0.006	-0.006	-0.006**	-0.006**
	[-1.334]	[-2.038]	[-1.610]	[-1.587]	[-2.000]	[-2.066]
Number of subsidiaries					-0.001	
					[-0.647]	
Number of countries with foreign subsidiaries						0.001
						[0.563]
Observations	12,075	18,570	18,570	18,570		
Adjusted R-squared	0.689	0.662	0.672	0.672		
S.E. clustering	Parent	Parent	Parent & year	Parent & year & subsidiary country	Parent	Parent
Subsidiary effects	√	√	√	√	-	√
Parent effects	-	√	-	-	-	-
Sub. industry effects	√	√	√	√	√	√
Parent industry effects	√	√	√	√	√	√
Sub. country-year effects	√	√	√	√	√	√

Table A9: Cross-sectional heterogeneity with additional fixed effects

The table reports coefficient estimates and *t*-statistics (in brackets) for all explanatory variables. The observational units are multinational subsidiaries with a foreign parent firm. All variables are defined in Table 1. The dependent variable is *Profit shifting 1* and all specifications include the controls in Table 5. The lower part of the table indicates the type of fixed effects used in each regression. The industry fixed effects are at the two-digit NACE level. The ***, **, and * marks denote statistical significance at the 1%, 5%, and 10% level, respectively.

Panel A: INEDs with audit experience 1

	(1)	(2)	(3)	(4)	(5)
Audit committee size	0.490***	0.490***	0.490***	0.491***	0.491***
	[2.806]	[2.821]	[2.802]	[2.894]	[2.872]
INEDs with audit experience	1.341**	1.337**	1.341**	1.326**	1.327**
	[2.355]	[2.371]	[2.352]	[2.399]	[2.374]
Audit committee size × INEDs with audit experience	-0.927**	-0.921**	-0.927**	-0.916**	-0.920**
	[-2.161]	[-2.163]	[-2.158]	[-2.195]	[-2.184]
Duality	-0.053	-0.055	-0.053	-0.052	-0.051
	[-1.156]	[-1.196]	[-1.155]	[-1.172]	[-1.128]
Network size	-0.329**	-0.325**	-0.329**	-0.326**	-0.329**
	[-2.014]	[-1.999]	[-2.012]	[-2.031]	[-2.044]
Observations	18,571	18,719	18,571	18,718	18,570
Adjusted R-squared	0.674	0.675	0.673	0.677	0.674
S.E. clustering	Parent	Parent	Parent	Parent	Parent
Subsidiary effects	√	√	√	√	√
Year effects	√	√	√	-	-
Sub. industry effects	√	-	√	-	√
Parent industry effects	-	√	√	-	√
Sub. country-year effects	-	-	-	√	√

Panel B: INEDs with audit experience 2

	(1)	(2)	(3)	(4)	(5)
Audit committee size	0.442***	0.444***	0.442***	0.444***	0.443***
	[2.822]	[2.844]	[2.819]	[2.924]	[2.895]
INEDs with audit experience	0.542**	0.544**	0.542**	0.538**	0.534**
	[2.275]	[2.300]	[2.272]	[2.337]	[2.303]
Audit committee size × INEDs with audit experience	-0.408**	-0.409**	-0.408**	-0.405**	-0.403**
	[-2.349]	[-2.369]	[-2.346]	[-2.409]	[-2.381]
Duality	-0.058	-0.059	-0.058	-0.056	-0.055
	[-1.227]	[-1.265]	[-1.225]	[-1.243]	[-1.199]
Network size	-0.319**	-0.315*	-0.319**	-0.315**	-0.319**
	[-1.978]	[-1.961]	[-1.976]	[-1.992]	[-2.007]
Observations	18,571	18,719	18,571	18,718	18,570
Adjusted R-squared	0.673	0.675	0.673	0.676	0.673
S.E. clustering	Parent	Parent	Parent	Parent	Parent
Subsidiary effects	√	√	√	√	√
Year effects	√	√	√	-	-
Sub. industry effects	√	-	√	-	√
Parent industry effects	-	√	√	-	√
Sub. country-year effects	-	-	-	√	√

Panel C: INEDs with audit experience 3					
	(1)	(2)	(3)	(4)	(5)
Audit committee size	0.491***	0.491***	0.491***	0.491***	0.491***
	[2.806]	[2.821]	[2.803]	[2.894]	[2.872]
INEDs with audit experience	1.341**	1.338**	1.341**	1.326**	1.327**
	[2.361]	[2.377]	[2.358]	[2.404]	[2.379]
Audit committee size × INEDs with audit experience	-0.927**	-0.921**	-0.927**	-0.916**	-0.920**
	[-2.166]	[-2.168]	[-2.164]	[-2.199]	[-2.189]
Duality	-0.053	-0.055	-0.053	-0.052	-0.051
	[-1.163]	[-1.202]	[-1.162]	[-1.179]	[-1.135]
Network size	-0.329**	-0.325**	-0.329**	-0.326**	-0.329**
	[-2.011]	[-1.996]	[-2.009]	[-2.028]	[-2.041]
Observations	18,570	18,718	18,570	18,717	18,569
Adjusted R-squared	0.674	0.675	0.673	0.677	0.674
S.E. clustering	Parent	Parent	Parent	Parent	Parent
Subsidiary effects	√	√	√	√	√
Year effects	√	√	√	-	-
Sub. industry effects	√	-	√	-	√
Parent industry effects	-	√	√	-	√
Sub. country-year effects	-	-	-	√	√

Panel D: INEDs with audit experience 4					
	(1)	(2)	(3)	(4)	(5)
Audit committee size	0.442***	0.443***	0.442***	0.444***	0.442***
	[2.820]	[2.842]	[2.817]	[2.921]	[2.893]
INEDs with audit experience	0.540**	0.542**	0.540**	0.536**	0.532**
	[2.268]	[2.292]	[2.265]	[2.329]	[2.296]
Audit committee size × INEDs with audit experience	-0.405**	-0.407**	-0.405**	-0.402**	-0.400**
	[-2.339]	[-2.359]	[-2.336]	[-2.399]	[-2.370]
Duality	-0.058	-0.059	-0.058	-0.056	-0.055
	[-1.226]	[-1.264]	[-1.224]	[-1.241]	[-1.198]
Network size	-0.319**	-0.315*	-0.319**	-0.315**	-0.319**
	[-1.978]	[-1.962]	[-1.976]	[-1.993]	[-2.007]
Observations	18,571	18,719	18,571	18,718	18,570
Adjusted R-squared	0.673	0.675	0.673	0.676	0.673
S.E. clustering	Parent	Parent	Parent	Parent	Parent
Subsidiary effects	√	√	√	√	√
Year effects	√	√	√	-	-
Sub. industry effects	√	-	√	-	√
Parent industry effects	-	√	√	-	√
Sub. country-year effects	-	-	-	√	√

Table A10: Cross sectional heterogeneity with alternative measures of profit shifting

The table reports coefficient estimates and *t*-statistics (in brackets) for all explanatory variables. The observational units are multinational subsidiaries with a foreign parent firm. All variables are defined in Table 1. The dependent variable is shown in the first line of the Table, with the different profit-shifting measures and all specifications include the controls in Table 5. The lower part of the table indicates the type of fixed effects used in each regression. The industry fixed effects are at the two-digit NACE level. The ***, **, and * marks denote statistical significance at the 1%, 5%, and 10% level, respectively.

Panel A: INEDs with audit experience 1

	(1) Profit shifting 2	(2) Profit shifting 3	(3) Profit shifting 4	(4) Profit shifting 5	(5) Profit shifting 6
Audit committee size	0.364***	0.431***	0.455***	0.493***	0.489***
	[3.027]	[3.038]	[2.748]	[3.538]	[3.413]
INEDs with audit experience	1.067**	1.232**	1.218**	1.287**	1.311**
	[2.292]	[2.294]	[2.240]	[2.428]	[2.436]
Audit committee size × INEDs with audit experience	-0.720**	-0.812**	-0.834**	-0.868**	-0.887**
	[-2.165]	[-2.096]	[-2.060]	[-2.313]	[-2.317]
Duality	-0.041	-0.047	-0.042	-0.041	-0.041
	[-1.142]	[-1.047]	[-1.091]	[-1.050]	[-1.038]
Network size	-0.221**	-0.255**	-0.309**	-0.223**	-0.231**
	[-2.472]	[-2.514]	[-2.160]	[-2.483]	[-2.449]
Observations	17,791	17,691	14,971	11,880	11,880
Adjusted R-squared	0.707	0.684	0.678	0.711	0.707
S.E. clustering	Parent	Parent	Parent	Parent	Parent
Subsidiary effects	√	√	√	√	√
Sub. industry effects	√	√	√	√	√
Parent industry effects	√	√	√	√	√
Sub. country-year effects	√	√	√	√	√

Panel B: INEDs with audit experience 2

	(1) Profit shifting 2	(2) Profit shifting 3	(3) Profit shifting 4	(4) Profit shifting 5	(5) Profit shifting 6
Audit committee size	0.325***	0.393***	0.419***	0.453***	0.447***
	[3.011]	[3.073]	[2.826]	[3.610]	[3.471]
INEDs with audit experience	0.421**	0.481**	0.503**	0.494**	0.505**
	[2.295]	[2.241]	[2.290]	[2.419]	[2.424]
Audit committee size × INEDs with audit experience	-0.317**	-0.353**	-0.372**	-0.355**	-0.363**
	[-2.463]	[-2.355]	[-2.326]	[-2.504]	[-2.503]
Duality	-0.045	-0.051	-0.046	-0.044	-0.045
	[-1.210]	[-1.101]	[-1.159]	[-1.111]	[-1.100]
Network size	-0.213**	-0.246**	-0.299**	-0.212**	-0.220**
	[-2.412]	[-2.434]	[-2.118]	[-2.382]	[-2.352]
Observations	17,791	17,691	14,971	11,880	11,880
Adjusted R-squared	0.706	0.683	0.678	0.711	0.706
S.E. clustering	Parent	Parent	Parent	Parent	Parent
Subsidiary effects	√	√	√	√	√
Sub. industry effects	√	√	√	√	√
Parent industry effects	√	√	√	√	√
Sub. country-year effects	√	√	√	√	√

Panel C: *INEDs with audit experience 3*					
	(1) Profit shifting 2	(2) Profit shifting 3	(3) Profit shifting 4	(4) Profit shifting 5	(5) Profit shifting 6
Audit committee size	0.364***	0.431***	0.455***	0.493***	0.489***
	[3.027]	[3.037]	[2.747]	[3.537]	[3.412]
INEDs with audit experience	1.066**	1.231**	1.217**	1.285**	1.309**
	[2.296]	[2.298]	[2.242]	[2.429]	[2.437]
Audit committee size × INEDs with audit experience	-0.719**	-0.811**	-0.833**	-0.866**	-0.885**
	[-2.169]	[-2.099]	[-2.063]	[-2.313]	[-2.317]
Duality	-0.041	-0.047	-0.042	-0.041	-0.041
	[-1.147]	[-1.052]	[-1.098]	[-1.054]	[-1.043]
Network size	-0.220**	-0.255**	-0.309**	-0.222**	-0.231**
	[-2.468]	[-2.510]	[-2.156]	[-2.477]	[-2.443]
Observations	17,790	17,690	14,970	11,879	11,879
Adjusted R-squared	0.707	0.684	0.678	0.711	0.707
S.E. clustering	Parent	Parent	Parent	Parent	Parent
Subsidiary effects	√	√	√	√	√
Sub. industry effects	√	√	√	√	√
Parent industry effects	√	√	√	√	√
Sub. country-year effects	√	√	√	√	√

Panel D: *INEDs with audit experience 4*					
	(1) Profit shifting 2	(2) Profit shifting 3	(3) Profit shifting 4	(4) Profit shifting 5	(5) Profit shifting 6
Audit committee size	0.325***	0.392***	0.418***	0.452***	0.447***
	[3.009]	[3.072]	[2.823]	[3.607]	[3.468]
INEDs with audit experience	0.419**	0.479**	0.501**	0.491**	0.502**
	[2.287]	[2.233]	[2.283]	[2.410]	[2.414]
Audit committee size × INEDs with audit experience	-0.315**	-0.350**	-0.370**	-0.352**	-0.360**
	[-2.451]	[-2.343]	[-2.318]	[-2.493]	[-2.493]
Duality	-0.045	-0.051	-0.046	-0.044	-0.045
	[-1.209]	[-1.100]	[-1.159]	[-1.110]	[-1.099]
Network size	-0.213**	-0.246**	-0.299**	-0.212**	-0.220**
	[-2.413]	[-2.435]	[-2.118]	[-2.383]	[-2.353]
Observations	17,791	17,691	14,971	11,880	11,880
Adjusted R-squared	0.706	0.683	0.678	0.710	0.706
S.E. clustering	Parent	Parent	Parent	Parent	Parent
Subsidiary effects	√	√	√	√	√
Sub. industry effects	√	√	√	√	√
Parent industry effects	√	√	√	√	√
Sub. country-year effects	√	√	√	√	√

Table A11: Sensitivity on the heterogeneity of the effect of audit committee size due to experience in audit committees (different standard error clustering)

The table reports coefficient estimates and *t*-statistics (in brackets) for all explanatory variables. The observational units are multinational subsidiaries with a foreign parent firm. All variables are defined in Table 1. The dependent variable is *Profit shifting 1* and all specifications include the controls in Table 5. In specification 1 and 2, we use *INEDs with audit experience 1.* In specification 3 and 4, we use *INEDs with audit experience 2.* In specification 5 and 6, use *INEDs with audit experience 3.* In specification 7 and 8, we use *INEDs with audit experience 4.* The lower part of the table indicates the type of fixed effects used in each regression. The industry fixed effects are at the two-digit NACE level. The ***, **, and * marks denote statistical significance at the 1%, 5%, and 10% level, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Audit committee size	0.489**	0.489***	0.441**	0.441***	0.489**	0.489***	0.441**	0.441***
	[3.054]	[3.413]	[3.220]	[3.582]	[3.054]	[3.413]	[3.218]	[3.580]
INEDs with audit experience	1.320**	1.320**	0.533**	0.533**	1.320**	1.320**	0.531**	0.531**
	[2.381]	[2.625]	[2.624]	[2.955]	[2.392]	[2.638]	[2.619]	[2.956]
Audit committee size ×	-0.914*	-0.914**	-0.402**	-0.402**	-0.914*	-0.914**	-0.400**	-0.400**
INEDs with audit experience	[-2.144]	[-2.350]	[-2.843]	[-3.212]	[-2.154]	[-2.361]	[-2.841]	[-3.219]
Duality	-0.050	-0.050	-0.054	-0.054	-0.050	-0.050	-0.054	-0.054
	[-1.165]	[-1.225]	[-1.234]	[-1.299]	[-1.173]	[-1.234]	[-1.233]	[-1.298]
Network size	-0.328*	-0.328*	-0.318*	-0.318*	-0.328*	-0.328*	-0.318*	-0.318*
	[-1.938]	[-2.003]	[-1.922]	[-1.984]	[-1.936]	[-2.000]	[-1.923]	[-1.985]
Observations	18,570	18,570	18,570	18,570	18,569	18,569	18,570	18,570
Adjusted R-squared	0.673	0.673	0.673	0.673	0.673	0.673	0.673	0.673
S.E. clustering	Parent & year	Parent & year&sub. country	Parent & year	Parent & year&sub. country	Parent & year	Parent & year&sub. country	Parent & year	Parent & year&sub. country
Subsidiary effects	√	√	√	√	√	√	√	√
Sub. industry effects	√	√	√	√	√	√	√	√
Parent industry effects	√	√	√	√	√	√	√	√
Sub. country-year effects	√	√	√	√	√	√	√	√

Table A12: Heterogeneity of the effect of audit committee size due to CEO duality (with different fixed effects and standard error clustering)

The table reports coefficient estimates and *t*-statistics (in brackets) for all explanatory variables. The observational units are multinational subsidiaries with a foreign parent firm. All variables are defined in Table 1. The dependent variable is *Profit shifting 1* and all specifications include the controls in Table 5. The lower part of the table indicates the type of fixed effects used in each regression. The industry fixed effects are at the two-digit NACE level. The ***, **, and * marks denote statistical significance at the 1%, 5%, and 10% level, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Audit committee size	0.175	0.177	0.175	0.173	0.172	0.172	0.172
	[1.487]	[1.517]	[1.486]	[1.526]	[1.496]	[1.257]	[1.320]
Duality	-0.340	-0.338	-0.340	-0.348*	-0.349*	-0.349	-0.349
	[-1.639]	[-1.646]	[-1.637]	[-1.717]	[-1.701]	[-1.487]	[-1.508]
Audit committee size ×	0.203	0.201	0.203	0.210	0.212	0.212	0.212
Duality	[1.444]	[1.443]	[1.443]	[1.512]	[1.506]	[1.279]	[1.328]
INEDs with audit	0.152	0.156	0.152	0.151	0.147	0.147	0.147
experience 1	[0.983]	[1.021]	[0.982]	[0.997]	[0.958]	[0.987]	[1.007]
Network size	-0.319**	-0.315*	-0.319*	-0.315**	-0.319**	-0.319*	-0.319*
	[-1.966]	[-1.951]	[-1.964]	[-1.982]	[-1.995]	[-1.925]	[-1.988]
Observations	18,571	18,719	18,571	18,718	18,570	18,570	18,570
Adjusted R-squared	0.673	0.674	0.672	0.676	0.673	0.673	0.673
S.E. clustering	Parent	Parent	Parent	Parent	Parent	Parent & year	Parent & year & sub. country
Subsidiary effects	√	√	√	√	√	√	√
Year effects	√	√	√	-	-	-	-
Sub. industry effects	√	-	√	-	√	√	√
Parent industry effects	-	√	√	-	√	√	√
Sub. country-year effects	-	-	-	√	√	√	√

Table A13: Heterogeneity of the effect of audit committee size due to CEO duality (with alternative measures of profit shifting)

The table reports coefficient estimates and *t*-statistics (in brackets) for all explanatory variables. The observational units are multinational subsidiaries with a foreign parent firm. All variables are defined in Table 1. The dependent variable is shown in the first line of the table, with the different profit-shifting measures and all specifications include the controls in Table 5. The lower part of the table indicates the type of fixed effects used in each regression. The industry fixed effects are at the two-digit NACE level. The ***, **, and * marks denote statistical significance at the 1%, 5%, and 10% level, respectively.

	(1) Profit shifting 2	(2) Profit shifting 3	(3) Profit shifting 4	(4) Profit shifting 5	(5) Profit shifting 6
Audit committee size	0.109	0.146	0.126	0.166	0.153
	[1.232]	[1.362]	[1.170]	[1.590]	[1.435]
Duality	-0.285*	-0.316	-0.397**	-0.381**	-0.390**
	[-1.731]	[-1.620]	[-1.998]	[-2.065]	[-2.073]
Audit committee size × Duality	0.173	0.191	0.252*	0.242*	0.249*
	[1.567]	[1.450]	[1.819]	[1.926]	[1.931]
INEDs with audit experience 1	0.143	0.190	0.147	0.168	0.169
	[1.170]	[1.338]	[1.015]	[1.246]	[1.227]
Network size	-0.212**	-0.246**	-0.299**	-0.211**	-0.219**
	[-2.379]	[-2.416]	[-2.105]	[-2.351]	[-2.323]
Observations	17,791	17,691	14,971	11,880	11,880
Adjusted R-squared	0.706	0.683	0.678	0.710	0.706
S.E. clustering	Parent	Parent	Parent	Parent	Parent
Subsidiary effects	√	√	√	√	√
Sub. industry effects	√	√	√	√	√
Parent industry effects	√	√	√	√	√
Sub. country-year effects	√	√	√	√	√

Chapter VI

Conclusion

Using firm-year level data, this thesis attempted to introduce a global profit shifting dataset and explore several potential determinants of profit shifting. Previous empirical work on profit shifting has produced many insights, especially on how to generally identify and estimate the potency of profit shifting, but we focused here on providing a comprehensive global dataset on profit-shifting intensity at the firm-year level. This new database shows that (i) the countries in which subsidiaries receive the largest amounts of profit shifting are the usual suspects (tax havens); (ii) the profit shifting average gradually declines after 2011.

Further, I use the novel profit shifting dataset to examine three potential determinants of profit shifting. First, robust evidence that democracy has a negative effect on profit-shifting is provided, implying that increasing democratic institutions in subsidiary countries lowers profit-shifting to other countries. The baseline results suggest that an increase of one standard deviation in the democracy index reduces profit-shifting by approximately 37%. This estimate is robust to an extensive series of sensitivity tests, including different measures of democracy. High-quality policy-making and the government's ability to protect property rights and enforce contracts are two key channels increasing democracy's effectiveness in keeping subsidiaries' profits home.

Second, I examine the causal relationship between profit shifting and the intangible assets. The results show that the ratio of intangible assets to total assets is the most important predictor of profit shifting. The most favored specification and rather conservative estimate shows a 4.4 percent increase in profit shifting following a one standard deviation increase in the intangible assets to total assets ratio. This effect is significantly stronger in countries with lower institutional quality.

Third, this thesis examines the role of corporate governance characteristics as explanatory variables of the estimated profit-shifting index. The baseline results suggest that an increase of one standard deviation in the audit committee size (approximately equal to adding 1.1 directors to the audit committee) increases profit shifting by an economically significant 7.8%. This estimate is robust to an extensive series of sensitivity tests, including different measures of audit committee size and profit shifting. Importantly, the results suggest that increasing the ratio of INEDs with functional audit experience on audit committees and abolishing CEO duality can substantially reduce or even eliminate the positive effect of audit committee size on profit shifting.

These findings are only a first step to uncovering the potential of this database for analyzing profit shifting at the firm or aggregate level. The global profit shifting database can be used by researchers to analyze either the factors causally affecting profit shifting or the causal effects of profit shifting on firm-specific or country-specific characteristics. The analysis reveals a need for substantial new research into questions pertaining to the determinants of profit shifting over and above cross-country tax differences, as well as into the industry profiles of firms that shift profit, and their capital structure, corporate governance, and investment decisions. Naturally, future

research might also be interested in the macroeconomic outcomes of profit shifting, especially with regard to the labor market, investment, innovation, climate change, and economic growth.

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