Essays on Corporate Taxation

by

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Abstract

This thesis aims to advance our understanding of corporate taxes and their effects on firm behaviour, particularly with regard to tax avoidance and investment, as well as how countries fight tax evasion and avoidance. Each chapter provides a distinct contribution to the corporation tax literature.

The first two chapters analyze the corporate tax payments of companies residing in the United Kingdom using confidential corporate tax returns data. Chapter 1 focuses on comparisons between various company-ownership types, distinguishing in particular between multinational and domestic companies. I find that multinational companies, in spite of constituting only 3 percent of the population of UK companies, pay the majority of UK corporation tax, around 55 percent on average, during the period 2000 - 2011. However, multinational companies pay a very small amount of tax relative to their size, in comparison to domestic companies, and the share of UK corporation tax paid by multinational companies has declined over the period.

Chapter 2 shows that there are systematic differences in how much taxable profits multinational and domestic companies report. Specifically, using comparable samples selected by propensity score matching, I estimate that UK subsidiaries of foreign multinationals report a 50 percent lower ratio of taxable profits to total assets than comparable domestic standalones. This difference is almost entirely attributable to the fact that a higher proportion of foreign multinational subsidiaries report zero taxable profits (59.2 percent) than domestic standalones (27.5 percent). A high share of foreign multinational subsidiaries are found to report zero taxable profits persistently over time, and high leverage is found to play an important role in producing this outcome. This suggests a very aggressive form of profit shifting for many of these foreign multinational companies.

Chapter 3 investigates how investment responds to tax incentives. In particular, using the announcement and subsequent implementation of an exogenous tax reform in Canada as a quasi-natural experiment, I consider the effect of a temporary and unexpected increase in the cost of capital for a group of firms (income trusts) which had (for tax reasons) limited availability of retained earnings as a source of finance for investment. I show that these firms did not respond to the cost of capital increase during the period when they had limited availability of retained earnings. In turn, a subsequent increase in the availability of internal finance, prompted by the implementation of the tax reform in 2011, is shown to increase their investment substantially. These findings suggest that financing constraints on investment may have been binding for these firms.

Chapter 4 discusses the exchange of tax information between tax havens and OECD countries. Together with Clemens Fuest, we analyze how tax havens have chosen their partner countries to sign tax information exchange agreements (TIEAs) with and hence comply with OECD standards. We find that tax havens have on average signed more TIEAs with countries to which they have stronger economic links. However, this does not mean that they exchange tax information with all important partner countries.

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Introduction

Corporation tax is an important source of government tax revenue in many developed countries. In 2015 corporation tax revenues in the OECD countries have ranged between 4.5 percent of GDP in Norway and 1.5 percent of GDP in Slovenia, with an average of around 3 percent of GDP. In the years since the recent financial crisis most of the OECD countries have experienced large declines in their corporate tax revenue as a percentage of GDP, e.g. in the United Kingdom corporate tax revenue has dropped from 3.4 percent of GDP in 2006 to 2.3 percent of GDP in 2015, and in Canada from 3.7 percent of GDP in 2006 to 3.1 percent of GDP in 2015.[1] Therefore, since 2008 policymakers and economists have been debating how to recover lost tax revenues, and also how corporate taxes could be reformed to speed up the sluggish economic recovery. In particular, at the heart of the debate are the questions of how various tax policies could improve government tax collection and economic growth.

First, this has led to a more prominent discussion of corporate tax avoidance practices, as authorities around the world saw combatting tax avoidance as an important means of recovering lost tax revenues. The roots of the discussion on tax avoidance centre around the role of tax havens and offshore financial centres, which are also seen to have contributed to the crisis by allowing financial institutions to escape financial regulation and supervision. In recent years, the OECD has furthered the discussion of tax avoidance practices with the establishment of the Base Erosion and Profit Shifting (BEPS) project[2]. Hence, the debate shifted to a more general analysis of various channels through which multinational firms in particular avoid corporation tax, such as debt shifting, transfer pricing, and the location of patents and royalties.

[1] https://stats.oecd.org/Index.aspx?DataSetCode=REV

[2] For the BEPS final reports see: http://www.oecd.org/tax/beps-2015-final-reports.htm

Second, some governments have focused on boosting corporate investment through various tax policies, aiming to improve productivity growth. Generally, using various fiscal policies, governments are able to affect firm level behaviour, such as for example how much taxes companies pay, how much they invest or how much they borrow. In doing so, they have to balance the effects of tax policies between increasing growth and subsequent tax revenues through raising investment rates and decreasing tax revenues through lower tax rates or increased avoidance.

This thesis contributes to the debate on the effects of corporate tax policies on firm level behaviour in three distinct ways. The first chapter discusses how much corporation tax companies pay, using the United Kingdom as a case study. Chapters 2 and 4 analyze tax avoidance practices and discuss approaches to combatting tax evasions and avoidance. Specifically, Chapter 2 estimates the potential size of profit shifting by UK subsidiaries of foreign multinational companies, while Chapter 4 discusses the role that tax information exchange agreements have played in the recent fight against tax evasion and avoidance. Chapter 3 studies how tax policies affect investment, specifically analyzing channels through which tax incentives to distribute profits affected the investment of income trusts in Canada.

In Chapter One, I explore the full population of UK corporate tax returns from Her Majesty's Revenue and Customs (HMRC) to analyze how much tax companies pay in the UK. In particular, I compare taxable profits of companies in the UK differentiating by their ownership type and other observable characteristics. This chapter analyzes the corporate tax revenues in the UK and lays a foundation for the analysis of the effects of corporate tax policies on tax collection and investment in later chapters of the thesis.

I show that on average over the period 2000 - 2011 multinational companies paid the majority (55%) of UK corporation tax, in spite of constituting only 3% of the population of companies in the UK. However, the fraction of tax revenue collected from multinationals declined between 2000 and 2011. This highlights the importance that governments have placed in recent years on the issues of tax avoidance by multinational companies. Further,

multinational companies pay very little tax relative to their size in comparison to domestic companies. I show that part of this difference arises because a large proportion of UK subsidiaries of multinational companies pay no tax in the UK. I also find that differences between size and sectoral distributions and leverage partially explain the large gap in the ratio of taxable profits to total assets between multinationals and domestic firms. In turn, differences in productivity and investment rates between these types of companies do not.

In Chapter Two, using the data and descriptive evidence from Chapter One, I focus on understanding what drives the differences in taxable profits between UK subsidiaries of foreign multinational companies and domestic standalone companies. In particular, I examine whether the gap in taxable profits between foreign multinational subsidiaries and domestic standalones is related to profit shifting. Hence, I consider a question of how aggressive are foreign multinational subsidiaries in lowering their UK corporation tax liability. Using comparable sub-samples selected by propensity score matching, I show that foreign multinational subsidiaries report 50 percent lower taxable profits than comparable domestic standalones. Almost all of the difference in taxable profits between these two ownership groups can be explained by a higher proportion of foreign multinational subsidiaries reporting zero taxable profits. However, conditional on reporting positive taxable profits, the difference in taxable profits between foreign multinational subsidiaries and domestic standalones is negligible. A high share of foreign multinational subsidiaries are found to report zero taxable profits persistently over time, and high leverage is found to play an important role in producing this outcome. This suggests quite an aggressive form of profit shifting by foreign multinational subsidiaries in the UK, which happens at the extensive margin.

I link these differences in the ratio of taxable profits to total assets between foreign multinational subsidiaries and domestic standalones to factors that the economic literature often associates with profit shifting. For instance, there is some evidence in the literature that companies which have affiliates in tax havens tend to report lower profits, which is often interpreted as a sign of profit shifting. In Chapter Two I show that the size

of the difference in the ratio of taxable profits to total assets between foreign multinational subsidiaries and domestic standalones is much larger for multinational companies headquartered in tax havens. This further suggests that the observed differences between foreign multinational subsidiaries and domestic standalones may be linked to profit shifting activities of multinational firms.

Chapter Three studies the question of how taxes affect investment. This question is relevant for policy design, especially in the context of designing tax reforms that aim to encourage growth. Recently, the discussion of the effects of tax policies on investment has focused on whether tax policies affect investment mainly through their effects on the cost of capital or through their effects on after-tax cash flows. This chapter contributes to this debate by providing evidence of the binding nature of financing constraints on investment for income trusts in Canada.

In particular, I use a quasi-natural experimental setting to examine the effects on investment of the announcement in 2006 and subsequent implementation in 2011 of the Canadian income trust tax reform. I investigate the effects of a temporary and unexpected increase in the cost of capital for a group of firms (income trusts) which has (for tax reasons) limited availability of retained earnings as a source of finance for investment relative to traditional corporations. I show that subsequent changes in the availability of internal finance dominated the effects of changes in the cost of capital for these income trusts.

Specifically, Canadian income trusts had to distribute all their profits to take advantage of the tax savings offered by the income trust structure. Hence, they had very low levels of retained earnings. The October 2006 Canadian income trusts tax reform announced an equalization of the tax treatment of income trusts and traditional corporations with effect from January 2011, or earlier if a trust chose to convert to corporate form. I calculate that the cost of capital during the transition period increased substantially for income trusts, but I find that their investment did not react to this increase. In contrast, after the reform came into force in 2011, the cost of capital for income trusts declined substantially

relative to the transition period, but increased relative to their cost of capital before the 2006 reform announcement. At the same time, since there no longer was a tax advantage to distributing all profits, income trusts (most of which had converted to corporate form by the beginning of 2011) had much higher availability of retained earnings. I find that investment of income trusts, after the reform came into effect in 2011 increased significantly relative to a matched control group of comparable traditional corporations.

This suggests that changes in the cost of capital have little effect on investment for firms with limited availability of retained earnings. Conversely, changes in the availability of internal finance affect investment rates strongly. This is important in terms of policy design, as tax incentives designed to increase investment through a reduction in the cost of capital may be ineffective in the case of firms with limited availability of retained earnings.

Chapter Four returns to analyzing issues related to tax avoidance through investigating the nature of tax information exchange agreements (TIEAs). It tackles a broader macroeconomic question of how effective the exchange of information for tax purposes has been and uses country, rather than firm level, data. In particular, together with Clemens Fuest, we investigate the TIEAs that tax haven countries have signed in order to comply with OECD standards. We specifically examine how tax haven countries have chosen their partner countries. If the agreements have been signed with countries with which havens have no economic links, the information exchange remains ineffective. Our research suggests that tax havens have not systematically undermined tax information exchange by signing TIEAs with irrelevant countries. We proxy economic links by trade, foreign direct investment and foreign portfolio investment between countries. However, this does not mean that tax havens now exchange tax information with all important partner countries. Tax havens have signed TIEAs with, on average, 2.4 out of their 5 most important trading partners. This research suggests that the efforts of the OECD to curb tax evasion and avoidance through the promotion of TIEAs have been reasonably successful.

Chapter 1

How much tax do companies pay in the UK? Evidence from UK confidential corporate tax returns.

Abstract

This paper uses the full population of UK corporate tax returns from Her Majesty's Revenue and Customs (HMRC) to explore the question of how much tax companies pay in the UK. In particular, I compare taxable profits of companies in the UK differentiating by their ownership type. I show that multinational companies pay the majority, 55%, of UK corporation tax, in spite of constituting only 3% of the population of companies in the UK. However, the fraction of tax revenues collected from multinationals has declined over time. Further, multinational companies pay very little tax relative to their size in comparison to domestic companies. I find that differences between size and sectoral distributions and leverage partially explain the large gap in the ratio of taxable profits to total assets between multinationals and domestic firms. In contrast, differences in investment rates and productivity between these types of companies do not.

1.1 Introduction

If you search online for a phrase "How much tax do companies pay in the UK?" you will discover that there are 1 million recent articles on this subject. The titles, such as "How much tax does Facebook pay in the UK?" by The Guardian or "Six British multinationals did not pay any UK corporation tax in 2014'" by the Independent, have been commonly seen in the UK press over the recent years. Why is there so much interest in the question of how much tax companies pay? One answer lies in the fact that no one really knows. Companies' financial statements show that a substantial fraction of very large firms in the United Kingdom report losses and hence pay no corporation tax. However, without tax returns data we do not know the actual tax payments of companies resident in the UK to the UK revenue authorities.

This paper uses Her Majesty's Revenue and Customs (HMRC) confidential corporate tax returns data for the United Kingdom to answer the question of how much tax companies pay in the UK. In particular, I focus on a comparison between multinational and domestic companies' taxable profits, using a unique match of tax returns data with financial statements and ownership data.

The economic literature provides us with some answers to the question of how much tax companies pay. For instance, we know that foreign headquartered multinational companies tend to report much lower taxable profits than domestic companies in the United States.[1] A contribution of the current paper is to examine whether the tax reporting behaviour of companies in the UK mirrors that of the US domiciled companies. This issue has not been previously studied, as it requires tax returns data. The US has been one of the first countries which made tax returns data available for research purposes. The UK has followed in their footsteps only recently by making their corporate tax returns information available to academics.

[1] Grubert *et al.* (1993), McCauley (1994), Mataloni (2000), Grubert (1998), Mills and Newberry (2004)

To advance our understanding of what drives the differences in taxable profits between companies with various ownership structure, I study the differences in tax payments between companies from various industries and of different sizes. I also explore whether the differences in taxable profits between ownership types are related to differences in leverage, capital allowances claimed, other tax deductions and productivity. I further our understanding of how much tax companies pay by using more disaggregated ownership categories, such as foreign multinational and domestic multinationals or domestic groups and domestic standalones.

I find that multinational companies, in spite of constituting only 3% of companies operating in the UK, have contributed 55% of total annual corporate tax revenue to the UK government from 2000 to 2011. The proportion of tax paid by multinational companies has decreased from 60% at the beginning of the sample, in 2000, to 50% at the end of it, in 2011. Further, multinational companies have contributed about 40% of UK trading turnover and have constituted about 70% of total assets of UK companies in the analyzed time period. The proportion of total assets held by multinational companies has increased from 60% at the beginning of the sample to over 75% in 2011, while the fraction of trading turnover attributable to multinational companies has fluctuated considerably over the years, with the highest - 60% - in 2008 and the lowest - 25% - in 2009.

This paper focuses on the differences in taxable profits between multinational and domestic companies. Since UK subsidiaries of both multinational companies headquartered in foreign countries (foreign multinationals) and multinationals headquartered in the UK (domestic multinationals) are generally larger in scale and more profitable than domestic companies, one would expect multinationals to pay the majority of UK corporation tax. However, the question remains as to whether multinationals 'should' be paying even more. I investigate this by comparing multinationals to domestic companies and find that, on average, multinationals report lower taxable profits relative to their size than domestic companies. This is especially true for the differences between multinationals and domestic standalones, where domestic standalones' ratio of taxable profits to total assets is between

0.1 and 0.12, while for foreign multinationals this ratio is 0.012. Domestic groups do tend to report a much lower taxable profits to total assets ratio (0.015-0.02) than domestic standalones, but higher than multinationals.

I further find that over 60% of all multinational firm-year observations report zero taxable profits and hence pay no corporation tax between 2000 and 2011; similar holds for 50% of domestic groups and 28% of domestic standalones firm-year observations. I find that companies reporting zero taxable profits do not differ from companies reporting positive taxable profits in terms of their observable firm-level characteristics. Companies which report zero taxable profits are very similar in terms of size, age and industry composition to those reporting positive taxable profits. Further, foreign multinational companies that report zero taxable profits in the UK are not consistently headquartered in countries with lower corporate tax rates that the UK. Companies headquartered in lower tax countries than the UK may have a higher incentive to report zero taxable profits in the UK and positive profits in their lower rate headquarters. The only significantly important determinant of reporting zero taxable profits this year is the firm's propensity to report zero taxable profits in previous years. I find considerable persistence in the duration of the zero taxable profit reporting spell. Within the subsample of companies which are observed continuously for the whole sample period of 12 years, foreign multinationals report zero taxable profits for 6 years on average, while domestic standalones report zero taxable profits for 3 years on average.

Multinational companies are much larger than domestic companies. When I compare companies of similar sizes, I find that their tax payments are more similar to each other. In contrast, the very large multinational companies report very low ratios of taxable profits to total assets. Foreign multinationals, domestic groups and other (unidentified) groups have substantially higher leverage than other types of companies. Firms in the mining sector have the highest taxable profits to total assets ratios, while firms in the finance, insurance and real estate sectors have the lowest. The latter is especially true for multinationals. These differences in observable characteristics between companies partially explain

why multinational companies report much lower taxable profits relative to their size than domestic companies.

There may be reasons other than tax avoidance why we observe multinational companies reporting taxable profits than domestic companies. First, it could be that multinational companies perform consistently worse than domestic companies. However, this is unlikely given widely accepted evidence that multinationals are more productive than domestic companies (Yeaple (2013), Harris and Robinson (2003), Griffith (1999), Benfratello and Sembenelli (2006), Girma and Gorg (2007), Wang and Wang (2015)). In any case, calculating a measure of total factor productivity (TFP) for multinational and domestic companies in my data reveals that the former are far more productive, which is consistent with the previous empirical evidence. Another reason could be that multinational companies might report zero taxable profits more frequently because they have more frequent losses than domestic companies. The UK system treats losses asymmetrically and when the company makes losses it reports zero taxable profits on the tax form. The firm can recover a portion of those losses once it becomes profitable again, by carrying them forwards and offsetting them against its future taxable profits. To do so, it has to record those losses on the tax form, which allows me to reconcile the companies which report zero taxable profits with those making losses. However, even after excluding companies which reported losses in the current period and hence are not liable to pay any corporation tax this period, 34 percent of foreign multinational companies report zero taxable profits relative to only 10 percent of domestic standalones. Finally, given that only an average of 9 percent of all companies brought forward losses from previous years to offset against their taxable profits in the current year, negative trading profits and low productivity do not appear to be the main reason driving the differences in taxable profits between multinational and domestic companies.[2]

[2]De Simone *et al.* (2015) and Hopland *et al.* (2015) both consider profit shifting with loss making companies and how presence of those affiliaties in the group affects the standard profit shifting incentives.

A second possible explanation is the fact that multinational companies and domestic groups can benefit from group tax relief, which is not available to domestic standalones.[3] However, the tax returns data shows that only 2 percent of companies reporting zero taxable profits use group tax relief to reduce their taxable profits to zero, suggesting that group tax relief is unlikely to be the main driver of companies minimizing their taxable profits to zero.[4] Further, group tax relief cannot explain the observation from the data that the difference in taxable profits between multinational companies with one establishment in the UK (i.e. companies which would not be eligible for group tax relief) and domestic standalones is also very large.

A third reason could be that multinational companies undertake more investment or research and development (R&D), which are tax deductible, than domestic companies. However, the tax returns data reveals that it is domestic companies which claim more capital allowances relative to their size, contradicting this hypothesis.

This chapter establishes that the differences in the observable firm level characteristics are unable to explain fully the size of the gap in the ratio of taxable profits to total assets between multinational and domestic companies. This suggests that companies may instead differ in terms of their unobservable characteristics, such as for example ability to use tax planning strategies to minimize their UK tax liability. As such, this chapter is a companion paper to Chapter 2 of this thesis. In Chapter 2 I use the confidential corporate tax returns data to estimate the size of the difference in taxable profits between two carefully chosen comparison groups of companies. I explore whether we can link the size of this difference to measures associated with profit shifting. In what follows, section 1.2 describes the data, section 1.3 outlines the stylized facts and section 1.4 concludes.

[3] A company with multiple subsidiaries in the UK, whether domestic or multinational, can use group relief offered by HMRC to offset losses made by one of the companies in a group against profits of another company in that group in the same year (https://www.gov.uk/hmrc-internal-manuals/company-taxation-manual/ctm80145).

[4] The fraction of companies using group loss offset provisions to reduce their taxable profits to zero does not vary between ownership types.

1.2 Data

1.2.1 Data description and sample selection criteria

The primary data source used in this paper is the confidential universe of unconsolidated corporation tax returns in the UK for the years 2000 - 2011 provided by HMRC. The dataset comprises all items that are submitted on the corporation tax return form (CT600 form) and the unit of observation is an unconsolidated statement in each of the years (see Appendix for the form). The information available encompasses various sources of taxable income, deductions and a final figure of taxable profits together with tax liability and tax payment. Each company is required to fill in at least taxable profits (box 37) and corporation tax liability (box 63) information (for details of box numbers and related variable names see Table 1.9 in the Appendix). However, firms are not required to fill in every single box on the CT600 form and, in fact, they do not. What is more, the HMRC data does not offer any firm level characteristic variables, apart from trading turnover. Therefore I merge the HMRC data with the accounting data from FAME dataset. FAME dataset, collected by Bureau van Dijk, includes balance sheet information for UK companies. For instance, it provides information on total assets, accounting profits, age of firms, number of employees, industry or leverage.

Ownership definition

FAME dataset also includes information on firm ownership, which I use to identify firms into various ownership categories. FAME ownership dataset is a cross section from the latest edition of the dataset (2013). I identify multinational companies based on whether they have any affiliates abroad (parents or subsidiaries). I distinguish between multinationals headquartered in the UK (domestic multinationals) and multinationals headquartered abroad (foreign multinationals). I define all other firms as domestic companies, but I distinguish between domestic groups and domestic standalones. I define a domestic stand-

alone as an independent company, which has no affiliates. I define a domestic group as a company that is part of a group that has no foreign affiliates.[5]

I supplement the FAME ownership data with other variables from FAME and HMRC datasets to identify companies into two additional ownership categories, which I call 'unidentified multinational' and 'other groups'. Unidentified multinationals are companies that have overseas income or have claimed double tax relief in the UK, while other groups are companies which have claimed group relief or have reported they have losses to surrender as group relief.[6]

Table 1.1 shows the number of firms and observations by ownership types using the 7 main categories described above: foreign multinational, domestic multinational, domestic group, domestic standalone, other group, unidentified multinational and missing ownership. Since FAME is most likely to report no ownership information in cases where companies are independent standalones, the companies in the missing ownership category are plausibly domestic standalones. The unidentified multinationals are most likely a mix of foreign and domestic multinationals. Over the analyzed time period, 2000 - 2011, 3.1% of companies are identified as multinationals, 36% are identified as domestic.[7,8]

Sample selected for the analysis

Matching HMRC data with the accounting data restricts the sample size. I find a matched unconsolidated accounting statement in FAME for 76 percent of unconsolidated tax returns from HMRC data, which includes 89 percent of the total tax liability and 92 percent of total trading turnover in the UK. I further ensure that I have non-missing total assets infor-

[5]This is only to the extent that I see no foreign affiliates 10 levels down for this company OR that its parent company has no foreign affiliates 10 levels down either.

[6]For more details on the criteria I used to identify companies into various ownership groups see Appendix 5.1.

[7]The remaining 61% of companies which I classified as missing ownership are most likely domestic standalones, which would imply that 97% of companies in the UK are domestic.

[8]The number of companies in each category has been increasing over time; the largest increase is for domestic standalones; their number increased five times between 2000 and 2011.

Table 1.1: Number of observations by ownership category.

	no of obs	no of firms	% of total firms
foreign multinational	382,353	45,839	1.4%
domestic multinational	43,249	4,751	0.1%
domestic group	911,670	112,026	3.5%
domestic standalone	3,573,689	608,231	18.9%
other group	3,105,551	435,654	13.6%
unidentified multinational	427,459	50,268	1.6%
missing ownership	8,304,161	1,953,622	60.9%

Note: Number of company-year observations classified into each ownership category. Whole sample. Source: HMRC data.

mation and full 12 months accounting period for each matched HMRC-FAME observation and call the obtained sample the selected sample.[9]

The selected sample is representative of the whole population. The chosen selection criteria exclude a similar proportion of number of observations, tax liabilities, taxable profits and trading turnover across the ownership types. Therefore the distribution of taxable profits and tax liabilities across ownership types is similar in the full population of UK companies and in the selected sample, which allows me to draw externally valid inference.

The majority of the comparisons in the paper focuses on the three distinct ownership types: foreign multinationals, domestic standalones and domestic groups; other groups are very similar to domestic groups, unidentified multinationals to foreign multinationals, while observations in the missing ownership category are similar to domestic standalones. I discuss domestic multinationals separately. This is because more than half of all domestic multinational companies in my sample report only consolidated accounts in FAME data. Therefore, the sample of matched FAME-HMRC domestic multinationals is quite small.

1.2.2 The choice of variables for the analysis

In this section I discuss the choice of the main variables for comparison of the profit reporting behaviour between companies. The decision to use the ratio of taxable profits to

[9]Section 1.5.1 in the Appendix describes each selection criteria in detail and discusses what each of them implies for the analyzed sample.

total assets is driven both by the conceptual issues and by the data availability. I further describe the merits of alterative options for both numerator and denominator of the ratio.

Most of the work in the public economics and finance literature, which focuses on corporation taxes, uses a measure of an effective tax rate to compare the tax paying behaviour of companies. The effective tax rate is defined as a measure of accounting tax liability divided by a measure of accounting profits before tax. This rate would be equivalent to the statutory tax rate, if accounting profits were equivalent to taxable profits and accounting measure of tax was equal to the actual tax liability. However, due to numerous deductions, capital allowances, group loss offset provisions and tax avoidance it is usually lower.

Using effective tax rates to compare companies' tax-paying behaviour has two main difficulties. The first one is that accounting profits appear to be systematically different than taxable profits for multinational companies but not for domestic companies. One reason for this may be that accounting profits measures might be affected by profit shifting to a larger degree for multinational companies.[10] This might generate a bias that could affect the comparison of effective tax rates based on accounting profit measures between ownership types. The second reason is that accounting profits are missing for a large proportion of observations in my sample.

Scaling tax liability from the tax returns by taxable profits by construction would yield the statutory tax rate. In turn, scaling tax liability by a measure of accounting profits and comparing it to statutory tax rates would in effect measure the difference between taxable and accounting profits. Since the main objective of this paper is to establish whether there are systematic differences in the taxable profits reported by multinational and domestic companies, the discussion of the differences between accounting and taxable profits is of secondary importance.

An alternative approach to compare the tax-paying behaviour of companies is to use a measure of tax liability from the returns but consider other scaling factors that are related

[10] Accounting profits include retained profits, royalty and interest receipts all of which could be manipulated.

to the size of the company, but might not be affected by companies' profit shifting to the same extent as accounting profits might be. The alternatives here are trading turnover from HMRC data, total or fixed assets from FAME data or shareholder funds from FAME data. I discuss each of these options in turn.

HMRC data includes information on trading turnover of companies, which is the total value of the sales of a company which arise from its trading activities. Since trading turnover only covers information on trading activities of companies, for consistency purposes the taxable profit measure used when scaling by trading turnover should also only include profits from trading activities, i.e. trading profits. However, a substantial fraction of taxable profits of multinational companies (over 30 percent) comes from activities other than trading, such as overseas income, interest on loans, capital gains (Figure 1.7, Appendix). This is not the case for domestic standalones which derive almost all of their taxable profits from trading activities. Therefore using this measure would disproportionately bias downwards the taxable profits of multinational companies.

What is more, since the trading turnover information comes from the HMRC data, we would expect it to have a universal coverage. However, companies are not required to report trading turnover to the HMRC and as a result many do not. In fact, the fraction of missing observations is larger for trading turnover than for total assets in case of multinationals, but not in case of domestic standalones. This could imply that using trading turnover as a size measure may bias the sample composition towards domestic standalones. However, it turns out that when considering the samples with non-missing trading turnover and non-missing total assets, they appear to be broadly comparable in terms of their main observable characteristics, in particular, the ratios of taxable profits to total assets. Hence, I do not consider the choice of the size measure to be driving the results shown in this chapter.

What is more, trading turnover is quite volatile and responds more strongly to business cycle fluctuations than taxable profits. This is because the measure of taxable profits includes profits not only from trading activities, which vary a lot over time, but also other

sources of profits such an interest from bank deposits, overseas income, net gains etc.[11] Therefore using trading turnover as a scaling measure could introduce additional fluctuations unrelated to the systematic differences in taxable profits between the ownership types.[12]

The size measures available in the accounts, especially the items from the balance sheet such as total assets, fixed assets and shareholder funds offer an alternative scaling factor.[13] Total assets are less volatile than trading turnover, hence they should be a better approximation of firms overall size over time. There are several concerns that may be raised against using total assets as a scaling measure for firm's profits. First, total assets include investments, part of which is the equity value of all subsidiaries that a company owns, which might make a company appear larger than its UK operations are. To alleviate this concern, first, I remove investments from total assets, in cases where data allows it. Second, for foreign multinationals and domestic groups I only use observations which report to have zero subsidiaries themselves. I am unable to do so for domestic multinationals, as 99 percent of them report to have at least one subsidiary. This is likely to be important in understanding why domestic multinationals appear to have one of the lowest ratios of taxable profits to total assets of all the ownership types.

A second issue is that total assets measure is equivalent to the sum of shareholder funds and liabilities. The interest payments (on debt) are deductible so that the corporate income tax base approximates the profits accruing to shareholders, not the profits accruing to shareholders and debtholders. This means that for companies with higher leverage (debt to asset ratio) total assets will be higher for a given level of shareholder funds. This in turn implies that the more leveraged the company is, the lower its taxable profits to total assets ratio would be. This may be a serious concern, especially in the light of multinational companies using debt shifting to minimize the size of their corporate tax base. However, since I have detailed data on leverage, I can explore the differences in debt to assets ratios

[11]For a breakdown of taxable profits into various categories see Appendix, Fig 1.7.

[12]For more details see Appendix 1.5.1.

[13]Table 1.11 in the Appendix outlines what each measure includes and how they are related to each other.

between multinational and domestic companies. This offers interesting insight into leverage differences between various ownership types.

Another possible scaling measure for taxable profits could be shareholder funds. Shareholder funds is a sum of issued capital and total reserves, which is the book value of equity of a given company. By definition shareholder funds are equivalent to total assets less liabilities, hence using this measure will exclude the discussion of leverage differences from the analysis. This may cause concern, since this measure does not reflect profit shifting through debt, which may be one of the sources of differences in taxable profits between ownership types.

The choice of the scaling factor cannot be discussed without considering the numerator. Since most of the tax literature uses corporation tax variable from the profit and loss account, a most natural candidate from the tax returns would be tax liability or net tax payable. The interpretation of any tax measure scaled by total assets is not a very obvious one. In turn, taxable profits scaled by total assets is a tax returns measure of returns on assets. This measure is an indicator of how profitable a company is relative to its total assets. What is more, since the UK taxes small and medium companies differently than the large ones, using taxable profits will eliminate the variation in the tax rates from the analysis.[14]

1.3 Stylized facts

In this section I present novel stylized facts on companies' contributions to tax and taxable profits in the UK. Specifically, I show the proportion of net tax payable and the differences in the mean ratios of taxable profits to total assets between various ownership types. I further discuss possible explanations for the observed differences.

Table 1.2 shows the fractions of net tax payable by ownership types. Columns 4 and 5 show the breakdown of net tax payable contributed by each ownership type for the

[14] In the UK smaller multinational subsidiaries often qualify for tax payments using small and medium tax rate.

selected sample, while columns 2 and 3 show the same breakdown for the whole sample.[15] Foreign multinationals have contributed 23% of total tax in the UK over the years 2000 - 2011. This, together with domestic multinationals and unidentified multinationals means that multinational companies paid 55% of total UK corporation tax over the period. This fraction is the same for taxable profits. Importantly, the fraction of tax revenues coming from multinational companies has declined since 2000, from around 60 percent in 2000 to 50% in 2011 (Figure 1.8, Appendix).[16]

Table 1.2: Net tax payable by ownership type.

	whole sample (bln)	%	selected sample(bln)	%
foreign multinational	104.0	23%	69.9	22%
domestic multinational	48.0	11%	29.1	9%
domestic group	49.5	11%	34.9	11%
domestic standalone	27.5	6%	24.7	8%
other group	83.2	18%	58.2	19%
unidentified multinational	97.7	21%	58.7	19%
missing ownership	47.4	10%	35.6	11%

Note: Total and proportion of net tax payable contributed by various types of companies by ownership type (in billions of pounds), selected vs whole sample, 2000 - 2011. Whole sample refers to the universe of corporate tax returns from the HMRC data, selected sample refers to the selection criteria described in section 1.2.1. Source: HMRC data.

However, the comparison of the levels of tax liability or the levels of reported taxable profits is not very informative, as we expect multinational companies to be much larger than domestic groups, which in turn would be larger than domestic standalones. If multinationals are larger than domestic companies, then we would expect them to also have more profits and hence pay more tax in levels. Therefore, I take into consideration the discussion of the scaling factors and profit measures from section 2 and consider the taxable profits scaled by total assets to understand the differences in taxable profits between companies by ownership type.

[15]Net tax payable is the tax liability after accounting for double tax relief and marginal tax relief.

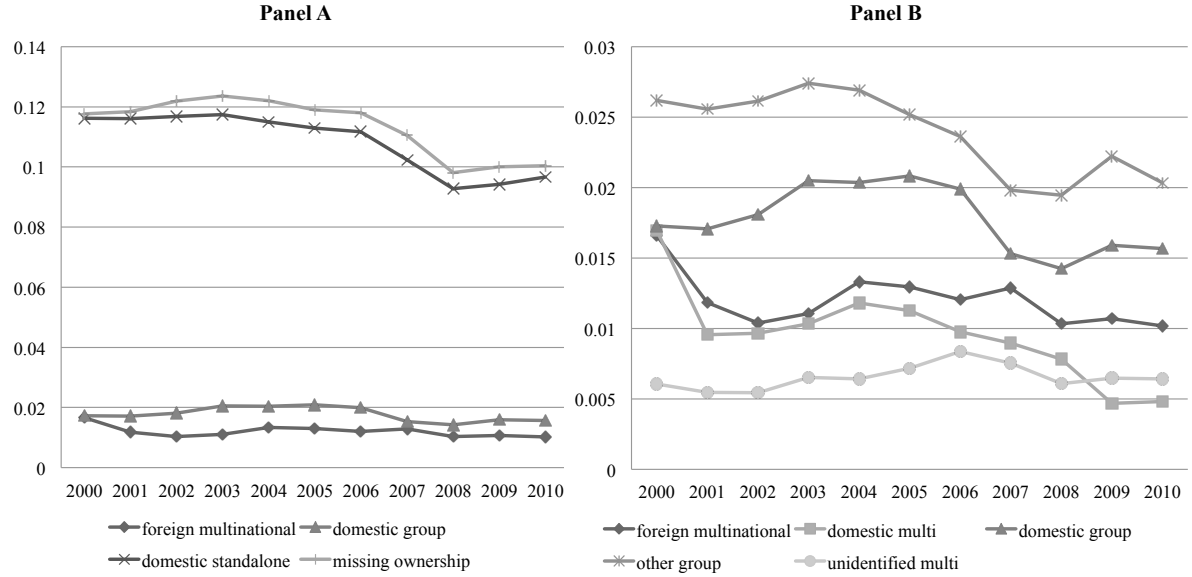
[16]The proportion of trading profits contributed by multinational companies is similar to that of net tax (see Figure 1.8 Panel B).

In Figure 1.1 I sum all taxable profits in each year by ownership type and do the same for total assets. I then divide one sum by the other to arrive at the weighted means of taxable profits scaled by total assets for each ownership type. In Panel A I show domestic standalones, companies in the missing ownership category, foreign multinationals and domestic group lines, while in Panel B I show in more detail the differences between different types of multinational companies and domestic groups. Domestic standalones and companies in the missing ownership category report substantially more taxable profits relative to their total assets than any other companies. For instance, the difference amounts to 10-11 percentage points between domestic standalones and foreign multinationals. Moreover, domestic groups and other groups report more taxable profits than multinational companies (Panel B). The difference in the ratio of taxable profits to total assets between domestic groups and foreign multinationals is much smaller than the one between domestic standalones and domestic groups, and amounts to 0.5 percentage points between foreign multinationals and domestic groups at most, with the largest difference between other group and unidentified multinationals, 2 percentage points. These differences mean that foreign multinationals report 25 percent lower ratio of taxable profits to total assets than domestic groups.

Further, it is important to note that domestic multinationals and unidentified multinationals are the two ownership groups which report the lowest ratio of taxable profits to total assets. This may be because, as mentioned above, almost all of the domestic multinationals actually report having subsidiaries, which means that their total assets measure includes the equity value of those subsidiaries and hence is relatively larger than the size of their unconsolidated operations in the UK. Conceivably, the same may be the case for unidentified multinationals, for which I have no ownership data. These are the companies that receive overseas income from abroad, and hence may be holding companies.

If the primary driving force behind the differences in taxable profits reported by multinationals and domestic companies was profit shifting, I would expect the difference between domestic groups and multinational companies to be larger. Domestic groups cannot shift

Figure 1.1: Taxble profits divided by total assets by ownership type.



Note: Weighted ratio of taxable profits divided by total assets calculated for each ownership type and for each year, 2000 - 2011, balanced selected sample. Panel A: domestic standalones vs multinatioanals vs domestic groups, Panel B: all groups. Source: merged HMRC and FAME data.

profits abroad. On the other hand, I find that domestic groups report much lower taxable profits relative to total assets than domestic standalones. I now turn to identify factors which explain the observed differences in the ratio of taxable profits to total assets between ownership types.

1.3.1 How Do Multinational Companies Report Lower Taxable Profits?

Proportion of zero taxable profit reporting companies

The first aspect of explaining the difference between multinationals and domestic companies is the proportion of observations where zero taxable profits are reported. 60 percent of observations identified as domestic multinationals and foreign multinationals report zero taxable profits (NB they may also make losses). In contrast domestic standalones report the lowest proportion of zero taxable profits, 27.5 percent. Domestic groups place in between those two extreme categories reporting zero taxable profits for 46 percent of their observations (Table 1.3).[17] These proportions fluctuate slightly over time and they

[17]Note that these fractions are very similar when I consider number of firms reporting zero taxable profits at least once during the sample period.

all increased following the financial crisis. However, the ranking between ownership types have remained unchanged since the beginning of the sample.

Table 1.3: Proportions of observations reporting zero taxable profits by ownership type.

	all observations	do not report trading loss	report trading loss
foreign multinational	59.2%	33.7%	25.6%
domestic multi	62.5%	48.1%	14.4%
domestic group	46.0%	23.9%	22.1%
domestic standalone	27.5%	9.8%	17.7%
other group	49.0%	18.1%	31.0%
unidentified multi	44.4%	26.2%	18.2%
missing ownership	34.9%	12.6%	22.3%

Note: Column 1: fraction of observations reporting zero taxable profits, Columns 2 and 3 sum up to column 1 and break zero taxable profits into observations with zero taxable profits, which report to have trading losses, column 2, and those which report to have no trading losses, column 3. Selected sample, 2000 - 2011. Source: HMRC data.

The zero taxable profit reporting behaviour is persistent, especially amongst foreign multinational companies. Specifically, the mean zero taxable profit reporting spell is the longest for foreign multinational companies and lasts 6 years. In contrast, it is only 3 years for domestic standalones.[18] Further, over 73 percent of foreign multinational companies report zero taxable profits more than once during the sample period, while only 43 percent of domestic standalones do so.

Companies may report zero taxable profits for various reasons. They may be loss making in the current year, they may be carrying losses back or forward or they may be investing and hence using capital allowance deductions to offset them against their taxable profits. The most important reason is likely to be the presence of taxable losses. The UK tax system treats profits and losses asymmetrically. This means that when a company makes a positive taxable profit, it pays tax. In turn, when it makes a loss, it does not receive tax credit on this loss, but instead pays no tax in that year. The portion of losses that is attributed to trading activities can be carried forward and offset against positive taxable profits in future years or alternatively carried back and offset against positive taxable profits in the previous year. In the tax return form, companies report

[18]Here I limit the sample of observations to a balanced panel, where firms have to report taxable profit for 12 years.

losses separately from their taxable profits. Taxable profits are censored at zero, but part of the losses that arise from trading activities can be recovered to understand where the zero taxable profits come from.

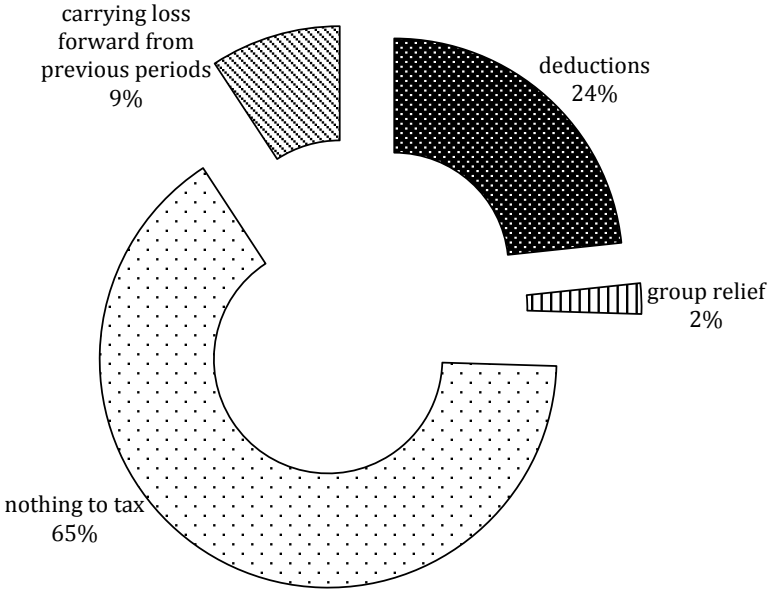
I find that over 57% of the zero taxable profit observations in the foreign multinationals category report to have no trading loss. At the same time just over 36% of the zero taxable profit observations in the domestic standalones category do so. This means that 34% of all foreign multinationals report zero taxable profits and no trading loss relative to only 10% of domestic standalones (see columns 3 and 4 in Table 1.3). For domestic groups, this fraction is 24%, placing it in between the two extreme ownership categories. However, it is important to note that companies can use profit shifting techniques, such as high leverage, abusive transfer pricing or royalty payments as part of their trading activities and hence manipulate trading profits to put themselves in the trading loss position. Therefore the trading loss position might not necessarily signify that a company is loss making in a traditional sense, it might also be a sign of profit shifting.

Most of the zero taxable profit observations - 65% - come from observations where companies report in their tax statement to have zero trading profits, no other sources of taxable income, and hence zero taxable profits. In Figure 1.2 these are companies called 'nothing to tax'. Amongst those companies some have made a loss in that particular year, some have used capital allowances or research and development expenditures to reduce their taxable profits, some did both, and for some I have no further information on how they reached zero taxable profits. 24% of observations which have taxable profits equal to zero, come from companies claiming various deductions. These deductions include items such as, for instance, management expense, non-trade capital allowances or interest distributions[19]. Specifically, those companies report positive taxable profit before deductions, but zero taxable profits after deductions. Companies claiming all of their remaining taxable profits as part of group relief constitute 2% of the zero taxable profits observations (see Figure 1.2). A company with multiple subsidiaries in the UK, whether domestic or multinational, can use group relief offered by HMRC to offset losses made by one of the companies in a

[19]For more details, see boxes 22, 24 to 30 and 32 on the CT600 tax return form in the Appendix.

group against profits of another company in that group. The contributions to zero taxable profits by source do not differ substantially between various ownership types; 63% of foreign multinationals report having 'nothing to tax' relative to 67% of domestic standalones.

Figure 1.2: Zero taxable profit observations by source.



Note: Sources of zero taxable profits come from the CT600 tax return form. Nothing to tax refers to companies which report zero trading profits; carrying loss forward from previous periods refers to companies which made positive trading profits, but have made losses in previous periods and are claiming those losses against their positive trading profits; deductions refers to box 33 in the tax return form, which is a sum of all tax deductible expenses; group relief refers to companies that had positive taxable profits even after deductions, but were able to offset those profits with losses of other members of the group. Selected sample, 2000 - 2011. Source: HMRC data.

To understand differences between companies reporting zero and positive taxable profits, I look at the differences in their observable characteristics, in particular, size, age, industry and headquarter location. In Figure 1.9 (Appendix), considering the two most extreme categories, foreign multinationals and domestic standalones, I show that zero taxable profit reporting companies are very similar to positive taxable reporting profit companies in terms of size for both ownership types. Companies reporting zero taxable profits seem to be slightly smaller, but not largely so.

In Figure 1.10 in the Appendix we can see that the distribution of age between positive and zero taxable profits companies is not that different for both foreign multinationals

and domestic standalones. What is more, there are no marked differences in terms of whether their headquarters are located in higher or lower tax countries than the UK. Of all foreign multinational companies with headquarters in countries with tax rates higher than the UK one, 58% of observations report to have zero taxable profits in the UK. This is not very different from the 54% of foreign multinational observations for companies that have parents in countries with tax rates lower than the UK one that report to have zero taxable profits in the UK. What is more, about half of foreign multinational subsidiaries operating in the UK are headquartered in countries with higher statutory corporate tax rates than the UK, while the other half is headquartered in countries with statutory corporate tax rate lower than the UK one. This suggests that companies which report zero taxable profits do not systematically come from countries where tax rates are much lower. Multinationals headquartered in countries with lower tax rate than the UK might have more of an incentive to locate their profits in their lower tax headquarters, hence shifting them away from the UK and lowering their tax liability here.

Further, a large fraction of observations from the foreign multinational companies category in finance and services sectors reports to have zero taxable profits in the UK (Table 1.12 in the Appendix). In case of domestic standalones more zero taxable profits are reported in agriculture and construction sectors than by finance and services companies. This is consistent with some of the recent newspaper articles "naming and shaming" large foreign finance and services companies paying little or no tax in the UK.

Non-comparable size distributions

Another reason why domestic and multinational companies might have very different ratios of taxable profits to total assets is because they are not comparable when it comes to their size. Multinationals and domestic groups may be larger, more productive and hence more profitable than domestic standalones (Yeaple (2013)). In this section I consider how multinational and domestic companies of comparable sizes differ from the non-comparable

ones. I focus the discussion mainly on the differences between the two most extreme categories, foreign multinationals and domestic standalones.

First, I look at the distribution plots of logarithm of trading turnover (Panel A) and logarithm of total assets (Panel B) by ownership type to see whether there are any overlapping regions between different types of companies (Figure 1.3). As expected domestic standalones are much smaller than foreign multinationals. The density plot of the size distribution of domestic multinationals seems to be furthest to the right, while domestic standalones furthest to the left, with foreign multinationals, unidentified multinationals, domestic groups and other groups in between.

To compare companies of the same sizes, I choose a sample of observations which includes the selected sample of foreign multinational companies and domestic standalones only. I take the largest domestic standalone in terms of total assets in each 2 digit industry and call all foreign multinationals larger than that domestic standalone, unmatched. I then take the smallest foreign multinational in terms of total assets and call all domestic standalones smaller than that multinational, unmatched. I now have what I call a matched sample and an unmatched sample, where using my method I excluded almost 9% of foreign multinationals and 3% of domestic standalones (Table 1.4, Panel A).

Table 1.4: Tax and taxable profit ratios for matched and unmatched samples.

		taxable profits/ total assets		tax/ total assets		% of matched obs
		matched	unmatched	matched	unmatched	
Panel A: min, max	foreign multinational	0.054	0.008	0.016	0.002	91.33
	domestic standalone	0.108	0.251	0.025	0.053	97.19
Panel B: 1 percentile	foreign multinational	0.077	0.012	0.021	0.003	57
	domestic standalone	0.108	0.395	0.025	0.052	95.1

Note: Weighted means of the ratio of taxable profits to total assets and the ratio of tax to total assets split by manually matched and unmatched sub-samples for various matching methods; selected sample, 2000 - 2011. Panel A: min and max used as a size cut-off benchmark, Panel B: top and bottom 1 percent used as a size cut-off benchmark. Source: merged HMRC and FAME data.

One may worry whether the largest domestic standalone is representative of the population and whether it is not substantially larger than the average. The same concern can be raised about the representative nature of the smallest foreign multinational. To alleviate

those concerns I also take top and bottom 1 percentile of the respective categories as a benchmark instead of the smallest and largest companies and perform the same analysis on this more limited sample. Using this method, 43 percent of foreign multinational companies are larger than top 1 percentile of the distribution of domestic standalones, while only 4.9 percent of domestic standalones are smaller than the smallest 1 percentile of the distribution of foreign multinational companies (Table 1.4, Panel B). This suggests that the largest domestic standalone is not very representative of the rest of the sample, while the smallest multinational is.

In Table 1.4, I compare the characteristics of the matched and unmatched samples in terms of the main variables of interest, i.e. the ratio of taxable profits to total assets and the ratio of tax to total assets.[20] Strikingly, across both matching methods the mean weighted ratio of taxable profits to total assets for the unmatched foreign multinationals is much smaller, e.g. 0.8% for min max matching, than that for the matched ones, e.g. 5.4% for min max matching, while the ratio of taxable profits divided by total assets for domestic standalones is much larger in the unmatched sample, 25.1% for min max matching, than in the matched one, 10.8% for min max one. Generally, the matched ratios are much closer to each other than the unmatched ones across both methods. This means that more comparable companies in terms of size report more similar profits relative to total assets and it is the tails of the distribution, i.e. the very large multinationals and the very small domestic companies that are mainly driving the large difference in the weighted means.

In Figure 1.4 I plot the weighted ratios of taxable profits to total assets for domestic standalones and foreign multinationals. Figure 1.4 also includes companies from the missing ownership category and unidentified multinationals for which a similar matching procedure has been applied. In Panel A I replicate Figure 1.1, which includes all observations from the selected sample. In Panel B, I limit the sample to include only companies of comparable sizes, as summarized in Table 1.4. The exclusion of the very large multi-

[20]Note that the mean ratios of taxable profits to total assets are calculated dividing the sum of taxable profits by the sum of total assets for each sub-group.

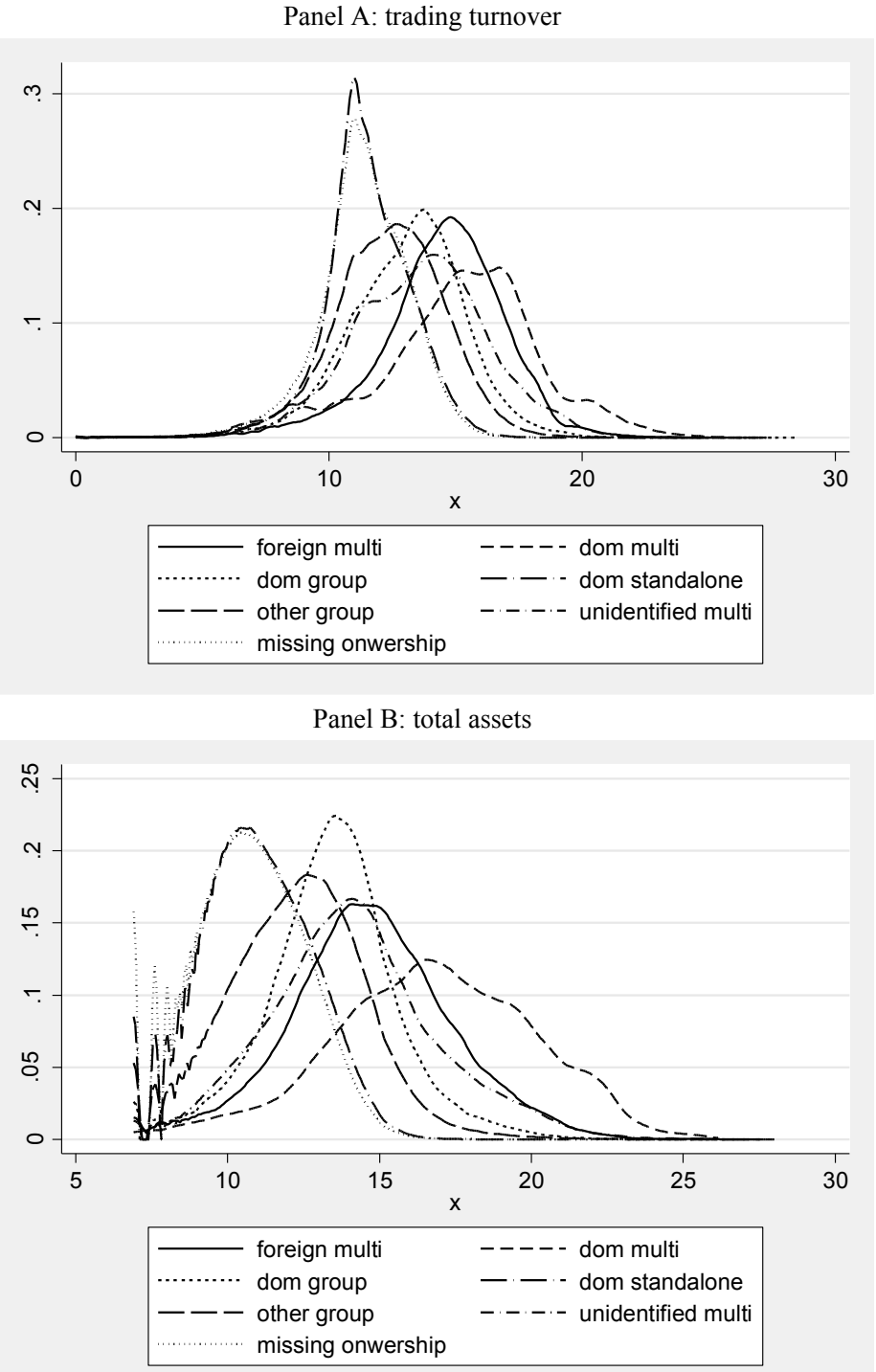
nationals and very small domestic companies brings the ratios of taxable profits to total assets for the analyzed ownership categories closer together. Here, the means of the weighted ratio of taxable profits to total assets do not change substantially for domestic standalones and missing ownership categories, but foreign and unidentified multinationals report much higher taxable profits relative to total assets compared to Panel A. Foreign multinationals still report the lowest ratios of taxable profits to total assets, but the difference between them and domestic standalones has declined substantially. The difference is around 11 percentage points using all observations, while after limiting the size of compared companies it is around 4 percentage points at the start of the sample period and 2 percentage points at the end of it.[21,22]

Finally, I remove all observations for companies that have reported zero taxable profits in a given year and calculate weighted means of the ratio of positive taxable profits to total assets for each ownership type for companies of comparable sizes (Figure 1.4, Panel C). First, the means of weighted ratios of taxable profits to total assets for all types of companies increase. Second, the ratios of taxable profits to total assets for domestic companies and multinationals is very similar during the sample period, conditional on reporting positive taxable profits. This indicates the importance of zero taxable profit reporting in accounting for the difference in the ratio of taxable profits to total assets between multinational and domestic companies.

[21] When I remove the smallest and the largest multinationals and domestic standalones, based on the minimum/ maximum strategy, the difference is a bit larger than in Panel B, as expected, with the foreign multinationals line at 0.07 at its highest and 0.04 at its lowest.

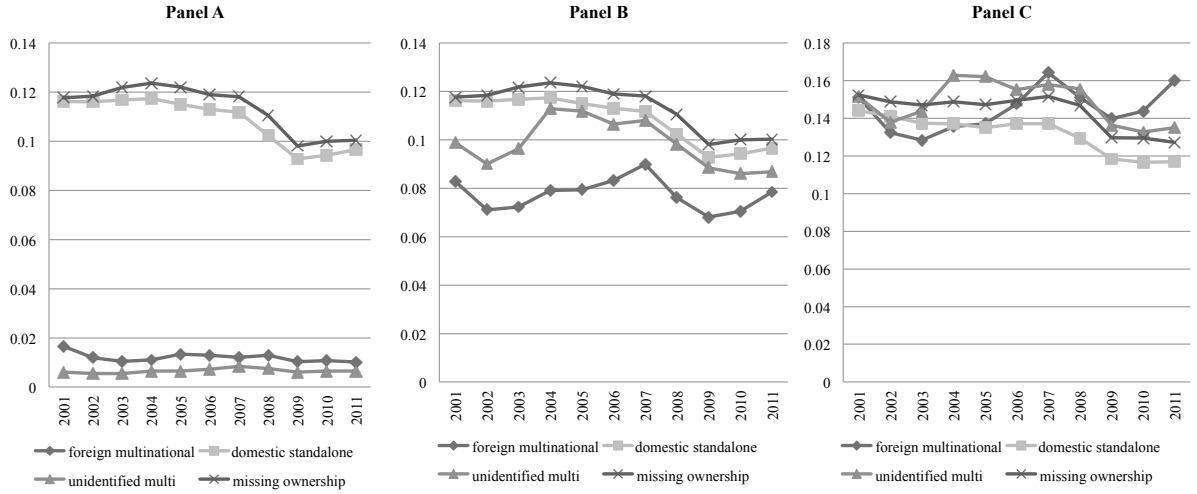
[22] When comparing multinationals to domestic groups, I find that the size of the difference in the ratio of taxable profits to total assets in the overlapping region is very similar to that in the whole sample. This is because there are very few domestic group members for which no comparable multinationals exist.

Figure 1.3: Size distributions of companies by ownership type.



Note: Panel A: logarithm of trading turnover, Panel B: logarithm of total assets, selected sample, 2000 - 2011. Source: merged HMRC and FAME data.

Figure 1.4: The ratios of taxable profits to total assets, various sub-samples.



Note: The ratio of taxable profits to total assets (weighted means), selected sample, 2000 - 2011. Panel A: selected sample, Panel B: selected sample after removing very large multinationals and very small domestic companies, using top and bottom 1 percentile in each ownership group; Panel C: positive taxable profits only on the manually matched sample, using top and bottom 1 percent of observations in each category as a size cut off point. Source: merged HMRC and FAME data.

1.3.2 Why Do Multinational Companies Report Lower Taxable Profits?

Differences in leverage

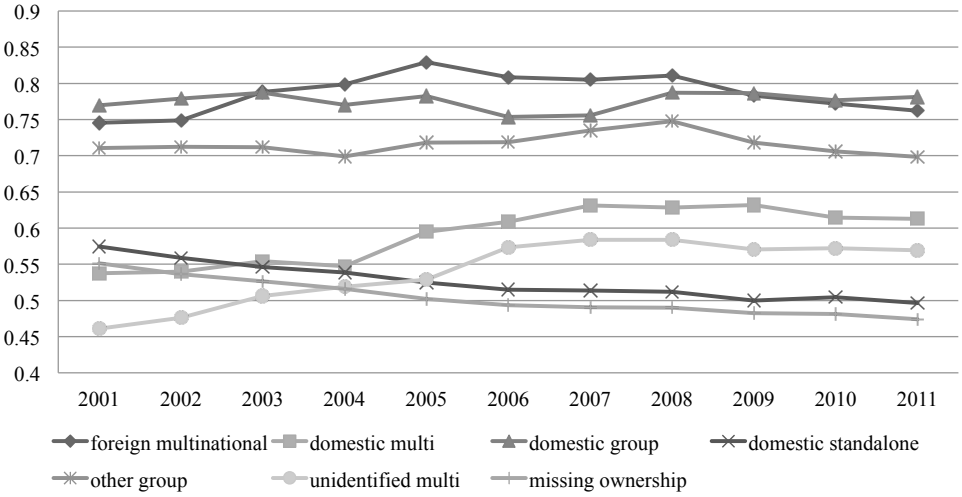
The evidence from the literature shows that larger companies tend to borrow more and hence domestic groups, which are larger than domestic standalones, might use more debt as a tax shield (Frank and Goyal (2009), Graham and Leary (2011)). This is confirmed in the data by looking directly at leverage (see Figure 1.5). Foreign multinationals and domestic groups report having much higher debt to assets ratio than domestic standalones. Their leverage is not very different from one another though.

The FAME accounting dataset includes information on stock measure of leverage of companies, i.e. total liabilities divided by total assets. This allows me to consider the differences in debt relative to total assets between companies of different ownership types. Specifically, Figure 1.5 shows the averages weighted ratios of total liabilities to total assets. Foreign multinationals, domestic groups and other groups have substantially higher leverage than other types of companies. Domestic standalones and companies in the missing ownership category have the lowest leverage in the second half of the sample period, after 2005. Before 2005 their leverage was comparable with what unidentified and domestic multinationals reported. The total leverage of foreign multinational companies is the largest amongst all ownership categories and amounts to somewhere in the region of 0.75 - 0.85, while the total leverage of domestic standalones is around 0.55- 0.45. This shows that foreign multinatationals are indeed more leveraged. To the extent that multinational companies use debt as part of their profit shifting strategies, this might also give an indication on the extent of their debt shifting practices.[23] Since interest payments are deductible against taxable profits in the UK, part of the large difference in the ratio of

[23]The total leverage figure can be separated into group loans, which correspond to intra-group lending, and other liabilities. Only domestic and foreign groups of companies have intra-group lending. Companies may choose to locate debt in the UK for non-tax reasons, such as a preference to hold debt in their headquarters, if these headquarters are located in the UK. In addition, intra-group lending could also be an indirect sign of debt shifitng practices. Group loans constitute between 13 %and 24 % of total liabilities of foreign multinational companies.

taxable profits to total assets between multinationals and domestic companies, could be explained by the differences in leverage between ownership types.

Figure 1.5: Leverage by ownership type.



Note: Weighted means of leverage measured as the ratio of liabilities to total assets by ownership type, selected balanced sample, 2000 - 2011. Source: merged HMRC and FAME data.

As discussed in section 1.2.2 an alternative scaling measure for taxable profits that can be used for comparison between ownership types is shareholder funds. Scaling taxable profits by total assets and comparing the results to scaling taxable profits by book value of equity will give me an indication on how much leverage is used by companies. Since total assets measure is equivalent to a sum of liabilities and shareholders equity, we would expect the total assets numbers to be larger for firms with the same shareholders funds that have higher liabilities in the UK. This implies that scaling by total assets makes the ratio of taxable profits to total assets smaller for highly leveraged firms. Figure 1.11 in the Appendix compares scaling taxable profits by total assets with scaling by shareholder funds. Taxable profit scaled by book value of equity are larger than those scaled by total assets with the relative difference largest for foreign multinationals. This confirms the direct evidence from the leverage plots in Figure 1.5.

There is quite a large sectoral heterogeneity for companies in my sample (Table 1.5 and Figure 1.6). There are clearly two significantly different groups of sectors where companies have different ratios of taxable profits to total assets The first group includes companies in mining, transportation and public utilities, retail trade, construction, wholesale trade and manufacturing sectors. The companies in those sectors have substantially higher ratios of taxable profits to total assets than companies that belong to the second group of sectors (finance, insurance, real estate, services, agriculture and public administration).[24] There is quite a large gap between the two groups, especially prior to 2006, where companies from sectors which have higher ratios of taxable profits to total assets report these ratios to be in a region of 4-6%, whereas companies which have lower ratios of taxable profits to total assets report these ratios to be in a region below 1%. The gap between the two groups narrowed since 2006, due primarily to declining ratios of taxable profits to total assets reported by companies in the construction and wholesale trade sectors. Mining has always had the largest ratio of taxable profits to total assets, because it includes North Sea oil companies, which pay much higher corporation tax rates than other companies in the UK. Finance companies tend to have one of the lowest ratios of taxable profits to total assets. This appears to pre-date the financial crisis.[25]

These differences are also quite pronounced between ownership types, where foreign multinationals report very low ratios of taxable profits to total assets in finance and services sectors relative to domestic standalones (Table 1.5). Domestic standalones report higher ratios of taxable profits to total assets for all but mining sector, where they do not have much presence. The ratios of taxable profits to total assets for domestic groups across industries are much more comparable to those of foreign multinationals. This is consistent with the overall picture that the ratios of taxable profits to total assets of domestic groups

[24]The sectors are created using SIC 4 digit industry codes from which I use 1st digit to construct a broad sector category. For the categories and corresponding digits see Table 1.5. The SIC 4 digit codes data comes from the FAME accounting dataset.

[25]Note that 40 percent of companies in the UK belong to the services industry, while 15 percent are in agriculture and 10 percent in transportantion and public utilities.

are more similar to those of foreign multinational companies than the ratios of taxable profits to total assets of domestic standalones. Even though there are major differences between industries in terms of the ratios of taxable profits to total assets reported, foreign multinationals have the lowest ratios across almost all sectors.

Table 1.5: Heterogeneity between sectors in the ratios of taxable profits to total assets.

Heterogeneity	all obs	foreign multinational	domestic standalone	domestic group	number of obs
1: agriculture, forestry and fishing (01-09)	0.009	0.008	0.100	0.017	1,756,233
2: mining (10-14)	0.103	0.124	0.028	0.063	164,224
3: construction (15-17)	0.032	0.036	0.097	0.043	78,102
4:manufacturing (20-39)	0.037	0.028	0.114	0.046	861,030
5:transportation & public utilities (40-49)	0.048	0.029	0.136	0.041	1,153,223
6: wholesale trade (50-51)	0.030	0.012	0.102	0.044	781,441
7: retail trade (52-59)	0.053	0.044	0.109	0.030	930,901
8: finance, insurance & real estate (60-67)	0.005	0.003	0.111	0.005	640,831
9: services (70-89)	0.008	0.011	0.113	0.017	4,740,751
10: public administration (91-98)	0.008	0.015	0.124	0.020	828,096

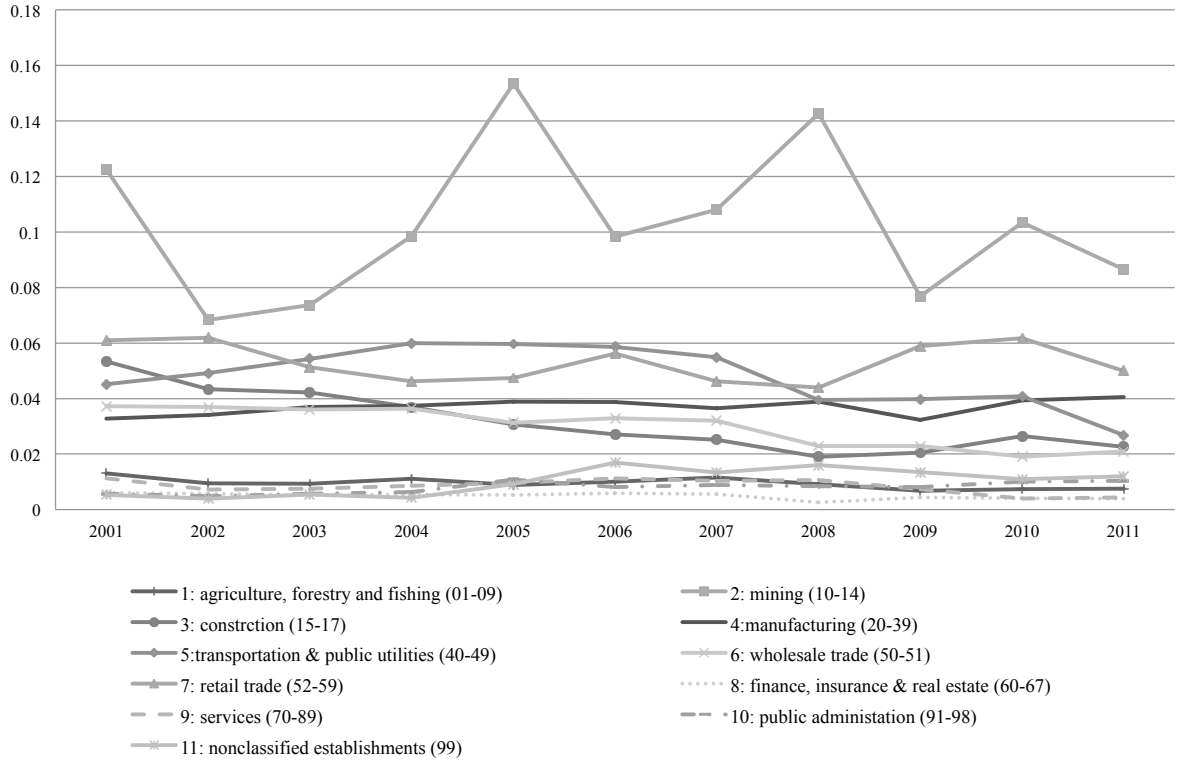
Note: The ratio of taxable profits to total assets, weighted averages, heterogeneity between sectors for the years 2000-2011, differences between ownership types, selected sample. Source: merged HMRC and FAME data.

Investment and productivity differences

Another possible explanation for lower ratio of taxable profits to total assets for multinational companies could be that multinationals invest more or spend more money on research and development (R&D) than domestic firms. Therefore they may be entitled to legitimate tax deductions such as capital allowances that can be responsible for bringing their profits down. This may also partially explain the larger fraction of zero taxable profit reporting companies amongst multinational companies as both capital allowances and R&D tax credits could be used to reduce the taxable profits to zero.

In Table 1.6 I present the ratio of capital allowances to total assets and mean capital allowances for each ownership type. Domestic standalones tend to claim much higher capital allowances as a fraction of their size than foreign multinationals, e.g. the ratio of capital allowances to total assets claimed by domestic standalones is 0.046, while it is 0.019 for foreign multinationals. Domestic groups claim 0.021 of capital allowances relative to

Figure 1.6: Sectoral and yearly heterogeneity of the ratios of taxable profits to total assets.



Note: The ratio of taxable profits to total assets, weighted averages by sector calculated separately for each year 2000-2011, selected sample. Sector categories are built based on the SIC 4 digit codes (2 digit SIC ranges in brackets). Source: merged HMRC and FAME data.

total assets, which again is in between the two extreme ownership categories and much closer to foreign multinationals ratio. Foreign multinationals claim higher mean capital allowances. However, this is primarily due to the fact that they are much larger than domestic standalones. This suggests that capital allowances cannot be the driving force in explaining the lower taxable profits reported by foreign multinational companies.

Further, the differences in profitability between firm ownership types do not come from the differences in productivity. There is large international trade literature which investigates the productivity of multinationals relative to domestic companies (Yeaple (2013), Harris and Robinson (2003), Griffith (1999), Benfratello and Sembenelli (2006), Girma and Gorg (2007), Wang and Wang (2015)) and finds that multinationals tend to more productive than domestic companies.

To investigate this I calculate total factor productivity (TFP) for each firm in the sample, which measures the portion of output not explained by the amount of inputs

used in production. Here I use a measure of TFP based on value added, which subtracts capital and labour inputs from firms outputs to measure the productivity residual, i.e. $TFP_{it} = va_{it} - (1 - sl_{it}) \times k_{it} - sl_{it} \times l_{it}$, where va_{it} is logarithm of value added, where value added is measured as a sum of wages and salaries and profit and loss before interest, sl_{it} is share of labour, which is a ratio of wages and salaries divided by value added, k_{it} is logarithm of fixed assets, l_{it} is logarithm of number of employees and i and t refer to firm and year.

Using the firm and year specific TFPs, I calculate the mean TFP for each ownership category across all sample years (Table 1.6). The mean total factor productivity is higher for foreign multinational companies than for domestic standalones, which is consistent with the previous literature on productivity differences. Again the productivity of domestic groups as measured by TFP here is very similar to that of multinationals in my sample. These results suggests that the observed differences in the ratio of taxable profits to total assets between various ownership types cannot stem from the differences in productivity. It appears that more productive companies report lower ratios of taxable profits to total assets.

Table 1.6: TFP and capital allowances by ownership type.

	mean TFP	mean ca	ca/ta
foreign multinational	14.5	554,680	0.019
domestic multinational	15.1	1,746,700	0.011
domestic group	14.1	151,510	0.021
domestic standalone	11.1	7,270	0.046
other group	13.9	53,395	0.030
unidentified multinational	14.4	406,751	0.017
missing ownership	11.2	5,920	0.043

Note: Column 2 shows mean total factor productivity (TFP) by ownership type, column 3 mean of total capital allowances claimed against taxable profits and column 4 weighted means scaled by total assets; ca is capital allowances, ta is total assets; selected sample, 2000 to 2011. Source: merged HMRC and FAME data.

1.4 Conclusion

This chapter uses the population of UK companies to present new stylized facts on taxable profit reporting behaviour of UK companies. In particular, I show that multinational companies paid the majority of the UK corporation tax, 55 %, over the period 2000 - 2011. However, the fraction of tax contributed by multinational companies to the UK tax revenue has decreased over time and dropped from 60 % in 2000 to just over 50% in 2011. Multinational companies contribute this large portion of the UK tax revenue, in spite of constituting only 3% of the number of all companies in the UK.

Even though multinationals pay a large amount of tax in levels, this is because they are typically much larger and hence generate much more turnover and much higher profits than domestic companies. Therefore in this chapter I focused mainly on comparisons between domestic and multinational companies in terms of the ratios of taxable profits to total assets. The ratio of taxable profits to total assets is much smaller for multinational companies than it is for domestic companies. The largest difference can be seen between foreign multinational companies and domestic standalones, where domestic standalones report 6 times more taxable profits relative to their size than foreign multinational companies. The difference in the ratio of taxable profits to total assets is much smaller between multinationals and domestic groups of companies.

This chapter also identifies factors associated with lower taxable profits of multinational companies. I show that a large fraction - 60 percent - of observations in the multinational ownership category reports zero taxable profits, while domestic companies have much lower propensity to report zero taxable profits. Further, I explore differences in leverage, industry distribution, size distribution, productivity and capital allowances as possible factors that could contribute to lower taxable profits of multinational companies. In particular, I show that multinational companies have higher leverage and are more productive than domestic companies. Multinational companies also report particularly low ratios of taxable profits to total assets in finance sector. In turn, it is domestic companies which on average claim higher capital allowances relative to total assets. Finally, the more comparable the size of

multinational and domestic companies, the closer their ratios of taxable profits to total assets are.

The availability of the new confidential corporate tax returns data for the UK has allowed me an in depth analysis of the tax paying behaviour of companies in the UK. The next chapter of this thesis uses the data described here to explore whether the differences in taxable profits can be attributed to profit shifting of multinational companies. In particular, I explore how we can use the UK confidential corporate tax returns data to learn about how aggressive are multinational companies in reducing their corporate tax liabilities.

1.5 Appendices

1.5.1 Further description of variables and data

Detailed ownership definitions

Comparing multinational companies to domestic companies means that one of the crucial parts of this paper is the identification of companies into the right ownership category. To do so, I start by using the ownership information available in the FAME dataset which contains data on global ultimate owners of companies, their country of residence and whether they are companies or individuals. I define a multinational as a company that

- has an ultimate parent which is not located in the UK[26], OR
- has a (wholly-owned) direct subsidiary which is not located in the UK, OR
- has a (wholly-owned) affiliate in the chain of ownership which is not located in the UK (ownership chain goes 10 levels down), OR
- has an ultimate parent which is located in the UK, but the ultimate parent itself has a foreign subsidiary.

I also distinguish between domestic and foreign multinationals and multinational subsidiaries and multinational headquarters. In the FAME data headquarter status is equivalent to the ultimate owner status. This leads to effectively having the following multinational categories:

- foreign multinational subsidiary,
- domestic multinational subsidiary,

[26] "To define an Ultimate Owner, FAME analyses the shareholding structure of a company having an Independence Indicator different from A+, A or A- (which means that the company is independent and consequently, has no Ultimate Owner). It looks for the shareholder with the highest direct or total % of ownership. If this shareholder is independent, it is defined as the Ultimate Owner of the subject company and a UO link is created between the subject company and the Ultimate Owner. If the highest shareholder is not independent, the same process is repeated to him until FAME finds an Ultimate Owner." The quote is taken directly from the FAME ownership Help file.

- domestic multinational parent.

In 70 percent of cases, FAME does not provide any information on the ownership structure of companies. For those companies with missing ownership information, I supplement the FAME ownership data with other variables from FAME and HMRC dataset to identify companies into two additional ownership categories, which I call 'unidentified multinationals' and 'other groups'. I define a company to belong to the 'unidentified multinationals' category if:

- it has overseas income (box 9 on the CT600 form is larger than 0), OR
- it has claimed double tax relief (box 73 on the CT600 form is larger than 0).[27]

I define a company to belong to 'other groups' category if:

- it has internal debt that is larger than 0 (using FAME long and short term internal borrowing), OR
- it does indicate on the CT600 form that it is part of the group (part of a group 'X' in the CT600 form), OR
- it claims group relief in the CT600 form (group relief in any of the years it existed is larger than 0 in box 36 on the CT600 form), OR
- it has losses to surrender as group relief (box 123 on the CT600 form is non zero).

For unidentified multinationals and other groups categories there is a time dimension to the ownership data. To avoid a situation where in some ownership categories I have companies being various types in different years, I assume that if a firm ever claimed any of the deductions it belongs to that given category in all other years.

[27]Note that overseas income refers to a narrow notion of income that has been generated by a foreign company abroad and is paid back to the UK affiliate of that company.

Criteria to select the sample for the analysis

Table 1.7 summarizes the detailed characteristics of the selected sample, where the last row shows the size of the sample after all selection criteria have been applied. The table also outlines how each selection criteria affects the number of observations, the total tax liability, trading turnover, trading profits and total assets. In what follows, I discuss each selection criteria in turn.

First, to be in the selected sample, I require the HMRC companies to be matched with the FAME data[28]. The matching is performed using firm and time identifier. Specifically, the unique firm identifiers from FAME and HMRC datasets are anonymized and matched by HMRC. The accounting period end date from FAME and the statement date from the CT600 form are merged as time indicators. Most of the unmatched companies come from the missing ownership category.

Second, I require the company from the FAME data to be reporting an unconsolidated statement and not consolidated or missing. Since companies report unconsolidated tax returns data on the CT600 forms, I require the accounting data to be reported at the unconsolidated level too. FAME never provides both consolidated and unconsolidated data for the same firm in the same year. Hence the matching algorithm can match a consolidated account from FAME with unconsolidated data from the HMRC.[29] Since it is often the company headquarters that report consolidated statements, I also exclude them from the selected sample.

Removing consolidated and missing financial reporting observations constitutes only 2% of companies, but those 300,000 observations account for over 20% of total tax liability, 16% of trading turnover and 70% of total assets. The fraction of observations with missing financial reporting type is very small and the fraction of tax that they pay is also very

[28]Special thanks to Strahil Leopev and Giorgia Maffini for sharing their matching strategy and baseline dataset with me.

[29]For smaller companies FAME will sometimes have alternating consolidated and unconsolidated data, switching from one to another depending on the year. In that case, if the trading turnover in FAME matches the trading turnover in the HMRC data, I keep that company in the sample and assign it to unconsolidated group. If the trading turnover is different by more than 10% between tax and accounting datasets, I exclude that company from my selected sample.

small. Most of these 300,000 observations come from consolidated statements. The fact that the exclusion of consolidated statements accounts for 70% of total assets is unsurprising since the consolidated statement would include information on total assets of multinational groups abroad. More importantly, those 2% of companies seem to contribute 20 percent of the tax liability in the UK, and together with the fact that they have large total assets it suggests that they are likely to be large and profitable companies. Therefore omitting them from the analysis might affect the results. However, since those 2 percent of companies report only consolidated accounting statements in FAME, I have no measure of the size of their operations in the UK. The issue is most severe for domestic multinationals, which report 27% of their accounts as consolidated ones, while foreign multinationals and unidentified multinationals report only 7%. Most of the tax liability excluded from the selected sample comes from the consolidated accounts of various types of multinationals (see Table 1.8).[30]

Specifically, Table 1.8 shows the proportions of tax, trading profits, trading turnover and taxable profits excluded through sample selection by ownership category. The sample selection process discards almost half of domestic multinationals. The companies with the largest fraction of remaining observations are domestic standalones, domestic groups and foreign multinationals (all above 70%). However, it is unidentified multinationals closely followed by foreign multinational companies for which we lose largest fraction of their tax liability (40 and 38%), trading turnover (29 and 27%) and taxable profits (41 and 29%) due to the sample selection process.

Additional information about variables in the merged dataset

In this section I define and describe in detail the variables I use in this chapter. Some of these definitions will also be relevant for the analysis in Chapter 2 of this thesis. The data section in the main body of the chapter discusses the choice of measures for taxable

[30] As another selection criteria to be included in the selected sample, I require companies to have 12 months of accounting data and positive total assets. This does not alter the sample in any meaningful way.

Table 1.7: Summary of the sample selection criteria.

	number of observations	total tax liability	trading turnover	total trading profits	total assets
CT 600 population	16.7	0.59	44.70	2.37	451.89
matched with FAME	12.7	0.53	41.00	2.13	451.89
unconsolidated	12.4	0.40	33.84	1.66	140.58
12 months accounts	12.1	0.40	32.95	1.64	137.62
non missing total assets	12	0.40	32.90	1.64	137.62
			percentages		
matched with FAME	76%	89%	92%	90%	-
unconsolidated	74%	68%	76%	70%	31%
12 months accounts	72%	67%	74%	69%	30%
non missing total assets	72%	67%	74%	69%	30%

Note: Summary statistics on how many observations we loose at each step of the selection process and what fraction of each of the following firm level observable variable levels we loose: total tax liability, trading turnover, total trading profits and total assets; currency, pound; unit, million. Source: matched HMRC and FAME data.

Table 1.8: Composition of the selected sample.

	tax	trading profits	trading turnover	taxable profits
foreign multinational	62%	72%	64%	63%
domestic multinational	71%	54%	73%	71%
domestic group	70%	76%	75%	71%
domestic standalone	90%	90%	96%	90%
other group	69%	73%	79%	70%
unidentified multinational	60%	63%	71%	59%
missing ownership	75%	79%	71%	76%

Note: Proportions of tax, trading profits, trading turnover and taxable profits which remain in the selected sample relative to the whole sample by ownership type. Source: HMRC data.

profits comparisons between multinational and domestic companies. This section discusses the availability of data that will allow for this comparison.

The CT600 data is my primary source for tax liabilities and taxable profits (Table 1.9[31]). The most relevant variables are taxable profits (box 37) and tax liability (box 63). It is also possible to break the taxable profits into profits before deductions (box 21) minus deductions (box 33) minus group relief (box 36).[32]

Moreover, the CT600 data offers unique information on the items that contribute to the taxable profits before deductions (boxes 3 - 20). The breakdown of profits before

[31]Schedule D Case V in Table 1.9 refers to income from overseas possessions (property, shares etc.)

[32]Box numbers correspond to the CT600 form.

Table 1.9: Description of box numbers and corresponding variables in the CT600 form and data.

box number	variable name	CT600 name	variable description
box 1	trading turnover	total turnover from trade of profession	turnover from trading activities
box 5	trading profits	trading and professional profits	profits arising from trading activities
box 9	overseas income	overseas income within Sch D Case V	income from overseas activities, such as dividend income
box 18	net gains	net chargeable gains	gross chargeable gains minus allowable losses including losses brought forward
box 21	profits before deductions	profits before other deductions and reliefs	total taxable income from all activities
box 33	deductions	total of deductions and reliefs	sum of all deductions variable to companies, apart from group relief
box 34	profits before group relief	profits before charges and group relief	difference between box 21 and box 33
box 37	taxable profits	profits chargeable to corporation tax	difference between box 34 and sum of boxes 35 (charges paid) and box 34
box 63	tax	corporation tax	corporation tax liability calculated based on box 37 profits

deductions[33] includes major items such as trading profits (box 5), bank, building society or other interest, and profits and gains, from non-trading loan relationships (box 6)[34], overseas income (box 9), net gains (box 18) and other items (sum of box 8, 10, 11, 12, 13, 14, 15 less boxes 19 and 20). The trading activity refers to any activity which is the result of a company carrying on its trade, i.e. operations; for example, selling goods in case of Tesco.

In Figure 1.7 I show that there are marked differences in the sources of taxable income between companies depending on their ownership types.[35] Domestic standalones derive

[33]Note that data for box 21 in the CT600 data is missing for a large proportion of observations, therefore I constuct it manually using the formula outlined on the CT600 form.

[34]This is simply the interest on deposits held by companies in banks, building societies and others.

[35]Note that since companies do not have to fill in all the boxes in the CT600, some companies which have no deductions to be itemised and no profits apart from trading ones will only fill in the taxable profits box. Therefore Figure 1.7 does not inlcude all the profits before deductions in the UK.

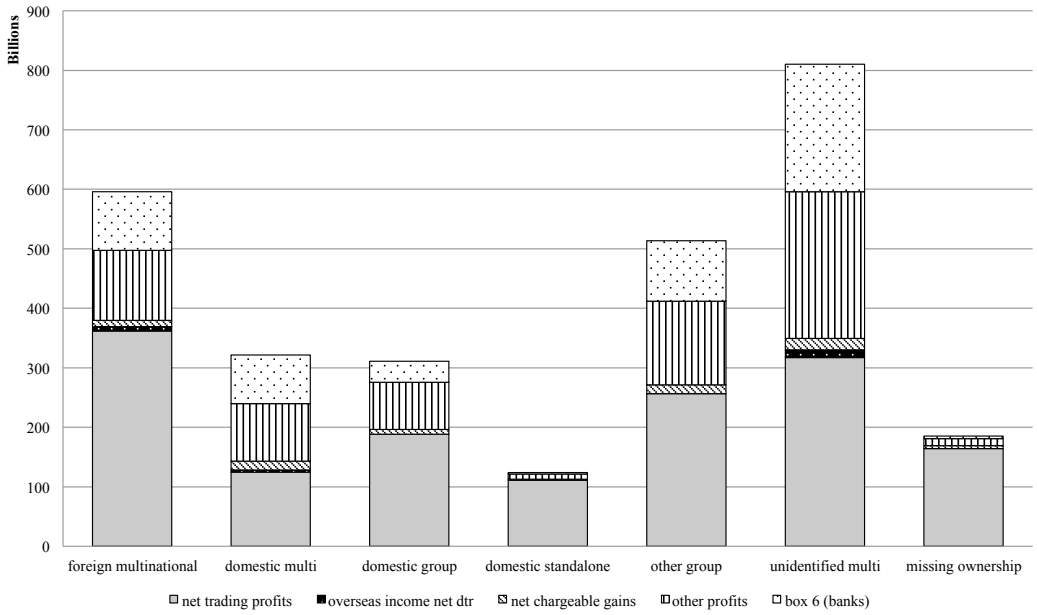
most of their income from trading activities in the UK, while multinational companies derive only two thirds of theirs from trading activities. This is to be expected considering the complicated nature of the activities of multinational companies. For instance, overseas income constitutes quite a substantial fraction of total income of multinational companies over the sample period. However, large fractions of overseas income have been sheltered by double tax relief and no tax is due on the sheltered portion of that income. When I exclude the overseas income sheltered by double tax relief, it appears that the unsheltered overseas income did not contribute significantly to the overall UK tax base (see Figure 1.7).[36]

Further, other groups and unidentified multinationals derive a substantial portion of their income from other types of profits and from net interests of their loans. These fractions are much larger than for other types of multinational companies.

Many companies in the HMRC data report to have missing trading turnover information in spite of reporting positive taxable profits and positive trading profits. In Table 1.10 panel A, I consider the whole population of companies from the HMRC dataset and calculate the proportion of missing observations for trading turnover and total assets. In panel B Table 1.10 I do the same exercise but for the selected sample only (hence no missing observations on total assets). The best coverage is offered for foreign multinationals and domestic standalones, 80% and 93% respectively. Interestingly, the majority of domestic multinationals that report missing trading turnover are also those that report consolidated statements in their accounts. Therefore it is impossible to know the size of their operations in the UK.

[36]There was a tax reform in the UK in 2009 as a result of which UK switched from a worldwide to a territorial tax system. After the reform firms no longer had to report dividends received from abroad since they received no tax credit on them (Grubert (2009), Lohse and Riedel (2013)). As a result there was a large decrease in the overseas income numbers reported on the CT600 form from 2010 onwards. This decrease means that multinationals which derived a substantial part of their profits from overseas income in the UK would report lower taxable profit numbers from 2010 onwards. However, the decrease in the tax paid is not as large as the decrease in overseas profits. This is because part of the overseas income was sheltered by double tax relief in the UK. Therefore multinational companies only paid tax on part of their overseas income before 2009.

Figure 1.7: Components of profits by ownership type.



Note: Components of profits before deductions by profits type and ownership type. Other profits is a sum of boxes 8 (annual payments not arising from loan relationships), 10 (income from which income tax has been deducted), 11 (income from UK land and buildings) and 15 (income from non-trading gains on intangible fixed assets, tonnage tax profits and profits not falling under any other heading). Box 6 (banks) refers to interest payments on loans. Selected sample, years 2000 - 2011.

The CT600 data contains some outliers. 122 of observations in the CT600 data report negative tax liabilities. Since HMRC has informed me that should not be the case, I discard those observations. They are mainly part of the missing ownership group with very little data available for them, hence I am inclined to believe that they might be genuine mistakes. There are several cases where trading profits are larger than trading turnover itself. I exclude those companies from the sample as well.

The selected sample also contains observations where taxable profits of a company are larger than its trading turnover, in some cases even 10 fold. This can arise for two main reasons; the first is that companies selling assets or shares are liable to pay capital gains tax on those sales. This will mean that a company with a small trading turnover in the UK, could be reporting large taxable profits in some years due to shares or assets sales and the profits arising from those. The CT600 form includes net gains that are added to trading profits to obtain taxable profits.

Table 1.10: Summary of missing observations.

	whole sample				
	missing trading turnover	%	missing total assets	%	no of obs
foreign multinational	88,831	23%	49,374	13%	382,353
domestic multinational	18,534	43%	4,420	10%	43,249
domestic group	174,602	19%	105,188	12%	911,670
domestic standalone	274,376	8%	601,604	17%	3,573,689
other group	496,374	16%	620,396	20%	3,105,551
unidentified multinational	125,965	29%	90,234	21%	427,459
missing ownership	1,260,113	15%	2,727,700	33%	8,304,161
	selected sample				
	missing trading turnover	%	missing total assets	%	no of obs
foreign multinational	54,628	20%	-	-	276,818
domestic multinational	9,705	43%	-	-	22,443
domestic group	114,197	17%	-	-	686,083
domestic standalone	190,511	7%	-	-	2,928,737
other group	292,489	12%	-	-	2,365,955
unidentified multinational	63,613	22%	-	-	283,205
missing ownership	464,683	9%	-	-	5,423,953

Note: Numbers and proportions of missing observations for trading turnover and total assets by ownership types. Comparison between whole and selected samples. Source: merged HMRC and FAME data.

The second reason why taxable profits may be larger than trading turnover could be that companies are receiving dividend payments from their subsidiaries abroad. This applies only to multinational companies. In this case, the taxable profit is often higher than turnover for several years in a row. A substantial fraction of both foreign and domestic multinational subsidiaries in the UK reports zero trading profits, while at the same time pays a non-zero tax in the UK. Those are very likely holding companies which often receive substantial amounts of overseas income, while having no trading activities and no other profits. After UK switched from credit to exemption system in 2009, those firms have ceased to report overseas income and hence they report no taxable profits.

Table 1.11: Balance sheet formulas - FAME data.

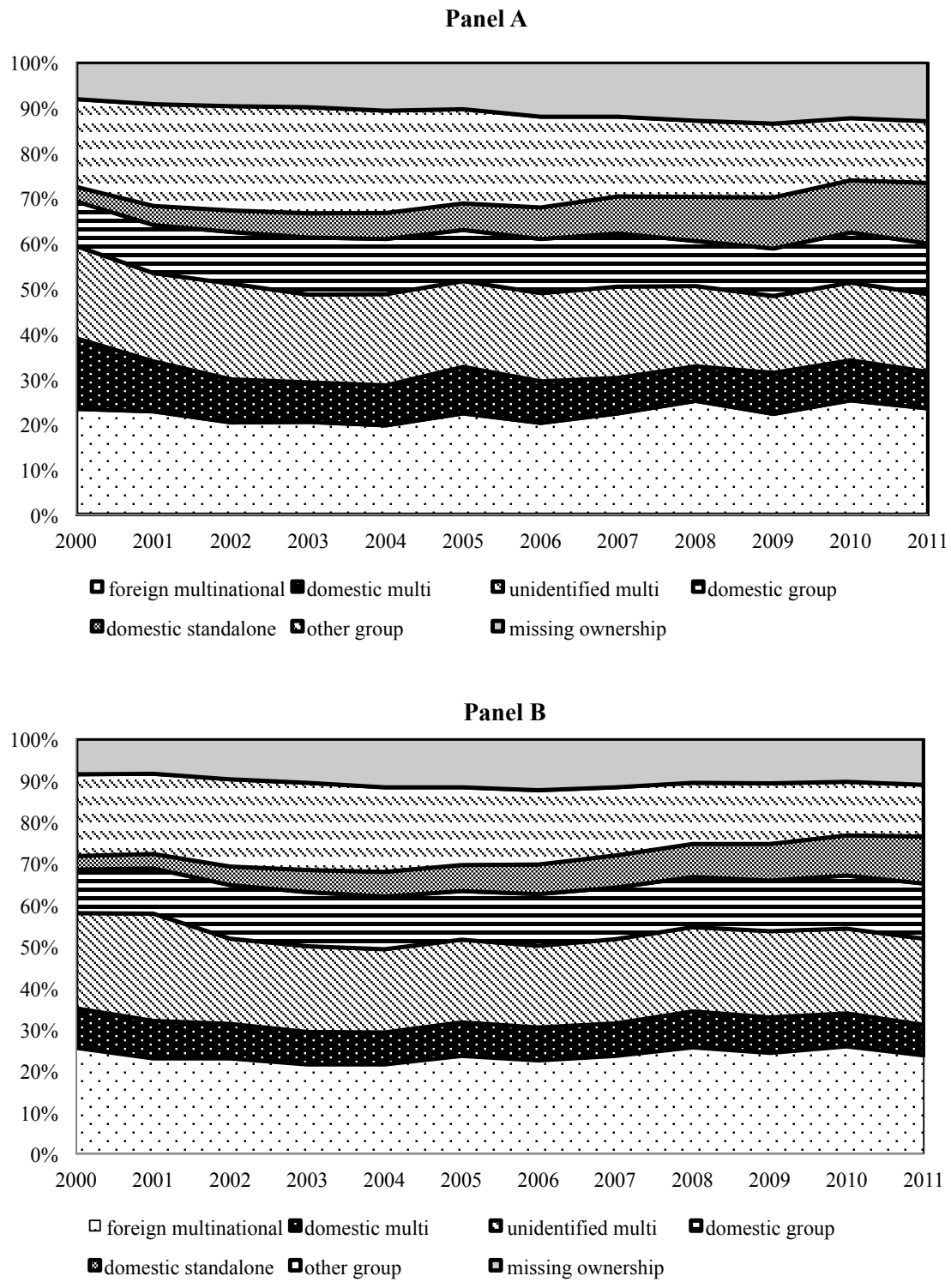
Line	Formula	Label	Comments
93	87+88	shareholders' Funds	equivalent to total assets less total liabilities
	66+85	total liabilities	
66	51+52+60	current liabilities	includes group loans (short term)
85	72+79+82+84a+84b	long term liabilities (-)	includes group loans (long term)
70	37+48	total assets	
37	31+35+36	fixed assets	
31	32+33+34+34	tangible assets	
35		intangible assets	
36		Investments	
48	38+41+42+43+47	current assets	includes investments

Table 1.12: Proportions of observations with zero taxable profits by sector and ownership type.

	foreign multinationals	domestic standalones	all obs
1: agriculture, forestry and fishing (01-09)	67.2%	32.7%	43.5%
2: mining (10-14)	53.5%	32.4%	38.6%
3: construction (15-17)	51.3%	36.8%	44.5%
4:manufacturing (20-39)	53.2%	31.3%	40.3%
5:transportation & public utilities (40-49)	63.6%	20.2%	28.2%
6: wholesale trade (50-51)	43.6%	28.0%	36.4%
7: retail trade (52-59)	61.4%	32.7%	40.6%
8: finance, insurance & real estate (60-67)	56.3%	27.3%	39.7%
9: services (70-89)	62.2%	24.5%	34.9%
10: public administration (91-98)	60.0%	30.7%	42.1%
11: non-classified establishments (99)	60.0%	44.6%	51.5%

Note: Comparisons betweenr foreign multinationals, domestic standalones and the whole sample; selected sample, 2000 - 2011. Source: matched HMRC and FAME data.

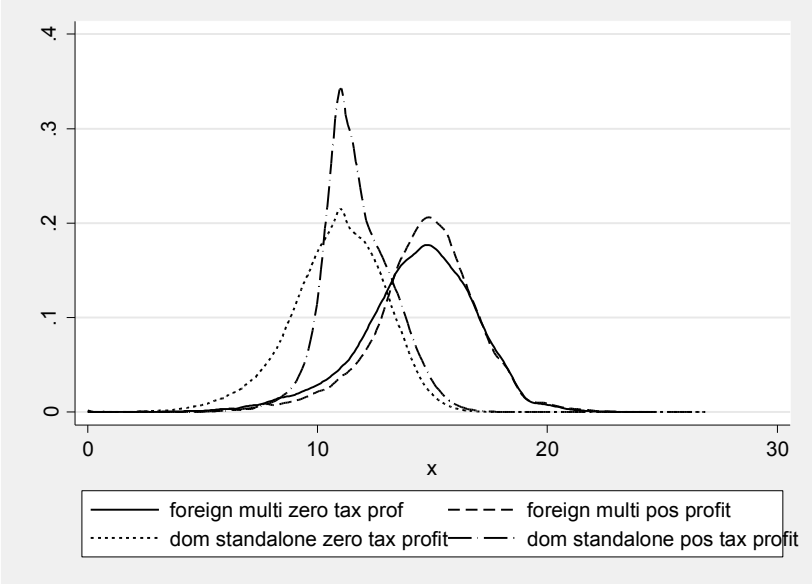
Figure 1.8: Net tax payable and trading profits - contributions by ownership type.



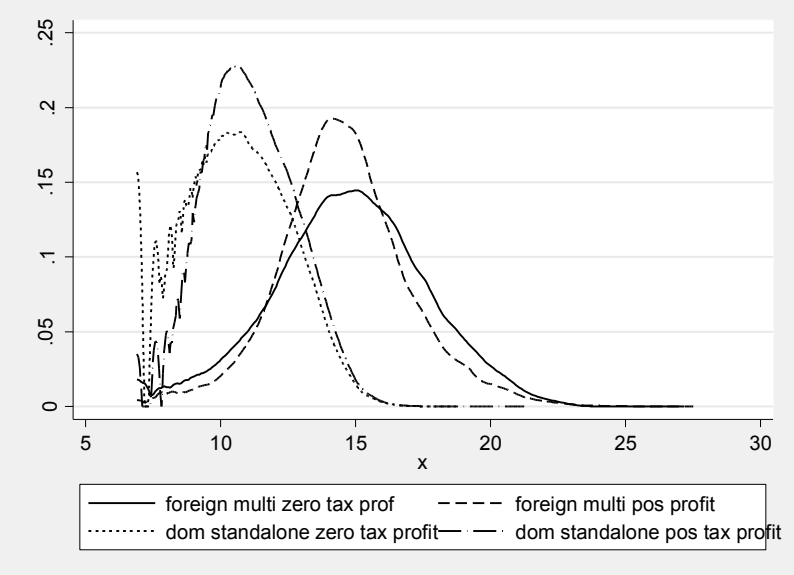
Note: Panel A: Net tax payable, Panel B: trading profits, contributions to total tax and total trading profits by ownership type, 2000 - 2011, selected sample. Source: matched HMRC and FAME data.

Figure 1.9: Size distributions by ownership type, comparisons between positive and zero taxable profits observations.

Panel A: trading turnover

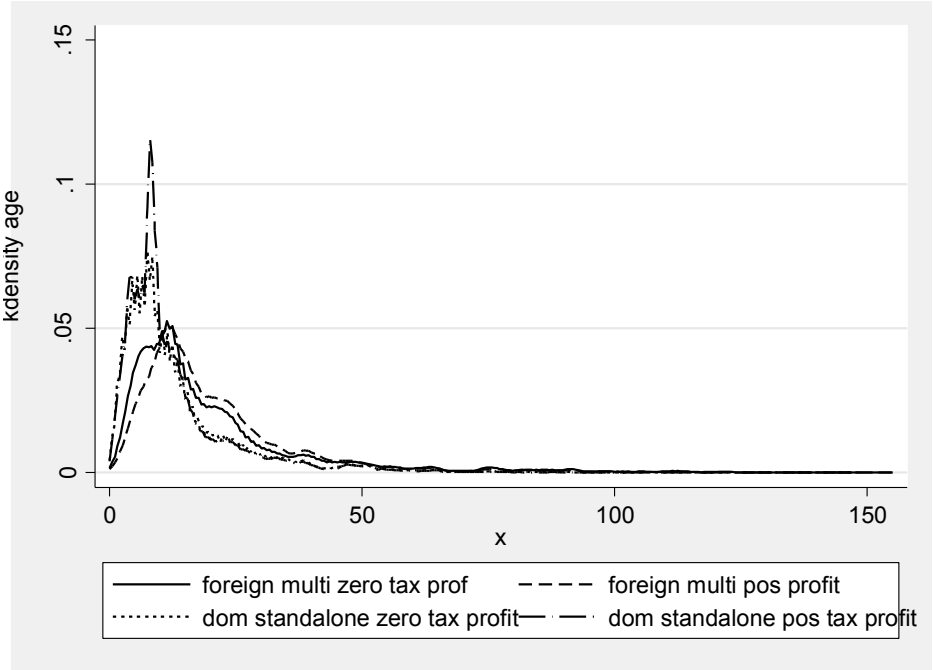


Panel B: total assets



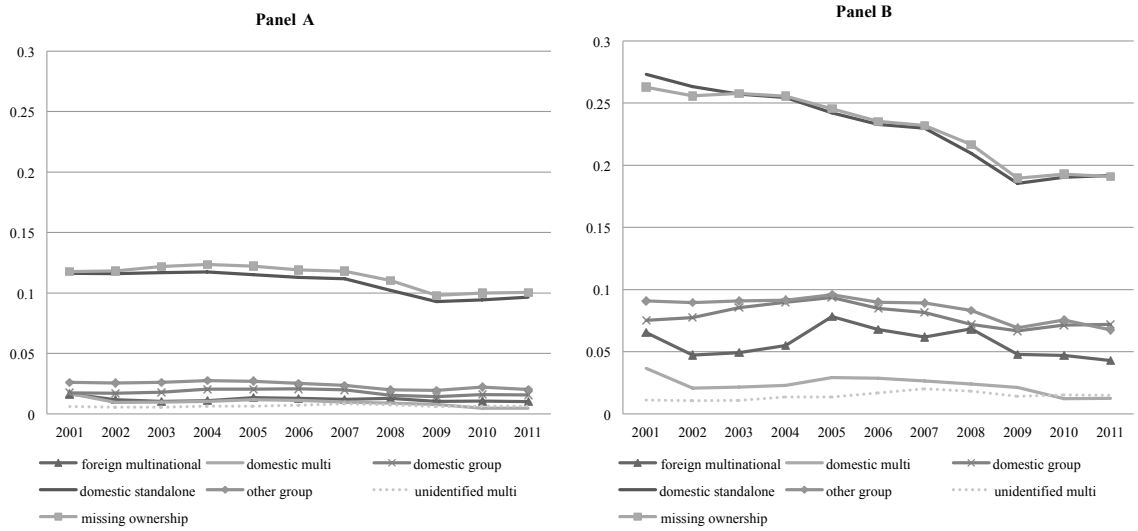
Note: Panel A: distribution of logarithm of trading turnover, Panel B: distribution of logarithm of total assets. Comparisons between positive and zero taxable profits observations for foreign multinationals and domestic standalones; selected sample, 2000 - 2011. Source: matched HMRC and FAME data.

Figure 1.10: Age distributions comparison.



Note: Distributions of firms' age for positive and zero taxable profits observations, differences between foreign multinationals and domestic standalones; selected sample, 2000 - 2011. Source: matched HMRC and FAME data.

Figure 1.11: Comparison of two scaling measures for taxable profits - total assets vs shareholder funds.



Note: Panel A: Weighted ratio of taxable profits to total assets, Panel B: Weighted ratio of taxable profits to book value of equity, both selected balanced sample, 2000 - 2011. Source: matched HMRC and FAME data.

Figure 1.12: CT600 tax returns form.

HM Revenue & Customs

Company Tax Return form

CT600 (2008) Version 2

for accounting periods ending on or after 1 July 1999

Your company tax return

If we send the company a *Notice* to deliver a company tax return (form *CT603*) it has to comply by the filing date or we charge a penalty, even if there is no tax to pay. A return includes a company tax return form, any Supplementary Pages, accounts, computations and any relevant information.
Is this the right form for the company? Read the advice on pages 3 to 6 of the Company tax return guide (the *Guide*) before you start.
The forms in the CT600 series set out the information we need and provide a standard format for calculations. Use the *Guide* to help you complete the return form. It contains general information you may need and box by box advice
Please note that some boxes on form *CT600* are not in order, reflecting changes made since the form was first published in 2004.

Company information

Company name

Company registration number | Tax Reference as shown on the CT603 | Type of Company

Registered office address

Postcode

About this return

This is the above company's return for the period

from (dd/mm/yyyy) to (dd/mm/yyyy)

Put an 'X' in the appropriate box(es) below

- A repayment is due for this return period
- A repayment is due for an earlier period
- Making more than one return for this company now
- This return contains estimated figures
- Company part of a group that is not small

Disclosure of tax avoidance schemes

- Notice of disclosable avoidance schemes

Transfer pricing

- Compensating adjustment claimed
- Company qualifies for SME exemption

Accounts

I attach accounts and computations

- for the period to which this return relates
- for a different period

If you are not attaching accounts and computations, say why not

Supplementary Pages

If you are enclosing any Supplementary Pages put an 'X' in the appropriate box(es)

- Loans to participators by close companies, form *CT600A*
- Controlled foreign companies, form *CT600B*
- Group and Consortium, form *CT600C*
- Insurance, form *CT600D*
- Charities and Community Amateur Sports Clubs (CASCs), form *CT600E*
- Tonnage tax, form *CT600F*
- Corporate Venturing Scheme, form *CT600G*
- Cross-border royalties, form *CT600H*
- Supplementary charge in respect of ring fence trade, form *CT600I*
- Disclosure of tax avoidance schemes, form *CT600J*

Company tax calculation

Turnover

1	Total turnover from trade or profession		1 £
2	Banks, building societies, insurance companies and other financial concerns. *Put an 'X' in this box if you do not have a recognised turnover and have not made an entry in box 1*	2	

Income

3	Trading and professional profits	3 £	
4	Trading losses brought forward claimed against profits	4 £	
5	Net trading and professional profits		box 3 minus box 4 5 £
6	Bank, building society or other interest, and profits and gains from non-trading loan relationships		6 £
7	*Put an 'X' in box 7 if the figure in box 6 is net of carrying back a deficit from a later accounting period*	7	
8	Annuities, annual payments and discounts not arising from loan relationships and from which income tax has not been deducted		8 £
9	Overseas income within Sch D Case V		9 £
10	Income from which income tax has been deducted		10 £
11	Income from UK land and buildings		11 £
12	Non-trading gains on intangible fixed assets	12 £	
13	Tonnage tax profits	13 £	
14	Annual profits and gains not falling under any other heading	14 £	
15	Income within Sch D Case VI		total of boxes 12, 13 and 14 15 £

Chargeable gains

16	Gross chargeable gains	16 £	
17	Allowable losses including losses brought forward	17 £	
18	Net chargeable gains		box 16 minus box 17 18 £
19	Losses brought forward against certain investment income		19 £
20	Non-trade deficits on loan relationships (including interest), and derivative contracts (financial instruments) brought forward		20 £
21	Profits before other deductions and reliefs		net sum of boxes 5, 6, 8, 9, 10, 11,15, & 18 minus sum of boxes 19 and 20 21 £

Deductions and reliefs

22 CVS loss relief, and losses on unquoted shares under S573 ICTA 1988 — 22 £

23 *Put an 'X' in box 23 if the entry in box 22 includes CVS loss relief, complete and attach form CT600G* — 23

24 Management expenses under S75 ICTA 1988 — 24 £

25 Interest distributions under S468L ICTA 1988 — 25 £

26 Schedule A losses for this or previous accounting period under S392A ICTA 1988 — 26 £

27 Capital allowances for the purposes of management of the business — 27 £

28 Non-trade deficits for this accounting period from loan relationships and derivative contracts (financial instruments) — 28 £

29 Non-trading losses on intangible fixed assets — 29 £

30 Trading losses of this or a later accounting period under S393A ICTA 1988 — 30 £

31 *Put an 'X' in box 31 if amounts carried back from later accounting periods are included in box 30* — 31

32 Non-trade capital allowances — 32 £

33 Total of deductions and reliefs — total of boxes 22, 24 to 30 and 32 — 33 £

34 Profits before charges and group relief — box 21 minus box 33 — 34 £

35 Charges paid — 35 £

36 Group relief — 36 £

37 Profits chargeable to corporation tax — box 34 minus boxes 35 and 36 — 37 £

169 Ring fence profits included — 169 £

Tax calculation

38 Franked investment income — 38 £

39 Number of associated companies in this period or — 39

40 Associated companies in the first financial year — 40

41 Associated companies in the second financial year — 41

42 *Put an 'X' in box 42 if the company claims to be charged at the starting rate or the small companies' rate on any part of its profits, or is claiming marginal rate relief* — 42

Enter how much profit has to be charged and at what rate of tax

Financial year *(yyyy)*	Amount of profit	Rate of tax	Tax
43	44 £	45	46 £ p
	47 £	48	49 £ p
	50 £	51	52 £ p
53	54 £	55	56 £ p
	57 £	58	59 £ p
	60 £	61	62 £ p

63 Corporation tax — total of boxes 46, 49, 52, 56, 59 and 62 — 63 £ p

64 Marginal rate relief — 64 £ p

65 Corporation tax net of marginal rate relief — 65 £ p

66 Underlying rate of corporation tax — 66 . %

67 Profits matched with non-corporate distributions — 67 £

68 Tax at non-corporate distributions rate — 68 £ p

69 Tax at underlying rate on remaining profits — 69 £ p

70 Corporation tax chargeable — *See note for box 70 in CT600 Guide* — 70 £ p

Reliefs and deductions in terms of tax

71 CVS investment relief — 71 £ p

72 Community investment relief — 72 £ p

73 Double taxation relief — 73 £ p

74 *Put an 'X' in box 74 if box 73 includes an Underlying Rate relief claim* — 74

75 *Put an 'X' in box 75 if box 73 includes any amount carried back from a later period* — 75

76 Advance corporation tax — 76 £ p

77 Total reliefs and deductions in terms of tax — total of boxes 71, 72, 73 and 76 — 77 £ p

Calculation of tax outstanding or overpaid

78 Net corporation tax liability — box 70 minus box 77 — 78 £ p

79 Tax payable under S419 ICTA 1988 — 79 £ p

80 *Put an 'X' in box 80 if you completed box A11 in the Supplementary Pages CT600A* — 80

81 Tax payable under S747 ICTA 1988 — 81 £ p

82 Tax payable under S501A ICTA 1988 — 82 £ p

83 Tax chargeable — total of boxes 78, 79, 81 and 82 — 83 £ p

84 Income tax deducted from gross income included in profits — 84 £ p

85 Income tax repayable to the company — 85 £ p

86 Tax payable - this is your self-assessment of tax payable — box 83 minus box 84 — 86 £ p

Tax reconciliation

87 Research and Development tax credit, including any vaccines tax credit, or film tax credit — 87 £ p

88 Land remediation or life assurance company tax credit — 88 £ p

170 Capital allowances first-year tax credit — 170 £ p

89 Research and Development tax credit payable, including any vaccines tax credit, or film tax credit payable — box 87 minus box 86 — 89 £ p

90 Land remediation or life assurance company tax credit payable — total of boxes 87 + 88 minus boxes 86 and 89 — 90 £ p

171 Capital allowances first-year tax credit payable — boxes 87, 88 and 170 minus boxes 86, 89 and 90 — 171 £ p

161 Ring fence corporation tax included — 161 £ p

166 Tax under S501A ICTA 1988 included — 166 £ p

91 Tax already paid (and not already repaid) — 91 £ p

92 Tax outstanding — box 86 minus boxes 87, 88, 170 and 91 — 92 £ p

93 Tax overpaid — total sum of boxes 87, 88, 170 and 91 minus box 86 — 93 £ p

94 Tax refunds surrendered to the company under S102 FA 1989 — 94 £ p

Indicators

Put an 'X' in the relevant box(es) if, in the period, the company

95 *should have made (whether it has or not) instalment payments under the Corporation Tax (Instalment Payments) Regulations 1998* — 95

96 *is within a group payment arrangement for this period* — 96

97 *has written down or sold intangible assets* — 97

98 *has made cross-border royalty payments* — 98

Information about enhanced expenditure

Research and Development (R&D) or films enhanced expenditure

167 *Put an 'X' in box 167 if the claim is for films expenditure* — 167

99 *Put an 'X' in box 99 if the claim is made by a small or medium-sized enterprise (SME), including a SME subcontractor to a large company* — 99

100 *Put an 'X' in box 100 if the claim is made by a large company* — 100

101 R&D or films enhanced expenditure — 101 £

102 R&D enhanced expenditure of a SME on work sub-contracted to it by a large company — 102 £

103 Vaccines research expenditure — 103 £

Land remediation enhanced expenditure

104 Enter amount equal to 150% of actual expenditure — 104 £

Information about capital allowances and balancing charges

Charges and allowances included in calculation of trading profits or losses

	Capital Allowances	Balancing Charges
172 Annual investment allowance	172 £	
105-106 Machinery and plant - special rate pool	105 £	106 £
107-108 Machinery and plant - main pool	107 £	108 £
109-110 Cars	109 £	110 £
111-112 Industrial buildings and structures	111 £	112 £
162-163 Business premises renovation	162 £	163 £
113-114 Other charges and allowances	113 £	114 £

Charges and allowances not included in calculation of trading profits or losses

	Capital Allowances	Balancing Charges
173 Annual investment allowance	173 £	
164-165 Business premises renovation	164 £	165 £
115-116 Other non-trading charges and allowances	115 £	116 £

117 *Put an 'X' in box 117 if box 115 entry includes flat conversion allowances* — 117

Qualifying expenditure

118 Machinery and plant on which first year allowance is claimed — 118 £

174 Designated environmentally friendly machinery and plant — 174 £

120 Machinery and plant on long-life assets and integral features — 120 £

121 Other machinery and plant — 121 £

Losses, deficits and excess amounts

		Arising	Maximum available for surrender as group relief
122-123	Trading losses Case I	122 £ (calculated under S393 ICTA 1988)	123 £ (calculated under S393A ICTA 1988)
124	Trading losses Case V	124 £ (calculated under S393 ICTA 1988)	
125-126	Non-trade deficits on loan relationships and derivative contracts	125 £ (calculated under S82 FA 1996)	126 £ (calculated under S83 FA 1996)
127-128	Schedule A losses	127 £ (calculated under S392A ICTA 1988)	128 £ (calculated under S403 ICTA 1988)
129	Overseas property business losses Case V	129 £ (calculated under S392B ICTA 1988)	
130	Losses Case VI	130 £ (calculated under S396 ICTA 1988)	
131	Capital losses	131 £ (calculated under S16 TCGA 1992)	
132-133	Non-trading losses on intangible fixed assets	132 £ (calculated under S29 FA 2002)	133 £ (calculated under S403 ICTA 1988)
		Excess	
134	Excess non-trade capital allowances		134 £ (calculated under S403 ICTA 1988)
135	Excess charges		135 £ (calculated under S403 ICTA 1988)
136-137	Excess management expenses	136 £ (calculated under S75 ICTA 1988)	137 £ (calculated under S403 ICTA 1988)
138	Excess interest distributions	138 £ (calculated under S468L(7) ICTA 1988)	

Overpayments and repayments

Small repayments

If you do not want us to make small repayments please either put an 'X' in box 139 or complete box 140 below. 'Repayments' here include tax, interest, and late-filing penalties or any combination of them.

Do not repay £20 or less 139 Do not repay sums of 140 £ or less. *Enter whole figure only*

Repayments for the period covered by this return

141	Repayment of corporation tax	141 £	p
142	Repayment of income tax	142 £	p
143	Payable Research and Development tax credit	143 £	p
168	Payable film tax credit	168 £	p
144	Payable land remediation or life assurance company tax credit	144 £	p
175	Payable capital allowances first-year tax credit	175 £	p

Surrender under S102 FA 1989 (including surrenders under Regulation 9 of the Instalments Regulations)
Repayments of advance corporation tax cannot be surrendered.

145	The following amount is to be surrendered under S102 FA 1989, and either	145 £	p
146	the joint Notice is attached (or)	146	*(put an 'X' in either box 146 or box 147)*
147	will follow	147	
148	Please stop repayment of the following amount until I send you the Notice	148 £	p

Bank details (for person to whom the repayment is to be made)

Repayment is made quickly and safely by direct credit to a bank or building society account.
Please complete the following details:

Name of bank or building society 149

Branch sort code 150

Account number 151

Name of account 152

Building society reference 153

Payments to a person other than the company

Complete the authority below if you want the repayment to be made to a person other than the company.

I, as *(enter status - company secretary, treasurer, liquidator or authorised agent, etc.)* 154

of *(enter name of company)* 155

authorise *(enter name)* 156

(enter address) 157

Postcode

Nominee reference 158

to receive payment on the company's behalf.

Signature 159

Name *(in capitals)* 160

Declaration

Warning - Giving false information in the return, or concealing any part of the company's profits or tax payable, can lead to both the company and yourself being prosecuted.

Declaration
The information I have given in this company tax return is correct and complete to the best of my knowledge and belief.

Signature

Name *(in capitals)*

Date *(dd/mm/yyyy)*

Status

Chapter 2

How aggressive are foreign multinational companies in reducing their corporation tax liability? Evidence from UK confidential corporate tax returns.

Abstract

In this chapter, I use confidential UK corporate tax returns dataset from Her Majesty's Revenue and Customs (HMRC) to explore whether there are systematic differences in the amount of taxable profits that multinational and domestic companies report. I estimate, using propensity score matching, that the ratio of taxable profits to total assets reported by foreign multinational subsidiaries is 12.8 percentage points lower than that of comparable domestic standalones, which report their ratio of taxable profits to total assets to be 25.2 percent. If we assume that all of the difference can be attributed to profit shifting, foreign multinational subsidiaries shift over half of their taxable profits out of the UK. The difference is almost entirely attributable to the fact that a higher proportion of foreign multinational subsidiaries report zero taxable profits (59.2 percent) than domestic standalones (27.5 percent), suggesting a very aggressive form of profit shifting. Comparison of propensity score matching results using accounting and taxable profits data reveals that the extent of profit shifting estimated using accounting data is much smaller than that estimated using tax returns data.

2.1 Introduction

Following the financial crisis, the issues of aggressive tax avoidance and profit shifting by corporations became more prominent in policy debates as authorities around the world saw combatting tax avoidance as one of the important means of recovering from the fiscal consequences of the crisis. For example, the United Kingdom has introduced the Diverted Profits Tax in April 2015 aimed at taxing profits shifted abroad by multinational companies.[1] UK also announced limits to interest deductibility—one of many ways in which corporations minimize their tax payments—from April 2017.[2] More generally, in 2015 the OECD countries have agreed to jointly reduce the extent of profit shifting via the Base Erosion and Profit Shifting (BEPS) project.[3] The media has also shown increased appetite for 'naming and shaming' many familiar multinational companies, such as Starbucks and Amazon, for paying too little tax.

The question remains as to whether it is only the very large multinationals that avoid paying corporation tax, or even whether it is only those for which we have public information available, or do all multinational do so. In this chapter, I analyze a universe of confidential corporate tax returns to consider the taxable profits that companies reported to Her Majesty's Revenue & Customs (HMRC) during the period 2000 to 2011. In particular, I focus on whether there are systematic differences in the amount of taxable profits that UK subsidiaries of foreign multinational companies (foreign multinational subsidiaries) and standalone UK companies (domestic standalones) report.

This is the first study to use the new administrative data, rather than accounting data, to analyze the profit shifting practices of multinational companies residing in the UK. Further, the availability of tax returns data allows me to explore a new phenomenon - companies reporting zero taxable profits. I find large bunching at zero taxable profits for

[1] HMRC's description of the diverted profits tax can be found at http://bit.ly/1sFOLcc.
[2] The UK 2016 Budget, p.56 (http://bit.ly/1R2QgNv).
[3] For the OECD report, see http://www.oecd.org/ctp/beps.htm.

foreign multinational subsidiaries relative to domestic standalones, which is not observed to the same extent in the accounting data.[4]

In this chapter I focus on the differences in the ratio of reported taxable profits to total assets between foreign multinational subsidiaries and comparable domestic standalones. These two ownership categories are chosen with a view to compare two distinct groups of companies, of which one has the ability to shift profits abroad (foreign multinational subsidiaries) and one does not (domestic standalones). Specifically, I analyze foreign multinational subsidiaries which have no further subsidiaries themselves and which report having positive trading turnover. I ensure that these selected companies are comparable with domestic standalones in terms of their observable characteristics. What is more, since foreign multinational subsidiaries are generally larger and generate higher levels of profits than domestic standalones, I use the ratio of taxable profits to total assets as a main comparison measure between those two ownership types.[5]

In order to appropriately account for the difference in size between foreign multinational subsidiaries and domestic standalones, as well as the endogeneity problem arising from self-selection into being a multinational, I adopt the propensity score matching approach (Paul R. Rosenbaum (1983), Rosenbaum and Rubin (1985)). I 'match' companies based on the size of their assets and industry and find that the unweighted mean ratio of taxable profits to total assets for foreign multinational subsidiaries is 12.4 percent, whereas for matched domestic standalones it is 25.2 percent, i.e. foreign multinational subsidiaries report 12.8 percentage points lower taxable profits relative to total assets than domestic standalones. If we attribute all of the difference between these matched samples of foreign multinational subsidiaries and domestic standalones to profit shifting, then foreign multinationals shift over half of their taxable profits out of the UK.

The difference between the matched samples of foreign multinational subsidiaries and domestic standalones is almost entirely explained by the fact that a higher proportion of

[4]Johannesen *et al.* (2016) find that companies are more likely to report near-zero accounting profits in their home country, the higher the average foreign tax rate of their subsidiaries is.

[5]The choice of the scaling variable is discussed at length in Chapter 1.

foreign multinational subsidiaries report zero taxable profits (59.2 percent) than domestic standalones (27.5 percent).[6] In particular, 85 percent of the average difference in the ratio of taxable profits to total assets between foreign multinational subsidiaries and domestic standalones can be attributed to foreign multinational subsidiaries reporting zero taxable profits. When restricting the sample to companies which report positive taxable profits, the difference in the ratio of taxable profits to total assets between the ownership types is small and insignificant. Once foreign multinational subsidiaries decide to report positive taxable profits, their reporting behaviour does not differ from that of domestic standalones.

One possible explanation for the large number of zero taxable profit reporting multinationals is that foreign multinational subsidiaries, unlike domestic standalones, are able to use various methods of profit shifting, such as debt shifting, patent or royalty location or transfer pricing to minimize their taxable profits in the UK (Dharmapala (2014)).[7] An example of debt shifting is when a UK subsidiary of a foreign multinational borrows from its parent company in a low tax country so as to reduce its taxable profits (tax base) in the UK (since interest payments are tax deductible), subject to Controlled Foreign Company (CFC) rules.[8] This increases the tax base in the lower tax country, so as to reduce the overall tax burden for the company. In a similar way, multinational can use transfer pricing to reduce its total tax liability; i.e. purchase goods from its foreign subsidiary at higher than a market price (Grubert (2003), Markle (2012)).[9] Finally, multinationals

[6]The taxable profits are either zero or positive in the tax returns form; negative profits are reported as zeros. Hence, the data is censored at zero. We can recover taxable losses from the back of the tax returns form, but only the portion of the losses which is related to trading activities. I discuss this further in the empirical section.

[7]This supports the evidence from Johannesen *et al.* (2016) who use bunching of the ratio of accounting profits to total assets around zero to estimate the extent of profit shifting of multinationals in Europe. They find that reporting near-zero accounting profits may be linked with aggressive tax avoidance by multinational companies and is related to the tax rate of their foreign parent.

[8]"The CFC rules are anti-avoidance provisions designed to prevent diversion of UK profits to low tax territories. If UK profits are diverted to a CFC, those profits are apportioned and charged on a UK corporate interest-holder that holds at least a 25% interest in the CFC." For more details see https://www.gov.uk/guidance/controlled-foreign-company-an-overview

[9]For a detailed analysis of profit shifting using transfer pricing by multinationals see Liu and Schmidt- Eisenlohr (2017). They use tax and trade linked data from the HMRC to look at transfer pricing strategies of multinational companies.

often set up subsidiaries in low tax countries where they hold a large proportion of their intellectual property, which they then license to their subsidiaries in higher tax countries, such as the UK. In this chapter, I find that in the UK domestic standalones report 14 percentage points lower leverage than comparable foreign multinational subsidiaries. Further, 40 percent of the gap in the ratio of taxable profits to total assets between foreign multinational subsidiaries and domestic standalones can be explained by the differences in leverage between ownership types. When restricting the sample to companies which report positive taxable profits, the difference in leverage between ownership types is reduced to 7 percentage points. This is consistent with the hypothesis that some companies use leverage to reduce their taxable profits to zero.

The large number of zero taxable profit reporting foreign multinational subsidiaries suggests a very aggressive form of profit shifting for some foreign multinationals. Moreover, a puzzle emerges, as I cannot identify any major differences in observable firm level characteristics between tax-payers and non tax-payers. This may suggest that firms instead differ in their unobservable characteristics such as their ability to shift profits or reputational costs of aggressive tax planning[10].

There are other possible explanations for why I find such a large difference in the ratio of taxable profits to total assets between foreign multinational subsidiaries and domestic standalones, which are unrelated to profit shifting. In this chapter, I empirically test their importance and find that only leverage explains a significant portion of the difference in the ratio of taxable profits to total assets between the analyzed ownership types. In turn, I find that foreign multinational subsidiaries, in spite of reporting lower taxable profits, are actually 25 percent more productive than domestic standalones. This suggests that the differences in profitability between ownership types do not arise because of the differences in productivity. Other possible factors, such as losses made in this or previous periods or group relief are discussed in detail in Chapter 1 of this thesis.

[10]The accounting literature identifies a relationship between firm's CEO who may be an aggressive tax planner and the amount of accounting profits that a firm reports (Armstrong *et al.* (2012), Armstrong *et al.* (2015)).

The differences in the ratio of taxable profits to total assets between foreign multinational subsidiaries and domestic standalones are related to traditional measures associated with profit shifting. In the previous literature the extent to which firm's profit is related to leverage, tax rates or firm structure, such as a presence of tax havens, has been used as an indicator of profit shifting (Hines and Rice (1994)). In this chapter, I find that, for instance, foreign multinational subsidiaries headquartered in tax havens report much lower taxable profits in the UK relative to domestic standalones than foreign multinational subsidiaries headquartered in higher tax countries. If we consider being headquartered in a tax haven as a sign of being a profit shifter, this suggests that companies which are more likely to be shifting profits out of the UK, report the lowest ratios of taxable profits to total assets in the UK.

I find that the UK corporate tax rate cuts did not have an effect on the ratio of taxable profits to total assets reported by foreign multinational subsidiaries relative to that reported by domestic standalones. If marginal cost of shifting profits abroad is equal to marginal benefits, we would expect a cut in the domestic corporate tax rate to reduce the marginal benefit of shifting profits abroad. This could induce a company to report higher taxable profits in the UK. The fact that I find no such response, suggests that the cost of reducing taxable profits may not be a convex function of firm's profits. Instead, it points towards firms in my sample having fixed cost of shifting profits. This is also consistent with the fact that the zero taxable profits reporting pattern is prevalent for foreign multinational subsidiaries, as those companies may be inelastic to changes in the corporate tax rates, in so far as they already report zero taxable profits.

Previous studies, which used accounting profits to proxy for taxable profits, may have underestimated the extent of profit shifting by multinational companies. To compare taxable and accounting profits I include in taxable profits, which are otherwise censored at zero, trading losses that companies report in the tax returns form. I find that companies which report positive profits, report significantly higher accounting profits than taxable

profits.[11] Further, bunching at zero (or near-zero) profits is much stronger in the tax returns data than in the accounting data. Both of those differences are systematically larger for foreign multinational subsidiaries, which suggests that they may be driven by factors unrelated to reporting standards and instead may be an indication of aggressive tax planning practices of multinational companies. Comparison of the propensity score matching results using accounting and taxable profits data reveals that the extent of the gap in the ratio of taxable profits to total assets estimated using accounting data is much smaller than that estimated using tax returns data.

The advantage of the work presented in this chapter over previous approaches is threefold. First, unlike most of the profit shifting literature, which uses accounting profits as a proxy for taxable profits, I use administrative data on taxable profits directly from the tax returns. Secondly, I select the sample of foreign multinational subsidiaries and domestic standalones from a full population of UK companies. This means that I have larger than previously analyzed sample of comparable companies. Finally, previous approaches have focused on studying the relationship between tax rates and logarithm of profits to estimate the extent of profit shifting of multinational companies (see Dharmapala (2014) for review of the literature). Using the logarithm of profits means that these studies have implicitly concentrated their analysis on the positive taxable profits.[12] In this chapter, I show that the most important aspect of understanding how much taxable profits foreign multinational subsidiaries report, is the zero taxable profit reporting behaviour.

Egger *et al.* (2010) use accounting data to show that multinationals earn significantly higher profits than comparable domestic firms in low tax countries, but earn significantly

[11]The difference between what companies report on their accounting statements and the taxable profits they report is to be expected (Desai and Dharmapala (2009)) due to the differences in accounting standards and tax reporting standards. This is partly due to the fact that accounting depreciation tends to be less generous than tax depreciation, which means that after taking into account capital allowances, accounting profits can be expected to be higher than taxable profits (Hanlon and Heitzman (2010), Dharmapala (2014)).

[12]The profit shfiting literature does not directly omit the negative and zero profits from their analysis. Instead, they often add a constant to the profits number and hence they do include negative and zero profits. However, this does not enable them to study the zero profits phenomenon directly.

lower profits in high tax countries. They define low tax countries as countries with statutory tax rates lower than the median in their sample. Given that the UK was a relatively high tax country during the sample period, their findings would suggest that multinationals operating in the UK would report lower accounting profits than domestic companies. If we assume that accounting profits are a good proxy for taxable profits, this is consistent with my finding that foreign multinational subsidiaries report lower ratios of taxable profits to total assets than domestic standalones.

In what follows, section 2.2 briefly describes the data used in this chapter, section 2.3 outlines the empirical methodology and the challenges associated with it, section 2.4 discusses the results and section 2.5 concludes.

2.2 Data description and sample selection criteria

The primary data source used in this chapter is the confidential universe of unconsolidated corporation tax returns in the UK for the years 2000 - 2011 provided by HMRC. This dataset together with the basic sample selection criteria is described in detail in Chapter 1 of this thesis.

I further limit the selected sample for the purpose of this chapter to include foreign multinational subsidiaries and domestic standalones only. These companies constitute about 30 percent of the total taxable profits in the UK and hold 50 percent of total assets. Their observable characteristics are similar to other types of multinationals and domestic companies, which makes them representative of the ownership classes they were chosen from.

I have chosen those two groups of companies with a view to find the two most comparable ownership groups, of which one has the ability to shift profits abroad (foreign multinational subsidiaries) and one does not (domestic standalones). To strengthen their comparability, I limit the foreign multinational subsidiaries sample to include affiliates with zero subsidiaries and with positive trading turnover.

The total number of foreign multinational subsidiaries in the sample is 270,000, of which 200,000 have no subsidiaries themselves. This means that I exclude from the main analysis around 25 percent of foreign multinational subsidiaries. This addresses two possible concerns: appropriate asset size and presence of overseas income. The total assets numbers that multinationals with zero subsidiaries report is not affected by the equity value of their subsidiaries, as they report to have none.[13] Also, the effect of overseas income on their taxable profits should be negligible after including only companies with no subsidiaries.[14,15]

Further, I ensure that foreign multinational subsidiaries selected for the analysis report having positive trading turnover in the UK. Out of 200,000 foreign multinational subsidiaries with no subsidiaries themselves, just under 150,000 also report to have positive trading turnover. This means that they have trading activities in the UK and do not exist solely as holding companies to transfer profits between company affiliates.

Sample size has plagued previous studies as important parts of the economy were omitted by excluding small firms. Accounting datasets generally report missing data for a large portion of observations. I am the first to use the HMRC tax returns data with universal coverage to solve this problem. When estimating the size of the difference in taxable

[13]Note that the ratio of taxable profits to total asstes increases for the foreign multinational subsidiaries sample as I introduce the addtional selection criteria. This is consistent with the total assets number being larger than the size of the operations of foreign multinational subsidiaries with subsidiaries in the UK.

[14]Some of the foreign multinational subsidiaries that report to have no subsidiaries themselves have reported overseas income in the UK. This may be because my ownership data may not capture the ownership structure of companies perfectly.

[15]The concern here could be that the treatment of overseas income has changed following the 2009 dividend tax reform, after which firms were no longer required to report overseas income on their tax returns. This could create a discord between the taxable profits of multinationals with overseas income before and after 2009. What is more, part of the overseas income was sheltered by double tax relief in the UK. This means that multinational companies only paid tax on part of the reported overseas income. The exclusion of the sheltered portion of overseas income from the taxable profits would decrease the numerator of the taxable profits to total assets ratio for multinational companies which receive overseas income. To allieviate this concern the main empirical analysis is performed using foreign multinational subsidaries with zero subsidiaries themselevs and in any case only 2.6% of the analysed sample has reported to bring any overseas income to the UK. Therefore the issue of including overseas income which is sheltered by double tax relief in the taxable profit measure is not a major one. I test this further in the empirical analysis.

profits between foreign multinational subsidiaries and domestic standalones I additionally rely on accounting information to obtain total asset figures. In contrast to information on accounting profits, data on total assets has substantially better coverage.[16] Therefore, in my propensity score matching analysis, I have larger than previously analyzed sample of foreign multinational subsidiaries and domestic standalones. I am able to find comparable domestic standalone companies not only for large foreign multinational subsidiaries, but also for smaller foreign multinational subsidiaries, for which a large number of comparable domestic standalones exists.

In my empirical analysis I do not consider domestic multinationals for two distinct reasons. First, one may think that they would be a good comparison group for foreign multinational subsidiaries. However, since domestic multinationals have similar opportunities to shift profits abroad as foreign multinationals, the size of the difference between these two groups would not give me any information on the potential size of profit shifting. On the other hand, they may present an interesting comparison with domestic standalones. However, the size of the total assets of domestic multinationals in my dataset is not a good approximation of the size of their operations in the UK. This is because all but a few of the domestic multinational observations in the selected sample report having at least one subsidiary, either foreign or domestic.[17] This means that the total assets figures in unconsolidated accounts of those companies may include the equity value of those subsidiaries, while their taxable profits do not include taxable profits of the subsidiaries. Thus, the ratio of their taxable profits to total assets will be biased downwards relative to companies with no subsidiaries which report the same taxable profits. Therefore those companies might not be as comparable to domestic standalones in terms of the main variable of interest as

[16]For instance, out of 150,000 foreign multinational subsidiaries for which I have total assets and taxable profits information, only 65,000 have reported profits information in their accounting statements.

[17]This is the case for both parent companies and their subsidiaries alike. This is not the case for foreign multinational subsidiaries, as only 25 percent of them report to have subsidiaries themselves and those I exclude from the sample.

foreign multinational subsidiaries without any subsidiaries are. Further, half of domestic multinationals report only consolidated accounts in the FAME dataset.[18]

I also do not focus the empirical analysis on the differences between foreign multinational subsidiaries and domestic groups. The exclusion of domestic groups from the empirical analysis comes from the fact that I cannot identify those types of companies with certainty. I can say with confidence that they are not domestic standalones, but due to missing ownership data, it is entirely plausible that a company that I have classified as a domestic group based on the lack of foreign income and the presence of domestic parent and no foreign subsidiaries, is actually a foreign multinational subsidiary.

2.2.1 Descriptive statistics

In this section I present descriptive evidence on the differences in the ratio of taxable profits to total assets between foreign multinational subsidiaries and domestic standalones. In Figure 2.1 I plot the weighted mean ratios of taxable profits to total assets for the two analyzed groups.[19] Specifically, I sum up all taxable profits in each year for each ownership type and do the same for total assets. I then divide one sum over the other to obtain the weighted means. In Panel A I consider the whole sample of observations for both ownership types. In Panel B I consider only companies of similar size, excluding very large foreign multinational subsidiaries for which no comparable domestic standalones exist and excluding very small domestic standalones for which no comparable foreign multinational subsidiaries exist. In Panel C I further impose a restriction that the companies considered in Panel B report positive taxable profits only.

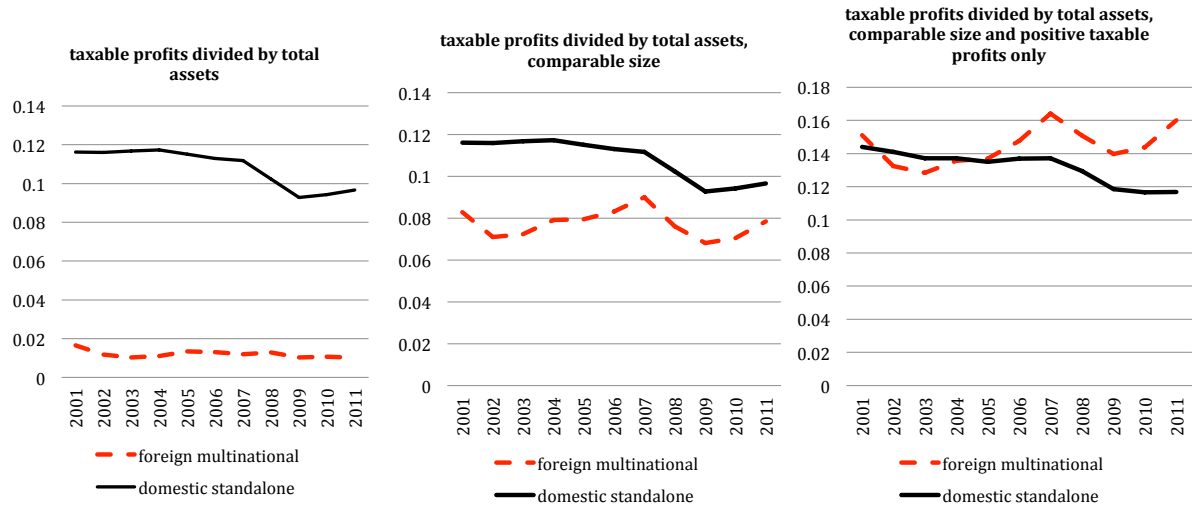
I find that in the raw data, domestic standalones report 6 times higher ratio of taxable profits to total assets than foreign multinational subsidiaries. When I compare companies

[18] An alternative would be to use trading turnover reported in the tax return form as a measure of size for domestic multinationals. However, this is not possible as trading turnover for domestic multinationals is almost always missing (likely because companies are not required to report turnovers). It means that I have no data source to approximate the size of domestic multinationals in the UK.

[19] This figure is similar to Figure 1.4 in Chapter 1. Here, I only include the lines for foreign multinational subsidiaries and domestic standalones.

of similar sizes, by excluding the very large multinationals and the very small domestic companies, they report more comparable taxable profits. The difference in the ratio of taxable profits to total assets between the two ownership types in Panel B is about 4 percentage points; foreign multinational subsidiaries report their ratio of taxable profits to total assets to be 8 percent, while domestic standalones report that to be 12 percent. Further, excluding companies which report zero taxable profits (almost 60 percent of foreign multinational subsidiaries and 27.5 percent of domestic standalones) we can see that the difference in the ratio of taxable profits to total assets between foreign multinational subsidiaries and domestic standalones disappears. Moreover, in the second half of the sample period foreign multinational subsidiaries which report positive taxable profits, report higher taxable profits than domestic standalones which also report positive taxable profits.

Figure 2.1: Taxable profits comparisons: foreign multinational subsidiaries vs domestic standalones.



Note: Differences in the ratio of taxable profits to total assets between foreign multinational subsidiaries and domestic standalones, The ratios are calculated by summing up all taxable profits of a particular ownership category in each year and dividing these by the sum of total assets of that paritcular ownership category in that particular year. Years used 2000 - 2011, selected sample. Source: merged HMRC and FAME data.

2.3 Empirical methodology

In this section I describe the empirical strategy I use to estimate the size of the difference in the ratio of taxable profits to total assets between domestic standalones and foreign multinational subsidiaries. The most straightforward and commonly used in the literature approach would be to use panel estimators, such as pooled OLS or within firm transformation to estimate the average difference in the taxable profits relative to total assets between multinationals and domestic standalones. Previous approaches have used changes in the tax rate differential between countries to identify the relationship between tax rates and reported accounting profits (the approaches following Hines and Rice (1994)).

However, this yields two types of biases. Firstly, foreign multinational subsidiaries are much larger than domestic standalones, hence, the OLS results may include companies which are not of comparable size. The evidence from Chapter 1 shows that the very large multinationals report lower ratios of taxable profits to total assets than smaller multinationals for which comparable domestic standalones exist. Conversely, very small domestic standalones report higher ratios of taxable profits to total assets than larger domestic standalones for which comparable foreign multinational subsidiaries exist. Hence, the OLS results on the whole sample may be upward biased. Secondly, foreign multinational subsidiaries and domestic standalones differ not only in terms of size, but also across other observable characteristics. For instance, trade literature over the last decades has documented that multinational and domestic firms differ in terms of productivity, size and wages (Harrison and Aitken (1999), Javorcik (2004), Sabirianova *et al.* (2005), Yasar and Morrison Paul (2007)).[20] This suggests that there may be a selection into being a multinational company that is a function of observable firm level characteristics.

The econometric approach that has been used extensively in trade and industrial economics literature to alleviate the two concerns raised above has been a non-parametric

[20]This endogeneity has also been explored theoretically (Markusen and Venables (1998), Helpman *et al.* (2004)).

matching method.[21] This method calculates predicted probabilities of being in the treatment group based on observable firm level characteristics and finds observations with similar propensity scores from treatment and control groups. Instead of comparing the average differences between two groups of companies, the propensity score matching method compares companies with similar propensity scores and calculates the average difference using the comparable pairs.

In the first stage a logit model is estimated with multinational dummy on the left hand side and determinants of being a multinational company on the right hand side. I use this regression to calculate the predicted probabilities of being a multinational company for each observation. These are called propensity scores (Paul R. Rosenbaum (1983), Rosenbaum and Rubin (1985)).

$$multinational_i = \alpha_i + \delta \mathbf{K}_{it} + ind_i + year_t + \epsilon_{it}. \tag{2.1}$$

where $multinational_i$ is a multinational dummy equal to 1 if a company is a multinational and 0 otherwise, $\mathbf{K}_{it}$ is a set of determinants of being a multinational, ind_i and $year_t$ are industry and year fixed effects. I use a nearest neighborhood matching strategy within a 0.1 caliper radius without replacement, which for each foreign multinational subsidiary finds a closest comparable domestic standalone within the 0.1 radius in terms of the propensity score.[22] That particular domestic standalone is used only once, hence the sample size of foreign multinational subsidiaries and domestic standalones used for matching without

[21] The non-parametric nature of the propensity score matching is important since it avoids misspecification of the equation as could be the case with OLS. To ensure OLS specification yields similar results to matching, we would need to control for a fully flexible industry size matrix. However, if OLS is correctly specified, it is more efficient (Hirano *et al.* (2003), Abadie and Imbens (2006)).

[22] Various robustness checks have been performed using different caliper and the results are not very sensitive to the choice of the radius. William G. Cochran (1973) and Rosenbaum and Rubin (1985) suggest using a caliper width that is a proportion of the standard deviation of the logit of the propensity score, specifically 0.2 of standard deviation was suggested to eliminate approximately 99% of the bias due to the measured confounders. Since the standard deviation of the logit of the propensity score is 0.5 in my baseline matching model, I choose 0.1 caliper width.

replacement is the same.[23] Furthermore, I impose a common support restriction for total assets, hence no company larger than the largest domestic standalone and no company smaller than the smallest foreign multinational is in the sample. This last condition is crucial and makes the propensity score matching (PSM) method a preferred approach to OLS especially in the light of very different size distributions between ownership types.

There are various other algorithms which can be used to obtain matched samples based on propensity scores, such as kernel or radius. Radius matching uses all domestic standalone companies with propensity scores within a certain radius from a given multinational to estimate the size of the difference. Kernel matching uses all domestic standalones, but weights the control observations inverse-proportionally to the propensity score difference to the multinational company. Using more observations for matching increases precision, but the more observations you use the less suitable they are as comparisons. This could lead to large biases. Since in Chapter 1 we have seen that larger multinationals are not comparable to smaller ones in terms of the ratio of their taxable profits to total assets, I use nearest neighborhood matching to avoid large biases and trade off efficiency of the estimates.

The critical difficulty of this chapter is in finding the appropriate group of companies to achieve the best matching possible. For each foreign multinational affiliate I want to find a comparable domestic standalone from the same industry of the same size. Therefore I keep the set of matching variables as simple as possible and in the baseline results use the following observable characteristics: industry, year and total assets.[24]

The propensity score generated in the first stage divides the sample into a group of "treated" foreign multinational subsidiaries for which a comparable domestic standalone with a similar propensity score was found, and remaining companies, which constitute the unmatched sample. Since the main outcome of interest is the ratio of taxable profits to

[23]The replacement feature enables the same domestic standalone to be used as a comparable company for foreign multinational subsidiaries multiple of times. This might be important in the right hand side tail of the distribution where there are not very many large domestic standalones to create a comparable group for foreign multinational subsidiaries. I test the robustness of the baseline estimates using the replacement feature.

[24]I check the robustness of the choice of the baseline matching variables in Section 2.4.1.

total assets, in the second stage a difference in the mean ratios of taxable profits to total assets between foreign multinational subsidiaries and domestic standalones is estimated using the matched sample (Paul R. Rosenbaum (1983)). This effect is presented as the average treatment effect on the treated (ATT, Imbens (2004)). Hence, the ATT is the percentage point difference in the ratio of taxable profits to total assets between foreign multinational subsidiaries and domestic companies accounting for selection into being a multinational. This approach is applied to alternative outcome variables as well.

The PSM results may be directly compared to the OLS estimates. However, this hinges on including a fully flexible size and industry interaction matrix together with exclusion of companies outside of the overlapping regions. For more discussion on the differences between PSM and OLS see Appendix 2.6.1.

In Chapter 1 I document large differences in the proportions of observations that report zero taxable profits between foreign multinational subsidiaries and domestic standalones. Therefore, the estimation of the unconditional means of the ratio of taxable profits to total assets is not the only interesting margin of comparison between the ownership types. The unconditional mean can be decomposed into the share of zeros and a mean conditional on reporting positive taxable profits in the following way:

$$E(y) = (1-p)E(y|y=0) + pE(y|y>0) = 0 + pE(y|y>0) = pE(y|y>0) \tag{2.2}$$

where $p = prob(y > 0)$ and $y = \frac{\text{taxable profits}}{\text{total assets}}$.[25] This suggests dividing the analysis into three main components; the unconditional mean of taxable profits relative to total assets, the mean of taxable profits conditional on reporting positive taxable profits and the binary outcome analysis of zero taxable profit reporting, that will directly estimate p. Dropping observations with $y = 0$ and performing PSM is a first attempt to consider the conditional mean, while selectivity correction may be considered a refinement. Since

[25] $E(y|y=0)$ is zero when y is reported taxable profits, censored at zero. However, UK tax system allows carryforward of losses for tax purposes, which would mean that $E(y|y=0)$ may not be zero when y measures the actual taxable profits. I discuss this particular feature of the UK tax system later in this section.

applying selectivity correction does not change the main result relative to PSM, I do not discuss it in the main body of the chapter. For more details on the two-stage Heckman selection approach and the results see Appendix 2.6.2.

The difference in ATT between the unconditional and conditional means indicates how much of the difference in taxable profits between foreign multinational subsidiaries and domestic standalones I can attribute to zero taxable profit reporting. Furthermore, I consider zero taxable profits dummy defined as one when the company is reporting zero taxable profits and zero otherwise as an outcome variable. The ATT coefficient on that outcome variable will tell me the difference in the proportion of observations that are reporting zero taxable profits between the two ownership types in the matched sample.

Another factor which may contribute to the differences in the ratio of taxable profits to total assets between foreign multinational subsidiaries and domestic standalones is differences in leverage.[26] This leads me to consider leverage as an additional outcome variable in the propensity score matching approach. I consider two measures of leverage, total liabilities divided by total assets - stock measure of leverage - and net interest (interest paid minus interest received) divided by profit and loss before interest - flow measure of gearing.

Furthermore, the propensity score matching approach allows me to calculate the proportion of the difference in taxable profits between foreign multinational subsidiaries and domestic standalones that can be attributed to the differences in leverage. To do so, in the first stage of PSM I use leverage as a matching variable. Therefore now, in the second stage, I will be comparing companies of similar size with similar leverage. The difference in the ATT coefficient between matching with and without leverage (on the same sample) will give me the fraction of the difference explained by leverage.

The question also arises whether we are only interested in taxable profits as they are recorded on the tax return form, i.e. taxable profits=max(0, taxable income), or whether we are also interested in the underlying taxable income, which may be either positive

[26]Higher leverage makes zero taxable profits more likely. Hence, differences in leverage and the proportion of zero taxable profits cannot be considered as separate factors.

or negative. This is conceptually unclear, given the asymmetric treatment of profits and losses. In the UK tax system when a company makes a loss it does not receive a tax credit on that loss, but instead records zero taxable income and hence pays no corporation tax on that income. It is then allowed to bring some of the losses it made forward into future periods and offset them against positive taxable profits, once it is profitable again. Alternatively, it can also bring the losses back one period and offset them against last year's profits, if those profits were positive. In the case of loss carryback the company would receive tax credit in that particular year. When taxable profits are positive, the corporation tax liability is paid. This means that the taxable profits are censored at zero.

What this implies for the purpose of this chapter is that with fully symmetric treatment, we would only be interested in the underlying taxable income, with fully asymmetric treatment (no carry back or carryforward of losses), we would only be interested in the recorded taxable profits (censored at zero). With the actual treatment (some carry back and carryforward at nominal value) we may be interested in both. We can potentially use additional information from the tax return, e.g. on losses, to recover or estimate the underlying taxable income. One of the possible sources of information is trading losses in the CT600 form, where firms have to report the amount of losses arising from their trading activities. The advantage of this measure is that we could simply subtract those trading losses from recorded taxable profit to recover some of the underlying taxable income. This measure would be more closely related to tax payments in the same year. The disadvantage is that we have no information on other sources of losses that companies may be incurring, which means that we are introducing a measurement error into the analysis. In the empirical analysis I primarily focus on the censored taxable profits as an outcome variable. However, I discuss comparisons between taxable income and recorded taxable profits measures when I compare propensity score matching results using taxable and accounting profits.

2.4 Results

In this section I present the results from propensity score matching. I then test their robustness, discuss channels which companies use to lower their taxable profits and compare my results with those using accounting profits. Finally, I consider the heterogeneity of the estimated differences.

The matching algorithm is based on size and industry, hence in the first stage I estimate a logit model using logarithm of total assets, 2 digit industry and year dummies.[27] First, I use the propensity score from this baseline regression to perform the nearest neighborhood matching procedure and look at the ATT from those estimations. The outcome variables I consider are taxable profits divided by total assets, tax liabilities divided by total assets, zero taxable profits dummy and taxable profits divided by total assets for positive taxable profits only. I then limit the matching sample to positive taxable profits only and repeat the matching exercise to obtain the ATT on the ratio of taxable profits to total assets for that smaller sample.

Using the first stage of PSM to create matched and unmatched samples, I first present descriptive statistics on foreign multinational subsidiaries and domestic standalones. I show mean unweighted outcome variables, such as size (total assets and trading turnover) and age. The results in Table 2.1 suggest that the matching procedure makes the two analyzed ownership types more comparable to each other in terms of main observable firm level characteristics. In the first row of each panel I show that the two ownership categories are very similar in terms of the matching variable (logarithm of total assets) after matching is performed. Further, the differences in the means of other observable

[27]The PSM analysis assumes that we have matched on all relevant characteristics and that there is no unobserved confounders that may account for the difference across the treatment and control groups. I test that assumption using Rosenbaum bounds sensitivity analysis (Rosenbaum (2002), see Appendix Table 2.8). The Roseunbaum analysis tests how much the unobserved covariate would need to increase the odds of being a multinational company before we could attribute the difference between foreign multinational subsidiaries and domestic standalones to unobserved factors. The results indicate that the unobserved factor would need to increase the likelihood of being a multinational more than three times before we could attribute the observed difference in the outcome variables to that unobserved factors. This suggests that the matching procedure is not sensitive to hidden bias.

firm level characteristics between the two ownership types are insignificant in the matched sample. Foreign multinational subsidiaries in the matched sample are on average smaller than in the unmatched sample, while domestic standalones are larger, both in terms of total assets and trading turnover. Foreign multinationals are younger in the matched sample than in the unmatched one, while domestic standalones are older.

Table 2.1: Summary statistics.

	foreign multinationals	domestic standalones
	whole sample	
log total assets	14.6	11.0
total assets (million)	118.0	0.27
trading turnover (million)	26.0	1.06
log trading turnover	14.5	11.5
age	20.6	13.3
	matched sample	
log total assets	13.1	13.1
total assets (million)	1.83	1.76
trading turnover (million)	3.17	2.29
log trading turnover	13.6	13.1
age	17.9	19.8
	unmatched sample	
log total assets	16.5	10.8
total assets (million)	255.0	0.19
trading turnover (million)	58.6	0.99
log trading turnover	15.9	11.4
age	23.7	12.9

Note: Unweighted means of observed firm level characteristics: comparison of whole, matched and unmatched samples for foreign multinational subsidiaries and domestic standalones, Matched sample is created using propensity score matching methodology described above, where I use total assets and industry as matching variables. The differences in the means of the observable firm level characteristics between foreign multinational subsidiaries and domestic standalones are significant in the whole and unmatched samples. In the matched sample, the differences in the means of observable firm level characteristics between foreign multinal subsidiaries and domestic standalones are insignificant for total assets, trading turnover and age. 2000 - 2011, selected sample. Trading turnover and total assets are in millions of pounds. Source: merged HMRC and FAME data.

The third column in Table 2.2 shows the mean of treated observations: foreign multinational subsidiaries, while column 4 presents the mean of control observations: domestic

standalones, both for matched sample. The average treatment effect (ATT) is the difference between those two means. The last two columns show the number of observations in both treated and control groups. The ATT estimates for the ratio of tax liabilities and taxable profits to total assets in the baseline specification are negative and highly significant (standard errors are in the column titled SE). The difference between domestic standalones and foreign multinational subsidiaries is estimated to be 12.76 percentage points for the ratio of taxable profits to total assets, while the difference in the ratio of tax liabilities to total assets is 2.51 percentage points. The mean of taxable profits relative to total assets for foreign multinational subsidiaries is 12.41 percent while that same ratio is 25.17 percent for domestic standalones. This implies that foreign multinational subsidiaries report just over 50 percent lower ratio of taxable profits to total assets and 46.7 percent lower ratio of tax liabilities to total assets.

The estimates of the difference in the ratios of tax liabilities and taxable profits to total assets are different. This is due to the proportion of small and medium companies that pay lower tax rate in the UK. I match companies on size measured by total assets rather than profits, the latter being the determinant of which tax band applies to a company.[28] If all companies were subject to the same tax rate in the UK, the difference between foreign multinational subsidiaries and domestic standalones for tax liabilities and taxable profits should be the same. However, the UK has lower tax rate for small and medium companies and these companies constitute a much larger proportion of domestic standalones than foreign multinational subsidiaries. This is the case even after matching procedure is applied, as the average tax rate is lower for domestic standalones than for foreign multinational subsidiaries in both whole and matched samples.[29] We would expect domestic standalones

[28]For more details on which tax rates apply to which types of companies see: https://www.gov.uk/government/publications/rates-and-allowances-corporation-tax/rates-and-allowances-corporation-tax

[29]The average tax rate is calculated as the ratio of tax liability to taxable profits in the tax returns data. If all companies were subject to the top statutory tax rate, this ratio would be equal to the top statutory tax rate. However, small and medium companies in the UK were subject to lower - 20 percent - corporate tax rate during the sample period. Hence, we would expect the average tax rate for of domestic standalones to be lower than for foreign multinational subsidiaries.

on average to pay lower tax on the same taxable profits, if they were subject to lower tax rate. Therefore we would expect the difference between multinationals and domestic standalones in terms of taxable profits to be larger than that on tax.

Furthermore, the ratio of tax liability to total assets divided by the ratio of taxable profits to total assets gives an implied tax rate. Comparison of those ratios for the treated and control groups reveals that the implied tax rate for foreign mutational subsidiaries is actually higher - 23 percent - than that for domestic standalones, 21.3 percent. The top statutory tax rate in the UK for most of the sample duration was 30 percent. However, a substantial portion of domestic standalones was subject to much lower, 20 percent, small and medium statutory tax rate over the sample period in the UK. Therefore, absent profit shifting, we would expect the difference in the implied tax rates between the two groups to be much larger.

I also find that foreign multinational subsidiaries are 31.8 percentage points more likely to report zero taxable profits in the matched sample; 56.7 percent of observations in the foreign multinational subsidiaries category and 22.9 percent of observations in the domestic standalones category report zero taxable profits. This leads me to explore the mean taxable profits to total assets ratio conditional on making positive taxable profits as an outcome variable. The ATT for the ratio of taxable profits to total assets is -1.45 percentage points and is insignificant, while the ATT for the ratio of tax liabilities to total assets turns positive and is also insignificant. This means that over 85 percent of the difference in taxable profits between the two ownership types can be attributed to the differences in the proportions of companies reporting zero taxable profits.[30]

[30] Alternatively, I do PSM on all companies and present the results for conditional mean of taxable profits to total assets. The results for matching on the baseline sample, but using restricted outcome variable show the ATT estimate to be -1.89 percent which is not statistically significantly different from the one obtained doing PSM on the resticted sample.

Table 2.2: Propensity Score Matching baseline results.

sample	variable	treated	control	ATT	SE	obs treated	obs control
Baseline	taxable profits/total assets	0.1241	0.2517	-0.1276	0.0118	149,581	149,581
Baseline	corporation tax/ total assets	0.0286	0.0537	-0.0251	0.0011	149,581	149,581
Baseline	taxable profits/total assets>0	0.2640	0.2830	-0.0189	0.0243	72,313	72,313
Baseline	zero taxable profits	0.5466	0.2288	0.3179	0.0014	149,581	149,581
Positive taxable profits only	taxable profits/total assets>0	0.2630	0.2775	-0.0145	0.0241	72,843	72,843
Positive taxable profits only	corporation tax/ total assets	0.0612	0.0598	0.0014	0.0022	72,313	72,313

Note: Results from the baseline propensity score matching estimatation, 2000 - 2011, selected sample. Matching on total assets and within industry and year. Baseline sample: foreign multinational subsidiaries and domestic standalones, Positive taxable profits only sample: foreign multinational subsidiaries and domestic standalones with positive taxable profits. Treated observations are foreign multinational subsidiaries, control observations are domestic standalones. Source: merged HMRC and FAME data.

2.4.1 Robustness checks

In this section I test the robustness of the baseline estimates of the difference in the ratio of taxable profits to total assets between foreign multinational subsidiaries and domestic standalones (Table 2.3). I first consider how various first stage matching specifications affect the main result. I use non-linear forms of total assets, such as square and cube of the logarithms. Instead of matching within each year, I use a cross-section regression with one observation for each firm, and with the average logarithm of total assets over the sample period to identify the matched observations, i.e. I match on static data so that a company is either always in the control or in the treatment group. I further test whether the estimates are robust to disaggregated industries and hence match using 3 digit rather than 2 digit industry codes. These changes to the first stage matching procedure alter the ATT estimates to a very small extent. The estimated size of the difference between ownership types varies between 12.53 and 13.42 percentage points.

There may be a concern about the effect that overseas income may have had on taxable profits of multinational companies. Since my sample includes only foreign multinational subsidiaries without any subsidiaries themselves, foreign multinational subsidiaries in the matched sample should have no subsidiaries which could be paying dividend income back to the UK. However, 2.6 percent of foreign multinational subsidiaries in the matched sample report to have some overseas income. This may be because I have no data on their subsidiaries and hence I did not exclude them in the selection process, or because their headquarters have paid dividends to their subsidiaries in the UK.

The concern is that overseas income as reported in the tax returns is calculated before double tax relief. This means that part of that overseas income in not actually liable to corporation tax and hence I may be overstating income of foreign multinational subsidiaries by not accounting for the sheltered portion of that income. To understand the effect of overseas income on my results I exclude profits sheltered by double tax relief from my taxable profits numbers (row 6 in Table 2.3).[31] Alternatively, I use only years before

[31]In the tax return form a company has to report the amount of double tax relief claimed, based on the amount of its tax liability. I use the tax rate that applies to each company and

the 2009 dividend tax reform (row 5 in Table 2.3). The exclusion of overseas income sheltered by double tax relief increases the ATT coefficient slightly. Excluding later years in the sample increases the size of the baseline coefficient significantly. I discuss the yearly heterogeneity of the estimated coefficients in section 4.4.

I exclude the ring-fenced profits from the taxable profits number to see whether my results are driven by the North Sea oil rig companies reporting large taxable incomes. In a similar spirit I exclude mining sector altogether, since we have seen in Chapter 1 that companies from that sector report incomparably high ratios of taxable profits to total assets. These exclusions do not change the results significantly (rows 7 and 8 in Table 2.3).

I further exclude companies that report to have positive investments on their balance sheets as part of their fixed assets number (row 9 in Table 2.3). This number is an approximate for equity value of their subsidiaries. This effectively excludes all companies that may have any subsidiaries, but which reported no information on this in the ownership data and hence have not been excluded during the sample selection process; 29 percent of foreign multinational subsidiaries and 5 percent of domestic standalones report data on investments in the FAME dataset. However, the exclusion of investments from the total assets measure does not seem to affect the main results; it changes the size of the estimated difference in the ratio of taxable profits to total assets between foreign multinational subsidiaries and domestic standalones only marginally.

I then consider matching using only the sub-sample of companies that report no trading losses to make sure that my estimates are not driven by companies reporting trading losses (row 10 in Table 2.3). The ATT estimate is 12.28 percentage points, which implies that foreign multinational subsidiaries report 40 percent lower ratio of taxable profits to total assets than domestic standalones. This suggests that the baseline results are indeed driven by zero taxable profit reporting foreign multinationals with no trading losses.

multiply that by the amount of double tax relief to obtain the amount of profits sheltered by double tax relief.

Furthermore, I explore whether matching with replacement affects my results and whether utilizing more than one domestic standalone to match with foreign multinational subsidiary makes a difference (rows 11 and 12 in Table 2.3). As discussed in the empirical methodology, using more observations as a control group increases the efficiency of the estimates, but might affect the bias of the coefficient. Using matching with replacement I can use the same large domestic standalone in the right hand side tail of the company size distribution several times, if it is the best match for a particular foreign multinational subsidiary. Therefore it is conceivable that I am using more comparable domestic standalones in this approach. Using matching with replacement results in the ATT increasing marginally to 13.17 percentage points. In turn, using 5-nearest neighborhood matching, instead of 1-nearest neighborhood matching, decreases the size of the estimated difference to 9.98 percentage points[32]. However, using various matching algorithms does not affect the implied size of the difference in the ratio of taxable profits to total assets between foreign multinational subsidiaries and domestic standalones; it remains around 50 percent.

Finally, I test how different is the ratio of taxable profits to total assets between foreign multinational subsidiaries and domestic group subsidiaries using the same matching approach as in the case of domestic standalones. I find that the gap in the ratio of taxable profits to total assets between foreign multinational subsidiaries and domestic group subsidiaries is just over a third of what it is between foreign multinational subsidiaries and domestic standalones; the ATT is -4.82 percentage points. This implies that foreign multinational subsidiaries report almost 30 percent lower ratio of taxable profits to total assets relative to domestic groups. This is 20 percentage points lower than their implied taxable profits difference relative to domestic standalones.

This is to be expected for two reasons. As I have already discussed, I am not certain whether some of the domestic groups subsidiaries are not part of the foreign multinational category. This introduces downward bias into the size of the estimated difference. Sec-

[32] 5-nearest neighbourhood matching uses 5 closest comparable domestic standalones for each foreign multinational subsidiary, instead of 1. The matching is still performed within the 0.1 predicted probability radius.

ondly, domestic groups have been shown to have as high leverage as foreign multinationals and since leverage can be used to shelter taxable profits, we would expect their taxable profits to be more comparable. However, foreign multinational subsidiaries can shift profits abroad while domestic group subsidiaries (if identified correctly into that ownership category) cannot. Therefore we may expect the differences in the ratio of taxable profits to total assets between domestic group subsidiaries and foreign multinational subsidiaries to signify, among other factors, the differences in profit shifting ability. In turn, the difference between foreign multinational subsidiaries and domestic standalones signifies a broader set of tax avoidance opportunities available to groups of companies.

In the second part of Table 2.3 I explore various company size measures which could be used as alternatives to total assets in the first stage of propensity score matching. I use number of employees, fixed assets and trading turnover. For each of the size variables, I perform PSM twice; first, matching on this alternative size variable and second, comparing the results to matching on total assets on the limited sample of observations for which I have data on each of those alternative size variables. This allows me to examine whether various matching alternatives change the inference in terms of the size of the gap in the ratio of taxable profits to total assets between foreign multinational subsidiaries and domestic standalones.

I find that matching on the number of employees, fixed assets or trading turnover instead of total assets increases the estimated size of the difference in the ratio of taxable profits to total assets between foreign multinational subsidiaries and domestic standalones twofold (see Panel B, Table 2.3). Most of the difference comes from the much higher ratio of taxable profits to total assets for domestic standalones. Foreign multinational subsidiaries in my sample often have a large proportion of their total assets held in intangible assets, while domestic standalones do not have the same proportion of intangible assets. Therefore, for instance, when matching only on fixed assets (rows 3 and 4 in Table 2.3), a multinational with large intangible assets that was previously a match for a domestic standalone, with no intangible assets will now be matched with much smaller domestic standalone company.

As we have seen in Chapter 1 smaller domestic standalones tend to report higher ratios of taxable profits to total assets. This explains why the ratio of taxable profits to total assets in the control group is much higher when matching on fixed assets. In case of matching on trading turnover this indicates that domestic standalones, which have similar trading turnover to foreign multinational subsidiaries, report higher taxable profits to total assets ratio than domestic standalones with similar total assets.

Further, I explore what happens when instead of having the ratios of taxable profits to total assets as an outcome variables, I perform the baseline matching analysis with trading profits to trading turnover as an outcome variable. These results are subject to the caveats discussed in Chapter 1. The mean ratio of trading profits to trading turnover for foreign multinational subsidiaries is lower than that for taxable profits to total assets. Since a large proportion of foreign multinational subsidiaries taxable income comes from sources other than trading profits, we would expect the size of the difference estimated here to be much smaller than the one for the ratio of taxable profits to total assets. This seems to be the case, as the ATT estimate is -6.2 percentage points; foreign multinational subsidiaries report 41 percent lower ratio of trading profits to trading turnover than domestic standalones.

Finally, multinational companies can have multiple subsidiaries in the UK and can choose to locate their taxable profits in one of those subsidiaries and report zero taxable profits in their remaining affiliates. This would be a concern especially because a large number of foreign multinational subsidiaries in the UK indeed report zero taxable profits. A direct way to deal with this concern would be to aggregate data on UK groups of companies. However, the issues of double counting of total assets arise if one company in the group owns another. Since, the ownership data does not have full coverage of all ownership links in the UK, hence, aggregating companies into groups would introduce a measurement error.

Alternatively, to alleviate those concerns I perform two additional tests. First, I do PSM on the sample of foreign multinational subsidiaries, which reported to have only

one subsidiary in the UK. The results are similar to the ones using the whole sample of foreign multinational subsidiaries. Foreign multinational subsidiaries report about 50 percent lower ratio of taxable profits to total assets than domestic standalones. Again, the difference between the two ownership types in entirely driven by the zero taxable profit reporting foreign multinational subsidiaries. Second, I calculate the weighted means of taxable profits relative to total assets for both ownership types on the PSM matched sample. The feature of the weighted mean is that it sums the observations for the denominator and the numerator. In a way, this will account for the presence of multiple subsidiaries of the same company in the UK. I find that the weighted ratio of taxable profits to total assets for foreign multinational subsidiaries in the matched sample is 10.8 percent, while it is 5.4 percent for domestic standalones. Hence, foreign multinational subsidiaries report 50 percent lower weighted ratio of taxable profits to total assets. This confirms that the baseline results is not driven by multiple subsidiaries of the same company reporting zero taxable profits.

2.4.2 Channels companies use to lower their taxable profits

In this section I explore potential factors driving the wedge in the ratio of taxable profits to total assets between foreign multinational subsidiaries and domestic standalones. For each potential channel that a company may be using to reduce its taxable profits, I use that channel as an outcome variable in the baseline propensity score matching to explore direct differences between foreign multinational subsidiaries and domestic standalones. In addition, I run a PSM using that factor as an additional matching variable and then perform baseline matching on the sample of observations for which I have data on this additional matching factor. That allows me to estimate whether the change in the ATT estimate is due to the sample composition or whether the variable itself affects the size of the estimate. The choice of the potential sources of the difference was guided by the analysis in Chapter 1. As such, I consider flow measure of gearing, stock measure of gearing - leverage, capital allowances and total factor productivity.

In Table 2.4 I show results in groups of three, for each potential channel that companies could use to reduce their taxable profits. For instance, in case of leverage, I first present results from matching on leverage and total assets, then from matching on total assets only with the ratio of taxable profits to total assets as an outcome variable and finally matching on total assets only with leverage as outcome variable; the latter two are performed using a sample of observations for which I have leverage data.

First, I consider the amount of debt that foreign multinational subsidiaries can take on. I look at both stock and flow measures of gearing, where stock measure is leverage, i.e. total liabilities divided by total assets, while flow measure is net interest divided by profit and loss before interest. First, I use leverage as an outcome variable in PSM and I find that foreign multinational subsidiaries take on about 14.1 percentage points more debt than comparable domestic standalones. Further, to estimate the importance of leverage, I run PSM using debt as an additional matching variable. I find leverage to be an important factor. The ATT from matching on leverage and total assets is -2.67 percentage points which is about 40 percent of what it is when matching on total assets only on the sample of observations with non-missing data on leverage (ATT of -4.21 percentage points)[33]. This would suggest that leverage explains 40 percent of the difference in taxable profits to total assets ratio between foreign multinational subsidiaries and domestic standalones.[34,35] This could suggest use of more debt shifting among UK subsidiaries of foreign multinational companies. However, it may also be that companies want to locate their debt in the UK due to highly advantageous tax system (low interest, CFC rules, etc.).

The other - unexplained - portion of the difference in the ratio of taxable profits to total assets between foreign multinational subsidiaries and domestic standalones may be

[33]This large reduction in the ATT estimates when matching on total assets on the sample on non-missing leverage data arises mainly because I only have data on leverage for larger foreign multinational subsidiaries and domestic standalones. These companies have lower ratios of taxable profits to total assets than the ones in the full analyzed sample; see the heterogeneity analysis in Section 2.4.4.

[34]Note that this evidence stands in stark contrast to Buettner and Wamser (2013), who provide evidence that debt shifting is unimportant for German affiliates.

[35]I find that differences in the flow measure of gearing do not alter the size of the baseline estimates.

attributed to other profit shifting strategies, such as transfer pricing and royalties licensing. I am unable to investigate this further since the effects of both transfer pricing and royalties licensing are already incorporated in the taxable profits (or trading losses) figure reported by foreign multinational subsidiaries on their tax income statements.

I further explore the results from matching on the ratio of capital allowances to total assets (rows 10 and 11 in Table 2.4) and TFP (rows 7-9 in Table 2.4). The difference in the ratio of capital allowances to total assets between the two ownership types in insignificant and matching on capital allowances in addition to total assets does not alter the estimates of the difference in the ratios of taxable profits to total assets between foreign multinational subsidiaries and domestic standalones relative to baseline estimates.

I find that foreign multinational subsidiaries report to have significantly higher productivity than domestic standalones. Moreover, when matching on TFP, the size of the difference in the ratio of taxable profits to total assets between the two analyzed ownership types falls from -0.56 to -0.42.[36] Foreign multinational subsidiaries are more productive than domestic standalones, yet conditional on having similar productivity levels they report lower taxable profits to total assets ratio than domestic standalones. This suggests that around 25 percent of the difference in the ratio of taxable profits to total assets between ownership types is explained by differences in productivity between firms.

[36] Again, when matching on TFP and total assets or on total assets on the sample of non-missing TFP observations, I find that the ratios of taxable profits to total assets for both ownership groups are much lower than in the sample analyzed in the baseline matching. This is again because we only have information on TFP for larger firms, which report lower ratios of taxable profits to total assets.

Table 2.3: PSM robustness tests.

sample	variable	treated	control	ATT	SE	obs treated	obs control
1st stage total assets enter as a square	taxable profits/total assets	0.1250	0.2503	-0.1253	0.0118	148,842	148,842
1st stage total assets enter as a square & a cube	taxable profits/total assets	0.1250	0.2523	-0.1274	0.0118	148,759	148,759
1st stage: matching on static data in logit model	taxable profits/total assets	0.1206	0.2548	-0.1342	0.0117	147,794	147,794
1st stage: 3 digit industry FEs	taxable profits by total assets	0.1235	0.2549	-0.1315	0.0117	150,370	150,370
use only years 2000 - 2008	taxable profits/total assets	0.1346	0.2333	-0.0987	0.0172	99,622	99,622
taxable profits less those sheltered by dtr	taxable profits (less sheltered overseas income) by total assets	0.1194	0.2543	-0.1348	0.0117	149,584	149,584
exclude comps with ring fenced profits	taxable profits by total assets	0.1228	0.2518	-0.1290	0.0117	149,584	149,584
exclude mining sector from analysis	taxable profits by total assets	0.1230	0.2589	-0.1359	0.0118	148,024	148,024
take out companies with larger investment to total assets ratio >0	taxable profits by total assets	0.1287	0.2664	-0.1377	0.0132	132,734	132,734
match of companies which report zero trading loss	taxable profits/total assets	0.1772	0.2999	-0.1228	0.0169	104,055	104,055
matching with replacement	taxable profits/total assets	0.1043	0.2360	-0.1317	0.0102	197,064	2,848,342
5 nearest neighbourhood	taxable profits/total assets	0.1043	0.2041	-0.0998	0.0099	197,064	2,848,342
foreign multis vs domestic groups	taxable profits/total assets	0.1182	0.1664	-0.0482	0.0379	135,296	163,093
Different size measures							
match on employment	taxable profits/total assets	0.0827	0.2260	-0.1433	0.0050	30,214	30,214
baseline (exmployment sample)	taxable profits/total assets	0.1050	0.1690	-0.0640	0.0082	30,214	30,214
match on fixed assets	taxable profits/total assets	0.0887	0.2430	-0.1543	0.0015	106,452	106,452
baseline (fx assets sample)	taxable profits/total assets	0.0959	0.1776	-0.0817	0.0018	106,452	106,452
match on trading turnover	taxable profits/total assets	0.1220	0.3262	-0.2042	0.0135	122,125	122,125
baseline (tr turnover sample)	taxable profits/total assets	0.1308	0.2319	-0.1011	0.0141	122,125	122,125
baseline (tr turnover sample)	trading profits/trading turnover	0.0939	0.1580	-0.0642	0.0006	122,125	122,125

Note: Results from the Propensity Score Matching estimates, various robustness tests. In Panel A of the table I show results from robustness specifications described in Section 2.4.1. In Panel B of the table I show results using alternative size measures instead of total assets in the first stage of PSM. The first row in panel B refers to matching on employment instead of total assets, the second row to matching on total assets, but using only the sample for which employment observations are avalable. The remianing rows perform the same comparison, using fixed assets and trading turnover. Treated observations are foreign multinational subsidiaries, control observations are domestic standalones. Selected sample, 2000 - 2011. Source: merged HMRC and FAME data.

Table 2.4: PSM channels.

sample	variable	treated	control	ATT	SE	obs treated	obs control
match on leverage	taxable profits/total assets	0.0878	0.1145	-0.0267	0.0008	53,064	53,064
baseline (leverage sample)	taxable profits/total assets	0.0843	0.1264	-0.0421	0.0009	54,512	54,512
baseline (leverage sample)	leverage	0.7618	0.6207	0.1411	0.0018	54,512	54,512
match on flow of gearing	taxable profits/total assets	0.0863	0.1393	-0.0530	0.0055	32,263	32,263
baseline (flow of gearing sample)	taxable profits/total assets	0.0866	0.1420	-0.0554	0.0052	32,672	32,672
baseline (flow of gearing sample)	flow of gearing	-0.0933	-0.1749	0.0817	0.0029	32,672	32,672
match on TFP	taxable profits/total assets	0.0878	0.1300	-0.0422	0.0021	19,877	19,877
baseline (TFP sample)	taxable profits/total assets	0.0870	0.1431	-0.0560	0.0022	20,552	20,552
baseline (TFP sample)	TFP	2.5623	2.4795	0.0828	0.0031	20,552	20,552
match on capital allow	taxable profits/total assets	0.1241	0.2558	-0.1317	0.0118	149,581	149,581
baseline (capital allow sample)	capital allowance	800,254	760,477	39,777	848,497	149,581	149,581

Note: Results from the Propensity Score Matching estimates showing channels which companies use to reduce their taxable profits. The first row shows results using leverage as additional matching variable to total assets and industry. The second row shows results from baseline matching on total assets and within industry, but only on the sample for which leverage data is available. The third row shows results from baseline matching on total assets and within industry, but uses leverage instead of the ratio of taxable profits to total assets as an outcome variable. The remiander of the table shows the results in similar groups of three for the following variables: flow of gearing, TFP and capital allowances. Treated observations are foreign multinational subsidiaries, control observations are domestic standalones. Selected sample, 2000 - 2011. Source: merged HMRC and FAME data.

2.4.3 Comparison of taxable and accounting profits

Most of the previous literature on profit shifting uses accounting profits to proxy for taxable profits. Since taxable profits are censored at zero, while accounting profits can take negative values, to compare taxable and accounting profits directly the literature tends to use two distinct approaches. The first method takes trading losses from the tax return form and subtracts them from taxable profits to recover the negative portion of taxable profits and obtain a measure which is closer to the current taxable profits. The second method converts all negative accounting profits into zeros, effectively censoring them in the same way as taxable profits are censored in the tax returns.

The accounting dataset - FAME - includes variables related to taxable profits, namely gross operating profits less depreciation and profit and loss before taxes. In Figure 2.2 I compare the positive taxable and accounting profits by plotting the distributions of logarithms of 3 different measures of profits.

Accounting profits as measured by profit and loss before tax or by operating profits less depreciation overestimate the taxable profits reported by foreign multinational subsidiaries (Panel A, Figure 2.2). The distribution of positive accounting profits is shifted to the right relative to the distribution of positive taxable profits. However, accounting profits seem to be a better approximation of taxable profits of domestic standalones (Panel B, Figure 2.2).[37] Accounting depreciation is smaller than tax depreciation, which is one of the reasons why we would expect accounting profits less accounting depreciation to be larger than trading profits, but to the same extent for both ownership types.

The PSM estimates suggest that the main difference in the ratio of taxable profits to total assets between foreign multinational subsidiaries and domestic standalones lies in the differences of the number of observations reporting zero taxable profits. Therefore I also compare the distributions of taxable profits minus trading loss scaled by total assets relative to profit and loss before taxes scaled by total assets around zero (method 1).

[37] Interest and royalty payments both are deducted at the operating profit levels already.

Figure 2.3 contains 4 panels where each panel plots distributions of the ratios of profits to total assets; the left hand side panels (A and B) refer to comparisons of accounting and taxable profits, the right hand side panels (C and D) compare foreign multinational subsidiaries with domestic standalones. The horizontal axis in those figures shows the ratios of profits to total assets, while on vertical axis we have kernel density estimate, which shows the density of observations at each particular value of the ratio of profits to total assets.

Bunching around zero profits in prevalent in both accounting data (as shown by Johannesen *et al.* (2016)) as well as tax returns. What is more interesting is that bunching around zero is much larger for taxable profits relative to accounting profits for foreign multinational subsidiaries than for domestic standalones (see LHS figures, Figure 2.3). In addition, foreign multinational subsidiaries bunch around zero taxable profits to a larger extent than domestic standalones (Panel C). However, there is no difference in bunching around zero accounting profits between foreign multinational subsidiaries and domestic standalones (Panel D).[38]

Furthermore, zero taxable profit reporting companies appear to come from the missing mass to the right of the taxable profits distribution, where the accounting profits distribution indicates that companies report much higher ratio of accounting profits to total assets. This suggests that accounting profits may overestimate taxable profits, especially in case of foreign multinational subsidiaries. Therefore I consider comparisons of PSM results using ratios of accounting and taxable profits to total assets as outcome variables, using the two methods described above.

In Table 2.5, using the first method I find that the difference in the ratio of taxable profits to total assets between foreign multinational subsidiaries and domestic standalones is estimated to be -14.7 percentage points (row 3), while the difference in the ratio of accounting profits to total assets on the same sample is -7.0 percentage points (row 4). Using the second method, I find the difference in taxable profits between the two ownership

[38]For additional evidence on the discrepancies between tax and accounting profits see Devereux *et al.* (2015) and Maffini *et al.* (2016a).

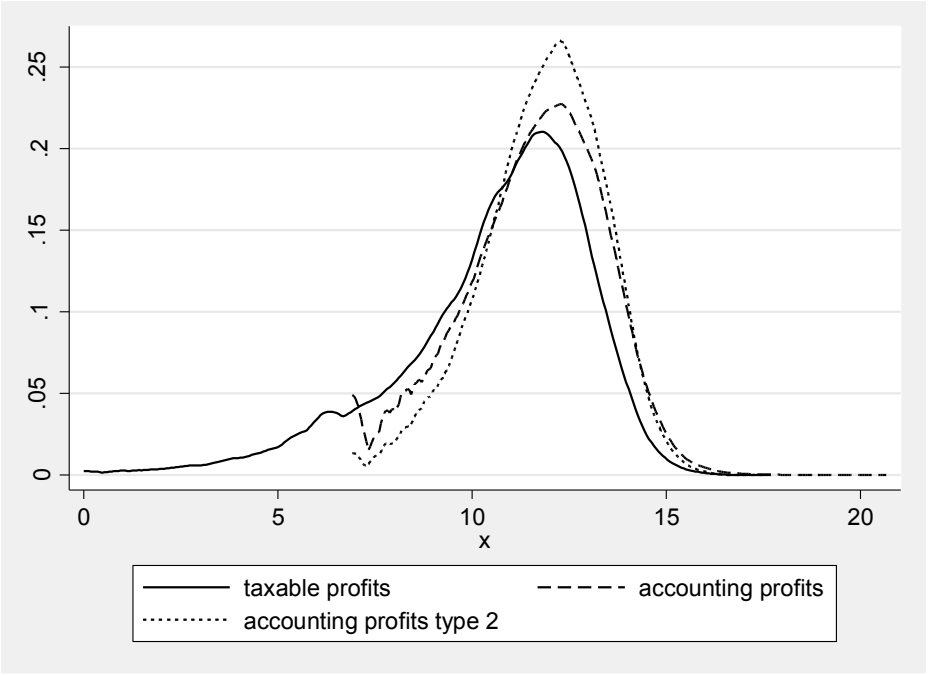
types to be -5.9 percentage points (row 1), while the difference in accounting profits is -2.7 percentage points (row 2). In both cases the estimates of the difference in the ratio of profits to total assets between foreign multinational subsidiaries and domestic standalones are substantially smaller when using accounting profits data than using taxable profits data. What is more, the ratios of taxable profits to total assets for foreign multinational subsidiaries are generally smaller than the ratios of accounting profits to total assets for both methods. This suggests that the previous estimates of profit shifting obtained using accounting data might be underestimating the true size of profit shifting of foreign multinational companies. Since the PSM results are driven by the zero taxable profit reporting companies, this is not at all surprising. Foreign multinational subsidiaries seem to be reporting positive profits in their accounts, while at the same time reporting zero taxable profits on their tax returns. This would bias the estimates of profit shifting obtained using accounting data downwards.

Finally, the last row in Table 2.5 considers differences in the effective tax rates between foreign multinational subsidiaries and domestic standalones. The effective tax rates are calculated as ratios of tax liability from tax returns to accounting profits measure (profit and loss before taxes). I find that foreign multinational subsidiaries report lower effective tax rates in the UK than comparable domestic standalones.

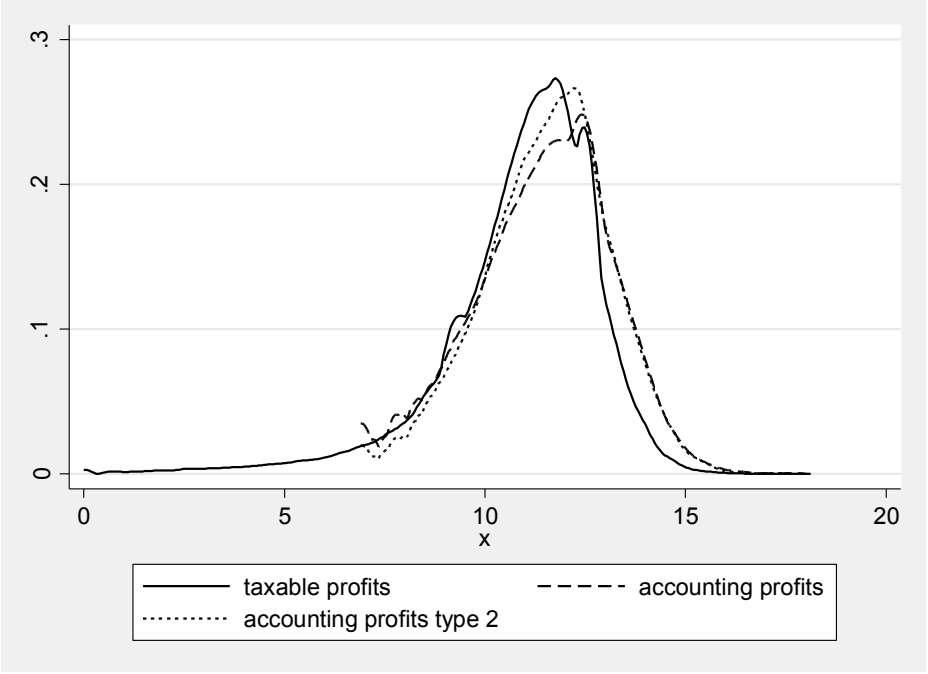
A more rigorous comparison of taxable and accounting data is outside the scope of this chapter. Understanding how using tax returns data instead of accounting data will help us to better understand the reporting behaviour of multinational companies is an interesting avenue for further research.

Figure 2.2: Distribution of profits. Comparison between tax and accounting measures.

Panel A: Foreign multinational subsidiaries



Panel B: Domestic standalones



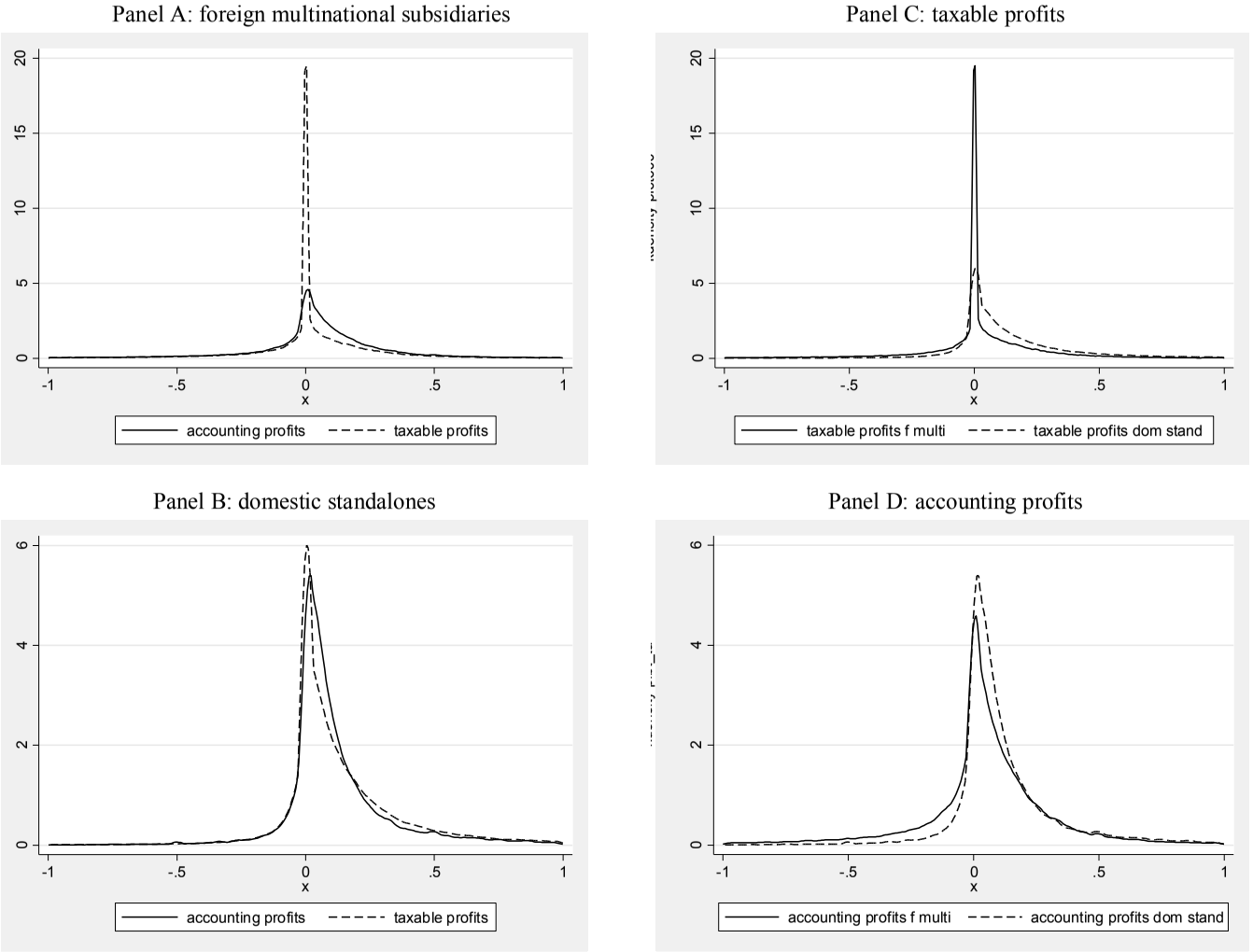
Note: Distribution of logarithm of profits, comparison between FAME and CT600 using the sample of matched companies. The propensity score matching was performed using total assets and within industry, 2000 - 2011. Accounting profits refer to profit and loss before tax, accounting profits type 2 refer to operating profits less deductions, taxable profits measure comes from the tax return form. Source: merged HMRC and FAME data.

Table 2.5: PSM results - comparison of taxable and accounting profits.

robustness test	variable	treated	control	ATT	S.E.	obs treated	obs control
accounting profits sample	taxable profits by total assets	0.0801	0.1340	-0.0539	0.0021	65,543	65,543
accounting profits sample	accounting profits (negative is zero) by total assets	0.1140	0.1407	-0.0266	0.0008	65,543	65,543
accounting profits sample	taxable profits (incl loss) by total assets	-0.0408	0.1065	-0.1473	0.0180	65,543	65,543
accounting profits sample	accounting profits by total assets	0.0503	0.1206	-0.0703	0.0012	65,543	65,543
accounting profits sample	tax by plbt	0.2057	0.2454	-0.0397	0.0135	47,406	47,406

Note: Results from the Propensity Score Matching estimates using total assets and within industry matching variables, The table provides comparison of taxable and accounting profits, where rows 1 and 2 are directly comparable and so are rows 3 and 4. In row 1, I use taxable profits divided by total assets as an outcome variable, in row 2 I use profit and loss before taxes, where all negative values were turned to zero, in row 3 I use taxable profits measure from the tax returns data from which I subtract trading losses that companies report in the current period, while in row 4 I use profit and loss before taxes from accounting statement without any adjustments. In row 5 the outcome variable is an effective tax rate - tax measure from tax returns divided by profit and loss before taxes. Treated observations are foreign multinational subsidiaries, control observations are domestic standalones. Accounting profits sample refers to observations for which I have accounting profits data. Selected sample, 2000 - 2011. Source: merged HMRC and FAME data.

Figure 2.3: Distributions of taxable and accounting profits - comparisons.



Note: Distribution of the ratios of taxable profits (including trading losses) from HMRC and profit and loss before taxes from FAME scaled by total assets, propensity score matched sample only, 2000 - 2011. The left hand side panels refer to comparisons of accounting and taxable profits for foreign multinational subsidiaries (Panel A) and domestic standalones (Panel B), the right hand side panels compare foreign multinational subsidiaries with domestic standalones for taxable profits (Panel C) and accounting profits (Panel D). Source: merged HMRC and FAME data.

2.4.4 Heterogeneity of the estimated coefficients

In this section I explore the heterogeneity of the baseline estimates of the difference in the ratio of taxable profits to total assets between foreign multinational subsidiaries and domestic standalones. I specifically focus on three aspects of heterogeneity; first, I discuss differences in the ATT estimates as the size of companies increases, then I focus on the yearly variation in the estimated coefficients and finally on the differences between foreign multinational subsidiaries depending on the location of their headquarters. The analysis of the latter two heterogeneities is aimed at linking the estimated difference in the ratio of taxable profits to total assets between ownership types to profit shifting.

First, I focus on estimating the differences in the ATT by size bins. I divide the sample of foreign multinational subsidiaries and domestic standalones into 10 equally-sized size bins based on total assets. Within each bin, I perform propensity score matching using total assets, within each industry. This gives me 20 different ratios of taxable profits to total assets, 10 for foreign multinational subsidiaries in each size bin and 10 for comparable domestic standalones in each of those size bins.

The results in Table 2.6 suggest that the size of the difference in the ratio of taxable profits to total assets between foreign multinational subsidiaries and domestic standalones declines as companies get larger, the only exception being the very smallest companies in size bin 1. Further, the ratios of taxable profits to total assets for both ownership categories fall as well. Hence, the implied size of the gap in the ratio of taxable profits to total assets between the two analyzed ownership types decreases as well. However, the implied gap in the ratio of taxable profits to total assets between foreign multinational subsidiaries and domestic standalones only significantly changes once companies are much larger than median in my sample.

The UK has introduced several corporate tax rate cuts starting in 2008. For a company for which the marginal cost of shifting its taxable profits out of the UK is equal to the marginal benefit, we would expect that a cut in the domestic corporate tax rate may induce subsidiaries of foreign multinational companies to report more taxable profits in

the UK, if the tax rates in other countries in which they have affiliates remained the same. This is because the marginal cost of reporting lower taxable profits in the UK increases following the domestic corporate tax rate cut.

However, it may well be that foreign multinational subsidiaries do not respond to the UK corporate tax rate cuts, because the benefit they accrue from reducing their taxable profits in the UK is not a convex function of their profits. Instead, they have fixed cost of shifting profits. Large companies with elaborate profit shifting strategies in place may be inelastic to changes in the tax rates, in so far as they already report zero taxable profits. The reduced tax rate would not offer them incentive high enough to exceed the fixed cost of switching to a different tax planning strategy to report higher (or even positive) taxable profits in the UK. This is consistent with a large and continuously increasing fraction of foreign multinational subsidiaries that report zero taxable profits in the UK. Of course, it may be that in more recent years, the reputational gain from reporting positive taxable profits may be of importance, especially in the context of a recent increase in naming and shaming of the largest companies (Google, Amazon, Starbucks). This may incentivize companies to report more taxable profits in the UK. However, this is likely to be outside of my analysis period, which ends in 2011.

Using the UK corporate tax rate cuts as a quasi-natural experiment and comparing taxable profits of foreign multinational subsidiaries to the ones of domestic standalones before and after the rate cut would help in linking the differences in the ratio of taxable profits to total assets with tax rate differentials. The previous literature on profit shifting has shown a very strong relationship in tax rate differentials between countries and the amount of profits reported in those countries.

The corporate tax rate cuts, together with the continuous effort of the tax revenue authorities to reduce profit shifting activities of multinational companies, mean that the question arises whether the size of the estimated difference in the ratio of taxable profits to total assets between foreign multinational subsidiaries and domestic standalones has decreased accordingly. To answer this question, I estimate the PSM for each sample year

separately and calculate the ATT for the ratio of taxable profits to total assets for each of the years 2000 - 2011. I then plot those ATT estimates alongside the confidence intervals in Figure 2.4. In addition to the ratio of taxable profits to total assets, I also plot the ATT estimates of the differences in the proportions of zero taxable profits between foreign multinational subsidiaries and domestic standalones.

I find that the size of the difference in the ratio of taxable profits to total assets between the two ownership types has increased from -5.1 percentage points in 2000 to -20.6 percentage points in 2011 with some fluctuations around the financial crisis. This increase can possibly be attributed to a constantly increasing difference in the fraction of zero taxable profit reporting companies. This has increased from 26 percentage points in 2000 to 37 percentage points in 2011. All of the yearly ATT estimates are significant. This confirms the hypothesis of fixed costs of profit shifting, as the size of the difference in taxable profits between foreign multinational subsidiaries and domestic standalones did not react to corporate tax rate cuts in the UK.

Finally, I explore differences in the ratio of taxable profits to total assets reported by foreign multinational subsidiaries depending on where their headquarters are located. This offers an alternative identification strategy to link the estimated size of the difference in the ratio of taxable profits to total assets between ownership types to profit shifting. There is some evidence in the literature that companies with affiliates in tax havens tend to report lower accounting profits, which is often interpreted as sign of profit shifting (Desai *et al.* (2006), Slemrod and Wilson (2009), Grubert and Slemrod (1998), Hines and Rice (1994)). Should that be the case, we would expect foreign multinational subsidiaries with parents in tax havens to be reporting lower ratios of taxable profits to total assets in the UK than foreign multinational subsidiaries with parents in higher tax countries. What is more, media has been pointing towards the US headquartered companies, such as recently 'named and shamed' Google, Amazon, Apple or Starbucks as those which tend to pay very little tax in the UK.[39] I explore both of those claims below.

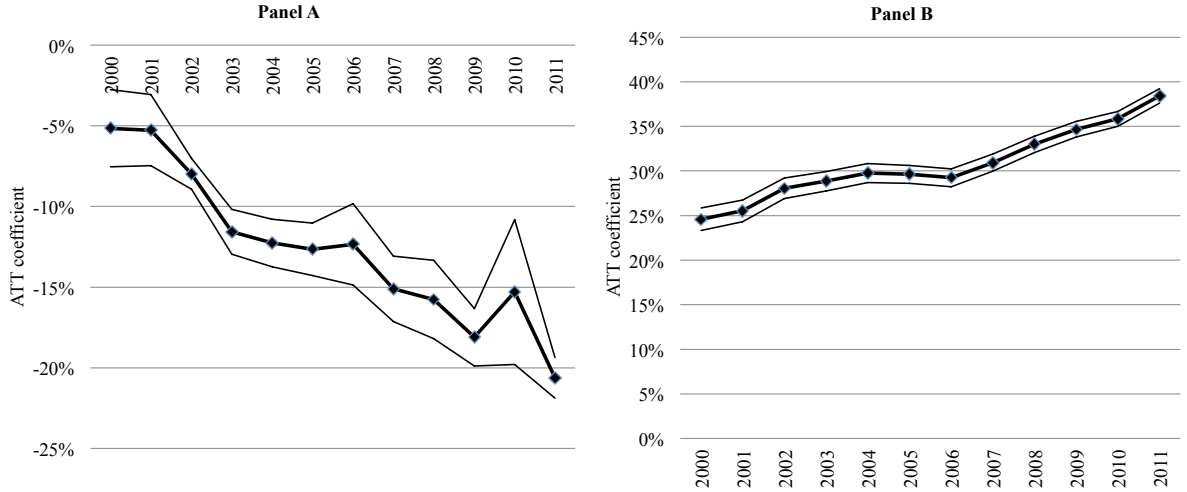
[39]See articles in e.g. BBC (http://www.bbc.co.uk/news/magazine-20560359), which talk about very large companies avoiding tax in the UK.

To estimate the differences in the ratios of taxable profits to total assets between foreign multinational subsidiaries and domestic standalones depending on where the multinational headquarters are located I perform PSM. I divide the sample of foreign multinational subsidiaries according to the location of their global ultimate owner. I then perform PSM separately for each of those sub-groups of foreign multinational subsidiaries finding the nearest neighborhood match among all domestic standalones. I use the whole population of domestic standalones for each of the sub-groups of foreign multinational subsidiaries with various headquarter locations, hence the same domestic standalone can be used in each subsample. I distinguish between the following headquarter locations: tax haven (excluding large tax havens), large tax haven such as Hong Kong, Singapore, Netherlands and Ireland, French multinationals, German multinationals, other European multinationals, US multinationals, Asian multinationals, other foreign multinationals.

The results from this matching procedure are presented in Table 2.7 and are ranked according to the size of the estimated difference in the ratio of taxable profits to total assets, from largest to smallest. The number of foreign multinational subsidiaries headquartered in each of the country groups are reported in the observation treated column. I find that foreign multinational subsidiaries headquartered in tax havens report much lower ratios of taxable profits to total assets in the UK relative to domestic standalones (the size of the difference is -16.95 percentage points). They are followed by foreign multinational subsidiaries headquartered in large tax havens. The smallest difference to domestic standalones, by far, is reported by other foreign multinationals (-3.34 percentage points). US headquartered companies do not report particularly low ratios of taxable profits to total assets in the UK relative to companies headquartered in other countries. This is especially interesting, considering that most of the very large multinational companies accused of profit shifting in the media are the ones headquartered in the US (e.g. Starbucks or Amazon). Further, subsidiaries of multinationals headquartered in other European coun-

tries (apart from France, Germany, Netherlands and Ireland) tend to report very similar ratios of taxable profits to total assets relative to domestic standalones in the UK.[40]

Figure 2.4: PSM - yearly heterogeneity.



Note: Results from the Propensity Score Matching estimated year by year. PSM using total assets and within each industry. The comparison group is foreign multinational subsidiaries and domestic standalones, I plot the ATT coefficients from propensity score matching, hence the numbers reflect the difference between treatment and control groups. Panel A: the outcome variable is the ratio of taxable profits to total asstes, Panel B: the outcome variable is zero taxable profits dummy. The estimated ATT coefficients for each year are significant. Selected sample, 2000 - 2011. Source: merged HMRC and FAME data.

[40]I can alternatively compute the weighted mean ratios of taxable profits to total assets for each of the headquarter location groups to see which foreign multinational subsidiaries report lowest ratios of taxable profits to total assets. In Figure 2.5 in the Appendix I show that foreign multinationals located in large tax havens tend to report lowest ratios of taxable profits to total assets in the UK.

Table 2.6: PSM results - by size bins.

size quantile	variable	treated	control	ATT	SE	implied gap	obs treated	obs control
1	taxable profits/ total assets	0.8487	1.2086	-0.3599	0.3643	30%	4,718	4,718
2	taxable profits/ total assets	0.2685	1.1086	-0.8402	0.0423	76%	3,610	3,610
3	taxable profits/ total assets	0.2888	0.8555	-0.5666	0.0644	66%	3,805	3,805
4	taxable profits/ total assets	0.1858	0.6724	-0.4866	0.0320	72%	4,741	4,741
5	taxable profits/ total assets	0.1709	0.4645	-0.2936	0.0165	63%	6,431	6,431
6	taxable profits/ total assets	0.1228	0.3373	-0.2145	0.0044	64%	9,385	9,385
7	taxable profits/ total assets	0.1147	0.2387	-0.1239	0.0039	52%	14,724	14,724
8	taxable profits/ total assets	0.0969	0.1731	-0.0761	0.0017	44%	22,424	22,424
9	taxable profits/ total assets	0.0820	0.1231	-0.0411	0.0014	33%	39,111	39,111
10	taxable profits/ total assets	0.0583	0.0765	-0.0182	0.0009	24%	38,128	38,128

Note: Results from the Propensity Score Matching estimates using total assets and within industry matching variables. Each row corresponds to one of the 10 different size quantiles. Matching is performed separately in each size quantile. Selected sample, 2000 - 2011. Source: merged HMRC and FAME data.

Table 2.7: PSM results - headquarter location heterogeneity.

sample	variable	treated	control	ATT	SE	obs treated	obs control
tax haven	taxable profits/total assets	0.0925	0.2621	-0.1695	0.0068	27,127	27,127
large tax haven (HK SG NL IE)	taxable profits/total assets	0.0997	0.2322	-0.1325	0.0051	30,387	30,387
French multinationals	taxable profits/total assets	0.0926	0.2162	-0.1235	0.0081	9,269	9,269
Asian multinationals	taxable profits/total assets	0.0781	0.1976	-0.1195	0.0054	13,913	13,913
other European multinationals	taxable profits/total assets	0.1113	0.2197	-0.1084	0.0147	18,043	18,043
US multinational	taxable profits/total assets	0.1308	0.2345	-0.1037	0.0085	47,941	47,941
German multinationals	taxable profits/total assets	0.0926	0.1872	-0.0947	0.0100	9,853	9,853
other foreign multinationals	taxable profits/total assets	0.0182	0.0516	-0.0334	0.0007	19,445	19,445

Note: Results from the Propensity Score Matching estimates, using total assets and within industry. I perform matching for each headquarter sub-sample to find comparable domestic standalones. Selected sample, 2000 - 2011. Source: merged HMRC and FAME data.

2.5 Conclusion

This chapter uses the administrative corporate tax returns data to show that foreign multinational companies report lower ratios of taxable profits to total assets than comparable domestic standalone companies. The propensity score matching approach controls for the differences between the two groups coming from size and industry variation, and estimates the remainder of the difference to be 12.76 percentage points. Assuming that similar sized companies from similar industries should be reporting similar taxable profits, unless they are involved in practices that aim at minimizing their tax liability in the UK, the difference estimated in this chapter suggests that foreign multinational subsidiaries shift a large proportion of their taxable profits out of the UK. Specifically, the baseline propensity score estimates suggest that foreign multinational subsidiaries underreport their taxable profits by about 50% relative to domestic standalones. This is the first study of that type which measures the size of the potential profit shifting of the UK companies.

Using the net tax payable from the tax returns together with the implied estimates of the size of the difference in the ratio of taxable profits to total assets, I can calculate the implied revenue gain from equalizing the taxable profits of domestic standalones and foreign multinationals. From the yearly PSM estimates, we know that the size of the gap in the ratio of taxable profits to total assets varies between 30 and 70 percent. Back of the envelope calculations show that the potential revenue gains from equalizing the tax payments of foreign multinational subsidiaries and domestic standalones would vary from £3 billion pounds at the beginning of the sample to £25 billion in 2011. Relative to the total UK corporate tax revenue, which was £30 billion in 2000 and £35 billion in 2011, this would imply that a full elimination of the differences in the taxable profits between domestic standalones and foreign multinational subsidiaries would lead to revenue gains of 10 percent in 2000 and 70 percent in 2011.[41] In the context of the recent proposals to reform the corporate tax system by introducing the destination base cash flow tax in the

[41] These calculations do not take into account possible behavioural changes that are likely to occur if such an equalization was possible.

US, these welfare gain calculations could help understand the benefits of equalizing the tax treatment of foreign and domestic companies. This is because destination base cash flow tax aims at elimination of the current channels of profit shifting and equalization of the tax treatment of foreign and domestic companies.

According to the propensity score matching estimates almost all of the estimated difference in the ratio of taxable profits to total assets between domestic standalones and foreign multinationals can be attributed to the large fraction of zero taxable profit reporting companies amongst foreign multinationals. Once multinational companies report positive taxable profits, their reporting behaviour does not differ substantially from that of domestic standalones. This suggests that most of the profit shifting is actually quite aggressive and occurs via reporting zero taxable profits.

These findings also have implications for theoretical modeling of profit shifting costs. If zero taxable profits are prevalent and they explain most of the difference in the taxable profit reporting behavior between foreign multinational subsidiaries and domestic standalones, then the assumption of fixed costs will be preferred to the previously assumed convex marginal costs of profit shifting. This means that firms may be less responsive to marginal tax rate changes than previously thought, as they bear a fixed cost of shifting profits and once they are large enough to incur that, they report no taxable profits. This may explain why the recent work using firm level data does not find large effects of tax rate changes on profits reported by firms. In contrast, majority of the previous literature that used aggregate data has found large responses. These large aggregate responses may come from firms near the fixed cost of profit shifting kink switching in and out of reporting positive taxable profits in response to tax changes. These may be thought of as extensive margin responses.

I further find that the previous estimates of profit shifting based on accounting data might be underestimating the true size of the problem. The extent of zero taxable profit reporting is much larger than near-zero accounting profit reporting for foreign multinational subsidiaries, but not for domestic standalones. Further work in this area is required

to shed more light on the differences between the estimates of the ratio of profits to total assets using accounting and taxable profits.

I also estimate that about 40 percent of the difference in the ratio of taxable profits to total assets between foreign multinational subsidiaries and domestic standalones in the matched sample comes from the differences in leverage between ownership types. Since difference in leverage suggests a presence of debt shifting, this could mean that up to 40 percent of foreign multinational profit shifting may be explained by debt shifting.

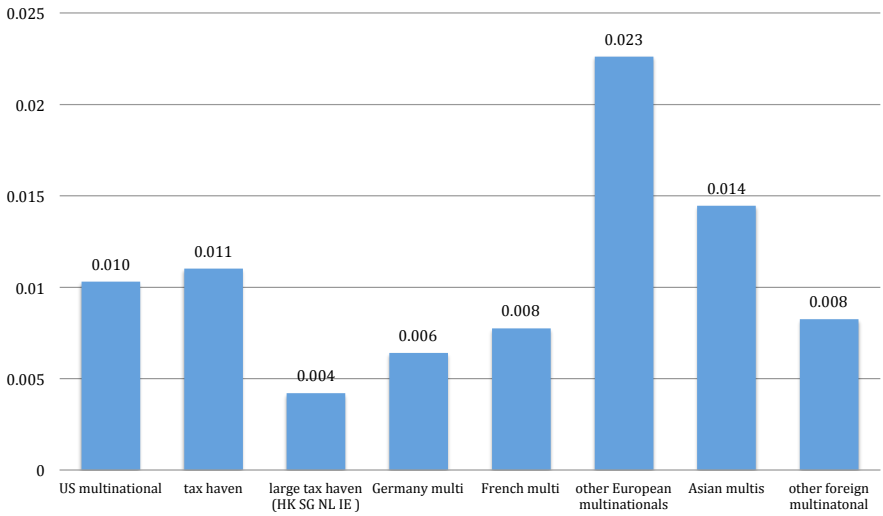
Finally, the estimate of the size of profit shifting presented in this chapter is likely to be an underestimate of the true size of profit shifting of all foreign multinational subsidiaries. This is because the propensity score matching leads to an exclusion of the very large foreign multinational subsidiaries (since no comparable domestic standalones exist) that report much lower ratios of taxable profits to total assets than the smaller foreign multinational subsidiaries in the matched sample. Specifically, the unweighted ratio of taxable profits to total assets is 5.6 percent for the very large, unmatched foreign multinational subsidiaries, less than half of the ratio for foreign multinational subsidiaries in the propensity score matched sample. This is inevitably more speculative since we do not have large enough domestic standalones to compare them to the largest multinationals and hence we are unable to say whether larger domestic standalones would have also reported lower taxable profits as a fraction of their size.

Table 2.8: Rosenbaum sensitivity tests.

Rosenbaum bounds for delta (N = 260617 matched pairs)						
Gamma	sig+	sig-	t-hat+	t-hat-	CI+	CI-
1	0	0	-0.06688	-0.06688	-0.06763	-0.06614
1.2	0	0	-0.08267	-0.05234	-0.08347	-0.05167
1.4	0	0	-0.09685	-0.04102	-0.09772	-0.04037
1.6	0	0	-0.10994	-0.03187	-0.11087	-0.03128
1.8	0	0	-0.12219	-0.02433	-0.12319	-0.02376
2	0	0	-0.1336	-0.01798	-0.13465	-0.01741
2.2	0	0	-0.14439	-0.0125	-0.14551	-0.01195
2.4	0	0	-0.15467	-0.00771	-0.15585	-0.00719
2.6	0	0	-0.16451	-0.00356	-0.16575	-0.00307
2.8	0	0	-0.17392	-0.00023	-0.17522	-1.6E-05
3	0	0.010836	-0.18295	-4.30E-07	-0.18432	-4.30E-07
* gamma - log odds of differential assignment due to unobserved factors						
sig+ - upper bound significance level						
sig- - lower bound significance level						
t-hat+ - upper bound Hodges-Lehmann point estimate						
t-hat- - lower bound Hodges-Lehmann point estimate						
CI+ - upper bound confidence interval (a= .95)						
CI- - lower bound confidence interval (a= .95)						

Note: Results from the Rosenbaum sensitivity tests for unobserved factors affecting the PSM estimates. In this table I test the baseline specification. Selected sample, 2000 - 2011. Source: merged HMRC and FAME data.

Figure 2.5: Taxable profits by headquarter location.



Note: Weighted mean ratios of taxable profits to total assets calculated for subsidiaries of foreign multinational companies in the UK by global ultimate owner of the multinational group. Selected sample, 2000 - 2011. Source: merged HMRC and FAME data.

2.6.1 Regression analysis

The propensity score matching results can be directly compared to the OLS estimates. The difference in the unconditional means of the ratios of taxable profits to total assets between foreign multinational subsidiaries and domestic standalones can be estimated using an OLS regression of taxable profits scaled by total assets on the left hand side on a multinational dummy and further control variables on the right hand side:

$$y_{it} = \alpha + \beta_1 multinational_i + \gamma X_{it} + ind_i + year_t + u_{it} \tag{2.3}$$

In these regressions the main variable of interest is $multinational_i$, which is a time-invariant dummy equal to one if the company is a foreign multinational subsidiary and 0 if it is a domestic standalone. With the dependant variable, y_{it}, being the ratio of taxable profits to total assets for firm i in year t, the coefficient β_1 on the multinational dummy is the difference in the ratio of taxable profits to total assets between domestic standalones and foreign multinational subsidiaries. The vector X_{it} controls for firm level observable

characteristics (total assets in the baseline specification), ind_i and $year_t$ are year and industry fixed effects. The constant is the mean ratio of taxable profits to total assets for domestic standalones.

The coefficient on the multinational dummy in a regression without any controls estimates the upper bound of the total size of the difference in the ratio of taxable profits to total assets between foreign multinational subsidiaries and domestic standalones. Inclusion of fixed effects and further controls will attribute parts of that difference to observable firm and industry level characteristics. Including flexible form of industry and size variables into the estimation, i.e. controlling for size and industry in the full sample would bring the coefficient on the multinational dummy closer to the PSM estimates of the difference. When we restrict the sample on which such an OLS regression is run to propensity score matched sample and use multinational dummy as the only explanatory variable, the coefficient on that multinational dummy will be equivalent to the ATT estimated by the PSM.

Similar to PSM, we can utilize the decomposition of the unconditional mean into conditional one and the binary outcome. Therefore I estimate the OLS regression on the sample of positive taxable profits only using both full and propensity score matched samples. I also estimate a binary regression model for the likelihood of reporting zero taxable profits depending on the ownership status. Hence, I estimate the following equation:

$$d_{it} = \alpha + \varphi_1 multinational_i + \varphi X_{it} + ind_i + year_t + \epsilon_{it}. \tag{2.4}$$

where d_{it} is a dummy equal to 1 when a company reports taxable profits to be zero and zero otherwise and other variables are defined as in equation 2.3. I estimate this binary model using linear probability model (OLS) and maximum likelihood estimate (probit). Further, I include leverage and other potential determinants of reporting zero taxable profits, such as firm structure and previous year's losses (see Table 2.9 for the list of variables). This estimation is designed to understand what determines the zero

taxable profit reporting behaviour of companies. One could also interact the explanatory variables with the multinational dummy to understand the differences in zero taxable profits determinants between foreign multinational subsidiaries and domestic standalone companies.[42]

Results from OLS and LDV specifications

In this section I present the results from the unconditional (Table 2.10) and conditional (Table 2.11) OLS estimations of the mean difference in the ratio of taxable profits to total assets between foreign multinational subsidiaries and domestic standalones as well as limited dependant variable estimations of the determinants of zero taxable profit reporting (Table 2.12).

The results from the OLS estimates (Table 2.10) on the unrestricted sample of foreign multinational subsidiaries and domestic standalones suggest a very large difference between the two ownership types in terms of the ratio of taxable profits to total assets. The coefficient on the multinational dummy in these regressions estimates the upper bound of the difference in taxable profits between foreign multinational subsidiaries and domestic standalones; this is 52.3 percentage points (column 1). The mean ratio of taxable profits to total assets for domestic standalones in 0.617. This means that foreign multinational subsidiaries report almost 90 percent lower ratio of taxable profits to total assets than domestic standalones.

This large difference is partially explained by industry fixed effects (column 2) and size differences (column 3). Similar to the propensity score matching estimates, about 40 percent of the difference between the analyzed ownership types is explained by differences in leverage (column 4), where the coefficient on the multinational dummy decreases substantially. Inclusion of total factor productivity (column 5) halves the coefficient on the multinational dummy, but this is primary due to sample composition. Controlling for

[42]For more detailed analysis of the loss making behaviour of UK companies please see Arulampalam, Guceri and Devereux (2017).

the ratio of capital allowances to total assets (column 6) does not change the size of the coefficient on the multinational dummy.

In columns 7 - 10 instead of including a linear function of size, I include size bins, which is more similar to what propensity score matching does. It turns out that controlling for size bins the coefficient on the multinational dummy declines substantially (column 7). Further, since the mean ratio of taxable profits to total assets in each size bin is lower as companies get larger, this confirms the conjecture from Chapter 1 that larger multinationals report lower taxable profits than the ones for which we can find comparable domestic standalones. Inclusion of leverage (column 8) and TFP reduce the coefficient on the multinational dummy further while capital allowances do not change it. In column 11 I provide the results from running OLS without any controls on the PSM matched sample. The coefficient on the multinational dummy is identical to the PSM estimate and is included for comparison purpose. The constant from that OLS regression is the mean ratio of taxable profits to total assets for domestic standalones and is equivalent to the one estimated using the PSM approach.

Limiting the sample to positive taxable profits (Table 2.11) the results looks very similar to the ones from Table 2.10 using the full sample of taxable profits. This suggests that in the restricted sample of positive taxable profits, the difference in the ratio of taxable profits to total assets between foreign multinational subsidiaries and domestic standalones exists and it is only when we use bins of total assets to control for size differences (column 7-10) that it disappears. The coefficients on the multinational dummy become insignificant and get smaller in columns 7-10 and including further controls for leverage, TFP and capital allowances reduces the coefficient to be almost zero and insignificant.

In Table 2.12 I present results from estimating the limited dependant variable model using OLS (the results using probit models are not significantly different).[43] The coefficient on the multinational dummy estimates how much more likely it is for a foreign multinational subsidiary to report zero taxable profits relative to a domestic standalone. In all

[43]Running the LDV models on the PSM sample generates very similar results.

cases the coefficient of interest is positive and significant implying that foreign multinational subsidiaries report taxable profits to be zero significantly more often than domestic standalone companies.

Table 2.9: Definitions of control variables used in LDV and in Heckman estimations.

variable	definition
liabilities_ta	total liabilities divided by total assets
ztp2yrs	zero taxable profits reported in at least last 2 out of 3 years; dummy 1 or 0
previous_losses_ta	dummy 1 if company has brought in forward losses from previous year to claim against taxable profits this year
guo_stattau	statutory tax rate in the country of global ultimate owner
lastyr_loss	dummy 1 if company reported zero taxable profits last year
tax_haven	dummy 1 if the global ultimate owner is located in tax haven
Ln_trading_turnover	logarithm of trading turnover (box 1) from CT600 data

These results in columns 2 - 9 explore potential factors that could be determining the likelihood of reporting zero taxable profits. Table 2.9 defines each of the variables used. I find that higher leverage, bringing losses forward from the previous periods, reporting taxable profits to be zero in at least last 2 out of 3 years, reporting zero taxable profits in the previous year and a parent company located in a tax haven increase the likelihood of reporting zero taxable profits. What is more, the higher the tax rate in the parent company and the higher the company's own trading turnover, the less likely a company is to report zero taxable profits in the UK. When I test the relative significance of these factors against each other (column 9), only the coefficients on previous year's losses and previous year's zero taxable profit reporting remain significant, which would suggest that persistency in reporting zero taxable profits is more important than any observable firm level characteristics. The evidence on leverage and tax haven parent are broadly consistent with the heterogeneities showed in the PSM results. They confirm that both leverage and

the presence of tax haven parents affect the zero taxable profit reporting behaviour of companies as well.[44]

What is more, for the binary part, the difference between the matched (smaller) foreign multinational subsidiaries and the matched (larger) domestic standalones companies is very similar to the difference between all foreign multinational subsidiaries and all domestic standalones (PSM matching coefficient was 31.7 vs 31.6 in column 1 Table 2.12). For the ratio of taxable profits to total assets, the difference between the matched subsamples is much smaller than the difference in the full sample (Table 2.10 column 1 vs 11). This suggests that the differences in the propensity to report zero taxable profits are not very important in explaining the differences in the ratio of taxable profits to total assets between matched (smaller) foreign multinational subsidiaries and unmatched (larger) foreign multinational subsidiaries and between matched (larger) domestic standalones and unmatched (smaller) domestic standalones.

[44]I can interact each explanatory variable with the multinational dummy to see whether their effects differ depending on which ownership category the company belongs to. The results show that there are differences in the magnitudes of determinants of zero taxable profits between ownership categories, but each of the variables disucssed in Table 2.12 is significant for both of the ownership groups.

Table 2.10: OLS results - unconditional means.

VARIABLES	1 all obs	2 all obs	3 all obs	4 all obs	5 all obs	6 all obs	7 all obs	8 all obs	9 all obs	10 all obs	11 all obs
multinational	-0.523***	-0.469***	-0.469***	-0.284***	-0.129***	-0.129***	-0.170***	-0.109***	-0.047***	-0.047***	-0.128***
	-0.082	-0.084	-0.084	-0.052	-0.029	-0.029	-0.043	-0.025	-0.009	-0.009	-0.027
total_assets			-0.000*	-0.000**	-0.000***	-0.000***					
			0.000	0.000	0.000	0.000					
liabilities_ta				0.000	0.000	0.000		0.000	-0.002*	-0.002*	
				0.000	0.000	0.000		0.000	-0.001	-0.001	
TFP_Solow					-0.003***	-0.003***			-0.002***	-0.002***	
					-0.001	-0.001			0.000	0.000	
capallowance						0.000				0.000	
						0.000				0.000	
2.pct_totass							-0.473***	-0.377***	-0.592***	-0.592***	
							-0.082	-0.047	-0.102	-0.102	
3.pct_totass							-0.852***	-0.708***	-0.977***	-0.977***	
							-0.088	-0.056	-0.118	-0.118	
4.pct_totass							-1.006***	-0.851***	-1.093***	-1.093***	
							-0.103	-0.072	-0.130	-0.130	
5.pct_totass							-1.038***	-0.901***	-1.175***	-1.175***	
							-0.105	-0.076	-0.125	-0.125	
Constant	0.617***	0.425***	0.425***	0.161***	0.148***	0.148***	1.182***	0.966***	1.297***	1.297***	0.252***
	-0.085	-0.022	-0.022	-0.013	-0.033	-0.033	-0.061	-0.071	-0.129	-0.129	-0.029
Observations	3,117,744	3,117,744	3,117,744	1,150,615	70,325	70,325	3,117,744	1,150,615	70,325	70,325	299,162
R-squared	0.003	0.012	0.012	0.066	0.079	0.079	0.026	0.152	0.247	0.247	0.000
Industry FE	NO	YES	YES	YES	YES	YES	YES	YES	YES	YES	NO
Year FE	NO	YES	YES	YES	YES	YES	YES	YES	YES	YES	NO
St err cluster	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Firm FE	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Type of matching	-	-	-	-	-	-	-	-	-	-	propensity score

Note: Results from the OLS estimations, unconditional means; foreign multinational subsidiaries and domestic standalones sample only. Columns 1 - 6 add additional explanatory variables, columns 7 - 10 instead of controlling for levels of total assets use bins of total assets as control variables. Column 11 shows results from the OLS estimation on the matched sample. The coefficient on the multinational dummy in column 11 corresponds to the ATT estimate in the PSM results. Selected sample, 2000 - 2011. Source: merged HMRC and FAME data.

Table 2.11: OLS results - conditional means.

VARIABLES	1 pos profits	2 pos profits	3 pos profits	4 pos profits	5 pos profits	6 pos profits	7 pos profits	8 pos profits	9 pos profits	10 pos profits	11 pos profits
multinational	-0.606***	-0.475***	-0.475***	-0.287***	-0.052**	-0.052**	-0.052	-0.055***	-0.005	-0.005	-0.019
	-0.086	-0.086	-0.086	-0.051	-0.023	-0.023	-0.045	-0.019	-0.009	-0.009	-0.028
total_assets			-0.000**	-0.000***	0.000	0.000					
			0.000	0.000	0.000	0.000					
liabilities_ta				0.013***	0.031	0.031		0.012***	0.016	0.016	
				0.000	-0.019	-0.019		-0.001	-0.017	-0.017	
TFP_Solow					-0.034***	-0.034***			-0.010***	-0.010***	
					-0.006	-0.006			-0.002	-0.002	
capallowance						0.000				0.000**	
						0.000				0.000	
2.pct_totass							-1.102***	-0.930***	-0.946***	-0.946***	
							-0.069	-0.030	-0.125	-0.125	
3.pct_totass							-1.611***	-1.381***	-1.402***	-1.402***	
							-0.077	-0.048	-0.133	-0.133	
4.pct_totass							-1.816***	-1.575***	-1.552***	-1.552***	
							-0.095	-0.064	-0.146	-0.146	
5.pct_totass							-1.893***	-1.653***	-1.650***	-1.650***	
							-0.098	-0.067	-0.136	-0.136	
Constant	0.831***	-2.674***	-2.674***	0.182***	0.796***	0.796***	2.143***	1.797***	1.900***	1.900***	0.283***
	-0.098	-0.057	-0.057	-0.016	-0.067	-0.067	-0.052	-0.068	-0.144	-0.144	-0.035
Observations	2,226,637	2,226,637	2,226,637	828,437	40,515	40,515	2,226,637	828,437	40,515	40,515	144,626
R-squared	0.001	0.012	0.012	0.141	0.149	0.149	0.041	0.306	0.338	0.338	0.000
Industry FE	NO	YES	YES	YES	YES	YES	YES	YES	YES	YES	NO
Year FE	NO	YES	YES	YES	YES	YES	YES	YES	YES	YES	NO
St err cluster	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Firm FE	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Type of matching	-	-	-	-	-	-	-	-	-	-	propensity score

Note: Results from the OLS estimation, conditional means; foreign multinational subsidiaries and domestic standalones, The OLS estimations are performed on positive taxable profits sample only. Columns correspond exactly to the ones from the OLS results table using unconditional means. Selected sample, 2000 - 2011. Source: merged HMRC and FAME data.

Table 2.12: LDV estimation results.

VARIABLES	1	2	3	4	5	6	7	8	9
multinationalnew	0.316***	0.309***	0.185***	0.324***	0.311***	0.286***	0.314***	0.410***	0.194***
	(0.030)	(0.028)	(0.019)	(0.030)	(0.027)	(0.031)	(0.031)	(0.024)	(0.011)
liabilities_ta		0.000**							0.000*
		(0.000)							(0.000)
ztp2yrs			0.520***						0.404***
			(0.004)						(0.008)
previous_losses_ta				0.011***					-0.004
				(0.004)					(0.003)
guo_stattau					-0.124***				-0.031
					(0.036)				(0.028)
lastyr_loss						0.416***			0.212***
						(0.013)			(0.006)
tax_haven							0.020**		0.007
							(0.010)		(0.011)
ln_trading_turnover								-0.055***	-0.016***
								(0.004)	(0.001)
Constant	0.626***	0.234***	0.478***	0.900***	0.897***	0.549***	0.678***	1.103***	0.234***
	(0.010)	(0.013)	(0.007)	(0.044)	(0.016)	(0.007)	(0.008)	(0.042)	(0.018)
Observations	3,205,555	1,150,615	3,205,555	3,117,744	456,125	3,205,555	2,974,833	2,834,906	167,367
R-squared	0.059	0.065	0.228	0.061	0.123	0.169	0.062	0.091	0.315
Industry FE	YES	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES	YES
St err cluster	YES	YES	YES	YES	YES	YES	YES	YES	YES
Firm FE	NO	NO	NO	NO	NO	NO	NO	NO	NO
Type of matching	-	-	-	-	-	-	-	-	-

Note: Results from the limited dependant variable estimation using linear probability model (LPM) on the sample of foreign multinational subsidiaries and domestic standalones, Columns 1 - 8 test the significance of each explanatory variable separately, while column 9 includes all possible explanatory variables together. Selected sample, 2000 - 2011. Source: merged HMRC and FAME data.

2.6.2 Selection Models

The results from the propensity score matching have revealed that the explanation for the differences in the ratio of taxable profits to total assets between matched foreign multinational subsidiaries and matched domestic standalones lies in the binary part of the distribution. The fact that the coefficient on the multinational dummy from the binary regressions is significant suggests that the estimate of the mean difference in the ratio of taxable profits to total assets between foreign multinational subsidiaries and domestic standalones from a simple OLS regression may be inconsistent and downward biased. There seems to be selection of companies into zero and positive taxable profit reporting groups, which suggests that the more appropriate model to be estimated is a selection type, such as Heckman selection model, which takes into account the bounded nature of the data. This type of model will allow me to disentangle the importance of the extensive and intensive margins for taxable profit reporting differences between ownership types. There are two choices here, either a simple censored regression model, such as Tobit (Tobin (1956)), or a more sophisticated selection model, such as Heckman (Heckman (1974), Heckman (1976)).

Tobit models assume that there is an unobservable latent variable y_{it}^*, which linearly depends on X_{it} via a parameter γ. In addition, there is a normally distributed error term u_{it}. The observable variable y_{it}, in my case the ratio of taxable profits to total assets, is defined to be equal to the latent variable whenever the latent variable is above zero and zero otherwise.

$$y_{it} = \begin{cases} y_{it}^* \text{ if } y_{it}^* > 0 \\ 0 \text{ if } y_{it}^* \leq 0 \end{cases} \tag{2.5}$$

where y_{it}^* is defined as :

$$y_{it}^* = \alpha + \beta_1 multinational_i + \gamma X_{it} + ind_i + year_t + u_{it}. \tag{2.6}$$

This is the same equation as the one estimated for the OLS model explaining the differences in the ratio of taxable profits to total assets between companies. A company can choose to report zero or positive taxable profits, the choice of which is determined by their profitability as well as, for example, their propensity to aggressively avoid tax. In case of Tobit models the latent variable absorbs both the process of reporting positive versus zero taxable profits and the 'outcome' of interest. Therefore both processes are determined by the same parameters. For a continuous variable from the vector X_{it} the partial effects of that variable in the zero taxable profit reporting equation, $P\left(y_{it} > 0|x\right)$, and its effect in the outcome equation $E(y|x, y > 0)$ have the same sign. Therefore it is impossible for an explanatory variable to have a positive effect of the likelihood of making positive taxable profits, but negative effect on how much profits the company makes in general. This is quite a large limitation of the Tobit approach and in case of comparing the taxable profits of foreign multinational subsidiaries with those of domestic standalones might be crucial. This is because the baseline OLS and Probit models suggest that being a multinational has an effect on both the binary (extensive) and continuous (intensive) parts of the distribution. As such, it seems to be of primary importance to understand which margin of response drives the difference in taxable profits between the two ownership types. Since the PSM estimates suggest that the extensive margin is of primary importance, I test this more formally in this section.

A more sophisticated alternative to Tobit model, that allows to separate the two margins, is Heckman selection model, which introduces a second latent variable that allows the process of reporting zero taxable profits and the outcome to be independent from each other, conditional on x.

$$y_{2it} = \begin{cases} y^*_{2it} \text{ if } y^*_{1it} > 0 \\ 0 \text{ if } y^*_{1it} \leq 0 \end{cases} \tag{2.7}$$

In Heckman selection model the variables determining whether a company reports positive profit are separate from the variables determining how much profit a company

is reporting once it decides to do so at all. Therefore, the first equation would determine why companies report positive profits

$$(1)\ y^*_{1it} = \beta z_{it} + e_{it} \tag{2.8}$$

$$(2)\ d_{it} = 1 \text{ if } y^*_{1it} > 0 \text{ and } d_{it} = 0 \text{ if } y^*_{1it} \leq 0 \tag{2.9}$$

where y^*_{1it} is a latent variable indicating the utility from reporting taxable profits, d_{it} is an indicator for profit reporting status, z_{it} denotes the determinants of this status, β is a vector of associated parameter estimates, and e_{it} is an error term with a standard normal distribution.

The second equation involves estimating a regression of taxable profits scaled by total assets conditional on $d_{it} = 1$ and a vector of explanatory variables x_{it} . This would be the same equation as the one estimated in the OLS model

$$y_{2it} = \alpha + \beta_1 multinational_i + \gamma X_{it} + ind_i + year_t + u_{it}. \tag{2.10}$$

The model, which comprises an equation determining sample selection and a regression model conditional on $d_{it} = 1$, is estimated jointly using the maximum likelihood technique, with (e_{it}, u_{it}) assumed to be bivariate normal. For identification purposes estimating Heckman selection model requires at least one variable in the first stage (part of z_{it}) that is not a determinant in second stage (not part of x_{it}).

Crucially, the distinction between (Heckman) selection models and (Tobit) censored regression models could be important if there is heterogeneity within the sample of multinationals, for example between 'aggressive tax avoiders' (which reported zero taxable profits most of the time) and 'unsophisticated tax planners' (which report zero taxable profits no more frequently than domestic standalones). In that case the binary part of the selection

model is where the differences lay and that would be reflected appropriately in a selection model, but not in a Tobit.

This suggest that including dummies for (e.g.) reporting zero taxable profits in at least 2 of the last 3 years in the probit part of the Heckman procedure, could help identification. Further variables that could be considered as identifying factors in the first stage regression can be for example the presence of a tax haven parent which determines whether a company is an aggressive tax avoider. This will affect whether it decides to report any profits in the UK or whether it shifts everything to, for example, its tax haven headquarter. The presence of the tax haven parent per se does not affect the profitability of the company in the UK. Another variable that I could potentially use in z_{it} could be last years losses carried forward. In box 4 in the tax return form, each company has to report whether is has any losses from previous periods that it wants to use to offset against taxable profits in this period. They affect whether the company reports zero taxable profits as it can use those losses to reduce its taxable profits to zero, but they do not affect how much profit the company made this year. Additionally, I use the average industry turnover, which approximates the business cycle fluctuations that would affect the proportion of companies reporting zero taxable profits in a particular year. Average industry turnover is calculated for each year and each 2 digit industry code using mean trading turnover from the CT600 data.

I use those four variables together with total assets in the first stage equation that determines whether a company reports zero or positive profits (z_{it}). In the second stage equation I use the same variables as in the case of the OLS model discussed in Section 2.6.1.

Results from the Heckman selection model specifications

Tables 2.13 and 2.14 show the results from estimating the Heckman selection model. Table 2.13 shows second stage marginal effects while Table 2.14 shows first stage coefficients from the binary part of the distribution. Note that in the first stage regressions the zero taxable

profits dummy is coded as 1 when positive taxable profits arise (reverse of what it is in the LDV estimations in section 2.6.1). This is dues to the specific nature of the Heckman selection model, whereby in the first stage one estimates the determinants of reporting positive profits. Therefore negative coefficients shown in Table 2.14 correspond directly to the positive ones from LDV regressions.

Column 1 estimates the model using unrestricted sample of foreign multinational subsidiaries and domestic standalones, while columns 2- 6 use the propensity score matched sample and experiment with various sets of explanatory variables, defined above, in the first stage regression.

First, in most of the estimations the inverse mills ratio - lambda (which estimates the significance of the selection problem) is significant suggesting that selection into reporting positive taxable profits is indeed an issue in my data. The most important feature of Tables 2.13 and 2.14 is that the estimates of the coefficient on the multinational dummy are larger and always significant in the first stage regressions. This suggests that being a multinational significantly negatively affects whether the company will report any taxable profits in the UK. Once a company reports positive taxable profits in the UK, being a multinational substantially reduces the reported ratio of taxable profits to total assets relative to domestic standalone in unrestricted sample only (column 1 Table 2.13). When I use comparable companies as matched through PSM, the coefficient on the multinational dummy in the second stage becomes much smaller and often insignificant. This suggests that being a multinational matters less once you report positive taxable profits (columns 2 and 3). What is more, column 1 results from second stage suggest that larger (unmatched) foreign MNCs report lower ratios of taxable profits to total assets than smaller (unmatched) domestic standalone, conditional on reporting positive taxable profits.

When the coefficients from the first stage regressions are converted to marginal effects, their magnitude oscillates around 0.3, which means that they are very similar to the ones obtained using PSM method.

In columns 4-6 I use dummies signifying zero taxable profit reporting; either for the last two out of 3 years ($ztp2yrs$), last year (ztp_11), 2 years ago (ztp_12), etc. However, the coefficient on lambda is insignificant in those regressions, which would suggest that selection is not a problem anymore. In columns 4-6 the coefficient on a multinational dummy in the second stage of Heckman selection model is marginally significant and negative which would suggest that being a multinational marginally reduces the taxable profits of positive taxable profit reporting companies relative to domestic standalones. Importantly, this coefficient is much smaller and much less significant than the one from the first stage regression on the binary part of the distribution.

The results from Heckman selection model broadly confirm the impression also gained from the propensity score matching methodology. There is little or no difference between matched (smaller) foreign multinational subsidiaries and matched (larger) domestic standalones, conditional on reporting positive taxable profits. In turn, the results from the first stage show that being a multinational matters significantly for reporting zero taxable profits.

Table 2.13: Heckman selection model estimation results - second stage.

VARIABLES	(1) Heckman	(2) Heckman	(3) Heckman	(4) Heckman	(5) Heckman	(6) Heckman
multinational	-0.281***	0.002	-0.005	-0.024**	-0.018*	-0.018**
	(0.007)	(0.011)	(0.010)	(0.009)	(0.010)	(0.009)
Observations	2,894,020	488,431	488,431	488,431	521,234	521,234
Industry FE	YES	YES	NO	NO	NO	NO
Year FE	YES	YES	NO	NO	NO	NO
St err cluster	YES	YES	YES	YES	YES	YES
Firm FE	NO	NO	NO	NO	NO	NO
Type of matching	-	propensity score	propensity score	propensity score	propensity score	propensity score

Note: Results from the Heckman selection model estimation, second stage marginal effects. Results on the smaple of foreign multinational subsidiaries and domestic standalones, Columns 1 - 6 correspond to various first stage estimations as shown in Table 2.14. Selected sample, 2000 - 2011. Source: merged HMRC and FAME data.

Table 2.14: Heckman selection model estimation results - first stage.

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)
1st stage results						
multinational	-0.936***	-0.769***	-0.769***	-0.651***	-0.774***	-0.673***
	(0.004)	(0.004)	(0.004)	(0.005)	(0.004)	(0.004)
ln_total_assets	0.071***	0.018***	0.018***	0.029***	0.027***	0.030***
	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
ztp2yrs	-1.138***	-1.176***	-1.176***	0.132***	-1.343***	
	(0.002)	(0.005)	(0.005)	(0.012)	(0.005)	
avg_indyrtrturnover	0.000***	-0.000***	-0.000***	-0.000***		
	(0.000)	(0.000)	(0.000)	(0.000)		
previous_losses_ta	-0.001	0.002*	0.002*	0.005***		
	(0.001)	(0.001)	(0.001)	(0.001)		
tax_haven	-0.011	-0.055***	-0.055***	-0.052***		
	(0.008)	(0.008)	(0.008)	(0.008)		
lastyr_loss	-0.777***	-0.514***	-0.514***	0.170***		
	(0.002)	(0.005)	(0.005)	(0.007)		
ztp_l1				-1.473***		-1.359***
				(0.007)		(0.005)
ztp_l2				-0.400***		-0.327***
				(0.009)		(0.006)
ztp_l3				-0.185***		-0.147***
				(0.008)		(0.007)
ztp_l4				-0.078***		-0.084***
				(0.008)		(0.007)
ztp_l5				-0.071***		-0.075***
				(0.008)		(0.008)
ztp_l6				-0.074***		-0.078***
				(0.008)		(0.008)
lambda	-0.075***	-0.108***	-0.093***	-0.017	-0.009	-0.009
	(0.010)	(0.028)	(0.028)	(0.024)	(0.028)	(0.023)
Constant	0.230***	0.858***	0.858***	0.827***	0.648***	0.815***
	(0.005)	(0.013)	(0.013)	(0.014)	(0.012)	(0.013)
Observations	2,894,020	488,431	488,431	488,431	521,234	521,234
Industry FE	YES	YES	NO	NO	NO	NO
Year FE	YES	YES	NO	NO	NO	NO
St err cluster	YES	YES	YES	YES	YES	YES
Firm FE	NO	NO	NO	NO	NO	NO
Type of matching	-	propensity score	propensity score	propensity score	propensity score	propensity score

Note: Results from the Heckman selection model estimation, first stage coefficients. The sample is foreign multinational subsidiaries and domestic standalones, Columns 1 - 6 show results using various first stage variables. Selected sample, 2000 - 2011. Source: merged HMRC and FAME data.

Chapter 3

Are financing constraints binding for investment? Evidence from a natural experiment.

Abstract

This chapter empirically tests the effects of changes in the cost of capital on investment for firms with low availability of retained earnings. I use the 2006 Canadian income trusts tax reform as a natural experiment. Income trusts are Canadian flow-through entities that were not taxed at the trust level, if they distributed all their profits. To benefit from this tax saving, income trusts had to forgo retained earnings that could have been used as a low cost source to finance their investments. The 2006 reform announcement revoked the tax privileges of income trusts with effect from 2011 and created a temporary and unexpected increase in their cost of capital in the transition period. At the same time, in 2011, there no longer was a benefit from distributing all profits. I find that the increase in the cost of capital in 2006 had no effect on investment. On the other hand, the subsequent reduction in the cost of capital in 2011 coupled with increased availability of retained earnings had large effects on investment. This suggests that financing constraints may be binding for investment of firms with low availability of retained earnings.

3.1 Introduction

The question of how taxes affect investment has been extensively analyzed in the economic literature. It is relevant for policy design, especially in the context of designing tax reforms that aim to encourage growth. Through the analysis of various tax policies the literature assesses the effects of taxation on investment.[1] The focus of the empirical and theoretical contributions centres around discussion of the effects of the cost of capital and financing constraints.

An increase in the cost of capital in the neoclassical framework tends to reduce investment (Jorgensen (1963), Hall and Jorgensen (1967), Tobin (1969)). The general agreement is that the estimated elasticity of the capital stock to the user cost of capital ranges between -0.25 and -1.[2] On the other hand, improved access to internal finance and the availability of after-tax cash flows increase investment.[3] Further, the cost of external sources of financing such as debt and new equity has been found to be higher than that of internal sources of financing such as retained earnings (Fazzari *et al.* (1988), Bond and Meghir (1994), Calomiris and Hubbard (1995) and Hennessy and Whited (2007)).[4] In the early literature, the effects of the cost of capital on investment have been analyzed separately from financing constraints. The more recent contributions discuss the interplay between those two effects (Keuschnigg and Ribi (2010), Edgerton (2010), Maffini *et al.* (2016b), Zwick and Mahon (2017)). The debate revolves around whether the effects of tax policies on investment are transmitted through changes in the cost of capital or through cash flow effects or both.

This chapter contributes to the debate on the joint effects of financing constraints and the cost of capital on investment. It investigates the binding nature of financing constraints

[1] For comprehensive literature reviews summarizing the effects of tax incentives on investment, see Hassett and Hubbard (2002) and Bond and Van Reenen (2007).

[2] This literature is vast and still very active. For summaries see Hassett and Hubbard (2002) and Hanlon and Heitzman (2010).

[3] For early contributions see Fazzari *et al.* (1988), Gertler and Hubbard (1988), Fazzari and Petersen (1993)

[4] The literature offers various explanations for why internal sources of financing may be less costly than new share issues and debt financing. Among the most important ones are transaction costs, tax advantages, agency problems, costs of financial distress and asymmetric information.

using an exogenous tax reform in Canada as a quasi-natural experiment. In particular, I consider a temporary and unexpected increase in the cost of capital for firms with low availability of retained earnings and find no effect of the tax reform on investment of those firms. In turn, a subsequent reduction in the cost of capital coupled with an increased availability of retained earnings has large effects on investment. This suggests that internal financing constraints may be binding for firms, as they prefer to use low cost retained earnings to finance their investment.

The empirical analysis takes advantage of a particular reform in Canada, which applied to a specific group of firms - income trusts - without affecting traditional Canadian corporations. Income trust structures are two-layer Canadian flow-through entities that were not taxed at the trust level, if they distributed all their cash flows. They consisted of an income trust and an operating company. The unitholders of income trusts were taxed on the distributions made at their marginal income tax rates. The popularity of the income trust structure can be attributed to two distinct tax advantages. The first one is the ability to decrease corporate income tax at the operating company level due to facilitating higher leverage, the second one is lower total tax on distributed profits for ultimate owners. Earnings, which might otherwise have been retained and used as a low cost source of finance for investment, were eliminated (by higher related-party debt) at the operating company level; the corresponding interest income received by the trust could not be retained (at the trust level) without foregoing the tax advantage. Therefore on one hand an income trust had a lower cost of capital for all sources of financing due to elimination of corporation tax, but on the other hand to achieve this tax saving it had to rely more on the more expensive external sources to finance its investment.

To investigate the binding nature of financing constraints I use an exogenous tax reform in Canada, which was announced in October 2006. The tax privileges of income trusts were to be revoked from January 2011. This meant that in 2011, there would no longer be a tax saving associated with being an income trust and there would no longer be a tax advantage from distributing all profits to unitholders. Income trusts were to be taxed on their income

at a standard corporation tax rate whether they distributed it or not. As a result most of them converted to traditional corporate structures and reduced their dividend payout ratios. A transitional grandfathering period was introduced for the years between 2006 - 2010, during which income trusts were allowed to exist on previous terms, but could also convert to corporate structure prematurely without any further tax penalties.

The reform lends itself to the analysis of the effects of changes in the cost of capital on investment for firms with limited availability of retained earnings in a difference-in-difference setting. The 2006 reform only applied to income trusts and did not affect Canadian corporations. Hence, in the empirical analysis I compare investment rates of income trusts to corporations before and after the 2006 reform announcement. Traditional corporations serve here as a control group for income trusts.

In Canada, income trusts were publicly traded companies that were not dissimilar to traditional corporations. In fact, some income trusts were previously publicly traded corporations before they decided to assume an income trust structure, primarily for tax saving purposes. At the height of their popularity income trusts constituted 13 percent of the total value of Toronto Stock Exchange and more than half of Canadian IPO activity, making them an attractive alternative option for Canadian shareholders. Income trusts, unlike mutual funds, do not invest in a variety of different projects, but similar to traditional corporations, hold equity and debt of one underlying operating company. The most similar structure in the United States is Master Limited Partnership.

The 2006 reform announcement led to the anticipation of higher corporation tax payments in 2011, or after the trust chose to convert to corporate form, than at the time the investment was made (and the initial investment allowances were claimed). For instance, for an investment that begun in 2007, income trusts would have received little benefit from capital allowances on the initial investment claimed against a zero corporation tax rate. However, they would have to pay tax on the eventual return at a relatively high corporate tax rate. This expectation of a higher corporate tax rate in the future resulted in a temporary increase in the cost of capital following the 2006 reform announcement for any source

of financing.[5] This created a large tax dis-incentive to invest during the transition period and may have discouraged companies from investment altogether or encouraged them to delay their potential investment until conversion out of income trust status or 2011.[6]

I find that the 2006 reform announcement had no effect on investment so long as enterprises remained in the income trusts structure, i.e. as long as they distributed most of their profits and retained only a small portion of their earnings. For firms with low availability of internal sources of finance, financing constraints may be binding and hence those firms may be less responsive to investment (dis)incentives than they would be in the neoclassical model.

The other aspect of the 2006 reform was the conversion to corporate structure which followed the reform announcement. Income trusts either converted to corporate form in 2011, as their tax privileges expired, or voluntarily beforehand, during the transition period. The effects of early conversion to corporate structure on investment may be endogenous as income trusts could choose the year in which they converted. The timing of the conversion to a traditional corporation can therefore be dictated by investment opportunities. If the availability of retained earnings is binding for investment, we would expect income trusts to convert to corporate form before the expiry of their tax privileges, if they had highly profitable investment opportunities. However, the effects of conversion in 2011, at the time of the loss of the tax privileges, are arguably exogenous. Those income trusts which stayed in the structure until 2011 would have likely continued to be income trusts had they not been forced to convert by the expiry of their tax privileges. Therefore the changes to investment rates of those income trusts are unlikely to be dictated by profitable investment opportunities before 2011.

I show that the expiry of income trust tax privileges was associated with a decrease in the cost of capital relative to the transition period, but an increase relative to the pre-2006 reform cost of capital. Comparing the period up to 2006 with the period after 2010 (i.e.

[5] Auerbach and Hines (1986), Howitt and Sinn (1989), Auerbach and Hines (1988).

[6] For a discussion of similar temporary changes in the cost of capital (but in reverse) that affected the UK after the 1984 reform, see Edwards (1984) or Devereux (1988).

starting in January 2011), I find that after 2010 income trusts have significantly increased their investment rates relative to corporations. Changes in the cost of capital cannot explain why investment rates should be higher after 2010 than before 2006. However, in 2011 due to the expiry of their tax privileges associated with dividend distributions, former income trusts have substantially reduced their dividend payout ratios and increased their earnings retention rates. At the same time, there were no significant changes in leverage and new equity issues by income trusts that would be consistent with an increase in other sources of financing. Therefore, the findings presented here are consistent with the binding nature of low cost financing options.

I present two additional pieces of evidence in line with the binding nature of the availability of low cost financing. First, I find that the increase in the investment rate of income trusts following the implementation of the reform in 2011 persists for more than one year. The investment rates of income trusts in both 2011 and 2012 are higher than they were in the transitional period. This suggests that the effects I find are not simply related to the timing of investment.

Second, I show that the changes in the investment rates of income trusts in 2011 are primarily driven by income trusts that were more likely to be financially constrained. As a proxy for financial constraints I use whether firms were distributing above or below median ratios of dividends to total assets in 2011, the year the income trusts tax reform came into force. I assume that firms which were distributing lower dividends in 2011 are the ones which retained more earnings. Financially constrained firms cannot easily resort to external funds to finance their investment, relying primarily on their retained earnings. I assume that income trusts with below median distributions of dividends and hence with above median retained earnings were more likely to be financially constrained.

I find that the investment rates increased in 2011 only for income trusts with below median dividend distributions. Therefore the increase in the availability of retained earnings, which was the result of conversion to corporate structure, only had effects on the investment of firms that were more likely to be financially constrained. This is in line with

the fact that financially unconstrained firms would not need to rely on retained earnings to finance their investment, but could more easily use external sources.

My findings suggest that when financing constraints are binding firms do not react to tax (dis)incentives. In turn, the availability, or not, of low cost financing at the firm level appears to be binding for the investment decisions of a substantial proportion of income trusts. These conclusions support recent contributions from the empirical literature on the effects of limited cash flow on investment incentives. Financing constraints may dampen the response to tax incentives as summarized by the tax-adjusted cost of capital or tax-adjusted q ratio (Edgerton (2010), Keuschnigg and Ribi (2010)); but may amplify the response of investment to tax changes which leave firms with additional post-tax income, as well as lowering their cost of capital (Zwick and Mahon (2017)).

The rest of the chapter is organized as follows. Section 3.2 gives an overview of the Canadian income trusts structure and their tax treatment in more detail, Section 3.3 illustrates the changes in the cost of capital, Section 3.4 describes the data, Section 3.5 presents a simple empirical model, while Section 3.6 reports the empirical results. Section 3.7 concludes.

3.2 Canadian Income Trusts

The income trusts structure consists of two main entities - an income trust and an operating company. There were several different ways a taxable Canadian company could decide to take advantage of the income trust structure. First, the operating company could be a private standalone firm whose shareholders decided to raise funds through a public offering of income trust units. An income trust then became a publicly traded entity, which is similar to the standard initial public offering. Second, we may have a private firm whose shareholders decided to have only part of its business to become an income trust. This could, for example, occur by setting up a royalty income trust which bought all of the patents or licenses of the operating company and leased them for a fee back to the operating company. The ordinary business of the underlying company remained

private. Third, the income trust could have been previously a publicly traded company whose shareholders decided to convert all, or part, of its shares into income trust units without any new financing at the time of conversion.[7]

The proceeds from the public offering were used to acquire subordinated debt and common shares of the operating company. These notes owned by the income trust were long-term unsecured high-yield debt. In reality this internal debt played the role of a tax-advantaged form of equity. It was used by the income trust to minimize the taxable income of the operating company. The interest payments on this internal debt flowed from the operating company to the income trust (see Figure 3.1) and the amount was usually set so that the taxable income of the operating company was reduced almost to zero.[8] The income trust used all of the income received from the operating company in the form of interest, royalty or lease payments and distributed it to its unitholders. In Canada, income trusts were qualified as mutual funds, which meant that, if they distributed all their income, they were not liable to pay any tax and hence were flowthrough entities for tax purposes. Undistributed income at the trust level was subject to tax at the highest personal income tax rate - which was 46% in Canada during early 2000s.[9] The amounts distributed to unitholders were taxed at the marginal personal income tax rate, which differed between different types of owners.

Income trusts were generally quite successful in reducing their operating companies' corporate tax payments to almost zero through a mixture of high internal leverage, royalty and lease payments.[10] This is shown in Figure 3.2, where I plot tax payments of income

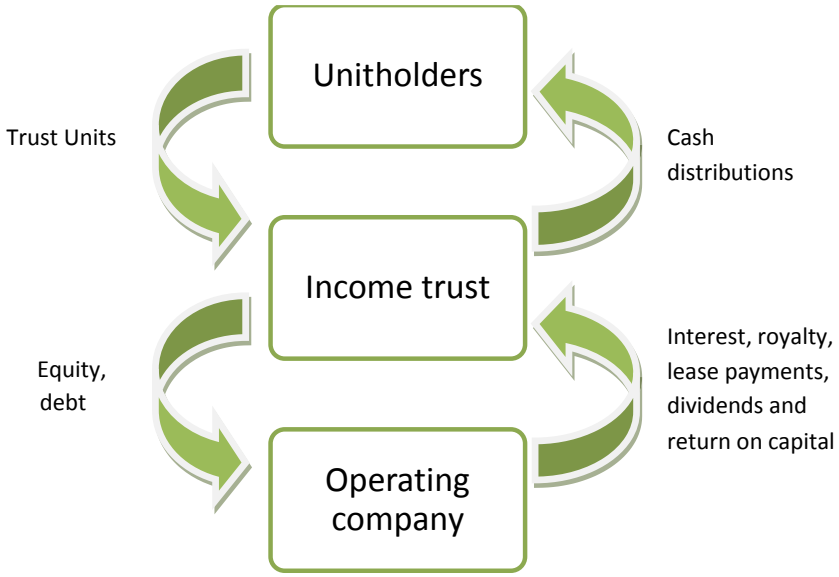
[7]Some of the utility type income trusts have been created by acquisition of new oil fields or pipelines which coincided with the creation of an income trust. For more details on why companies converted to income trusts see Appendix.

[8]An alternative would be to set up a royalty income trust which bought all of the patents of the operating company and leased them the operating company for a fee that would wipe out the taxable profit. Therefore, the income paid to the income trust by the operating company could also take the form of lease or royalty payments.

[9]Distributions in excess of the income generated reduced the cost base of the trust units for capital gains purposes resulting in higher capital gains taxes on the sale of the trust units.

[10]We cannot obtain data on any internal transactions, such as for instance interest payments, between the income trusts and their operating companies. Therefore we do not know the extent of internal debt that existed within these structures.

Figure 3.1: Simple sketch of income trust structure.



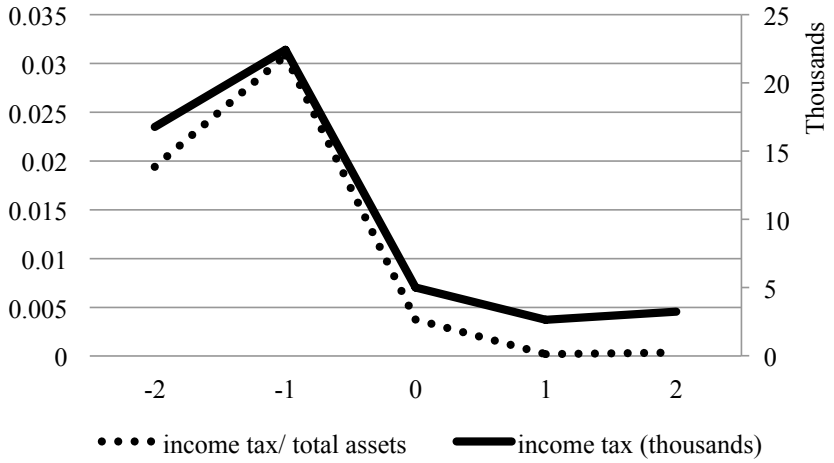
trust structures.[11] Both income tax and income tax divided by total assets decrease sharply in the year of conversion and one year after conversion to income trust status. There seems to be no further change from the first to the second year after the conversion in terms of tax payable. Moreover, the income taxes paid by converted companies are very close to zero, which implies that the income trust structure was very successful in reducing the overall tax charge.[12]

It was possible for the operating company to retain some of their profits to fund investment. The retained profit was then taxed at the corporate tax rate and the treatment was no different than that of the traditional corporation. If the operating company did not retain any profits to fund new investment, the alternative was for the income trust to rely on external funding. It faced two options, either to issue new units or third party

[11]The only available measure in Datastream is consolidated total income tax, which represent all income taxes levied on the income of a company by federal, state and foreign governments. This is a crude proxy for Canadian corporate income tax, but it is the best one available in the data we have. This is due to the inclusion of foreign taxes in the measure.

[12]Doidge and Dyck (2015) present evidence on the effects of conversion to income trust status on investment and distributions, finding negative effects of conversion on investment, but positive effects on payouts.

Figure 3.2: Tax payments of income trusts.



Note: Mean income taxes payable and income tax divided by total assets, balanced panel. Year 0 corresponds to the calendar year in which a company converted to income trust. Only previously publicly traded companies included here. Right hand side axis refers to income tax in thousands of CAD, left hand side axis refers to the ratio of income tax to total assets. Source: Datastream.

debt. It was tax inefficient to retain income at the trust level as it was taxed at the highest marginal personal tax rate.[13]

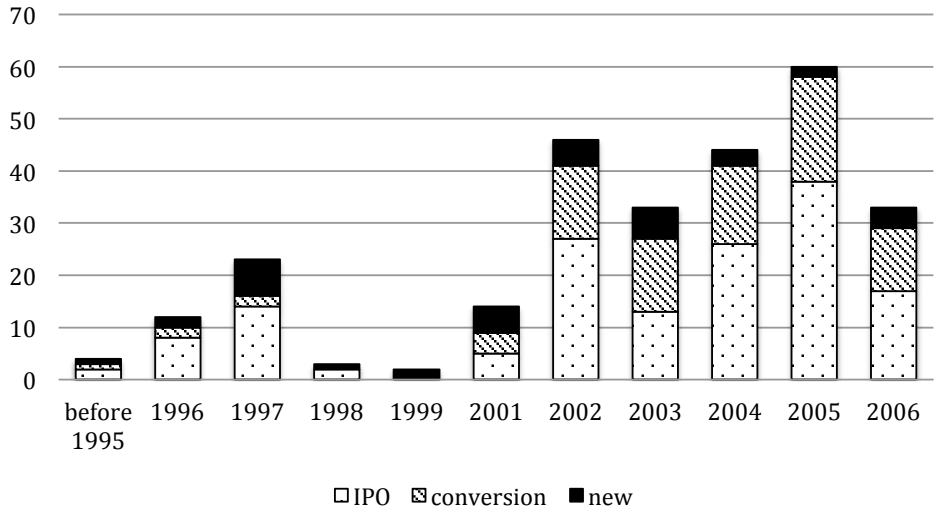
3.2.1 The rise of income trusts

The first Canadian tax ruling that enabled the creation of income trust structures was awarded in December 1985 to Enerplus Resources Fund Royalty Trust. The first corporate conversion into an income trust structure occurred in 1995 and was done by Enermark Income Fund. Initially, the income trust structure was not very popular and there were not very many conversions or IPOs using this strategy until the beginning of the 2000s (see Figure 3.3).

After the dot-com bubble crash of 2000, the regular IPO market in Canada dried out. This meant that investment banks were looking for new sources of fees. Moreover, the tax-efficient distributions of income trusts allowed unitholders to pay a premium to purchase income trust units when compared with shares in corporations, particularly in

[13]For more details on why a company would choose to become an income trust rather than do a traditional IPO see Appendix 3.8.3.

Figure 3.3: Number of income trusts created by year.



Note: Conversion refers to conversion of a previously publicly traded company to income trust, IPO means that a previously private company used income trust as means of an IPO, new means newly acquired utility or real estate assets that went public in the trust form immediately after inception as a company. Trusts, in their traditional form, were no longer created after the 2006 reform. Source: own data.

the low interest rate environment that followed the dot com crash. The first high profile conversion to income trust form was done by Yellow Pages Group after it became Yellow Pages Income Fund in 2003.

Since then, income trusts recorded a spectacular surge in popularity. In 2003 they represented 7% of the entire capitalization of the Toronto Stock Exchange (Aggarwal and Mintz (2004)), while the number of public offerings involving income trusts constituted 41% and 86% of the total Canadian IPOs in 2002 and 2003 respectively (Pazzaglia *et al.* (2005)). At their peak in 2006 they constituted 13% of the total value of the Toronto Stock Exchange (Doidge and Dyck (2015)).[14] At the end of 2005 the largest income trusts were added to S&P/TSX Composite Index. Such a quick rise in their importance and numbers meant that sooner or later they must have come under detailed scrutiny of the Canadian government.

[14]Income trusts received another boost when some of the Canadian provinces in years 2004 - 2005 implemented limited liability legislation that shielded trusts investors from personal liability.

One of the reasons why the income trust structure became so popular in Canada is that it allowed Canadian corporations to avoid paying corporate income tax. What appealed to unitholders was that during the early 2000s the relevant marginal Canadian income tax rate was lower than combined corporate and dividend tax rates across all types of investors. This meant that there was a tax advantage to unitholders of income trusts over shareholders of Canadian corporations. Table 3.1 summarizes the after-tax income of shareholders and unitholders in Ontario (one of Canadian provinces) and compares it between different types of investors.[15]

In Ontario the combined federal and provincial tax rate for a traditional corporation was 35%. On top of this a shareholder had to pay an effective 14% tax rate on dividend payments, which meant the total tax rate was 49%.[16] In turn the Canadian top personal tax rate was 46%. Pension funds in Canada are tax-exempt entities, which meant that the only tax for pension fund shareholders in Canadian corporations was 35% - the corporate tax rate - while pension funds paid no tax, if they held units of income trusts. No tax credits were available for pension fund and non-resident shareholders of Canadian corporations. In addition, foreign investors were liable to pay a withholding tax, which for example for US investors was 15%. This meant that foreign unitholders of income trusts paid a 15% tax rate, while foreign shareholders of Canadian corporations paid a 45% tax rate.[17] It is clear that the benefits of holding trust units were largest for tax-exempt investors such as pension funds, and also for foreign investors. It is less clear whether the structure was an attractive tax-saving opportunity for Canadian resident tax payers.

[15] An additional complication in the case of Canada was that the corporate provincial tax rate varied between provinces.

[16] Canadian resident tax payers could obtain a tax credit on tax paid by company, but before the tax reform of 2005 there was no full integration and hence taxable Canadian unitholders and shareholders were not indifferent between whether they held interests in income trusts or corporations. Income trusts were strictly preferred. This changed after the November 2005 reform, which increased dividend tax credits and fully integrated the tax system for Canadian resident tax payers (for more details see Edwards and Shevlin (2011) and PwC report: http://www.caiti.info/resources/Income_trust_Dec_2006_discussion_paper.pdf)

[17] Some of the witholding tax rate was deductible against the corporate tax liability.

Table 3.1: After-tax income received out of 100 dollars of income, by type of investor (Ontario) in 2005.

	top Canadian tax payer	pension fund	foreign investor (US)
income trust	54	100	85
corporation	51	65	55

Note: The after-tax income calculations for income trusts assume that no corporation tax is paid at the operating company level.

3.2.2 The fall of income trusts

The Canadian government became concerned with the issue of income trusts, especially the potential tax leakage that they might cause. It made multiple attempts to discourage the increasing income trusts numbers; the first one was made in 2004. In that year's March budget the Canadian Finance Minister tried to prohibit pension funds from investing more than 1% of their assets in income trusts or owning more than 5% of any one trust. This proposal was not accepted by the parliament, but this indicated that income trusts had clearly become an important part of the political debate in Canada.

Further, in 2005 the Canadian government officially started investigating the issue of income trusts. In September, the Minister of Finance announced a freeze on advance tax rulings for companies converting to income trusts, which was interpreted as an action against the trust structure. This led to cessation of IPO activity for 2 months (from September until November) and a reduction in trust index value of approximately 20% (as reported by Halpern and Norli (2006)). It was widely anticipated that the government's next move would be to eliminate the tax-free status of income trusts (Elayan (2007)). Instead, in November that year the government announced that it would not be implementing any changes to the taxation of Canadian income trusts, but instead introduced a dividend tax reform. Specifically, by introducing an enhanced gross-up and dividend tax credit mechanism it equalized the treatment of Canadian resident taxpaying shareholders and unitholders in terms of their tax liability. This eliminated the tax advantage income

trusts had for taxable Canadian domestic investors.[18] However, it did not eliminate the advantage for tax-exempt or foreign shareholders.[19]

After that reform, the issue of income trusts appeared to be settled, which resulted in more income trust conversions at the end of 2005 and at the beginning of 2006. However, in October 2006 the final blow to Canadian income trusts was given by the government as it announced a tax on income trust distributions (excluding real estate income trusts - REITs) with effect from 1st January 2011. The reform, which was announced on October 31, 2006, is also known as the Halloween Massacre or Tax Fairness Plan (TFP).[20] The imposition of this tax, which was announced to be equivalent to that paid by corporations, was meant to equalize the tax treatment of Canadian corporations and income trusts.[21] The government said that the main motivation behind the reform was a response to an increase in tax avoidance. As a result the income trust structure would no longer be tax beneficial to companies starting from January 2011. The reform was to take effect immediately with respect to all new trusts created after 31st October 2006, but no new ones were created. Trusts that already existed were given a 4 year grandfathering period during which they were allowed to operate on previous terms, provided that they adhered to "normal growth" limitations imposed after the TFP reform. Specifically, if the trust grew by more than 100% of its market capitalization in 2006, it would immediately be

[18] In the context of after-tax income received out of 100 dollars of income (Table 3.1) top Canadian tax-payers holding shares of corporations now received 54 dollars, which was equivalent to that of top Canadian tax-payers holding units of income trusts.

[19] This move had academic support before it was introduced. The advocates of the enhanced dividend tax credits were Aggarwal and Mintz (2004).

[20] The 2006 reform has met with some criticism in the academic literature. Namely, Alarie and Iacobucci (2007) suggest that in spite of claims of being neutral, the reform actually actively discouraged the adoption of trust structure. They say that this might not be welcome from an efficiency perspective.

[21] The government announcement in October 2006 did not give a specific tax rate that was to be applied to income trusts. The only aspect that was specified by the government was that trusts and corporates will be taxed the same. The 2006 reform also announced a decrease in corporate tax rates by 0.5 percentage points from 2011. This was coupled with corporation tax rate decreases already announced in the 2006 budget that decreased the Canadian federal corporation tax rate from 21% to 19% by 2010. Combined with provincial taxes that meant that the rate in Ontario would fall from 35% in 2006 to 32% by 2010 and then to 31.5% in 2011.

subject to the new tax.[22] After January 2011 companies were allowed to remain in the trust structure with no tax benefits associated with the structure.

Table 3.2 describes the tax rates imposed on income trusts and corporations as of January 2011 using the province of Ontario as an example. As mentioned above the combined federal and provincial corporation tax rate has been decreased in Ontario from 35% in 2006 to 31.5% in 2011. This meant that pension funds, which were not liable to pay any investor-level tax and received no tax credits, were only taxed at the corporate tax rate of 31.5%. In turn, domestic Canadian residents who were shareholders of Canadian corporations were now taxed at the 31.5% corporation tax rate and an effective 14% dividend tax rate, which meant that the total investor tax rate was 45.5% in 2011. In the case of foreign investors, with the 31.5% corporation tax rate and the 15% withholding tax rate (US), their total tax liability was 41.5% in 2011.[23] The reform has changed the tax treatment of pension funds and non-resident investors, without altering that of resident taxpayers.

Table 3.2: After-tax income received out of 100 dollar of income, by type of investor (Ontario) in 2011.

	top Canadian tax payer	pension fund	foreign investor (US)
income trust	54.5	68.5	58.5
corporation	54.5	68.5	58.5

Note: The after-tax income calculations for income trusts assume that no corporation tax is paid at the operating company level.

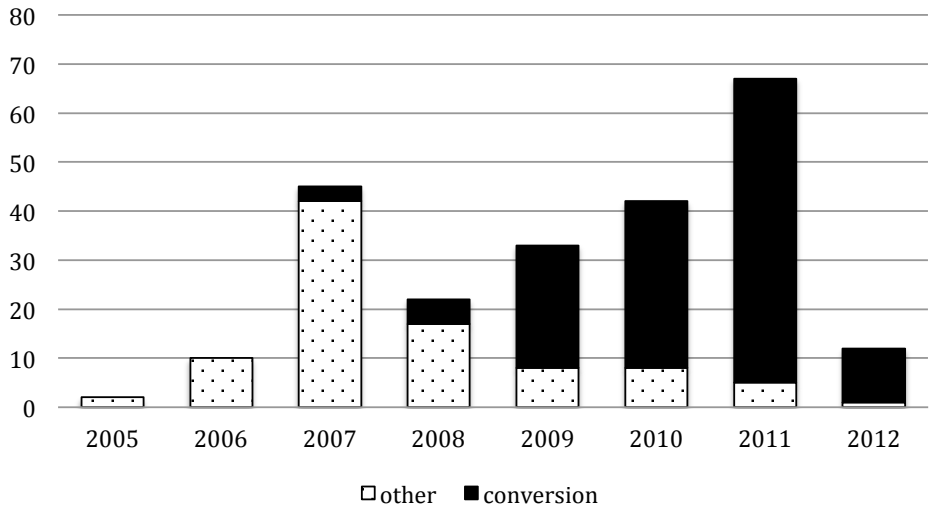
Due to the fact that the 31.5% tax rate was imposed on distributions of income trusts, it effectively equalized the treatment of corporations and income trusts for all types of investors. Until the expiry of their privileges on January 1st 2011, existing trusts had 4 years to decide what to do next. The first option was given to them by the Canadian Department of Finance which announced, in 2006, that income trusts would be allowed

[22]For example, the government cited the example of the insertion of a disproportionately large amount of additional capital as one of the situations when tax would be immediately imposed.

[23]Some of the witholding tax rate was deductible against the corporate tax liability.

to convert into taxable Canadian corporations without any additional adverse tax consequences to them or their unitholders so long as the conversion occurred before December 31st 2012. Therefore, in the period between January 2011 and December 2012 trusts could still convert to corporate structure, but in that period there would be no tax advantage from being an income trust. If they converted after December 2012 there would be an additional tax cost associated with the conversion. Therefore most of the conversions happened before or on January 1st 2011 (Figure 3.4).[24] Some income trusts exited the income trust status immediately in 2007, some waited longer even until 2011 when their privileges expired. The "normal growth" constraint on income trusts would have meant that trusts with better growth prospects would exit the trust structure before January 2011 and only trusts with lower growth prospects would remain trusts for as long as possible. After December 2012 only 16 companies that were not REITs have remained in a trust structure and only 11 of those were still trading as of September 2013.

Figure 3.4: Number of exits out of the trust structure.



Note: Conversion means conversion to publicly traded corporate structure, other is either conversion to private company, liquidation, etc. Source: own data.

[24]The Conversion Rules were enacted into law in 2009 and allow two different conversion methods. The first one is the exchange method: unit for share exchange with corporate successor. The second one is the distribution method: distribution of shares of a corporate subsidiary by the income trust to its unitholders on redemption of the trust units.

Alternatively, income trusts could have converted to private companies. The reform could have induced large pension funds to take existing trusts, in which they had large shares, private. Another option was a takeover by other private or public companies or other income trusts. This could have occurred due to the fact that the 2006 reform caused the aggregate market capitalization of income trusts to drop by 13% (Doidge and Dyck (2015)). As a result of this market capitalization drop, companies which converted to income trust structure for tax saving purposes, but whose underlying business might have not been suitable for the structure, could have faced withdrawal of investors and might have been forced to liquidate or to become acquisition targets. Most of those other types of exits from the trust structure occurred in the early years after the 2006 reform (see Figure 3.4).

In Table 3.3 I show how income trusts reacted to the 2006 reform in terms of decisions on how and whether to carry on operating.[25] We can see that over a half of existing income trusts have decided to carry on as publicly traded corporations and convert, while only 6% of all trusts decided to continue in trust form and not convert. Most of those have said that the cost of conversion to corporate form was too high (Doidge and Dyck (2015)). 14% of income trusts were taken over by private companies, while 4% were taken over by public ones. Not many businesses converted to private companies - only 4%. Once the company went public, it did not have the incentive to go back to being private again.

Finally, after the 2006 reform no more traditional income trusts were created in Canada as there was no tax advantage to this structure anymore. However, the structure has recently received some attention with some new energy trusts emerging in 2010 - 2012. These new trusts are exploiting a loophole in the 2006 legislation, which allows trusts holding non-Canadian properties or assets to exploit the income trust structure. The four

[25]In many cases, the question of what happened to income trusts after the 2006 reform does not have a straightforward answer. For example, the trust would first be taken over by another trust which then would convert to a publicly traded company. Or the trust would first go private but then one year later it will be in liquidation. In Table 3.3, I only show what initially happens to the trust, i.e. if it first went private and then wound down, I will count it as "to private".

Table 3.3: Income trusts operation, 2006 - 2011.

	number	%
to publicly traded corporation	147	52
takeover by private company	39	14
not affected	23	8
takeover by another trust	21	7
not converting	16	6
in liquidation	15	5
to private	11	4
takeover by public company	10	3
other	3	1

Note: Responses of income trusts to the 2006 reform announcement in the period 2006-2011. Total sample of trusts is 286, REITs are included in the "not affected" category. Source: own data.

new energy trusts, currently trading on TSX, are Argent, Crius, Eagle and Parallel. They all hold utility type assets located in US, but the income trust itself is located in Canada.

3.3 Cost of capital

In this section I illustrate the effects of the tax reform announcement on the cost of capital for income trusts. I consider a value-maximizing income trust which invests in period 1. I assume that income from that investment is taxed and variable costs are fully tax-deductible. I further assume that this income trust does not convert back to corporate form until the expiry of its tax privileges in 2011. I also assume, for simplicity, that the shareholder is a pension fund, hence it is exempt from personal taxation.[26] I calculate the cost of capital for income trusts which use retained earnings to finance their investment under three different tax scenarios.

In scenario 1 an income trust is taxed at a zero corporate tax rate in all time periods, if it distributes all its income to its shareholders. This scenario corresponds to the case of income trusts before the 2006 reform announcement. In scenario 2, an income trust is taxed at a zero corporate tax rate in period 1 but at the statutory Canadian corporate tax rate in later periods. This scenario corresponds to the transition period after the reform

[26]This means that I set both the personal tax rate on dividend income and the capital gains tax rate to be zero.

was announced in 2006, but before it was implemented in 2011. In scenario 3, an income trust is taxed at the statutory Canadian corporate tax rate in all periods, irrespective of whether it distributes all income to its shareholders. This scenario corresponds to the case of income trusts after 2011 as well as to Canadian corporations throughout the analysis period.

Using these three scenarios and following the methodology outlined in Devereux and Griffith (1998)[27], I calculate the net present value of capital allowances and the corresponding cost of capital for each of the three tax scenarios for three types of assets: machinery, buildings and intangibles in Canada for the years 2003 - 2012. The cost of capital calculations for scenario 2 take into account that capital allowances for each of the transition period years differ slightly. This is because capital allowances claimed against investment incurred in 2007 will be claimed against a zero corporate tax rate until 2011, i.e. for 4 years, while capital allowances claimed against investment incurred in 2008 will be claimed against a zero corporate tax rate for only 3 years, etc. I also assume that unused depreciation allowances in initial years cannot be carried forward and that an income trust starts paying tax immediately after it converts to corporate form, i.e. it did not accumulate losses during the period it was not paying taxes.[28]

For simplicity, let us define the net present value of allowances per unit of investment as A_{SL}, when the allowed depreciation method for a particular asset is straight line. In turn, when the allowed depreciation method for a particular asset is declining balance, let us define the net present value of allowances per unit of investment as A_{DB}. If we simplify the scenarios to assume that period 1 investment is subject to tax rate, τ_1, while for period 2 and later periods the tax rate is τ_2, while T is the length of time that the asset is allowed to depreciate for, we can define those two present values as the following:

[27]Which follows earlier work of Auerbach (1979) and King and Fullerton (1984).

[28]The assumption that an income trust starts paying tax immediately after it converts to corporate form is confirmed by empirical evidence. Both income tax and income tax divided by total assets increase sharply for income trusts in the year of conversion to corporate form and in later years. See Appendix Figure 3.11.

$$A_{SL} = \tau_1\phi + \frac{\tau_2\phi}{\rho} \times \{1 - (\frac{1}{1+\rho})^{T-1}\} \tag{3.1}$$

$$A_{DB} = \tau_1\phi + \tau_2\phi\frac{1-\phi}{\phi+\rho} \tag{3.2}$$

where ϕ is the capital allowances rate[29], and ρ is the shareholders discount rate, which in the absence of personal taxes is equal to the nominal interest rate[30]. The net cost of one unit of physical investment in period t is therefore $(1 - A)$. Hence, for an investment project financed using retained earnings, the net present value of investment, which is equal to the net present value of the economic rent, is:

$$R_{RE} = -\gamma(1-A) + \frac{\gamma}{1+\rho}\{(1+\pi)(p+\delta)(1-\tau_2) + (1+\pi)(1-\delta)(1-A)\} \tag{3.3}$$

where γ measures discrimination between new equity and distributions[31], π is inflation, and δ is the economic depreciation rate.[32] We can calculate the cost of capital, i.e. the marginal financial rate of return $\widetilde{p}_{RE}$, in period t by setting the net present value of investment to be zero at the margin. If we define the real interest rate, r, to be $(1+i) = (1+r)(1+\pi)-1$ then for investment financed by retained earnings the cost of capital will be:

$$\widetilde{p}_{RE} = \frac{1-A}{1-\tau_2} \times (r+\delta) - \delta \tag{3.4}$$

[29]Various assets are subject to various depreciation methods and rates. In Canada during the time period we have the following: machinery until 2007 had a declining balance depreciation schedule at 15 percent each year, with initial year depreciation rate at 30 percent; from 2007 onwards machinery was allowed to depreciate at 50% over two years using the straight line method; buildings had a declining balance depreciation schedule at 2 percent with initial year depreciation rate at 4 percent; intangibles had a declining balance schedule at 7 percent.

[30]Assuming that the real interest rate, r, is 0.05 and inflation, π, is 0.025, $\rho = (1+r)*(1+\pi)-1 \Rightarrow \rho = 0.07625$

[31]$\gamma = (1-m^d)/(1-c)(1-z)$ where m^d is the personal tax rate on dividend income, c is the rate of tax credit available on dividends paid and z is the accruals-equivalent capital gains tax rate. In this illustration, since I assume that a shareholder is a pension fund $m^d = c = z = 0$, hence γ is one.

[32]The economic depreciation rate is assumed to be 0.175 for machinery, 0.031 for buildings and 0.1535 for intangibles. For details and sources of all the assumptions please see "CBT Corporate Tax Ranking 2012". http://www.sbs.ox.ac.uk/sites/default/files/Business_Taxation/Docs/Publications/Reports/cbt-tax-ranking-2012.pdf

Using the stated assumptions on the parameters, I calculate the cost of capital for income trusts in Canada over the analyzed time period.[33] The results are summarized in Table 3.4. The cost of capital for income trusts for machinery and intangibles more than tripled immediately after the reform announcement, from 0.05 to 0.169 for machinery and to 0.16 for intangibles. The change in the cost of capital was smaller for buildings, but still nearly doubled. This very large increase in the cost of capital for investment in all types of assets after the reform announcement arises because in the transition period capital allowances are claimed against a zero corporate tax rate until 2011, but taxes are paid on the return from this investment at the Canadian statutory tax rate after 2011. After the reform came into force, in 2011, the cost of capital for income trusts decreased to 0.053 for machinery, to 0.089 for intangibles and to 0.071 for buildings, and was equal to the cost of capital for corporations. Further, the cost of capital for income trusts for all types of assets after the reform came into force in 2011 is higher than it was before the reform announcement in 2006.

In Figure 3.5 I plot the cost of capital time series for income trusts against that of corporations for each type of asset. Here we can see, first, that the cost of capital for income trusts was much lower than for Canadian traditional corporations before the 2006 reform announcement. Second, there is a spike in the cost of capital for income trusts following the 2006 reform announcement, that increases their cost of capital above that of corporations. It is largest for machinery and smallest for buildings. Third, the cost of capital for income trusts aligns itself with that for traditional Canadian corporations after the reform comes into force in 2011, as now income trusts are treated no differently than Canadian corporations.

Using these cost of capital calculations, we can form expectations as to what would happen to investment of income trusts relative to Canadian corporations in the absence of any financing constraints. If investment simply responded to changes in the cost of capital,

[33]The calculations also take into account the capital allowances reform in Canada that changed the depreciation schedule for machinery. For detailed calculations of capital allowances for each asset type see Appendix 3.8.4.

Table 3.4: Cost of capital for various types of investment.

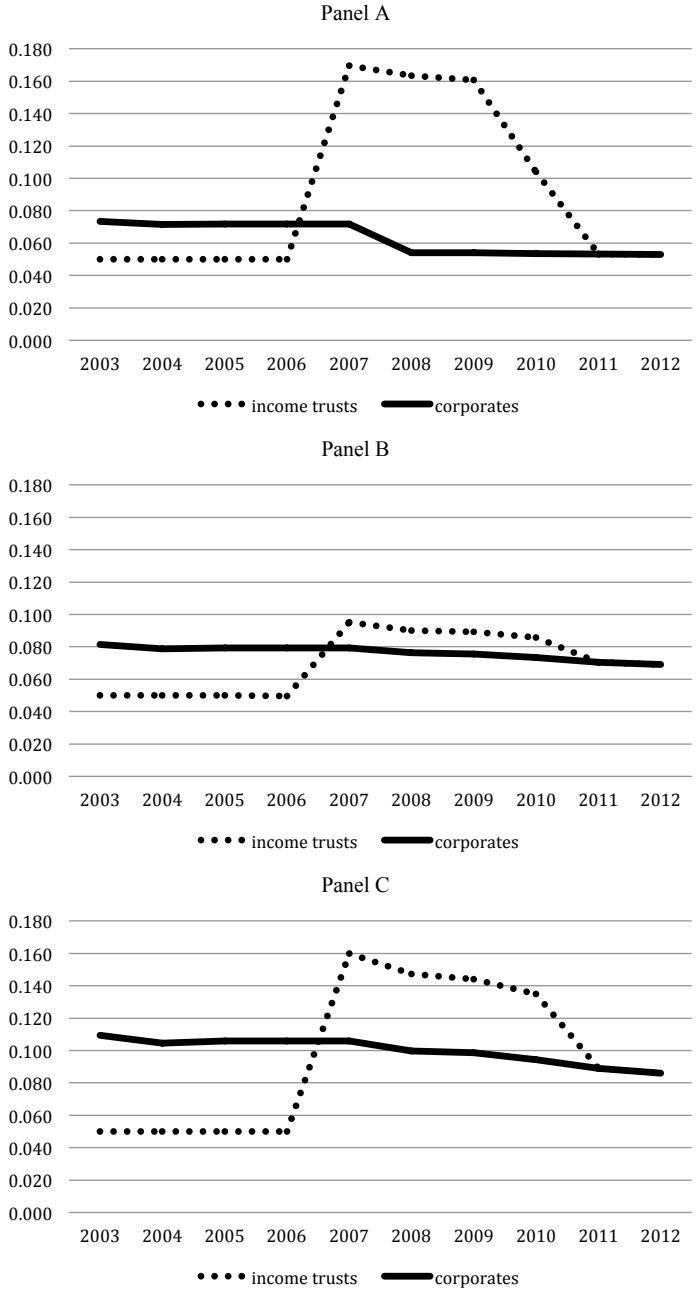
	income trusts		
year	machinery	intangibles	buildings
2003	0.050	0.050	0.050
2004	0.050	0.050	0.050
2005	0.050	0.050	0.050
2006	0.050	0.050	0.050
2007	0.169	0.160	0.095
2008	0.163	0.147	0.090
2009	0.161	0.144	0.089
2010	0.104	0.135	0.086
2011	0.053	0.089	0.071
2012	0.053	0.086	0.069
	corporates		
	machinery	intangibles	buildings
2003	0.073	0.110	0.081
2004	0.071	0.105	0.079
2005	0.072	0.106	0.079
2006	0.072	0.106	0.079
2007	0.072	0.106	0.079
2008	0.054	0.100	0.076
2009	0.054	0.099	0.076
2010	0.054	0.094	0.073
2011	0.053	0.089	0.071
2012	0.053	0.086	0.069

Note: Cost of capital is calculated assuming the investment is financed by retained earnings. Source: CBT tax database and own calculations.

we would expect it to decrease sharply following the 2006 reform announcement, and then after the reform came into force in 2011 to increase relative to the transition period, but to decrease relative to the pre-2006 reform announcement period.[34]

[34]Strictly, these are statements about the desired levels of the capital stock, with implications for investment depending on how the actual capital stock adjusts to a gap between the desired and inherited capital stock levels. For instance, if capital stocks adjust rapidly, the rising level of the desired capital stock from 2007 - 2011 could require higher investment in those years than before 2006.

Figure 3.5: Cost of capital: income trusts vs corporations.



Note: Cost of capital calculated for income trusts and corporations using assumptions from the CBT Corporate Tax Rankings 2012. Panel A: machinery, Panel B: buildings, Panel C: intangibles. Source: CBT corporate tax database.

3.4 Data

3.4.1 Data sources description

A substantial part of this project involved detailed data collection on Canadian income trusts. The sample of Canadian income trusts comes from a list of income trusts traded on the Toronto Stock Exchange (TSX) at the end of October 2006. To this, I also added income trusts that traded on TSX before October 2006 and were taken over or wound down before the 2006 reforms. The total number of income trusts in Canada during the analyzed time period is 286, of which 16 were no longer trading in October 2006.

To obtain detailed information about each income trust I manually collect data on each of them from SEDAR.[35] SEDAR offers access to most public securities documents and information filed by public companies in Canada. The type of information offered, which is useful in the context of this chapter, includes:

- initial public offering (IPO) documents, which detail the operations of a private company before the income trust conversion as well as the name of underlying operating company
- material change documents, notices and news releases, which enable me to collect information on conversions to and from income trusts and exact dates of those events

The above documents also enable me to collect data on the type of company that an income trust was before the conversion, namely private or public, and the method of conversion, namely using an IPO and going from private to public or converting the shares into trust units, or setting up a new entity to purchase properties or mines as was the case for a lot of REITs and energy trusts. SEDAR also includes information on what happened with the income trust after it stopped reporting information in the Datastream database. Therefore, I collect information on names of corporations that income trusts converted to, names of trusts or companies that took over the income trusts and information on whether

[35] http://www.sedar.com/homepage_en.htm This is equivalent to the UK's Companies House in so far as it publishes accounting statements of all Canadian companies.

and how income trusts stopped their operations. This enables me to link income trusts with their corporate counterparts and collect financial information for the structure for the duration of the sample.

In Canada over the period 2003 - 2013 there were 286 income trusts in total, of which 61% were business income trusts, while the rest were utility income trusts or real estate income trusts (see Table 3.5). I define a business trust as a trust that was classified by S&P as business type, while a utility trust is any trust classified as energy or power and pipelines.

11% of companies in my initial sample are REITs, that were not publicly traded companies before, but either were created for the purpose of purchasing new properties at the time of the IPO or were private companies before. Of the total 286 income trusts, around 60% were private companies before they decided to do an IPO using the income trusts structure. 23% were publicly traded companies in Canada which decided to convert all of their shares into income trusts units, while 7% converted only part of their business into an income trust.[36] Complementary to that information, 30% of income trusts converted from publicly traded corporations, while 55% became income trusts via an IPO. The remaining 14% of companies were created just prior to an IPO and those were mainly REITs and energy trusts.

For financial variables I use the Datastream database, which is commonly used in Canadian corporate finance studies.[37] Datastream includes information on Canadian listed companies only. This is a limitation in that around 60% of Canadian income trusts were private companies before the conversion to the trust structure. This will determine the sample selection and empirical methodology used to estimate the effects of the 2006 reform

[36]Bautex Energy Trust is an example of trust which did a conversion, but only partially. Bautex Energy Ltd reorganized itself into Bautex Energy Trust and Crew Energy Inc. In this arrangement Bautex Energy Ltd split into two units, an income trust that traded units and a corporation which traded shares. Private companies also do partial IPOs, where only part of their company goes public using the income trust structure. An example here is AirCanada, which operated as private company, but created Aeroplan income trust which purchased all customer license loyalty cards from the operating company and leased them back for a fee.

[37]I also re-run some robustness checks using data from Compustat. However, Compustat covers fewer income trusts and does not offer any additional information over Datastream.

Table 3.5: Distribution of income trusts by type.

	number	%
Business Trust	173	61
Energy Trust	32	11
not traded in Sept 2006	32	11
REIT	28	10
Power and Pipelines	21	7

Note: Both Energy and Power and Pipelines income trusts belong to the Utility Income trusts group used below. Source: own data.

on investment. However, since there is no reporting requirement for private companies in Canada, there is no publicly available data on the previous accounts of those companies anywhere.[38] Furthermore, the financial statements of income trusts are generally consolidated ones, which means that I cannot distinguish between accounts of income trusts and their underlying businesses.[39]

In Datastream I found information for 275 income trusts. The sample used in the econometric analysis is further limited, since not all income trusts have reported information on investment and other firm level variables.

3.4.2 Sample selection

In the empirical analysis I always exclude REITs and income trusts that are based in the US, but have done an IPO in Canada. This is because the reactions of the latter to the reform will not be comparable to purely domestic Canadian income trusts. I exclude REITs due to the fact that the reform of 2006 did not apply to them. This means that I exclude just over 10% of income trusts at the outset.

In 2005, one year before the TFP reform was announced, Datastream has investment information for 152 income trusts and 802 corporations. In Table 3.6 I compare the characteristics of companies in both groups for that particular year. First, since the smallest

[38]This has also been confirmed by looking at the income trusts in the Orbis dataset, which contains accounting data on private and public companies if it is available.

[39]See Jog and Wang (2006) for further discusson on different discolure requirements for Canadian enterprises.

income trust had total assets of 27 million CAD in 2005, I limit the sample of corporations in the descriptive statistics to those with total assets above 20 million CAD. Hence, I consider only 286 corporations here.

The results suggest that, on average, income trusts invested less than corporations, held less cash, and were larger (higher median total assets, higher median net sales). They also, on average, paid higher dividends, had higher external leverage, cash flow and profitability[40]. Further, income trusts did not necessarily operate in all of the industries in which Canadian corporations operated.[41]

This suggests that not all Canadian corporations are comparable with income trusts. To the extent that businesses with different observable characteristics from different industries might react differently to economic developments, this creates a concern about using all Canadian corporations as a control group in the empirical analysis. To alleviate this concern I use propensity score matching (PSM, Paul R. Rosenbaum (1983), Rosenbaum and Rubin (1985)).[42] Using this approach, I choose a sample of corporations comparable to income trusts based on their observable characteristics. In my control group sample, I want corporations with similar observable characteristics to income trusts in 2005, the year prior to the 2006 reform announcement. I choose comparable corporations based on their size and industries in which they operate. Therefore for the sample of around 450 observations, for which I have data on investment and size in 2005, I run a regression where on the left hand side I have an income trust dummy, which is 1 if a company was an income trust in 2006 and 0 otherwise. On the right hand side I include lagged total assets and industry fixed effects. I estimate this equation using probit regression.[43] The

[40] All but the net sales and total assets statistics referred to here are the ratios of the variables to total assets. For detailed definitions of each variable see Appendix 3.8.5.

[41] For a summary table with industries included in the selected sample see Table 3.12 in the Appendix.

[42] For a detailed description of the Propensity Score matching methodology, see the empirical analysis section in Chapter 2 of this thesis.

[43] I test the robustness of this simple matching procedure by including additional factors that could determine why a company is an income trust, such as for instance growth opportunities and profitability. For more details see the robustness tests section.

predicted probabilities from this regression are known as propensity scores. I use those propensity scores to construct the matched sample of income trusts and corporations.

This approach ensures that in my sample all companies have existed at least 1 year prior to the 2006 reform. This means that my sample only includes income trusts that were publicly traded in 2005 and later.

The matching algorithm I use is the nearest neighborhood matching within a caliper, without replacement.[44] This means that for each income trust I find the closest comparable Canadian corporation and also require the propensity scores for the income trust and matched corporation to be within a certain distance in terms of predicted probability. This strategy generates a sample of income trusts that belong to the treated group and a same-sized sample of Canadian corporations that belong to the control group. These corporations have the closest propensity scores to the income trusts.[45]

The matched sample includes 149 income trusts and 149 comparable corporations. Of the 149 income trusts, 90 were private companies before they became income trusts and 59 were publicly traded corporations; 106 are business income trusts and 43 are utility income trusts.; 99 converted to publicly traded corporations after the 2006 reform announcement and 45 of those have done so on 1st January 2011.

After the propensity score matching was performed the means of observable firm level characteristics such as cash flows, payouts and leverage are now more similar between the groups of income trusts and corporations.[46] In the remainder of this chapter, unless otherwise specified, I use the matched sample of income trusts and corporations.

[44]I experiment with various matching approaches, but they all yield similar results. When considering propensity score matching one always has to trade off bias with variance of the estimates, i.e. using more observations to construct the matched sample (e.g. matching within a radius, k-nearest neighbourhood or kernel meatching) implies lower variance in the estimates, but if the observations used for matching are not very similar to the treated group then bias increases.

[45]PSM only excludes one income trust for which data on all observable characteristics exists, but for which the matching procedure found no suitably comparable corporate. In turn, 124 corporations are excluded.

[46]For a table outlining means of the observable characteristics for income trusts and corporations see Table 3.13 in the Appendix.

Table 3.6: Descriptive statistics: income trusts vs corporations.

			income trusts			
stats	N	mean	sd	p50	max	min
income taxes	150	6,720	56,025	0	610,000	-42,804
total assets	152	1,087,632	4,438,326	321,707	49,100,000	27,382
net sales	151	404,778	757,656	175,059	6,124,000	0
net income	152	64,543	166,331	14,490	1,209,000	-156,271
income taxes/ total assets	150	0.0027	0.016	0	0.06	-0.07
investment rate	152	0.12	0.24	0.03	1.69	0
investment rate 2	108	0.25	0.36	0.10	1.91	0
cash holdings	151	0.03	0.05	0.01	0.33	0
payouts	151	0.09	0.06	0.08	0.45	0
leverage	152	0.22	0.17	0.19	0.87	0
cash flows	152	0.11	0.13	0.11	0.75	-0.71
market to book ratio	152	1.42	0.76	1.22	5.18	0.43
profitability	152	0.10	0.08	0.08	0.66	-0.03
new working capital	52	0.01	0.10	0.01	0.27	-0.28
tangibility	152	0.42	0.34	0.39	0.94	0
			corporates			
stats	N	mean	sd	p50	max	min
income taxes	286	33,886	153,801	1643	1,709,000	-271,000
total assets	286	1,437,377	4,186,932	176,003	40,100,000	20,154
net sales	286	1,025,865	2,900,935	81,813	20,400,000	0
net income	286	56,920	322,858	5,329	2,014,000	-3,110,546
income taxes/ total assets	286	0.0180	0.031	0	0.16	-0.11
investment rate	286	0.32	0.85	0.05	7.28	0
investment rate 2	204	0.39	1.04	0.07	7.62	0
cash holdings	284	0.15	0.20	0.07	0.87	0
payouts	277	0.01	0.05	0	0.50	0
leverage	286	0.19	0.19	0.14	0.88	0
cash flows	284	0.07	0.15	0.08	0.54	-1
market to book ratio	286	1.62	1.32	1.28	11.48	0.11
profitability	286	0.05	0.13	0.06	0.39	-0.62
new working capital	126	0.09	0.21	0.05	0.79	0
tangibility	281	0.40	0.30	0.37	0.97	0

Note: Means for income trusts and corporations is calculated for 2005. I only include corporations from industries where income trusts also have a presence. I further limit the sample to include only firms with total assets larger than 20 million CAD, with investment rates and leverage below 10, and with market to book ratio below 100. The first four rows are in levels in thousands of 2005 Canadian dollars (income tax, total assets, net sales and net income), the remaining rows are ratios, where investment rate is capital expenditures divided by last year's total assets, investment rate 2 is capital expenditure plus acquisitions divided by last year's total assets, while the remaining ratios are all scaled by current year total assets. Cash holdings is cash and short term investments, payouts is total distributions, leverage is short term plus long term debt, cash flows is net income before extraordinary items plus depreciation and amortization, market to book ratio is short term debt plus long term debt plus market capitalization, profitability is net operating income plus depreciation and amortization, net working capital is current assets minus cash minus current liabilities, tangibility is gross property plant and equipment minus accumulated depreciation. Source: Datastream.

3.4.3 Descriptive evidence

In this subsection I provide descriptive statistics on the main variable of interest - investment - using the propensity score matched sample. I consider the behaviour of investment around the 2006 TFP reform for both income trusts and publicly traded corporations. I further show heterogeneity in investment responses to the 2006 reform for income trusts by considering differences between income trusts that are more likely to be financially constrained and those that are less likely to be financially constrained. Then, I show differences in investment rates between income trusts by the year in which they decided to convert (back) to corporate form as a result of the 2006 reform. Finally, I show how various sources of investment financing have changed following the 2006 reform.

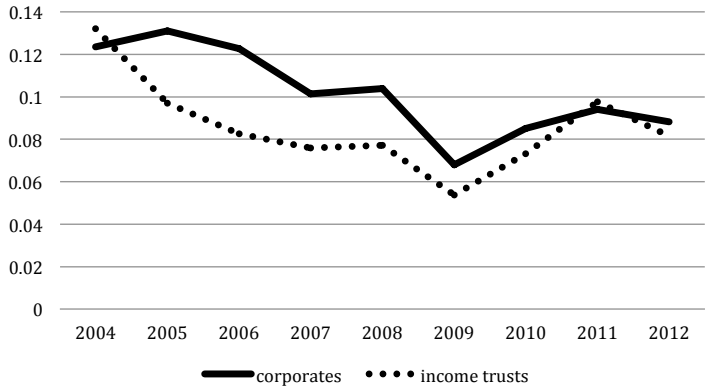
First, Figure 3.6 compares investment rates, defined as capital expenditures divided by last year's total assets, of matched income trusts and corporations in the years 2004 - 2012.[47] I calculate means of investment rates for income trusts and corporations and I continue to classify businesses as income trusts after they convert (back) to publicly traded corporations. Therefore for later years means of investment rates for income trusts include income trusts which have already exited the structure.

The investment rates of both income trusts and corporations move together quite closely over the years in Figure 3.6. There was a large gap in investment rates of income trusts and corporations before the 2006 reform. This gap has somewhat narrowed following 2006. However, the effect of the financial crisis and subsequent recovery dominate any effects of different paths for the investment rates.

In Figure 3.7 I use the matched sample of income trusts and corporations and subdivide the sample into trusts that appear more likely to be financially constrained and those that appear less likely to be financially constrained. As a proxy for financial constraints I use

[47] Here I consider a balanced panel of income trusts and corporations, which includes 74 corporations and 72 income trusts.

Figure 3.6: Investment rate comparison - corporations and income trusts.



Note: Mean investment over previous year's total assets, comparison of matched corporations and income trusts. All data winsorized at 1 percent. 74 corporations and 72 income trusts constitute a balanced panel. Source: Datastream.

whether firms were distributing above or below median dividends in 2011, the year the income trusts reform came into force.[48]

The assumption here is that income trusts with above median payouts in 2011 are those that were less likely to be financially constrained during the time they were in the trust structure. In turn, income trusts with below median payouts in 2011 are those that were more likely to be financially constrained during the time they were income trusts. If an income trust after conversion to corporate form pays low dividends in 2011, that means it is retaining earnings or has low earnings. A financially constrained income trust is unable to get funding from external sources, hence it relies more heavily on internal sources to finance its investment. I assume that income trusts with low dividend payouts were more likely to be financially constrained.[49]

[48] As a measure of dividends I use dividends divided by total assets. The median payout ratio for income trusts was 0.088 in 2006 and 0.04 in 2011. The median corporate payout ratio was 0 in both 2006 and 2011.

[49] Using dividend payouts as a proxy for financial constraints could introduce endogeneity as a firm often makes a choice whether to pay their earnings out to their shareholders or to invest them. However, under the null hypothesis of perfect capital markets, firms do not have to choose between retained earnings and investment, as the cost of financing using retained earnings is equal to that using external sources of finance. Since in this chapter I test the null hypothesis of perfect capital markets, the ratio of dividends to total assets can be considered an appropriate proxy for financing constraints. Further, early conversions to corporate form also provide a signal of which income trusts were most likely to be financially constrained.

In Figure 3.7 we can clearly see that the investment rates of the financially constrained income trusts (Panel B) behave very differently from the non-financially constrained income trusts (Panel A). Income trusts with below median payouts have increased their investment rates dramatically relative to matched corporations in 2011 (Panel B). Income trusts with above median payouts did not change their investment rates differentially from corporations in 2011 (Panel A).[50]

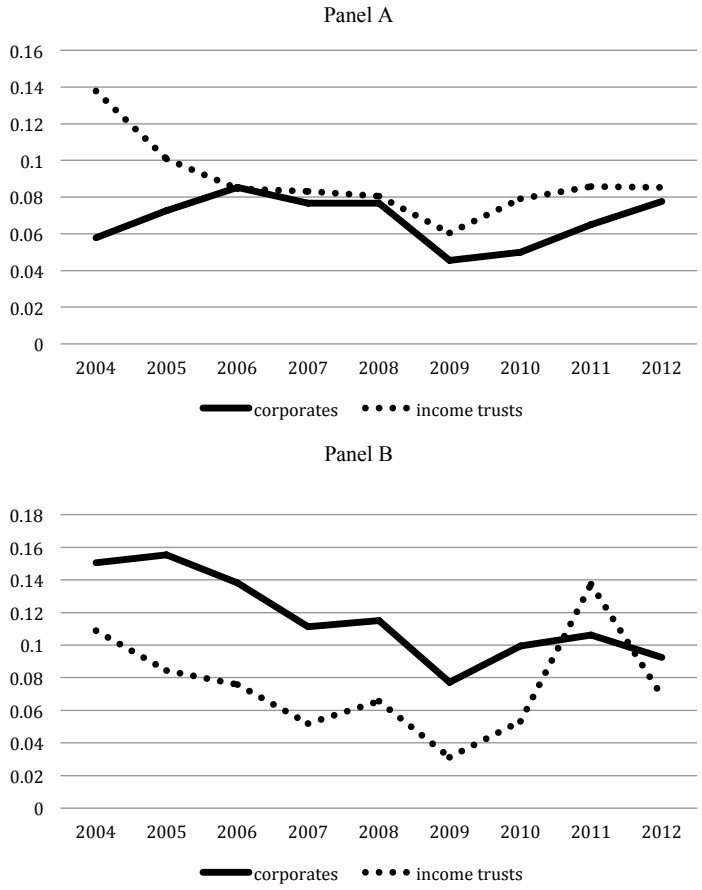
The mean investment rates of corporations differs between Panels A and B in Figure 3.7. This is because I do PSM for each subgroup of income trusts. Hence, for financially constrained income trusts I find a group of most comparable corporations. This group is different from corporations that are most comparable to non-financially constrained income trusts.

Figure 3.8 explores heterogeneity in the investment rates between income trusts depending on the year in which they exited the income trust structure. In Panel A, the 2007 line refers to the mean investment rate of income trusts that exited the income trust structure in 2007, irrespective of whether they ceased to exist altogether or whether they converted to corporate form. Here, the lines end in the year the income trust exited the structure. Panel A in Figure 3.8 therefore considers a larger sample of income trusts than that considered in Figures 3.6 and 3.7. In Panel B, the 2007 line refers to the mean investment rate of only those income trusts that converted to corporate form in 2007. Here, the lines continue until 2012 to show what happened to investment rates after the conversion to corporate form.

In Panel A in Figure 3.8 we can see that trusts that exited the sample in 2012 had the lowest investment rate on average amongst all groups. Trusts that exited in 2011 had a slightly higher mean investment rate while trusts which exited in 2010 had an even higher mean investment rate. A similar pattern prevails in Panel B, where income trusts which converted late had low investment rates, while income trusts that converted early had higher investment rates.

[50]Figure 3.7 looks the same if we use distributions in 2012 to proxy for financially and non-financially constrained companies. The spike still appears in 2011.

Figure 3.7: Investment rate comparison - income trusts vs corporations.



Note: Mean investment over previous year's total assets, comparison of matched corporations and income trusts. Panel A: income trusts with above median payouts matched with corporations, Panel B: income trusts with below median payouts matched with corporations. PSM on 2005 characteristics. All data winsorized at 1 percent. Source: Datastream.

This raises a concern about selection out of the income trust structure. If it is indeed true that income trusts have decided to convert prematurely to corporations because of their investment opportunities, then the effects of the early conversions back to corporate structure on investment are endogenous. Further, all income trusts have increased their investment rates after conversion to corporate structure, irrespective of the year the conversion took place (Panel B). The evidence is quite strong for income trusts which converted in 2010 and 2011. In turn, this evidence is less compelling for the income trusts which converted at the height of the financial crisis. It is also conceivable that the increases in investment rates of income trusts that we see after 2010 may be related to recovery following the financial crisis. The empirical specification used in the subsequent analysis takes

account of the differences between premature converters and those income trusts that lost their tax privileges in 2011.

Income trusts that exited the sample altogether had on average lower investment rates after the 2006 reform than those that converted to corporate form. This pattern prevails across almost all exit years, apart from 2009 (see Figure 3.13 in the Appendix). This would suggest that the trusts which converted to publicly traded corporations were those with better investment opportunities.

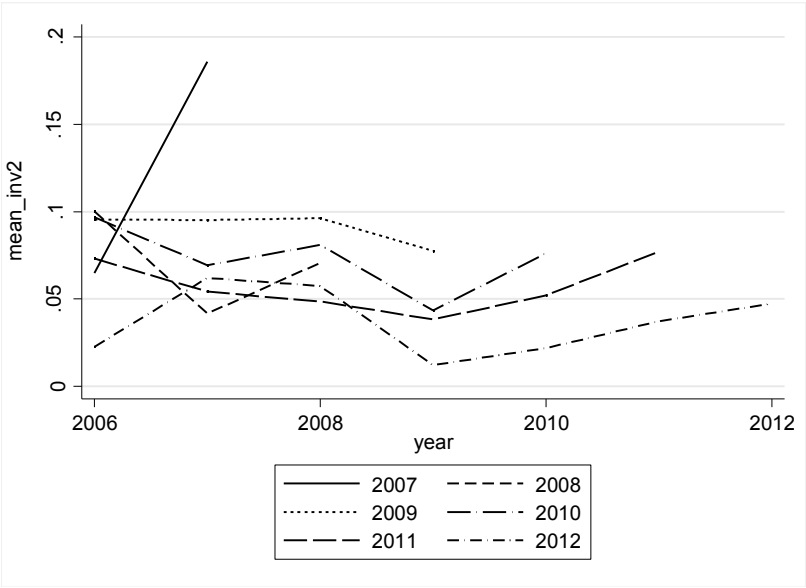
In Figure 3.9 I compare three indicators that can be used to proxy for three main sources of financing for investment: retained earnings, new equity and debt. First, I consider the dividend payout ratio (Panel A), which I define here as the ratio of cash dividends to total net income. If this ratio is close to one then companies pay all of their income as dividends to their shareholders and retain none of their earnings. In Panel A we can see that the mean of this ratio is very close to 1 for income trusts throughout the sample. This ratio is much larger than for comparable corporations. Crucially, the ratio of dividends to net income for income trusts has dipped significantly in 2011, at the expiry of income trusts' tax privileges. At the same time, there was no corresponding change in the dividend payout ratio for corporations.[51]

This suggests that income trusts have seen a significant change in their retention rates at the expiry of their tax privileges. This supports the claim that income trusts may have been financing their increased investment rates in 2011 using higher retained earnings. This is especially likely, since neither new equity issues (Panel B) nor leverage (Panel C) have increased substantially for income trusts relative to corporations in 2011. Further, Panels B and C in Figure 3.9 suggest that trusts were more reliant on external sources of finance prior to 2011.

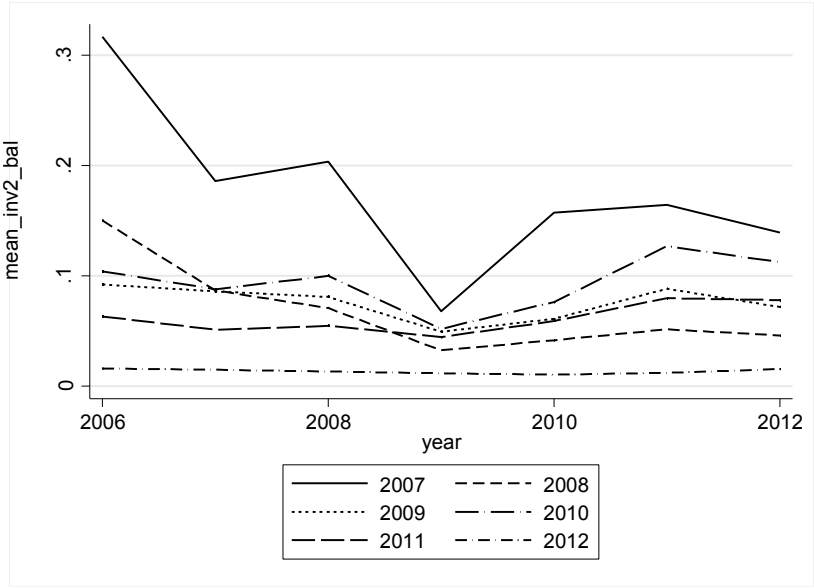
[51]Note that the denominator of the dividend payout ratio, net income, may be zero. Hence, the ratio may be infinitely high, and behaviour of means may be highly misleading. The median dividend payout ratio plot looks very similar, which suggests that the mean trends are not driven by outlier observations in the matched sample.

Figure 3.8: Investment rates by year of exit from the income trust structure.

Panel A

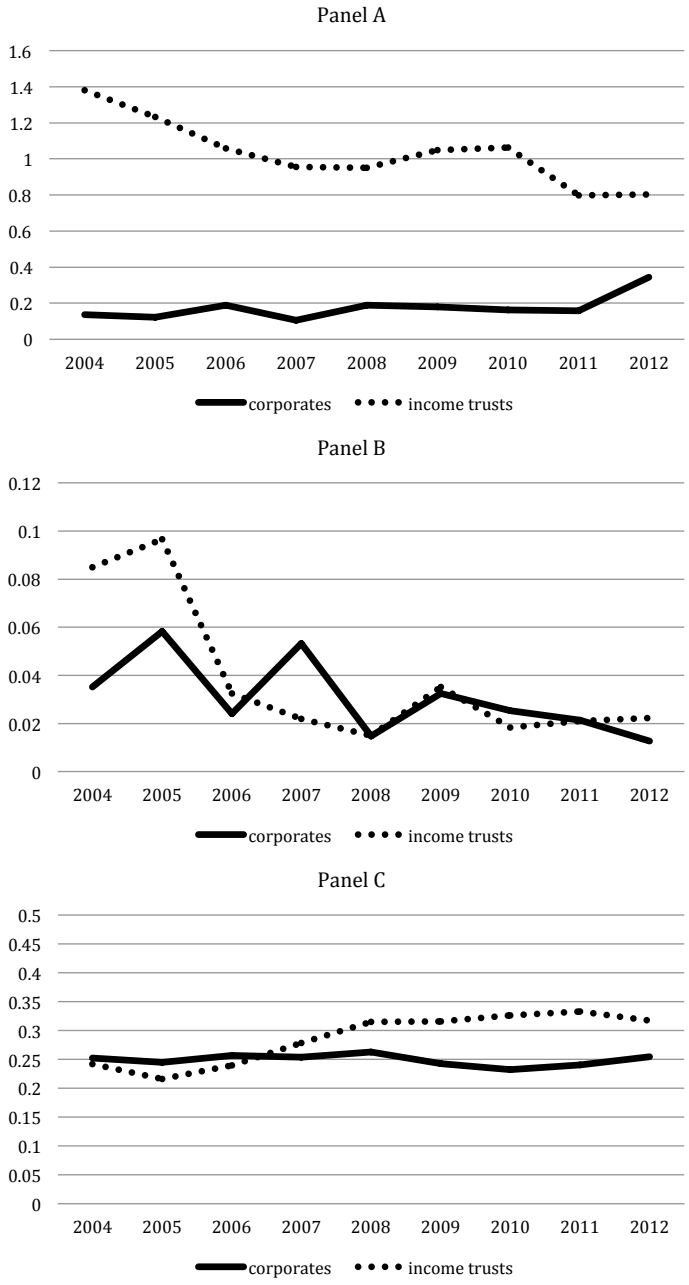


Panel B



Note: Mean investment over previous year's total assets calculated for income trusts by the year in which they exited the trust status. Panel A: includes investment rates of all income trusts until they exit the structure. Panel B: includes investment rates only of those income trusts which converted to corporations and were still active in 2012. For example, plot for year 2009 shows the yearly evolution of the mean investment rate of all income trusts which ceased to be income trusts in 2009. In Panel A this plot will stop in 2009, in Panel B it will continue until 2012, showing investment of former income trusts in the corporate form for the years 2010 - 2012. All data winsorized at 1 percent. Source: Datastream.

Figure 3.9: Dividend payout ratio, new equity issues and leverage: corporations vs income trusts.



Note: Mean of three different sources of financing calculated on a PSM matched sample of income trusts and corporations. Panel A: dividend payout ratio, which is defined as dividends paid relative to net income, Panel B: mean new equity issues, which is calculated as the ratio of proceeds from the issued sales to total assets; Panel C: mean leverage, which is the ratio of short term and long term liabilities to total assets. All data winsorized at 1 percent. Source: Datastream.

To estimate the effects of the 2006 income trusts tax reform on investment rates I use the exogenous shock created by the announcement of the 2006 reform. This reform affected income trusts only, with no effect on corporations. Therefore it is suited to using the difference-in-difference methodology by comparing the effects of the reform on investment of income trusts, relative to that of publicly traded Canadian corporations to control for unobserved factors that affected all Canadian firms. The identification strategy relies on the fact that corporations with similar observable characteristics were not affected by the announcement of the 2006 reform, while the cost of capital has sharply increased for income trusts following the reform announcement, as discussed in Section 3.3. Further, the reform was exogenous as Canadian markets did not anticipate its introduction (see Figure 3.10 for the unanticipated drop in the market value of income trusts relative to corporations).[52]

To identify the effects of the reform on investment I also require common trends in investment rates in the absence of the 2006 reform. Since most of the conversions to the income trust structure in my sample happened in the years 2002 - 2006, it is difficult to present any long-run time series of investment rates for both groups of companies (see Figure 3.6 for an attempt). However, as described above the reform was primarily intended to curb tax avoidance, hence it is likely that it was not introduced in response to any changes in investment for one type of business.

To ensure comparability between income trusts and corporations, I use the propensity score matched sample of income trusts and corporations. I estimate, using OLS, the following baseline model:

$$I_{it} = \alpha + \beta_1 trust_i + \beta_2 trust_i \times post\_TFP_t + \gamma X_{it} + ind_i + year_t + \epsilon_{it}$$

where I_{it} is the investment rate of company i in year t, $trust_i$ is a dummy variable equal to 1 in all years if the company was an income trust in 2006, $post\_TFP_t$ is a dummy that

[52]For further evidence in the literature that the 2006 reform resulted in negative unit price and market value effects for income trusts see Doidge and Dyck (2015), Edwards and Shevlin (2011), Glew and Johnson (2011).

takes value 1 in 2007 and remains 1 after that ind_i are industry fixed effects[53], $year_t$ is year fixed effects, and X_{it} is a vector of control variables. The investment rate is defined as capital expenditures divided by last year's total assets. The vector X_{it}, which is included in the regressions where indicated, includes control variables suggested by the previous literature on Canadian income trusts; these are lagged log total assets and industry median investment, payouts, cash holdings and leverage.

I use the sample of observations from 2003 until 2012. I do not track the company before it converted to the trust structure, even if it was previously publicly traded. This means that an income trust enters the sample either in 2003 or in the year it converts from corporate to income trust structure (for previously publicly traded income trusts) or the year it does an IPO (for previously private income trusts). This allows me to abstract from the issue of self-selection into the income trust structure. There is evidence in the literature that some Canadian corporations have chosen to become income trusts based on their characteristics, hence the conversion to the structure was an endogenous decision.[54]

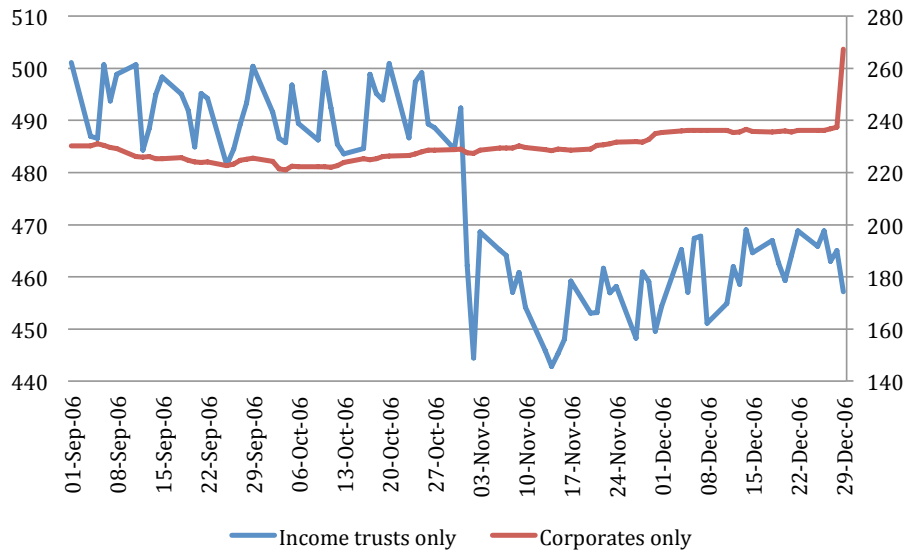
Due to the fact that existing trusts received a grandfathering period after the 2006 reform until 2011, it is very hard to identify the immediate effects of the 2006 reform. This is due to difficulty in determining what the treatment group is in those immediate years. Trusts could choose to remain in the trust structure or convert to corporations and exit from the trust structure at any point they wanted to, without any additional tax cost associated with this decision beyond the loss of their tax saving opportunity. This implies that after the 2006 reform companies would make a decision about the timing of their exit from the trust structure. I use this information to consider the effect that the 2006 reform announcement had on investment of income trusts after they lost their tax privileges.

The effects of early conversions to corporate structure are potentially endogenous. This is because income trusts could choose the year in which they converted to corporate structure during the transition period. An early conversion to corporate structure can

[53]See Appendix, Table 3.12 for a summary of industry codes and which industry they refer to. Some specifications exclude industry fixed effects, while others include firm fixed effects instead.

[54]For details on why Canadian companies converted to income trusts see Appendix 3.8.2.

Figure 3.10: Market value of Canadian income trusts relative to corporations.



Note: The right hand side axis refers to market value of corporates; the left hand side axis refers to market value of income trusts. 29th December was the last trading date of 2016. Source: Datastream.

therefore be dictated by investment opportunities and hence an increase in investment after premature conversion to corporate structure could be the cause rather then the result of the early conversion.[55]

In the empirical specification I distinguish between the effects of conversion before 2011 (early conversions) on investment and the effects of the expiry of tax privileges in 2011 on investment. The latter are arguably more exogenous. Those income trusts which stayed in the structure until 2011 would have likely continued to be income trusts had they not been forced to convert by the expiry of their tax privileges. This suggests that the effects of the reform coming into force in 2011 could be considered exogenous, since income trusts had no choice but to lose their tax privileges and convert to corporate structure.

I extend the baseline model to account for both the effects of early conversions and the 2011 expiry of tax privileges. Therefore, I estimate the following:

[55]Under the null hypothesis of perfect capital markets, external funds are perfect substitutes for internal funds, and I would not expect to see early conversions at all. Insofar as my goal here is to test the null hypothesis, there should be no concern about endogeneity of early conversions under the null.

$$I_{it} = \alpha + \beta_1 trust_i + \beta_2 trust_i \times post\_TFP_t + \beta_3 post\_conv_{it}$$
$$+\beta_4 trust_i \times post\_2010_t + \gamma X_{it} + ind_i + year_t + \epsilon_{it}$$

where $post\_conv_{it}$ takes the value 1 in the year that an income trust exits the trust structure (if that happens before 2011) to become a corporation and remains 1 after that, while $post\_2010_t$ takes the value 1 in 2011 and remains 1 after that.

The coefficient β_2 on the interaction term between the $trust_i$ dummy and the $post\_TFP_t$ variable will give me the effects of the 2006 reform announcement on investment rates of income trusts while they remained in the income trust structure. The coefficient β_3 on the $post\_conv_{it}$ dummy describes any additional effects on investment rates of early conversion out of the trust structure to corporate form. The coefficient β_4 on the interaction term between the $trust_i$ dummy and $post\_2010_t$ shows any additional effects of the 2006 reform coming into force in 2011 on investment rates of (former) income trusts relative to corporations.

Recalling the cost of capital calculations associated with the 3 different tax regimes that have applied to income trusts over the analyzed time period, the equation I estimate also refers to the effects that changes in the cost of capital have on investment rates of firms with limited availability of retained earnings. The 2006 reform announcement has increased the cost of capital for income trusts relative to corporations significantly in the transition period. Upon conversion back to corporate structure, or in 2011, the cost of capital of income trusts has decreased relative to the transition period and aligned itself back with that of corporations. Further, either on conversion or in 2011, income trusts experienced an increase in their availability of retained earnings due to no longer having to distribute all their profits to unitholders.

Therefore β_2 will directly estimate the effects of the temporary increase in the cost of capital for firms with limited availability of retained earnings following the 2006 reform announcement. In turn, β_4 estimates the effects of changes in the cost of capital in conjunction with an increased availability of retained earnings.

I further explore heterogeneities between different types of income trusts. First, I consider heterogeneity in the response of the investment rates according to whether income trusts were more likely to be financially constrained. Second, I compare income trusts according to whether they were previously publicly traded or private companies. Third, I compare business income trusts with utility income trusts. To consider differing investment responses between different types of income trusts, I allow the coefficients in the baseline model to take two different values depending on the type of income trust. Therefore I estimate a triple difference-in-difference model. For comparisons between companies that were more likely to be financially constrained and those that were less likely to be financially constrained, I estimate the baseline model on two sub-samples and compare coefficients across those sub-samples.

Finally, I test the dynamic nature of the investment rate responses. Here, I allow the coefficients on the interactions between $trust_i$ dummy and $post\_TFP_t$ and $post\_2010_t$ to vary across years following the announcement or implementation of the reform. Therefore, I estimate a model in which the effects of the TFP reform (or announcement) could be different in each year following the reform (or announcement).

3.6 Results

3.6.1 Baseline estimates

Table 3.7 presents the results from estimating the two versions of the baseline model described above. I include year fixed effects in all specifications, industry fixed effects in columns 5 and 6 and firm fixed effects in columns 7 and 8. First, I focus on the coefficients on the interaction term between the $trust_i$ dummy and the $post\_TFP_t$ dummy, which will tell me how investment rates of income trusts changed after the reform announcement relative to investment rates of all corporations (columns 1-4), relative to corporations from the same sector (columns 5 and 6) or relative to their own investment before the reform announcement (columns 7 and 8).

Column 1 examines the differential effects of only the 2006 reform announcement on investment rates of income trusts. Column 2 introduces the effects of the reform coming into force in 2011 (interaction between $trust_i$ and $post\_2010_t$), while column 3 further introduces the $post\_conv_{it}$ dummy to isolate the effects of early conversions. Where indicated, the specifications include a set of control variables: logarithm of total assets and industry medians of investment, leverage, cash holdings and payouts.

Results from Table 3.7 indicate that income trusts before the 2006 reform had on average lower investment rates than comparable corporations (the coefficient on $trust_i$ is negative and significant across specifications). Choosing to forego access to internal finance was associated with lower investment rates for income trusts in Canada during the period.

Investment rates of income trusts did not react immediately to the 2006 reform announcement. The coefficient on the interaction term between $trust_i$ and $post\_TFP_t$ is insignificant in all specifications and its magnitude is also close to zero in most of them. This suggests that the 2006 reform announcement had no effect on investment rates of income trusts relative to corporations, both overall and within industries, as well as relative to their own previous investment, while they remained in the trust structure. This means that the anticipation of a higher corporate tax rate in the future and hence the higher cost of capital in the interim did not affect investment of income trusts with limited access to finance from retained earnings. This was the case for income trusts, as they distributed most of their cash to their shareholders and had little left available at the operating company level.

In contrast, I find that conversion to corporate structure and gaining access to internal finance was associated with an increase in investment rates of (former) income trusts. The coefficients on both the $post\_conv_{it}$ dummy and the interaction term between $trust_i$ and $post\_2010_t$ are significant and positive across most of the specifications. There was a strong positive effect of premature conversions to corporate structure on investment rates of income trusts (the coefficient on the $post\_conv_{it}$ dummy in columns 3 - 6 is positive and significant). However, this effect disappears when we compare post-conversion invest-

ment rates to pre-conversion investment rates of the same income trust (the coefficient on $post\_conv_{it}$ dummy is insignificant and close to zero in columns 7 and 8 where we control for firm-specific fixed effects) . Since the $post\_conv_{it}$ dummy could be endogenous, the estimates suggest a positive association between premature conversion and investment, but the relationship may not be causal.

In turn, the significance of the coefficient on the interaction term between $trust_i$ and $post\_2010_t$ suggests that investment rates of (former) income trusts have also increased after 2011, relative to corporations. The coefficient on this interaction term is significant even in the most demanding specification in column 8 with firm fixed effects and additional control variables. As argued above the effect of conversions to corporate form in 2011 on investment of (former) income trusts is more plausibly exogenous than the effect of premature conversions before 2011.

Ignoring early conversions, the cost of capital for (former) income trusts is lower after January 2011 than in the period 2007 - 2010, but not lower than in the period up to 2006. Therefore changes in the cost of capital for income trusts (relative to corporations) cannot explain why the investment rates should be relatively higher after 2010 than before 2006. However, in 2011 there no longer was a tax saving benefit to income trusts from distributing all their earnings to their shareholders. As a result income trusts have reduced their dividend payout ratios and increased their retained earnings (see Panel A in Figure 3.9). Therefore, the findings presented here are consistent with investment responding to having improved access to (low cost) internal finance. The results suggest that the effect of limited access to retained earnings can be binding for investment, as income trusts did not react to the 2006 reform announcement in spite of large changes in the cost of capital. In contrast, improved access to internal finance resulted in an immediate increase in investment rates, in spite of the cost of capital of income trusts being higher than before the 2006 reform announcement. The effect of access to low cost internal finance dominated that of the higher cost of capital.

Table 3.7: Baseline results.

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
trust	-0.048***	-0.048***	-0.048***	-0.047***	-0.056***	-0.052***		
	(0.015)	(0.016)	(0.016)	(0.010)	(0.011)	(0.010)		
trust*post_TFP	0.014	0.002	-0.004	0.000	0.011	0.007	0.011	-0.000
	(0.012)	(0.012)	(0.012)	(0.010)	(0.011)	(0.010)	(0.012)	(0.010)
post_conv			0.035***	0.034***	0.015*	0.023**	-0.006	0.007
			(0.013)	(0.009)	(0.009)	(0.009)	(0.012)	(0.011)
trust*post_2010		0.040***	0.046***	0.035***	0.031***	0.032***	0.019	0.025**
		(0.012)	(0.012)	(0.011)	(0.011)	(0.011)	(0.012)	(0.011)
Observations	2,404	2,404	2,404	2,403	2,404	2,403	2,404	2,403
R-squared	0.063	0.066	0.068	0.404	0.428	0.457	0.076	0.172
Controls	NO	NO	NO	YES	NO	YES	NO	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES
Industry FE	NO	NO	NO	NO	YES	YES	NO	NO
Firm FE	NO	NO	NO	NO	NO	NO	YES	YES

Note: Standard errors clustered at the firm level in parentheses, *** p<0.01, ** p<0.05, * p<0.1. Investment rates winsorized at 1 percent. Trust dummy equals 1 if a company was ever an income trust, postTFP is 1 from 2007 onwards, postconv equals 1 from the year a trust converts back to a corporation, if it is before 2011, it is zero otherwise. Post2010 is equal to 1 from 2011 onwards. Where indicated control variables included are lagged log total assets and industry median investment, payouts, cash holdings and leverage.

3.6.2 Heterogeneity of the estimated coefficients

Financially constrained vs non-financially constrained

In Table 3.8 I present results from estimating the baseline model for Canadian firms on two sub-samples. First, I estimate the model on the sample of firms that are more likely to be financially constrained; second, I estimate the model on the sample of firms that are less likely to be financially constrained. As a proxy for financial constraints I use whether income trusts had a below median ratio of dividends to total assets in 2011, the year the reform came into force[56]. I assume that trusts with below median ratios of dividends to total assets have retained more earnings to finance their investment.[57]

For the financially constrained income trusts, I would expect the effect of the income trusts tax reform coming into force on investment to be stronger than for those income trusts which are less likely to be financially constrained. Access to retained earnings is more important for financially constrained companies, since it is more costly or more difficult for them to access external sources to finance their investment.

In Table 3.8, columns 1-3 show the results for companies with above median payouts, while columns 1a-3a show the results for companies with below median payouts. The coefficients on the interaction term between $trust_i$ and $post\_2010_t$ are large, positive and significant only in the case of the sub-sample of income trusts with below median payouts in 2011. They are insignificant for the sub-sample of income trusts with above median payouts in 2011. These results indicate that it is primarily income trusts with below median distributions of dividends that have reacted to the implementation of the tax reform in 2011. These are also the income trusts which have increased their investment rates after premature conversion to corporate form. Further, the magnitudes of the coefficients on the interaction term between $trust_i$ and $post\_2010_t$ between the two sets of regressions are also significantly different from each other.

[56]These results also hold if I re-estimate using top and bottom quartiles of the distribution of payouts.

[57]The results using the ratios of dividends to net income are very similar (see Table 3.14 in the Appendix).

For income trusts that appear less likely to have been financially constrained, there is some evidence that they may have reduced investment rates in response to a temporary increase in the cost of capital in the period 2007 - 2010 (the coefficient on the interaction term between $trust_i$ and $post\_TFP_t$ is negative and significant at 10 % level in column 1 and negative, although not significant, in columns 2 and 3). This finding further supports the hypothesis that financing constraints may be binding.

Income trusts that were more likely to be financially constrained had stronger responses to the 2006 reform coming into force in 2011. These findings support the baseline results and show that investment rates of financially constrained firms responds to increases in the availability of retained earnings. Limited access to external sources of finance meant that financially constrained income trusts were more likely to rely on retained earnings to finance their investment. Hence, financing constraints may be binding for firms with limited access to retained earnings.

Previously public vs private income trusts

There are large differences in investment rates between income trusts that were previously publicly traded corporations and those that were previously private companies. The results in Table 3.9 explore this heterogeneity (columns 1-3). Investment rates of the previously publicly traded income trusts were not significantly different from those of corporations before the 2006 reform announcement (the coefficient on $trust_i$ is insignificant, at least in column 1, and only weakly significant in column 2). In turn, investment rates of the previously private income trusts were significantly lower than those of the previously publicly traded income trusts and as a consequence also significantly lower than those of comparable corporations (the coefficient on the interaction between $character_i$ and $trust_i$ is significantly negative in columns 1 and 2)[58].

Neither of the income trust types changed its investment rate significantly in response to the 2006 reform announcement. However, both types of income trusts increased their investment rates in response to the reform coming into force in 2011. The interaction

[58]Here the dummy variable $character_i$ takes the value one for previously private income trusts.

Table 3.8: Heterogeneity estimations: financially constrained firms.

VARIABLES	(1) above med pay	(2) above med pay	(3) above med pay	(1a) below med pay	(2a) below med pay	(3a) below med pay
trust	0.021	-0.002		-0.091***	-0.065***	
	(0.020)	(0.020)		(0.021)	(0.015)	
trust*post_TFP	-0.029**	-0.012	-0.011	-0.010	0.002	-0.020
	(0.014)	(0.012)	(0.011)	(0.017)	(0.016)	(0.018)
post_conv	0.018	0.001	-0.001	0.064**	0.029**	0.011
	(0.013)	(0.012)	(0.010)	(0.030)	(0.014)	(0.032)
trust*post_2010	0.017	0.015	0.021	0.093***	0.069***	0.048*
	(0.013)	(0.013)	(0.013)	(0.027)	(0.025)	(0.026)
Observations	1,262	1,262	1,262	1,142	1,141	1,141
R-squared	0.027	0.423	0.158	0.123	0.507	0.226
Controls	NO	YES	YES	NO	YES	YES
Year FE	YES	YES	YES	YES	YES	YES
Industry FE	NO	YES	NO	NO	YES	NO
Firm FE	NO	NO	YES	NO	NO	YES

Note: Standard errors clustered at the firm level in parentheses, *** p<0.01, ** p<0.05, * p<0.1. Investment rates winsorized at 1 percent. Trust dummy equals 1 if a company was ever an income trust, postTFP is 1 from 2007 onwards, postconv equals 1 from the year a trust converts back to a corporation, if it is before 2011, it is zero otherwise. Post2010 is equal to 1 from 2011 onwards. Where indicated control variables included are lagged log total assets and industry median investment, payouts, cash holdings and leverage. Columns 1 - 3 correspond to columns 3, 6 and 8 in the baseline results table. Columns 1-3 present estimates for high distribution firms, while columns 1a-3a present results for low distribution firms.

term between $trust_i$ and $post\_2010_t$ is significant, while the triple interaction with the $character_i$ dummy is insignificant. This suggests that investment rates of the previously publicly traded companies and the previously private companies did not react differentially to the income trusts tax reform coming into force. Therefore, in spite of being very different in terms of their initial investment rates, both types of income trusts react similarly to the 2006 reform announcement and implementation.

Business vs utility income trusts

Further, I consider heterogeneity between business and utility income trusts. Utility companies tended to have a business structure that generated steady and predictable sources of income. This makes the tax charge easy to anticipate and subsequently eliminate using

the leverage of the operating company. Further, these characteristics also made utility firms less likely to default on debt and hence relatively attractive to third party lenders. In turn, business income trusts came from various industries, some of which were growing fast and hence the tax charge was less predictable. They were generally thought of as being less suitable for the income trust structure (Aggarwal and Mintz (2004), Lefebvre and Goomar (2006), Halpern and Norli (2006)).

In columns 4 - 6 in Table 3.9 I focus on the differential reactions of business and utility income trusts to the 2006 reform[59]. First, utility income trusts had significantly lower investment rates than corporations from the same sectors (the $trust_i$ dummy in column 5 is significant and negative), but not relative to corporations on average (column 4). This suggests that utility income trusts might have operated in industries with higher investment rates on average. Second, business income trusts had significantly lower investment rates than utility income trusts and corporations on average (the interaction between $trust_i$ and $character_i$ in column 4 is negative and significant).[60]

Neither of the income trust types changed its investment rates after the 2006 reform announcement. However, again both types of income trusts increased their investment rates following the income trusts tax reform coming into force in 2011. There is no difference in the investment rate increases between business and utility income trusts (the triple difference-in-difference coefficient on the interaction term between $trust_i$, $post\_2010_t$ and $character_i$ in columns 4 - 6 is insignificant and very close to zero in magnitude). Hence, there is no differential effect of the 2006 reform on investment rates of business and utility income trusts.

[59]Here the dummy variable $character_i$ takes the value one for business income trusts.

[60]This does not hold within industries. This is to be expected since business and utility income trusts operated in different industries.

Table 3.9: Results: heterogeneity between business vs utility and previously private vs previously publicly traded income trusts.

VARIABLES	(1) private	(2) private	(3) private	(4) business	(5) business	(6) business
trust	0.004	-0.028*		0.015	-0.069***	
	(0.021)	(0.015)		(0.022)	(0.017)	
trust*post_TFP	-0.026	-0.005	0.000	-0.003	0.004	-0.003
	(0.017)	(0.014)	(0.013)	(0.020)	(0.017)	(0.018)
post_conv	0.024	0.024**	0.015	0.023	0.048***	0.027*
	(0.017)	(0.011)	(0.011)	(0.026)	(0.016)	(0.016)
trust*post_2010	0.038***	0.030**	0.024*	0.037**	0.037**	0.034**
	(0.014)	(0.014)	(0.014)	(0.019)	(0.017)	(0.017)
trust*character	-0.083***	-0.040**		-0.098***	0.026	
	(0.020)	(0.016)		(0.021)	(0.020)	
trust*post_TFP*character	0.035**	0.019	-0.001	0.013	0.003	0.004
	(0.016)	(0.014)	(0.015)	(0.020)	(0.017)	(0.019)
post_conv*character	-0.014	-0.018	-0.027	0.007	-0.038**	-0.030
	(0.019)	(0.016)	(0.024)	(0.027)	(0.018)	(0.020)
trust*post_2010*character	0.006	0.001	0.002	0.008	-0.008	-0.013
	(0.013)	(0.013)	(0.013)	(0.017)	(0.016)	(0.016)
Observations	2,404	2,403	2,403	2,404	2,403	2,403
R-squared	0.096	0.463	0.172	0.117	0.460	0.173
Controls	NO	YES	YES	NO	YES	YES
Year FE	YES	YES	YES	YES	YES	YES
Industry FE	NO	YES	NO	NO	YES	NO
Firm FE	NO	NO	YES	NO	NO	YES

Note: Standard errors clustered at the firm level in parentheses, *** p<0.01, ** p<0.05, * p<0.1. Investment rates winsorized at 1 percent. Trust dummy equals 1 if a company was ever an income trust, postTFP is 1 from 2007 onwards, postconv equals 1 from the year a trust converts back to a corporation, if it is before 2011, it is zero otherwise. Post2010 is equal to 1 from 2011 onwards. Where indicated control variables included are lagged log total assets and industry median investment, payouts, cash holdings and leverage. Character interaction term refers to either previosuly private income trusts, in columns 1-3, or business income trusts, in columns 4-6.

3.6.3 Dynamic responses to the reform

In this section I discuss results from estimating a more general specification in which I allow the effects of the 2006 reform announcement and implementation to vary over time. The previous specifications assumed that the 2006 reform announcement and subsequent implementation had permanent effects on investment rates, and estimated their average effects over the periods 2007 - 2010 and 2011-12 respectively.

In columns 1 and 2 in Table 3.10 I first test whether the TFP reform announcement might have had differential effect on the investment rates of income trusts across different years. I report results from estimations using firm and year fixed effects, which is the most demanding specification I use in the static version of the model. I define a set of impulse dummies that take the value 1 in one year and 0 in all other years; $post\_TFP\_1yr_t$ is 1 in 2007, $post\_TFP\_2yr_t$ is 1 in 2008, etc.[61] I interact those variables with the $trust_i$ dummy and find that the investment rates of income trusts declined in the first and second years after the TFP reform was announced. However, the effect is quite small and weakly significant only in the first year and only when the interaction terms for later years are omitted (column 2). In turn, in years 3 and 4 after the TFP reform (in 2009 and 2010) the investment rates of income trusts were marginally higher than those of corporations. This is why the average effect of the 2006 reform announcement over the period 2007 - 10 was found to be very close to zero in the static specifications.

In column 3 in Table 3.10 I explore whether the reform implementation in 2011 had a differential effect on the investment rates of income trusts in 2011 and 2012. I define $post\_2010\_1yr_t$ to be 1 in 2011 and $post\_2010\_2yr_t$ to be 1 in 2012; they are zero otherwise. I interact these time dummies with the $trust_i$ dummy and find that the investment rates of income trusts following the 2011 reform implementation increased in both 2011 and 2012. Further, these increases are of very similar magnitude in both years, suggesting that the effect of the implementation in 2011 was not a strictly temporary one. Increased

[61] Note that since the specification includes year fixed effects these dummies are redundant without the interaction with the $trust_i$ dummy.

access to retained earnings generated a persistent increase in the investment rates of income trusts (at least for the 2 years for which I have data).

In columns 4 and 5 in Table 3.10 I analyze whether premature conversions to corporate form had a differential effect on the investment rates of income trusts across different years. I define $post\_conv\_1yr_{it}$ to be 1 one year after an income trust converts to corporate form, $post\_conv\_2yr_{it}$ to be 1 two years after an income trust converts to corporate form, etc.; these are zero otherwise. The impulse dummies are individually and jointly insignificant, which suggests that there was no effect of premature conversions on the investment rates of income trusts in any of these years[62].

Finally, in column 6 in Table 3.10 I include all the dynamic effects in one specification. Again, I find that the investment rates of income trusts decreased in the first and second years after the TFP reform announcement and increased in the first and second years after the reform implementation. The coefficients on the interaction between $trust_i$ and $post\_2010\_1yr_t$ and $post\_2010\_2yr_t$ are jointly statistically significantly different from zero (with a p-value of 0.02) and also not statistically different from each other. This means that imposing a restriction on the coefficients on the interaction between $trust_i$ and $post\_2010\_1yr_t$ and $post\_2010\_2yr_t$ to be equal in column 6, results in the parameter estimate of 0.02 with standard error of 0.01 and a p-value of 0.06.

In Table 3.15 in the Appendix I use less restrictive specifications, without firm fixed effects, to investigate the robustness of the dynamic results. The strongest effect seems to be the increase in investment rates following the implementation of the 2006 reform in 2011. This again suggests that the increase in investment rates in 2011 is not a one-year spike, it persists in 2012 as well.

3.6.4 Robustness tests

In this section I show that the baseline results are more precisely estimated when I include a larger sample of comparable corporations and forego propensity score matching. I also show

[62]Note that I also found no significant effect on premature conversions in the corresponding static specification reported in column 8 of Table 3.7.

that the baseline estimates are quite robust to matching income trusts and corporations on the basis of various additional variables. Finally, I discuss how my results compare to those of Doidge and Dyck (2015), who also consider investment of Canadian income trusts.

In columns 1 - 3 in Table 3.11 I present baseline results that are run on the non-matched sample of income trusts and corporations. Here, instead of doing PSM in the first stage to find the most comparable corporations for each income trust, I perform a simple matching procedure. I exclude corporations that have total assets smaller than 22million CAD or operate in industries in which income trusts do not have any presence.[63] Since the sample size is much larger now, most of the coefficients are estimated more precisely. The main coefficients of interest on the interaction term between the $trust_i$ and $post\_2010_t$ dummies are still positive and significant. Their magnitude is also not that different from the estimates obtained in the baseline regressions on the propensity score matched sample. Further, the coefficients on the interaction term between $trust_i$ and $post\_TFP_t$ are still insignificant and close to zero (apart from column 1). This suggest that income trusts might have been operating in industries which were hit more by the financial crisis and hence their investment rates were lower after the 2006 reform announcement.

In columns 4 - 6 in Table 3.11 I show difference-in-difference estimates using a more limited sample of matched income trusts and corporations. In addition to matching on size and industry in the propensity score matching procedure, here I also include the market to book ratio and profitability in the probit regression.[64] Further, in columns 7 - 9, I include additional factors that the Canadian income trust literature has identified as possible determinants of why companies have chosen to be income trusts back before the 2006 reform was announced. These include cash flows, leverage, payouts, tangibility and tax rate. Arguably, the additional matching variables considered in columns 7 - 9 create quite a specific and unusual control group of corporations that I am now comparing income trusts to. For instance, corporations that have a low tax rate may be tax avoiders

[63] See distribution of size of corporations and income trusts in Figure 3.12 in the Appendix and distribution of income trusts and corporates across industries in Table 3.12 in the Appendix.

[64] For precise definitions of these variables see Appendix.

or may be making losses. Further, some of the variables that I match on in this extended PSM, such as leverage and payouts, are also financial choice variables that companies may determine jointly with their investment decisions. This could generate a bias in the difference-in-difference estimates as the control group is chosen based on having made similar financial choices to the treatment group of income trusts.

With these caveats in mind, the results from columns 4 - 9 broadly confirm the main findings from the baseline estimates. The effects of the 2006 reform announcement on the investment rates of income trusts are small and insignificant. In turn, the effects of the 2006 reform implementation in 2011 are stronger and positive.

Comparison to Doidge and Dyck (2015)

Doidge and Dyck (2015) is the closest paper to this work. Using data for the years 2007 - 2010 only, they estimate differential changes in investment rates during the period after the reform announcement, attributing all of the differences between income trusts and corporations over the analyzed period to the 2006 reform announcement.

If I estimate the baseline model that Doidge and Dyck (2015) estimate on my data and restrict the sample to years 2007 - 2010, I can replicate their results. Further, I use their specifications, include years 2011 - 2012 in the sample and estimate the differential effects of the tax reform implementation on changes in the investment rates of income trusts. I find that the tax reform implementation in 2011 had positive and significant effects on changes in the investment rates of income trusts. This is in line with the main findings presented in this chapter.

However, in this chapter, my preferred specification is the model which uses levels of investment rates rather changes to investigate the effects of the 2006 tax reform on investment of income trusts. Relative to my findings, Doidge and Dyck (2015) find no effects of conversion back to corporate structure on investment rates of income trusts. Their analysis stops in 2010, before most of the conversions to corporate form actually happened and before the tax reform was implemented in 2011. Therefore their estimates of the effects

of conversion to corporate form are comparable to my estimates of the effects of premature conversions on investment rates of income trusts. Further, their specifications are estimated using differences in investment rates rather than levels. Hence, they indirectly eliminate the firm fixed effects. This means that the most appropriate comparison would be to my specifications that control for firm fixed effects. In those specifications I also find no effect of early conversions to corporate form on investment rates of income trusts.

Finally, Doidge and Dyck (2015) find positive effect of the 2006 reform announcement on changes in the investment rates of income trusts. In contrast, in my firm fixed effects specifications I do not find a significant positive effect of the reform announcement on the investment rates of income trusts with or without PSM matching. If we consider the investment rates of income trusts and corporations over the period 2007-2010, in Figure 3.6 we can see that there was no change in the investment rates of income trusts in that period. In turn, investment rates of corporations decreased sharply. This may be why Doidge and Dyck (2015) find positive and significant effect of the 2006 reform announcement on changes in the investment rates of income trusts during their sample period.

Table 3.10: Results: dynamic effects of the 2006 reform on investment rates.

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)
trust*post_TFP_1yr	-0.013	-0.017*				-0.018*
	(0.011)	(0.009)				(0.009)
trust*post_TFP_2yr	-0.009	-0.014				-0.015
	(0.012)	(0.010)				(0.009)
trust*post_TFP_3yr	0.014					
	(0.014)					
trust*post_TFP_4yr	0.019					
	(0.013)					
trust*post_2010_1yr			0.023*			0.019
			(0.012)			(0.012)
trust*post_2010_2yr			0.023*			0.019
			(0.012)			(0.012)
post_conv _1yr				0.006	0.007	0.005
				(0.010)	(0.010)	(0.010)
post_conv _2yr				0.006	0.008	0.005
				(0.014)	(0.011)	(0.011)
post_conv _3yr				-0.032		
				(0.026)		
post_conv _4yr				0.015		
				(0.070)		
Observations	2,403	2,403	2,403	2,403	2,403	2,403
R-squared	0.174	0.173	0.171	0.172	0.172	0.173
Controls	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES
Industry FE	NO	NO	NO	NO	NO	NO
Firm FE	YES	YES	YES	YES	YES	YES

Note: Standard errors clustered at the firm level in parentheses, *** p<0.01, ** p<0.05, * p<0.1. Investment rates winsorized at 1 percent. Trust dummy equals 1 if a company was ever an income trust, PostTFP1yr takes the value 1 one year after the reform announcement, in 2007, postTFP2yr takes value 1 two years after the reform announcement, in 2008; post20101yr is 1 in 2011 and post20102yr is 1 in 2012; postconv1yr takes the value 1 one year after the income trust converts to corporate form, postconv2yr takes the value 1 two years after the income trust converts to corporate form etc. Where indicated control variables included are lagged log total assets and industry median investment, payouts, cash holdings and leverage.

Table 3.11: Results: robustness tests.

VARIABLES	(1) no PSM	(2) no PSM	(3) no PSM	(4) extra PSM	(5) extra PSM	(6) extra PSM	(7) full set PSM	(8) full set PSM	(9) full set PSM
trust	-0.035***	-0.042***		-0.040**	-0.045***		-0.023	-0.039***	
	(0.010)	(0.007)		(0.016)	(0.011)		(0.015)	(0.011)	
trust*post_TFP	-0.030***	-0.001	-0.002	0.007	0.012	0.007	-0.002	0.006	0.000
	(0.009)	(0.008)	(0.008)	(0.012)	(0.010)	(0.010)	(0.011)	(0.010)	(0.010)
post_conv	0.044***	0.036***	0.009	0.030**	0.021**	-0.001	0.031**	0.016*	-0.001
	(0.011)	(0.009)	(0.009)	(0.013)	(0.009)	(0.011)	(0.013)	(0.009)	(0.011)
trust*post_2010	0.037***	0.037***	0.029***	0.031***	0.020*	0.015	0.032***	0.020*	0.021**
	(0.008)	(0.008)	(0.008)	(0.011)	(0.011)	(0.011)	(0.010)	(0.010)	(0.010)
Observations	9,727	9,529	9,529	2,244	2,243	2,243	2,383	2,378	2,378
R-squared	0.027	0.269	0.080	0.056	0.450	0.156	0.039	0.446	0.119
Controls	NO	YES	YES	NO	YES	YES	NO	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES	YES
Industry FE	NO	YES	NO	NO	YES	NO	NO	YES	NO
Firm FE	NO	NO	YES	NO	NO	YES	NO	NO	YES

Note: Standard errors clustered at the firm level in parentheses, *** p<0.01, ** p<0.05, * p<0.1. Investment rates winsorized at 1 percent. Trust dummy equals 1 if a company was ever an income trust, postTFP is 1 from 2007 onwards, postconv equals 1 from the year a trust converts back to a corporation, if it is before 2011, it is zero otherwise. Post2010 is equal to 1 from 2011 onwards. Where indicated control variables included are lagged log total assets and industry median investment, payouts, cash holdings and leverage. No PSM referes to baseline results on the non-matched sample; extra PSM columns include profitability and market to book ratio as additional matching variables; full PSM columns include a full set of explanatory variables to determine the likelihood of becoming an income trust: log of total assets, market to book ratio, payouts, tax rate, cash holdings, tangibility, profitability and leverage.

3.7 Conclusion

In this paper I have shown that investment does not respond to changes in the cost of capital in a situation when firms have limited access to retained earnings. In turn, changes in the availability of low cost internal financing have large effects on investment. I show that an increase in the availability of retained earnings for (former) income trusts in Canada following the implementation of a tax reform in 2011 resulted in an increase in their investment rate, in spite of a concurrent increase in their cost of capital. This suggests that the effects of financing constraints dominated those of the cost of capital. These findings feed into the literature on the importance of the availability of low cost internal financing for the investment decisions of companies.

Further, the analysis of the 2006 reform episode in Canada has shown that the availability of retained earnings plays a larger role for financially constrained firms. It is only the firms that were more likely to be financially constrained that changed their investment rates in response to changes in both the cost of capital and the availability of retained earnings.

Finally, I show that the increase in the availability of retained earnings following the implementation of the income trusts tax reform in 2011 generates persistent effects on the investment rates of (former) income trusts. However, a persistent increase in investment rates may not necessarily be a beneficial outcome for the owners of firms. For instance, since income trusts were committed to distributing most of their earnings, any investment would have been financed using more expensive external sources of finance. Since this increased the cost of investment, it also may have meant that the income trust structure invested only in very profitable projects. The availability of additional low cost internal financing may increase investment in less profitable projects with lower returns. This could lead to wasteful investment for firms which used to be income trusts, particularly, if the interests of owners and managers are not well aligned.

3.8 Appendices

3.8.1 How did companies convert to income trusts?

The general mechanism of setting up an income trust usually starts with the management of an existing company proposing the structure to the company shareholders. Subject to their approval a Canadian resident income trust is set up as a separate entity, which sells its units to the public via an offering. The trust is controlled by a group of trustees and is established for the benefit of investors who are its beneficiaries, and whose interests in the trust capital and income are represented by their ownership of publicly issued units in the trust (Mintz and Richardson (2006)). The proceeds gathered from the public offering are used to acquire subordinated debt and common shares of the operating company (usually third party loans such as bank loans remain in the hands of the operating company). The underlying company can be a previously private company or income producing assets such as real estate.[65]

3.8.2 Why did companies convert to income trusts?

Income trusts were a controversial subject in Canada at the beginning of this century. The opinions on benefits and disadvantages of the income trust structure have varied amongst the policy makers and the public opinion. Some say that income trusts have brought about investment gains and helped the stagnating market boom (Hayward (2002), Aggarwal and Mintz (2004), Glew and Johnson (2011), Elayan *et al.* (2009), Doidge and Dyck (2015), Hudec and Rogers (2004), Wang (2006)). Some say that they have caused big tax leakages for Canadian tax revenues and hampered growth by reducing investment (Aggarwal and Mintz (2004), Tait and Lawford (2007)). Many authors seem to agree that the income trust structure has no added benefits apart from the tax saving advantage (Edgar (2004), Alarie and Iacobucci (2007)). Specifically, Iacobucci (2013) points out that the fact the 2006 reform has almost eliminated income trusts from Canadian markets, means that

[65]For a detailed analysis of an example of income trust IPO - General Donlee, which was a private company before doing an IPO as an income trust - see Hayward (2002).

even though they utilized some of the benefits of choosing their own governance form, this clearly was not the driving factor for choosing to convert into income trust structure.[66]

Generally, a decision of a company to convert to an income trust or to use an income trust as a means of public offering is a complex one. Most of the companies at the time seemed to have been driven by the prospect of liquidity at an attractive price (see the survey by Hudec and Rogers (2004)). This was especially beneficial for companies with large debt, who could obtain large amounts of cash without having to give up the control of management and decision making. What is more, Tait and Lawford (2007) suggest that the pressure from investors might have contributed to firms being forced into income trust structure to maximize shareholder value.[67]

There is obviously a cost to converting to an income trust, which varied from $200,000 to $110,000,000 (see Iacobucci (2013)). This cost as a percentage of total market capitalization of these companies ranged from 0.02% to 6.9% (only 6 conversions were more than 1%). Part of this cost is certainly the investment banking industry fees. Jog and Wang (2004) estimate that these have amounted to $800 million in the years 2001 - 2003. This clearly indicates that the conversions from standard corporations as well as income trust IPOs were a very good deal for the investment banks and encouragement on their side for companies to use this structure could not be neglected.

The fact that some firms used the structure to gather funds, while some seemed pressed to convert in spite of their misgivings, seems to suggest that some companies could have benefited from the structure more than others. The question that a large body of the Canadian tax law literature explores is what are the characteristics that make a business

[66]The income trust structure allows owners of a taxable corporation to retain many of the non-tax advantages of the corporate form while avoiding payments of corporation tax. Specifically, units have attributes of ordinary common shares in that each carries a right to vote and to receive distributions. What is more, annual meetings of unitholders are held during which trustees are elected, auditors are appointed and other matters are discussed. Finally trustees have rights and obligations similar to those of directors of ordinary corporations (Hayward (2002), Mintz and Richardson (2006)).

[67]The authors of this paper discuss an enormous relief that some of the directors and CEOs of companies felt after the 2006 reform was announced. They cite a high profile CEO who said that companies were under increasing pressure to use the income trust structure.

suitable to become an income trust (Aggarwal and Mintz (2004), Lefebvre and Goomar (2006), Halpern and Norli (2006)). The best candidates are operating companies with relatively stable operating cash flows and minimal need for new investment. These companies display no cyclicality, have very limited existing or potential competition, have mature products in mature markets, exhibit low levels of fixed and variable costs, and have more than one revenue stream containing some degree of diversification.[68] These characteristics imply that these companies have very predictable tax charges which is a key aspect in eliminating the taxation at the operating company level. Importantly, these theoretically conducive characteristics seemed to be also displayed by converting companies in practice. For instance, Pazzaglia *et al.* (2005) find that the companies converting to income trusts had higher market to book ratios and higher profitability than non-converting companies.[69]

The best suited candidates for the income trust structure were real estate and utility type trusts. However, later conversions in spite of being from other types of businesses, also display some of the listed characteristics; for example restaurants, sugar producers or transport companies might not be ideal candidates for this type of structure, but they possess some of the desirable characteristics such as mature products.[70] The biggest worry in Canada in 2005 and 2006 was that the income trust structure became so popular that even businesses that did not have any characteristics conducive to being a good income trust started converting to the structure.

[68]NB. These are also the characteristics which allow leverage to be high for traditional corporations.

[69]NB. These characteristics could be associated with higher market power, rather than with better growth opportunities.

[70]Non-traditional income trust offerings include for example: Connors Brothers Income Fund (a sardine cannery), A &W Revenue Royalties Income Fund (a restaurant), Keg Royalties Income Fund (a restaurant), Sun Gro Horticulture Income Fund (a distributor of peat moss), Davis + Henderson Income Fund (a cheque printer), Versacold Income Trust (an operator of refrigerated warehousing, distribution, and related businesses), General Donlee Income Fund (a manufacturer of precision-machined products for the military, aerospace, and other commercial industries), Swiss Water Decaffeinated Coffee Income Fund (a coffee producer), Prime Restaurants Royalty Income Fund (a restaurant).

3.8.3 Why not a traditional IPO?

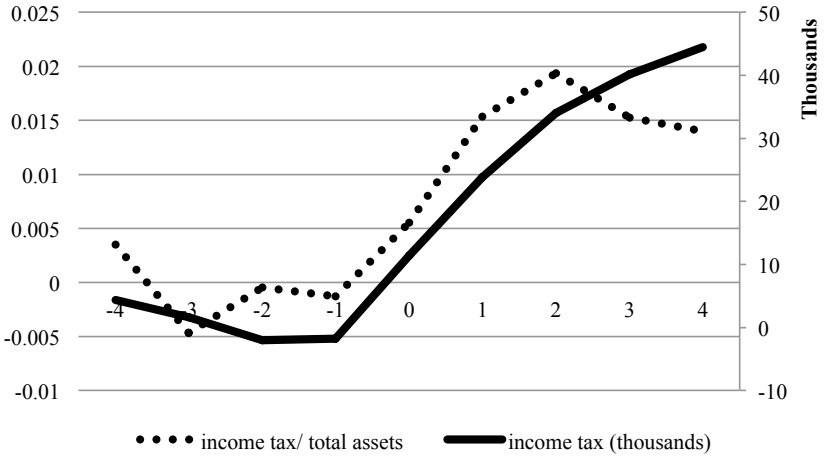
A similar structure that yields similar tax benefits to an income trust can of course be achieved by any company using a combination of related-party debt and equity. For example, in the "closely held company" setting, where there are few shareholders, owners can lend to companies in order to reduce the corporate tax liability. However, Canada, as many other countries, has anti-avoidance rules for "closely held companies" designed to prevent owners lending to companies in order to reduce corporate income tax (CIT) liability.[71] The high levels of related-party debt required to reduce taxable profits are more difficult to coordinate when there are many shareholders - i.e. in the "widely held company" setting. Income trusts seem intended to make the closely-held companies form of CIT avoidance available to more widely held companies. The lack of legislation to govern this particular form of tax avoidance seems to be an important omission and possibly a motivation for later reforms.

Another advantage of an income trust IPO over a traditional IPO is that the income trust structure internalizes the distinction between shareholders and debtholders by making them the same people. This is achieved by so called "stapled financing", which combines debt and equity into a single security - a unit, which pays out a combination of interest and dividends. This means that the operating company can handle large amounts of internal debt to create a tax shelter without risk of default or bankruptcy. For example, if the operating company has lower cash flow and cannot make interest payments as they become due, the trust can renegotiate the debt terms by lowering interest payments in a manner that preserves value without entering into costly bankruptcy proceedings. Furthermore, by the fact that shareholders and debtholders are the same people, the incentives of the underlying company to make unprofitable, value reducing investments are lower.[72]

[71] General Anti Avoidance Rules (GAAR) provisions were introduced in Canadian jurisdiction in 1988.

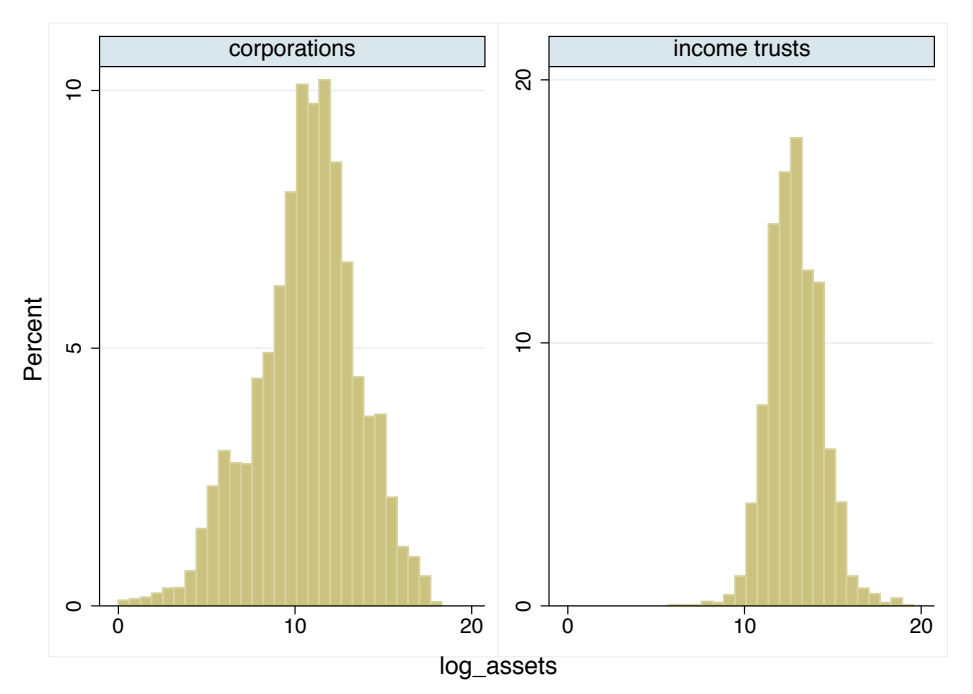
[72] In Canada, before 2006, the thin capitalization rules which are intended to limit the ratio of debt to equity only applied to Canadian corporations, but not to partnerships or income trusts. Since then the rules have been tightened.

Figure 3.11: Tax payments of income trusts around conversion to corporate form.



Note: Mean income taxes payable and income tax divided by total assets, balanced panel. Year 0 corresponds to the calendar year in which an income trust converted to corporate form. Only income trusts from the matched sample included here. Right hand side axis refers to income tax in thousands of CAD, left hand side axis refers to the ratio of income tax to total assets. Source: Datastream.

Figure 3.12: Size distributions - corporate and income trusts comparison.



Note: Size distribution plots are after dropping industries in which trusts do not operate. Log assets refers to logarithm of total assets in millions of 2006 Canadian dollars. These distributions were constructed using data for the year 2006. Source: Datastream.

Table 3.12: Datastream industry codes, corresponding names and number of income trusts and corporates in each industry. Source: Datastream data.

industry name	industry code	income trusts	corporates
Building Mat.& Fix.	30	7	47
Gas Distribution	31	1	19
Industrial Suppliers	32	2	13
Specialty Chemicals	33	3	41
Computer Hardware	34		17
Farm Fish Plantation	35	2	14
Home Construction	36		5
Electrical Equipment	37		31
Forestry	38	2	28
Heavy Construction	39	1	18
Delivery Services	40	1	6
Media Agencies	41	1	17
Consumer Finance	42	1	4
Industrial Machinery	43	3	55
Defence	44		6
Healthcare Providers	45	2	21
Financial Admin.	46	1	7
Waste, Disposal Svs.	47	1	15
Personal Products	48		3
Coal	49	2	35
Exploration & Prod.	50	39	701
Oil Equip. & Services	51	21	163
Pipelines	52	4	18
Nonferrous Metals	54	2	142
Recreational Services	55	1	15
Iron & Steel	56	1	37
Electronic Equipment	57		43
Software	58	1	145
Dur. Household Prod.	59	1	6
Furnishings	60	2	22
Toys	61		15
Nondur.Household Prod	62	1	7
Auto Parts	63	1	17
Transport Services	64	6	13
Automobiles	65		3
Apparel Retailers	66		11
Brewers	67	3	12
Distillers & Vintners	68		5
Clothing & Accessory	69		13
Containers & Package	70	1	14
Food Products	71	8	50
Restaurants & Bars	72	10	27
Renewable Energy Eq.	74		12
Consumer Electronics	75		6
Investment Companies	77	1	49
Plat.& Precious Metal	78		76
Tobacco	79		2
Hotels	80		8
Paper	82	3	26
Alternative Fuels	83		11
Publishing	84	3	37
Business Support Svs.	86	12	84
Broadline Retailers	87	2	14
Food Retail,Wholesale	88	3	18
Diamonds & Gemstones	89		39
Specialty Retailers	90	5	27
Multiutilities	91	2	5
Commodity Chemicals	92		21
Aluminium	93		7
Travel & Tourism	94	1	8
Pharmaceuticals	95		43
Alt. Electricity	96	6	23
Integrated Oil & Gas	97		18
Aerospace	98	1	15
Marine Transportation	99	1	4
Gambling	100	3	13
Divers. Industrials	101	1	15
Banks	102		20
Medical Supplies	103	1	7
Asset Managers	104		26
Life Insurance	106		12
Prop. & Casualty Ins.	107		13
Insurance Brokers	108		4
Investment Services	111	2	22
Real Estate Hold, Dev	112	6	74
Specialty Finance	113	4	245
Soft Drinks	114		9
Broadcast & Entertain	115	5	49
Unclassified	116		91
Comm. Vehicles,Trucks	117	2	14
Gold Mining	119		424
Drug Retailers	120		4
General Mining	122		609
Telecom. Equipment	126	1	58
Unquoted equities	127	5	139
Airlines	129	2	13
Semiconductors	130		20
Trucking	131	3	13
Medical Equipment	132	1	33
Full Line Insurance	141		4
Fixed Line Telecom.	142	2	26
Mobile Telecom.	143		12
Water	144		5
Computer Services	150	1	35
Internet	151		25
Mortgage Finance	152	3	22
Recreational Products	155	1	3
Spec.Consumer Service	156	4	19
Biotechnology	157		92
Exchange Traded Funds	159		1
Ind. & Office REITs	160	13	35
Retail REITs	161	8	19
Residential REITs	162	5	22
Diversified REITs	163	2	13
Specialty REITs	164		2
Hotel & Lodging REITs	166	5	12
Con. Electricity	169	7	23

3.8.4 Cost of capital calculations

In this section I present a detailed derivation of the cost of capital for each asset type for years 2003 - 2012. Let me first consider investment in buildings. In Canada in years 2003 - 2012 buildings could be depreciated at 0.04 percent in the first year and at 0.02 percent from year 2 onwards. Further, they were subject to declining balance depreciation schedule. Suppose that ϕ_1 is depreciation rate in the first year, while ϕ_2 is depreciation rate in the second year and following years. Hence, the net present value of capital allowances for a unit investment in buildings for a company subject to the statutory corporate tax rate, τ, in Canada is:

$$A_{DB} = \tau\phi_1 + \tau\phi_2 \frac{1-\phi_1}{\rho+\phi_2} \tag{3.5}$$

This corresponds to scenario 3, when income trusts were taxed at the statutory tax rate. This is also the net present value of capital allowances for investment in buildings by corporations throughout the analysis period. In case of income trusts before the 2006 reform announcement, since the effective corporate tax rate, τ, was zero, A_{DB} was also zero.[73]

In the transition period for an investment in buildings at the beginning of 2007, an income trust that converted to corporate form in 2011 was claiming capital allowances against a zero corporate tax rate, τ_1, until 2010, i.e. for 4 years, and against the statutory corporate tax rate, τ_2, from 2011 onwards. This means that the net present value of its capital allowances was:

$$A_{DB,07} = \tau_1\phi_1 + \tau_1\phi_2\{\frac{1-\phi_1}{1+\rho} + \frac{(1-\phi_1)(1-\phi_2)}{(1+\rho)^2} + \frac{(1-\phi_1)(1-\phi_2)^2}{(1+\rho)^3}\} \tag{3.6}$$

$$+\tau_2\phi_2\{\frac{(1-\phi_1)(1-\phi_2)^3}{(1+\rho)^4} + ...\} \tag{3.7}$$

[73] I assume that the November 2006 reform announcement was unanticipated, so the cost of capital calculations for 2003 - 2006 assume $\tau = 0$ indefinitely.

where ρ is the shareholders discount rate, which in the absence of personal taxes is equal to the nominal interest rate[74]. If we assume that unused depreciation allowances in initial years cannot be carried forward, then for the case where τ_1 is zero this becomes:

$$A_{DB,07} = \tau_2\phi_2\{\frac{(1-\phi_1)(1-\phi_2)^3}{(1+\rho)^5} + ...\} \tag{3.8}$$

$$= \tau_2\phi_2\frac{1-\phi_1}{\rho+\phi_2}\left(\frac{1-\phi_2}{1+\rho}\right)^3 \tag{3.9}$$

Similar calculations lead to the net present value of capital allowances for investment in buildings in years 2008 - 2010 to be the following:

$$A_{DB,08} = \tau_2\phi_2\frac{1-\phi_1}{\rho+\phi_2}\left(\frac{1-\phi_2}{1+\rho}\right)^2 \tag{3.10}$$

$$A_{DB,09} = \tau_2\phi_2\frac{1-\phi_1}{\rho+\phi_2}\left(\frac{1-\phi_2}{1+\rho}\right) \tag{3.11}$$

$$A_{DB,10} = \tau_2\phi_2\frac{1-\phi_1}{\rho+\phi_2} \tag{3.12}$$

For investment in intangible assets, the calculations are very similar since the approved depreciation method for intangibles in Canada was also declining balance. The only difference is that there was no first year accelerated allowance for intangibles, hence $\phi_1 = \phi_2$.

Calculating the net present value of capital allowances for machinery is more complicated since there was a tax reform in Canada in 2008, which changed the depreciation schedule for machinery from declining balance with first year accelerated allowance to the straight line method, at 50% rate in each of the two years the asset was allowed to depreciate over.

Therefore, the net present value of capital allowances for investment in machinery in years 2003 - 2007 is calculated the same way as for buildings. Hence, in years 2003 - 2006 it is zero, while in 2007 it corresponds to the formula used to calculate is $A_{DB,07}$. In 2008,

[74] Assuming that the real interest rate, r, is 0.05 and inflation, π, is 0.025, $\rho = (1+r)*(1+\pi)-1 \Rightarrow \rho = 0.07625$

the investment in machinery was allowed to depreciate at 50 percent rate per year over two years, $\phi = 0.5$. Hence, the net present value of capital allowances claimed against a zero corporate tax rate, $\tau_1 = 0$, in both 2008 and 2009 was:

$$A_{SL,08/09} = \tau_1\phi + \frac{\tau_1\phi}{1+\rho} = 0 \tag{3.13}$$

While in 2010, when capital allowances were claimed against a zero corporate tax rate, $\tau_1 = 0$, in 2010, but against the statutory corporate tax rate, τ_2, in year 2011, the net present value of capital allowances was:

$$A_{SL,10} = \tau_1\phi + \frac{\tau_2\phi}{1+\rho} = \frac{\tau_2\phi}{1+\rho} \tag{3.14}$$

In years 2011 onwards, the net present value of capital allowances for income trusts and corporations was calculated following the standard approach, as the allowances were claimed against the statutory corporate tax rate for both types of companies. Hence, the net present value of capital allowances for a unit of investment in machinery, using the top statutory tax rate, τ_2, in each year, was the following (where $T = 2$)

$$A_{SL,11} = \tau_2\phi\left\{1 + \left(\frac{1}{1+\rho}\right)\right\} = \tau_2\phi\left(\frac{2+\rho}{1+\rho}\right) \tag{3.15}$$

3.8.5 Variable definitions

The main variable of interest in this chapter is a rate of investment. In baseline specifications I define it as capital expenditures[75] divided by last year's total assets. Possible alternatives would be to use the sum of capital expenditures and acquisitions[76] divided

[75]In Datastream capital expenditures are defined as funds used to acquire fixed assets other than those associated with acquisitions. It includes but is not restricted to: additions to property, plant and equipment and investments in machinery and equipment.

[76]In Datastream acqusitions represent assets acquired through pooling of interests or mergers. It does not include capital expenditures of acquired companies. It includes but is not restricted to: net assets of acquired companies, additions to fixed assets from acquisitions, working capital of companies acquired, excess of cost of acquired companies, discount on acquisitions. Income trusts are observed to make on average larger acqusitions than corporations in similar sectors and of similar size.

by last year's total assets, or capital expenditures divided by last year's fixed assets. The control variables are defined as follows:

- payouts: total dividends (or distributions in case of income trusts) paid divided by current year total assets
- cash holdings: cash and short term investments divided by current year total assets
- market to book ratio: short term debt plus long term debt plus market capitalization divided by current year total assets
- cash flow: net income before extraordinary items plus depreciation and amortization divided by current year total assets
- leverage: short term external debt plus long term external debt divided by current year total assets
- net working capital (NWC): current assets minus cash minus current liabilities divided by current year total assets
- (gross) profitability: net operating income plus depreciation and amortization divided by current year total assets
- tangibility: net PPE divided by current year total assets, where net PPE is gross property, plant and equipment minus accumulated reserves for depreciation, depletion and amortization.

Table 3.13: Descriptive statistics: income trusts vs corporations after PSM.

stats	income trusts	corporates
income taxes	8,069	60,183
total assets	1,193,071	2,279,175
net sales	447,558	1,662,779
net income	69,626	118,604
income taxes/ total assets	0.00	0.02
investment rate	0.11	0.37
investment rate 2	0.27	0.49
cash holdings	0.02	0.09
payouts	0.08	0.01
leverage	0.22	0.21
cash flows	0.11	0.10
market to book ratio	1.43	1.55
profitability	0.10	0.08
net working capital	0.01	0.07
tangibility	0.43	0.45

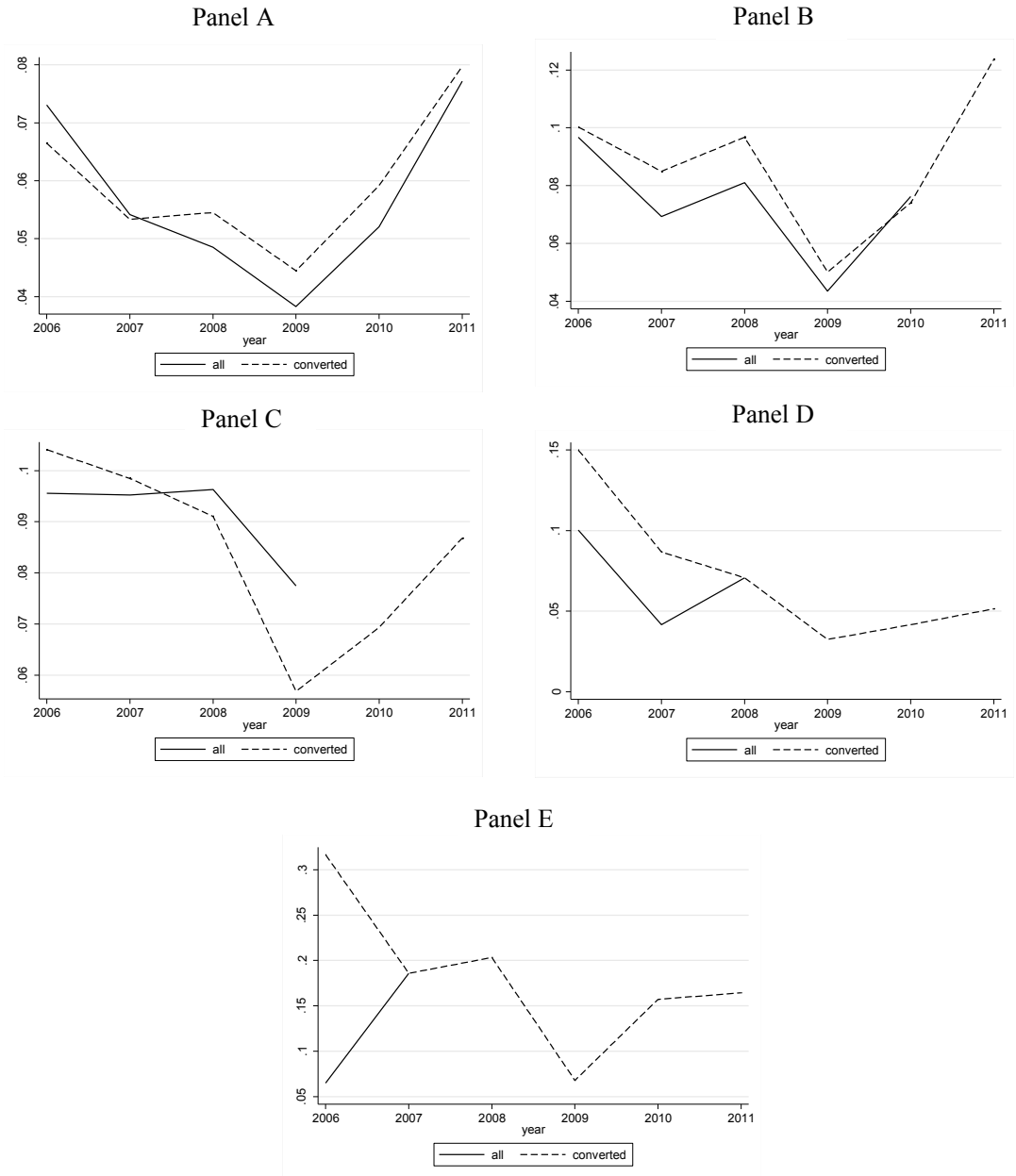
Note: Means for income trusts and corporations is calculated for 2005. I only include corporations from industries where income trusts also have a presence. I further limit the sample to include only firms with total assets larger than 20 million CAD, with investment rates and leverage below 10, and with market to book ratio below 100. The first four rows are in levels in thousands of 2005 Canadian dollars (income tax, total assets, net sales and net income), the remaining rows are ratios, where investment rate is capital expenditures divided by last year's total assets, investment rate 2 is capital expenditure plus acquisitions divided by last year's total assets, while the remaining ratios are all scaled by current year total assets. Cash holdings is cash and short term investments, payouts is total distributions, leverage is short term plus long term debt, cash flows is net income before extraordinary items plus depreciation and amortization, market to book ratio is short term debt plus long term debt plus market capitalization, profitability is net operating income plus depreciation and amortization, net working capital is current assets minus cash minus current liabilities, tangibility is gross property plant and equipment minus accumulated depreciation. Source: Datastream.

Table 3.14: Heterogeneity estimations: financially constrained firms. Robustness.

VARIABLES	(1) above med pay	(2) above med pay	(3) above med pay	(1a) below med pay	(2a) below med pay	(3a) below med pay
trust	0.016	-0.007		-0.078***	-0.064***	
	(0.020)	(0.020)		(0.021)	(0.014)	
trust*post_TFP	-0.020	-0.005	-0.004	-0.013	0.000	-0.018
	(0.015)	(0.013)	(0.012)	(0.016)	(0.014)	(0.016)
post_conv	0.028*	0.009	-0.001	0.041*	0.020	0.012
	(0.015)	(0.013)	(0.011)	(0.024)	(0.013)	(0.023)
trust*post_2010	0.019	0.015	0.021	0.069***	0.049**	0.037*
	(0.014)	(0.014)	(0.014)	(0.021)	(0.020)	(0.020)
Observations	1,105	1,105	1,105	1,299	1,298	1,298
R-squared	0.024	0.441	0.143	0.111	0.496	0.214
Controls	NO	YES	YES	NO	YES	YES
Year FE	YES	YES	YES	YES	YES	YES
Industry FE	NO	YES	NO	NO	YES	NO
Firm FE	NO	NO	YES	NO	NO	YES

Note: Standard errors clustered at the firm level in parentheses, *** p<0.01, ** p<0.05, * p<0.1. Investment rates winsorized at 1 percent. Trust dummy equals 1 if a company was ever an income trust, postTFP is 1 from 2007 onwards, postconv equals 1 from the year a trust converts back to a corporate form, if it is before 2011, it is zero otherwise. Post2011 is equal to 1 from 2011 onwards. Where indicated control variables included are lagged log total assets and industry median investment, payouts, cash holdings and leverage. Columns 1 - 3 correspond to columns 3, 6 and 8 in the baseline results table. Columns 1-3 present estimates for income trusts with high dividends to net income ratios, while columns 1a-3a present results for income trusts with low dividends to net income ratios.

Figure 3.13: Investment rates by year of exit: pairwise comparisons.



Note: Mean investment over previous year's total assets calculated for income trusts by the year in which they exited the trust status. Panels A - E correspond to conversion dates, Panel A: 2011, Panel B: 2010, Panel C: 2009, Panel D: 2008, Panel E: 2007. For example, Panel C shows the yearly evolution of the mean investment rate of all income trusts which ceased to be income trusts in 2009 (solid line) and yearly evolution of the mean investment rate for income trusts which converted to corporate form in 2009 (dashed line). All data winsorized at 1 percent. Source: Datastream.

Table 3.15: Results: dynamic effects of the 2006 reform on investment rates. Robustness.

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
trust*post_TFP_1yr	-0.026**	-0.012					-0.027**	-0.013
	(0.011)	(0.010)					(0.011)	(0.010)
trust*post_TFP_2yr	-0.020*	-0.010					-0.021*	-0.011
	(0.011)	(0.010)					(0.011)	(0.010)
trust*post_2010_1yr			0.047***	0.034***			0.038***	0.035***
			(0.013)	(0.013)			(0.014)	(0.013)
trust*post_2010_2yr			0.042***	0.029**			0.034**	0.029**
			(0.013)	(0.012)			(0.014)	(0.013)
post_conv_1yr					0.032**	0.015	0.029**	0.017
					(0.013)	(0.011)	(0.014)	(0.011)
post_conv_2yr					0.031*	0.026*	0.028	0.027*
					(0.018)	(0.014)	(0.018)	(0.014)
Observations	2,404	2,403	2,404	2,403	2,404	2,403	2,404	2,403
R-squared	0.069	0.457	0.067	0.457	0.067	0.457	0.068	0.457
Controls	NO	YES	NO	YES	NO	YES	NO	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES
Industry FE	NO	YES	NO	YES	NO	YES	NO	YES
Firm FE	NO	NO	NO	NO	NO	NO	NO	NO

Note: Standard errors clustered at the firm level in parentheses, *** p<0.01, ** p<0.05, * p<0.1. Investment rates winsorized at 1 percent. Trust dummy equals 1 if a company was ever an income trust, PostTFP1yr takes the value 1 one year after the reform announcement, in 2007, postTFP2yr takes value 1 two years after the reform announcement, in 2008; post20101yr is 1 in 2011 and post20102yr is 1 in 2012; postconv1yr takes the value 1 one year after the income trust converts to corporate form, postconv2yr takes the value 1 two years after the income trust converts to corporate form etc. Where indicated control variables included are lagged log total assets and industry median investment, payouts, cash holdings and leverage. Columns 1, 3, 5 and 7 include no additional fixed effects and no controls, columns 2,4,6 and 8 include industry fixed effects and additional control variables.

Chapter 4

With which countries do tax havens share information?

with Clemens Fuest[1]

Abstract

In recent years tax havens and offshore financial centres have come under increasing political pressure to cooperate with other countries in matters of taxation and efforts to crowd back tax evasion and avoidance. As a result many tax havens have signed tax information exchange agreements (TIEAs). In order to comply with OECD standards tax havens are obliged to sign at least 12 TIEAs with other countries. This paper investigates how tax havens have chosen their partner countries. We ask whether they have signed TIEAs with countries to which they have strong economic links or whether they have systematically avoided doing this, so that information exchange remains ineffective. We analyze 565 TIEAs signed by tax havens in the years 2008–2011 and find that on average tax havens have signed more TIEAs with countries to which they have stronger economic links. Our analysis thus suggests that tax havens do not systematically undermine tax information exchange by signing TIEAs with irrelevant countries. However, this does not mean that they exchange information with all important partner countries.

[1]This is author's version of an already published paper. The original paper has been published in *International Tax and Public Finance,* April 2014, Volume 21, Issue 2, pp. 175-197.

4.1 Introduction

In recent years, tax havens have been put under increasing political pressure to cooperate with high tax countries in efforts to reduce tax evasion and tax avoidance. One particular area of concern is the exchange of information for tax purposes. A recent example for this trend is a statement made by the G20 at its London summit in April 2009:

> "We call on countries to adopt the international standard for information exchange...
>
> We stand ready to take agreed action against those jurisdictions which do not meet international standards in relation to tax transparency." G20 (2009), p.4

The fact that the G20 has put the issue of tax havens and offshore financial centres to the top of the international political agenda is the result of various developments. First, the G20 initiative reflects that the financial crisis and the worldwide recession which started in 2008 has placed a huge burden on government finances, so that efforts to crowd back tax evasion and collect revenue are necessary. At the same time, tax havens and offshore financial centres are seen to have contributed to the crisis by allowing financial institutions to escape financial regulation and supervision. Transparency in taxation and regulation are widely considered as mutually reinforcing.

Second, there is an ongoing debate about the implications of international tax competition for government finances. Starting with a report launched in 1998, the OECD has argued that certain forms of tax competition are harmful for the world economy as a whole because they undermine government finances.[2] Cases where countries seem to attract investors by offering bank secrecy and protection against information exchange in tax matters are seen as one important form of harmful tax competition. The reason is that this practise allows investors residing in high tax countries to evade taxes.[3] In order

[2]The EU has also launched an initiative against tax practices which are seen as harmful, which has led to a 'code of conduct' in business taxation, see EU (1999). The focus of this code of conduct is on special tax regimes offered to multinational firms. For a critique of this approach see Keen (2001).

[3]Along similar lines the EU has taken initiative for more effective enforcement of taxes on capital income by introducing automatic information exchange for tax purposes and source taxes

to encourage the exchange of tax information between countries the OECD has created the 'Global Forum on Transparency and Exchange of Information for Tax Purposes'. The Forum includes both OECD member countries and non OECD countries. Its role is to provide a framework for international cooperation in the area of exchange of tax information.[4]

Many tax havens[5] have reacted to this political pressure by changing their policies with regard to bank secrecy and information exchange. Between 2000 and 2002 most of them made formal commitments to comply with the standards developed by the OECD. In 2002 the OECD published a 'black list' of seven jurisdictions which refused to make these commitments.[6] Since then all of these jurisdictions have agreed to comply with the standards. As part of these standards countries are expected to sign tax information exchange agreements (TIEAs) with other countries. TIEAs are particularly important in cases where no double taxation agreements exist because double taxation agreements often include arrangements for information exchange. Currently tax havens are required to sign a minimum of 12 TIEAs in order to avoid being put on the list of uncooperative jurisdictions. Figure 4.1 illustrates the expansion in the number of TIEAs since the year 2000. The total number of TIEAs signed in this period was 600.[7] Among these agreements, 565 are cases where at least one of the two partners is a tax haven.

within the European Union through its directive for the taxation of savings (Council Directive 2003/48/EC). For assessments of the impact of the directive see Hemmelgarn and Nicodeme (2009), Johannesen (2014) and Klautke and Weichenrieder (2010).

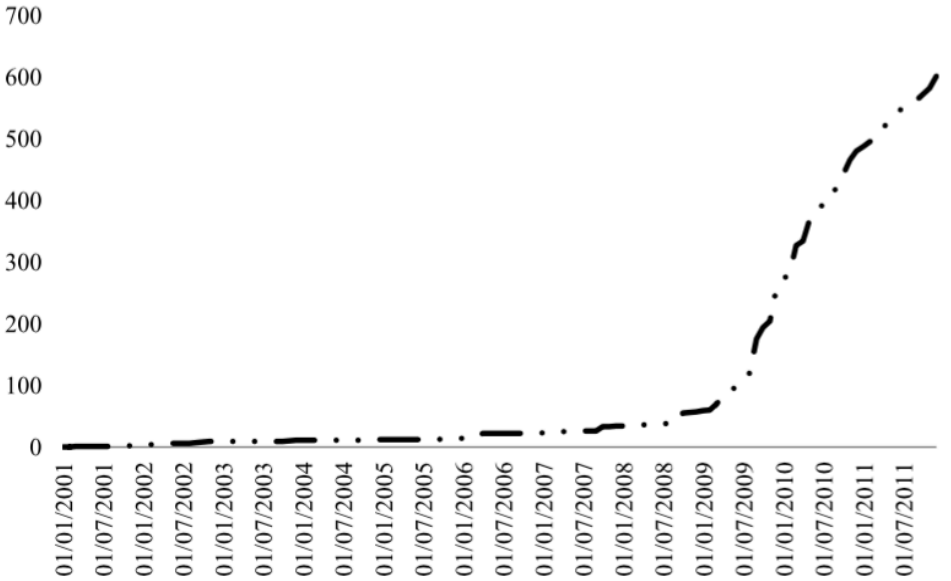
[4]There are at least two additional important factors driving the move towards more information exchange. First, after the terrorist attacks on the United States on September 11, 2001, the US started to take action against offshore financial centres in order to make sure that these centres implement effective measures against terrorism financing and money laundering. Second, various spectacular cases of tax evasion were detected because employees of banks stole data from their employers and passed it on to tax authorities in various countries. This has drawn the attention of the public to the issue of bank secrecy and tax evasion.

[5]When we refer to 'tax havens' in this paper we do so based on the list of countries classified as tax havens by the OECD, to which we add Switzerland, Luxemburg, Hong Kong and Singapore. The list we use is provided in the Appendix (Table 4.5).

[6]These included Andorra, Liechtenstein, Liberia, the Republic of the Marshall Islands, Monaco, the Republic of Nauru and the Republic of Vanuatu.

[7]This information is based on data on TIEA provided by the OECD. More information on our dataset is provided in Section 4.4.

Figure 4.1: Cumulative number of all TIEAs, 2000 - 2011.



The large number of TIEAs certainly suggests that the OECD initiative to foster tax information exchange is a success. However, it cannot be excluded that tax havens formally comply with the requirement to have 12 TIEAs but choose partner countries other than those where tax evaders are likely to reside. A rather blunt way of doing so would be to choose other tax havens as partners. However, our database only includes 34 agreements where both partners are tax havens. A more subtle way of strategically choosing countries as partners would be to focus on countries which are not tax havens but which are unlikely to be residence countries of relevant investors in a particular tax haven.

This paper focuses on the question of how tax havens choose their partners for the signing of TIEAs and, as a consequence, whether the network of TIEAs develops so that it can be effective in fighting tax evasion. The effectiveness of TIEAs in addressing tax evasion depends on whether TIEAs are signed in cases where they are actually relevant. With whom should we expect tax havens to sign TIEAs? We focus on two possible views about how TIEAs emerge. First, if tax havens host investments from residents of a particular set of countries, they could systematically avoid these countries as partners in TIEAs. This would of course require that tax havens can actually decide freely whether or not they want to sign a TIEA with another country. Second, if a residence country knows

that its residents favour a particular tax haven, it will try to achieve TIEAs precisely with this tax haven, rather than with other tax havens. Of course, this would only work if the residence country can effectively impose TIEAs on a tax haven even in cases where the tax haven would prefer not to sign the agreement. It is our objective to investigate empirically whether the network of TIEAs we observe is consistent with either of these views.

In studies related to tax evasion, a key issue is that evasion is not easily observable. If it was, it would not take place. We are interested in cases where residents try to conceal their assets from the tax authorities in their countries of residence. Unsurprisingly, no data are available to observe these asset holdings directly. Instead, we use a number of observable indicators for economic links which are likely to be related to these asset holdings. We focus on three indicators: foreign direct investment, foreign portfolio investment, and trade. These indicators are far from being ideally suited for our purposes, but they are the best available. The underlying assumption is that stocks of observable foreign investment and trade flows will be positively correlated to activities involving tax evasion. We discuss this assumption further below.

Our main findings are as follows. On average stronger economic links increase the likelihood of signing agreements. This effect is robust and quite strong for foreign direct investment, but less robust for FPI and trade. Quantitatively, an extra $US 1 billion of FDI into a tax haven from a given country increases the likelihood of an agreement between the pair by 21.4 %; the effect for trade is smaller and equal to 2.1–2.5 %.[8] When it comes to portfolio investment data we find a coefficient which is positive but has large standard errors.[9] If we focus on the five partner countries which are most important in terms of economic links in the form of foreign direct investment for each haven, we find that on average tax havens have agreements on information exchange, either in the form of TIEAs or enshrined in double taxation agreements (DTAs), with 2.41 of those five countries.

[8]The mean for FDI is $US 2.58 billion, while for trade it is $US 0.96 billion. The average predicted probability of a tax haven signing a TIEA is 52.6 %.

[9]One should note that the available portfolio investment data does not report portfolio investment of residents of one country in another country. It reports holdings of securities by residents of one country which are issued in another country. As we discuss further below it is not clear how relevant this type of economic link is to our analysis.

Moreover, only 21 (30) out of 44 tax havens in our sample have concluded TIEA (TIEAs + DTAs) with their most important economic partner country. These results suggest that tax havens do not systematically avoid signing TIEAs with countries to which they have strong economic links. But the fact that, on average, tax havens only have agreements with roughly half of their five most important partner countries illustrates that not all important and potentially relevant countries are covered. Moreover, our analysis suggests that the threshold of 12 TIEAs might play a role. It seems that the activity of signing TIEAs slows down after countries have signed 12 of them. However, it is not clear how robust this finding is because TIEAs are a rather recent phenomenon, so that studying dynamic aspects of their signing is difficult.[10]

The rest of the paper is organized as follows. Section 4.2 reviews the relevant literature. In Section 4.3 we discuss the main hypotheses which guide our empirical analysis. In Section 4.4 we describe and take a first look at the data. Section 4.5 includes our regression analysis, a discussion of the results, and robustness checks. In Section 4.6 we discuss whether the threshold of 12 TIEAs plays a role. Section 4.7 concludes.

4.2 The Literature

This paper is related to a small but growing theoretical and empirical literature on tax information exchange.[11] The studies most closely related to our paper are Ligthart and Voget (2008) and Johannesen and Zucman (2014). Ligthart and Voget (2008) analyze the empirical determinants of information sharing for income taxation between the Netherlands and other countries. The authors find that the level of the domestic income tax rate, the marginal cost of public funds, and the share of a country's interest-bearing deposits held abroad increase a country's willingness to engage in information sharing. In addition, reciprocity is important. The present paper differs from Ligthart and Voget (2008) in that we look at what determines the signature of tax information exchange agreements, not the

[10] For this and other reasons our regression analysis does not capture dynamic effects.

[11] Keen and Ligthart (2006a) offer an introduction to the key issues in the debate on information exchange.

number of information requests. Moreover, we focus on agreements between tax havens and non-haven countries.

Johannesen and Zucman (2014) investigate the impact of TIEAs on bank deposits in tax havens. Using confidential data about bank deposits in tax havens provided by the Bank for International Settlements (BIS), they find that the signing of TIEAs has led to a modest relocation of bank deposits between tax havens but no significant repatriation of funds. The difference to our paper is that we focus on the determinants of TIEAs, not on the impact of TIEAs on bank deposits.

There are various other empirical studies which are related to our analysis. Huizinga and Nicodeme (2004) investigate the impact of tax policy on international depositing. They find that international patterns of bank deposits across 19 industrialized countries in 1999 were affected by tax rates but not by information exchange. This is relevant for our investigation in so far as it suggests that there is no reverse causality problem between information exchange and portfolio investment or bank deposits.

Our paper is also related to the literature on the determinants of double taxation agreements. In a recent paper Ligthart and Voget (2011) analyze the determinants of double tax treaty formation. Their study uses a sample of 189 countries, of which only 15 are tax havens. They consider information exchange agreements as one of the determinants of double tax treaties formation. We do the reverse of that, by including a double tax treaties dummy as one our explanatory variables.[12]

Another related literature focuses on the EU Savings Taxation Directive. For example, Hemmelgarn and Nicodeme (2009) find that the directive had no significant effects on different investments that fall under the scope of the Directive. Klautke and Weichenrieder (2010) investigate the impact of the directive by comparing the returns on bonds which are exempt from the directive to bonds which are not exempt. They find no significant

[12] As they note, their empirical approach is similar to Baier and Bergstrand (2004) and Egger and Larch (2008). These papers investigate why a pair of countries enters into a bilateral preferential trade agreement. The empirical method Ligthart and Voget (2011) use is a dynamic probit approach which controls for unobserved regional heterogeneity. The data they use spans a long time period. TIEAs, in contrast, are a recent development. This is why we do not use the same dynamic panel approach in our paper.

difference and conclude that the impact of the directive is negligible- Johannesen (2014) investigates the effects of the directive by comparing Swiss bank deposits of residents from EU countries to deposits of residents from non-EU countries and finds that deposits from EU residents have declined, which does suggest that the directive has had an effect.

The theoretical literature mostly investigates whether countries have incentives to voluntarily exchange tax information. Bacchetta and Espinosa (1995) show that countries may want to exchange information if that mitigates tax rate competition. Bacchetta and Espinosa (2000) look at repeated interaction between countries and analyze the role of tax information exchange clauses in double taxation treaties. Eggert and Kolmar (2002) show that voluntary information exchange can be an equilibrium in a standard small-country model of tax competition, whereas it may not be an equilibrium when the size of the financial sector has positive impact on the wage structure of an economy.

Huizinga and Nielsen (2003) analyze the sustainability of information exchange and source taxes in a model with repeated interaction. They derive conditions under which information exchange can be sustained as a cooperative equilibrium (see also Keen and Ligthart (2006b)). Finally, Elsayyad and Konrad (2012) develop a model with multiple tax havens, where tax havens are sequentially induced to exchange tax information. As the number of uncooperative tax havens declines, competition between tax havens becomes less intense, so that the benefit from being a tax haven increases. This implies that achieving information exchange with all tax havens is difficult.

4.3 Theoretical hypotheses guiding our empirical analysis

For purposes of our empirical analysis the most important result emerging from the theoretical literature is that, unsurprisingly, tax havens have incentives to avoid information exchange with high tax countries because this undermines their 'business model', which is to host investment from residents of high tax countries. If we take as given that tax havens need to sign at least 12 TIEAs, this suggests that tax havens will avoid signing

TIEAs with countries from where they attract a lot of investment which escapes residence based taxation.

How can we identify these countries? As mentioned in the introduction, it is impossible to directly observe investment which escapes residence based taxation. In our empirical analysis we will focus on three variables as proxies for the volume of economic activity which is likely to escape residence based taxation without information exchange: foreign direct investment, trade, and foreign portfolio investment. This approach is based on the assumption that tax evaders are not perfectly mobile in the choice of the tax havens where they hold their assets. This is plausible because travelling to remote tax havens is costly and tax evaders may find it easier to deal with banks and lawyers who speak the same language.[13] Proximity and a common language or culture are also determinants of observable economic links like FDI or trade. Thus, the interests of tax havens suggest that they will avoid signing TIEAs with countries to which they have strong economic links in the form of investment or trade.

However, there are other relevant factors determining the choice of partner countries in TIEAs apart from the interests of tax havens. An aspect less well explored in the theoretical literature is whether countries with high residence based taxes can exert pressure on tax havens to exchange information, either indirectly through institutions such as the OECD and its 'naming and shaming' of jurisdictions which deny information exchange, or directly, for instance by threatening to disrupt economic relations. One example of the latter would be the threat of the United States to effectively ban Swiss banks from operating in the US if they do not provide information on bank accounts of US residents. Of course, the threat to disrupt economic relations only matters, if there are significant relations in the first place.

For our empirical analysis this possibility is interesting because it suggests that tax havens will be more, not less likely to (be forced to) sign TIEAs with high tax countries, if they have significant economic relations in the form of trade or investment with these

[13] Clearly, if tax evaders were perfectly mobile individuals, TIEAs would not matter as long as at least one tax haven remains outside the network of information exchange agreements.

countries. This implies that we can again use the variables mentioned above: foreign direct investment, trade, and foreign portfolio investment.

To summarize, our theoretical considerations yield two contrasting hypotheses:

> **Hypotheses** The likelihood that a TIEA between a tax haven i and a non tax haven country j exists is decreasing (hypothesis 1) or increasing (hypothesis 2) in the volume of relevant economic links between i and j.

Relevant economic links are measured by the following three variables: the stock of FDI country j holds in tax haven i, the volume of exports from country j to tax haven i, and the stock of portfolio investment from country j to tax haven i. The data we use will be described in greater detail in the next section.

4.4 Data and descriptive analysis

4.4.1 Data

We use data from various sources. Our dependent variable, the existence of bilateral TIEAs, is taken from the information on TIEAs provided by the OECD on its tax information exchange website (http://www.eoi-tax.org/). We take into account all TIEAs reported in this database and signed before January 1st, 2012. In our analysis we also take into account cases where double taxation agreements exist and include provisions for information exchange.

Our key explanatory variables are foreign direct investment, trade and foreign portfolio investment. FDI data come from two sources: OECD and Eurostat. The OECD compiles a dataset on bilateral observations of foreign direct investment stocks from OECD countries into tax havens and vice versa. Eurostat compiles a very similar dataset. We use it as a complement to the OECD database, as it covers a slightly different set of countries—the European Union. Thus we merge the two datasets and convert the amounts into US dollars.

The portfolio investment data comes from the Coordinated Portfolio Investment Survey (CPIS), which is conducted on an annual basis since 2001 by the International Monetary

Fund (IMF). The first pilot survey data were collected in 1997 and the latest available data is for 2010. As defined on the IMF website the purpose of the CPIS is to "collect information on the stock of cross-border holdings of securities valued at market prices prevailing at end-December of the reference year". The CPIS data we use is broken down by the economy of residence of the issuer of the securities. There are around 75 countries reporting their portfolio investment positions into the full subset of tax havens; the reporting countries also include 13 tax havens.

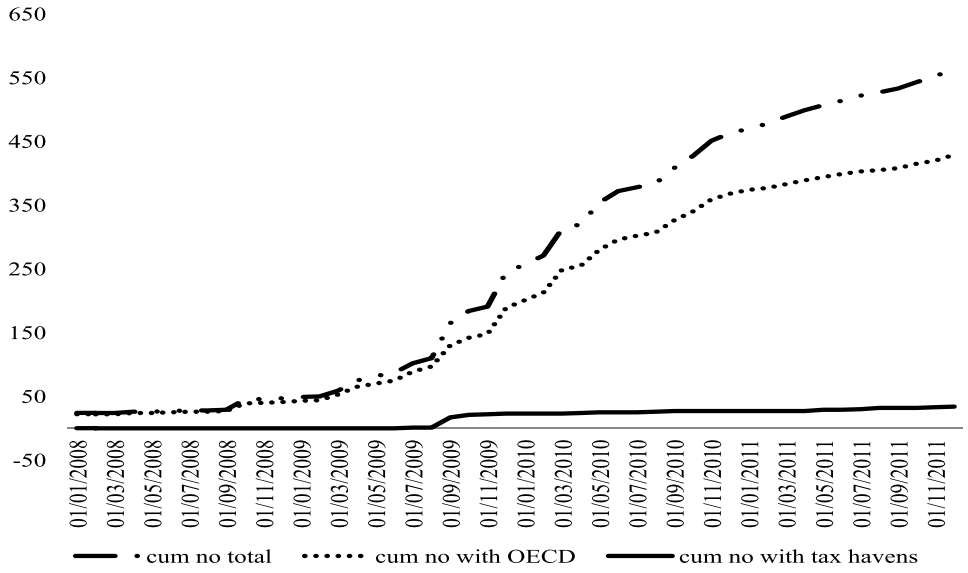
We should emphasize that the portfolio investment holdings in this dataset do not measure investments where residents of one country necessarily hold bank accounts in other countries. Rather, portfolio investments of country A in country B mean that residents of country A hold securities issued in country B. For instance, if a resident of the Netherlands holds a bond issued in Cayman Islands in his brokerage account in the Netherlands, this will be classified as a portfolio investment going from the Netherlands to the Cayman Islands. Therefore the portfolio investment data cannot be used to directly measure portfolio investment in bank accounts located in tax havens and held by residents of other countries. Given this, one could argue that FPI is probably the least relevant indicator for economic links in the context of our paper. The fact that residents of a high tax country buy securities issued in a tax haven does not necessarily imply that they ever go to that tax haven, know anyone there or have a bank account there.

Trade data comes from the OECD and the IMF databases. Both report bilateral exports and imports between reporting countries and tax havens. Finally, the bilateral control variables such as common language, common legal origin or presence of regional trade agreement come from Head *et al.* (2010).

4.4.2 Descriptive Analysis

Given that the motivation for introducing TIEAs is to prevent tax evasion by residents of high tax countries, we are particularly interested in the TIEAs where tax havens are at least one of the partners. This applies to 565 out of 600 TIEAs in our database. Figure

Figure 4.2: Cumulative number of TIEAs signed by tax havens on at least one side, 2008 - 2011.

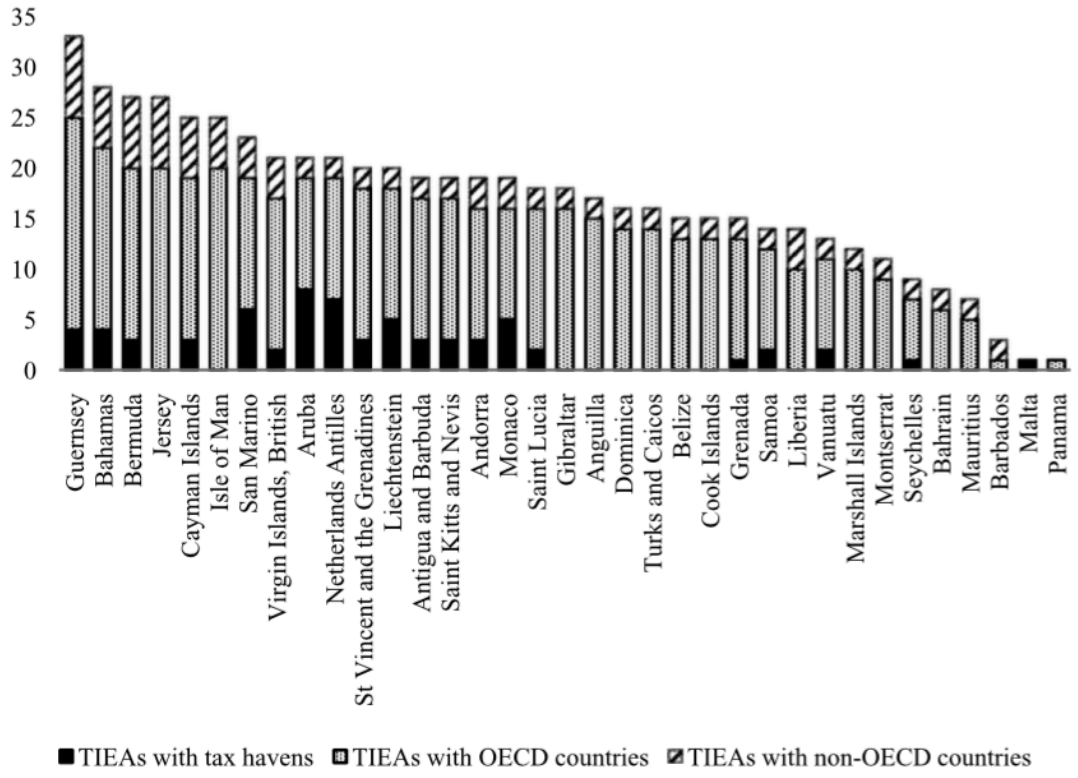


4.2 shows how the TIEAs signed by tax havens on at least one side are distributed across groups of partner countries. We distinguish between tax havens, OECD countries, and non-OECD-countries. The figure shows that most agreements with tax havens on one side have been signed by OECD countries on the other side.

Among the 44 tax havens in our sample, 35 have signed at least one TIEA. Five tax havens have not signed TIEAs because they have information exchange clauses in their DTAs. Four tax havens (Maldives, Tonga, Niue and Nauru) have not signed any TIEAs yet but have committed to doing so. Figure 4.3 illustrates the number of TIEAs signed by the individual tax havens and the structure of partner countries for each tax haven. The tax havens in our sample have signed TIEAs with OECD as well as non-OECD countries. 20 tax havens have also signed TIEAs with other tax havens.

Our main interest is to investigate whether tax havens have signed TIEAs with countries to which they have strong economic links. To give a first impression, we ask whether tax havens have signed TIEAs with the five countries to which they have the strongest economic links, measured by inward foreign direct investment into the tax haven from this country, inward foreign portfolio investment, and exports to the tax haven from the partner country. In the following, we refer to these countries, which may differ for each

Figure 4.3: Number of TIEAs signed by each tax haven.



individual tax haven, as the top 5 FDI, FPI and trade countries, respectively. One important issue in this context is that some tax havens have DTAs that include information exchange provisions, rather than TIEAs. Therefore we report TIEAs with the top 5 partners as well as TIEAs plus DTAs.[14] Figure 4.4 reports results for the top 5 FDI countries.[15] On average, tax havens have signed agreements (TIEAs or DTAs) with 2.41 of the top 5 FDI countries. This is significant but maybe less than one might expect. No tax haven has signed TIEAs with all five countries. But some tax havens which use DTAs do cover all five partner countries.

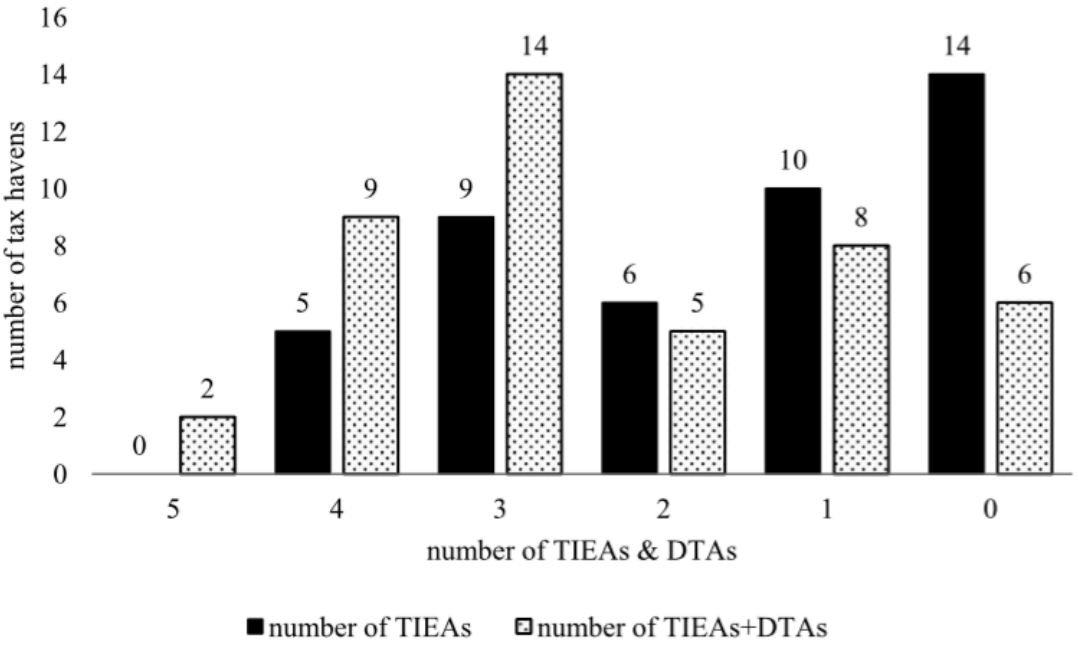
These findings suggest that tax havens do not seem to face an overwhelming pressure to sign TIEAs with the countries to which they have the strongest economic links.[16]

[14]It is important to distinguish between ordinary DTAs and the ones that OECD lists as meeting the standards of information exchange. Here, we only include DTAs that meet the standards set by the OECD.

[15]These are all OECD member countries because our FDI data is restricted to the OECD. Since the patterns for FPI and trade are similar, we do not report them here. They are available from the authors on request.

[16]It would be natural to ask whether tax havens focus on signing agreements with countries to which they have no or negligible economic links. Here we find that no tax haven has signed

Figure 4.4: Number of TIEAs and TIEAs plus DTAs with the top 5 FDI importers, OECD countries.



4.5 Regression analysis

4.5.1 The model

To test the hypotheses described in Section 4.3 we estimate a model where the dependent variable is a dummy which takes value 1 if there is a TIEA between tax haven i and reporting country j, and 0 otherwise. A pair of counties i and j adopts a TIEA if and only if:

$$TIEA_{ij} = \begin{cases} 1 \text{ if } TIEA^*_{ij} \geq 0 \\ 0 \text{ if } TIEA^*_{ij} < 0 \end{cases} \tag{4.1}$$

where $TIEA^*_{ij}$ denotes a latent variable:

$$TIEA^*_{ij} = \alpha + \beta_1 F_{ij} + \beta_2 F_{ij} \times n_i + \beta_3 F_{ij} \times USdummy_j + \theta \overline{X_{ij}} + \gamma_i + \delta_j + \epsilon_{ij}$$

Here F_{ij} describes the economic link between tax haven i and partner country j, n_i is the total number of non-OECD TIEAs that a tax haven i has signed, $USdummy_j$ is

TIEAs with more than three out of five bottom trade partners. More detailed results are available from the authors on request.

a dummy variable equal to 1 when the partner country is the US, $\overline{X_{ij}}$ is a matrix of country pair characteristics, γ_i and δ_j are tax haven and partner country fixed effects, respectively, and ε_{ij} is normally distributed error term. The coefficient β_1 describes the effect of the economic link variable on the probability of a TIEA; β_2 and β_3 are coefficients of interaction effects that will be discussed further below. θ is the vector of coefficients of country pair characteristics. This simple binary choice model is estimated using a probit model with robust standard errors.

The use of country fixed effects controls for time-invariant unobserved country specific characteristics for both tax havens and reporting countries. Since there is no time variation in our data, the country fixed effects play the role of country control variables.[17]

The tax haven and reporting country fixed effects do not control for the bilateral relationships between countries that might affect the likelihood of a TIEA formation, such as for example distance between countries or presence of bilateral tax treaty. Hence, in the main specification we include a set of bilateral controls as suggested by gravity equations trade literature.[18]

In our baseline specification we use TIEAs signed after 1st January 2007 as the dependent variable. To evaluate the impact of economic links, we use stocks of FDI and FPI at the end of 2007 as well as the sum of exports from j to i in the period from 2001 to 2007. We use year 2007 for two reasons: Firstly, most of the agreements were signed in 2009–2010. Leaving a lag of two years from the signature to the start of negotiations seems plausible. Secondly, 2007 is the last year before the financial crisis, so that the economic link variable we use is not affected by the crisis.

[17] As discussed in the introduction, the theoretical literature suggests numerous country specific determinants of tax information exchange treaties formation. The inclusion of country fixed effects means that we do not need to control for country specific determinants of treaty formation. The use of control variables instead of country fixed effects is explored as a robustness check. However, the criticism can be that the choice of control variables is spurious. Data for tax havens are very limited; hence the control variables are likely to exclude important determinants of treaty formation as suggested by the theoretical literature.

[18] The variables included are: distance, common colonizer, both countries member of WTO, double tax agreement between the two, regional trade agreement between the two, common language, common currency, and common legal origin.

The result tables include five specifications. Each of these uses a different variable to proxy for the economic links between country pairs:

1. FPI: portfolio investment defined as purchase of shares and bonds issued by a tax haven to reporting country residents;
2. FDI: bilateral FDI from reporting country (OECD country only) into tax haven;
3. FDI_total: bilateral FDI from reporting country (OECD + EU only) into tax haven;
4. OECD_trade: exports from reporting country (OECD country only) into tax haven;[19]
5. IMF_trade: exports from a reporting country into tax haven.

Due to data limitations, we only have OECD countries in the reporting countries group for *FDI* and *OECD_trade*. Therefore the conclusions drawn for those two variables apply only to the formation of TIEAs with OECD countries. For the other three regressions the sample is larger and includes, in addition to OECD countries, European Union countries for *FDI_total* and the whole world for *IMF_trade* and *FPI*.

Further, each of these five specifications includes an interaction variable between the economic links proxy and US dummy to control for a differing impact of links to the US for the likelihood of treaty formation. The US dummy is not included on its own, as its effect is captured by the partner country fixed effect. Importantly, to account for the lack of many non-OECD countries in some of the samples, each regression includes the total number of non-OECD TIEAs each tax haven has and interacts this variable with the economic link proxy. This interaction term accounts for the fact that as the number of non-OECD TIEAs grows, the importance of the economic links variable might decline. This is because pressure from OECD countries with strong economic links may be less effective if a tax haven has a number of TIEAs with other countries or is in the process of negotiating them.

[19] In the robustness checks in Section 4.5.3 we also analyse imports of OECD countries from tax havens.

The total number of non-OECD TIEAs does not enter the main specification on its own because it is picked up by the tax haven fixed effect. However, as with the US dummy, it is included in the robustness checks and the coefficient on this variable is estimated to be negative. The idea behind that is that the larger the number of non-OECD TIEAs, either existing or under negotiation, the smaller the pressure on a tax haven to sign a TIEA. This would suggest that there is a simple substitution effect between TIEAs with OECD and non-OECD countries.

Additionally, since some of the tax havens on the OECD list have not signed any TIEAs, we drop those from the sample and use only the ones that have at least one TIEA signed. This means we do not include Cyprus, Hong Kong, Luxembourg, Maldives, Malta, Nauru, Niue, Singapore, Switzerland, Tonga and the U.S. Virgin Islands. Moreover, since we are using only post 2007 TIEAs, we drop the country pairs that signed an agreement before 2007. Otherwise they would show as observations with large flows and no treaty and distort our results. As a result country pairs such as US and Cayman Islands or UK and Bermuda are not considered here. Finally, we exclude TIEAs signed before 2000 such as the one between US and Marshall Islands.[20]

4.5.2 Regression results

Baseline regression

In our baseline regression we find that economic links have a positive impact on the likelihood of TIEA formation. In Table 4.1 we present the marginal effects from our estimations using various proxies for economic links between countries. The effect is strong and positive for FDI, while smaller for trade and FPI. In case of FDI the average marginal effect is 10 %; the marginal effect calculated at the mean number of non-OECD TIEAs for non-US investment is 12.5 % while for US investment it is 15.1 %.[21] This means that an additional

[20] Clearly, this implies that we drop important tax havens from our sample. In the robustness checks we address this problem and obtain similar results.

[21] A marginal effect at the mean is a point estimate of the marginal effect at a chosen value. In contrast an average marginal effect is a mean marginal effect for a population. Specifically, in the average marginal effect case a marginal effect is computed for each value and the all the effects

$US 1 billion of investment increases the likelihood of an agreement by 10 % on average, while the standard deviation for FDI is $US 13 billion. For FPI the average marginal effect is much smaller—3.7 %, while for IMF trade data it is 2.8 %. The average predicted probability of a tax haven signing a TIEA is 52.6 %.

The result for the interaction between economic links and the number of existing non-OECD TIEAs suggests that the impact of economic links is weaker the larger the number of non-OECD TIEAs signed. Interestingly, the effect of economic links on the likelihood of treaty formation turns negative at large values of non-OECD TIEAs. This is especially true for FDI, while for trade and FPI the number of non-OCED TIEAs does not change the result. For example, the positive impact of economic links on the likelihood of an OECD treaty formation turns negative at more than nine non-OECD TIEAs for FDI (see Figure 4.5).[22]

It is important to note that the results presented here are robust to the inclusion of the US investment and implicitly, via country fixed effects, of US dummy. Thus, we are confident that these results are not driven by the relationship between the US and tax havens.

are averages. Hence, the average marginal effect represents better the impact of the variable on the likelihood of the TIEAs.

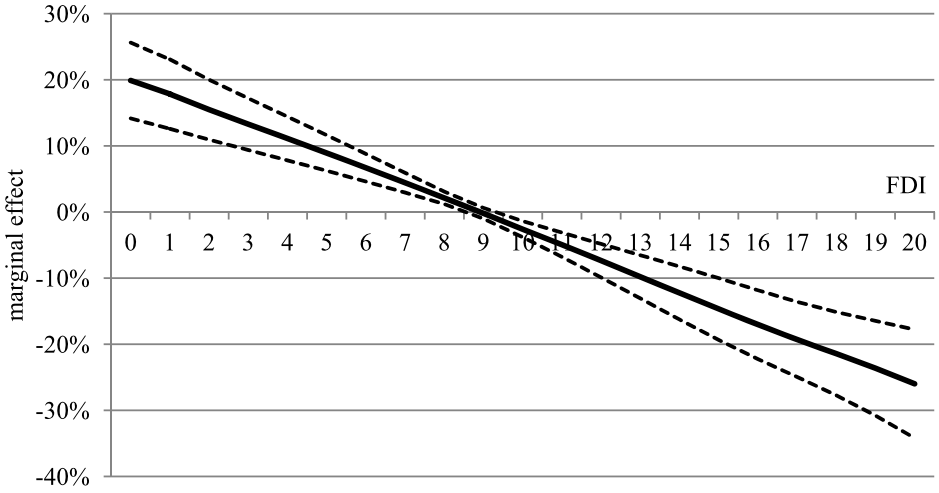
[22]The average number of non-OECD TIEAs that a tax haven has is 3.7, with standard deviation equal to 3.4. The values range from zero for some countries to maximum of 12.

Table 4.1: Marginal effects from the baseline probit models with non-OECD treaties; post 2007 TIEAs.

Variables	(1) FPI	(2) FDI	(3) FDI_total	(4) OECD_trade	(5) IMF_trade
F	0.0830*	0.214***	0.205***	0.0211*	0.0255**
	(0.0504)	(0.0319)	(0.0303)	(0.0117)	(0.0114)
F*n	−0.00868	−0.0240***	−0.0230***		
	(0.00561)	(0.00362)	(0.00341)		
F*US	−0.0287	0.0257***	0.0247***	0.137***	0.104***
	(0.0486)	(0.00606)	(0.00547)	(0.0289)	(0.0257)
ME: US inv	0.0222	0.1510	0.1447	0.1581	0.1295
ME: non-US inv	0.0509	0.1253	0.1200	0.0211	0.0255
AME	0.0369*	0.0999***	0.0940***	0.0249**	0.0276**
	(0.020)	(0.0142)	(0.0132)	(0.0116)	(0.0112)
Observations	563	302	328	508	617

Standard errors in parentheses; *** p $<$ 0.01, ** p $<$ 0.05, * p $<$ 0.1, n: total number of non-OECD TIEAs, US: US dummy, F: refers to the proxy for economic links and corresponds to variable in the column header for each columns, i.e. in column 1 we use FPI as a proxy for economic link, in column 2 FDI etc. ME: non-US inv (marginal effect for non-US investment) is calculated as: $\frac{\partial y}{\partial F} = \beta_1 + \beta_2 \times n$ where β_1, β_2 are coefficients on economic links proxy and interaction term between economic links proxy and total number of non-OECD TIEAs as defined in Equation 1. For US investment (ME: US inv) we add β_3 which is a coefficient on the interaction term between economic links proxy and US dummy. We use average number of non-OECD TIEAs to calculate these effects. We also include average marginal effects (AME) of F_{ij}.

Figure 4.5: Marginal effect of FDI at different values of non-OECD TIEAs.



Shares regression

So far we have used levels of the economic links variables. Instead, in this section we use shares. For instance, for Cayman Islands we sum all the incoming investment and calculate what proportion comes from each reporting country. This gives us a share variable for each country pair. The reason for considering shares is that they may reflect the relative importance of a partner country for a tax haven. This method also controls for the differences between tax havens that attract large volumes of investment (such as Cayman Islands) and the ones that attract less investment (e.g. Vanuatu). In the levels specification, Cayman Islands-US pair is more likely to sign the TIEA than Vanuatu-US because the level of investment from US to Cayman Islands is much larger than the one to Vanuatu. However, when considering shares, it may well be that the share of investment into Vanuatu coming from the US is much larger than the one coming to Cayman Islands, which might cause the former to be more likely to conclude an agreement with US.

In Table 4.2 we regress the shares of investment described above on our dependent variable in a similar fashion to the baseline regression. We find that the shares regression results confirm the main results of our baseline specifications. Again, the effect of economic

links is positive[23] and it weakens as tax havens have more non-OECD TIEAs and turns negative at larger values of these. One surprising difference is that the US interaction effect is now negative. A possible explanation is that the US focuses on achieving treaties with tax havens where their levels of economic links indicators are significant and neglects small tax havens.

4.5.3 Robustness checks

Our baseline specification uses reporting country and tax haven fixed effects to control for all the country specific effects that may have an impact on the likelihood of the treaty formation. As an alternative to this approach we exclude these two sets of country fixed effects and instead incorporate a large number of country controls. Many of the control variables used are suggested as determinants of information exchange agreements in the theoretical literature. This includes, for instance, country size variables, governance variables like the corruption index, and corporate and personal income tax rates. The results essentially confirm our baseline regressions. However, one should note that, for some variables of interest like e.g. the size of the banking sector, no data are available for most tax havens, so that potentially important variables are omitted in this approach.

The baseline approach of using country fixed effects resolves this issue by controlling for all country determinants of the treaty formation. Therefore the baseline approach is our preferred method and we do not report the results from the estimations with country control variables here. But the results and the list of country control variables are available from the authors on request.

Instead we focus on robustness tests for the baseline specifications for nominal and shares regressions. Most importantly, we check whether the results presented above are robust to the inclusion of double tax agreements that contain information exchange provisions. To do so, we construct a new dependent variable that is equal to 1 if there is a TIEA or DTA that meets the OECD standards between a pair of countries. Using this

[23] We find that a 10 % increase in the shares of investment in tax haven increases the likelihood of a TIEA formation by 4.5 %; the standard deviation is 17 %.

new dependent variable we run the same regressions as in Tables 4.1 and 4.2. The results presented in Table 4.3 confirm our baseline regression.[24] In case of levels, the effects of economic links are smaller, but remain significant; apart from the effects of FPI. In case of shares regressions the effects are broadly similar to the ones using TIEAs only, with the magnitudes for the economic links effects smaller and the average marginal effects insignificant, similar to the baseline regression.

What is more, the results from the baseline regression are robust to the inclusion of all the TIEAs. To test for that, we use 2001 data to approximate for the economic relationship between countries that signed a TIEA before 2007, leaving the post 2007 data unchanged. The coefficients are broadly similar in terms of signs and magnitudes for both shares and nominal values regressions. The results are also robust to the use of data from a different year to proxy for the economic links; we use 2005, 2006 and 2008, adjusting the TIEAs included accordingly. The results again remain broadly unchanged in terms of main coefficient signs, but the magnitudes differ.

Finally, we re-run the trade regressions (column 4 in Tables 4.1–4.3) using imports from tax havens into OECD countries rather than exports from OECD countries to tax havens as an indicator of economic links. We do so because the threat of disrupting imports from tax havens might be more plausible as a possible sanction against tax havens than the threat of reducing exports to tax havens.

The coefficients on the economic links variable are insignificant. In contrast, the coefficients on the US imports from tax havens are always significantly positive and much larger than in the exports regressions. This would suggest that imports to the US from tax haven have a positive effect on the likelihood of the agreement formation; however, imports from other countries do not. This could be explained by the presence of the EU countries in the OECD sample. The exports from tax havens into the EU countries can enter one country, but need not necessarily be destined for this country. This means that it might not be possible to identify the impact of imports to reporting countries on the likelihood of the treaty formation using imports from tax havens as a proxy for economic

[24]Columns 1–5 match columns in Table 1, while columns 1' to 5' match columns in Table 2. .

links. In addition, trade policy is run at the EU level, not at the level of the individual member countries. These issues might also explain the weaker effects of trade variables, compared to the effects of FDI, on the likelihood of treaty formation.

Table 4.2: Marginal effects of probit models with non-OECD treaties, using shares, post 2007 TIEAs.

Variables	(1) FPI	(2) FDI	(3) FDI_total	(4) OECD_trade	(5) IMF_trade
F	0.987**	0.449***	0.419***	0.203	0.544*
	(0.492)	(0.133)	(0.124)	(0.155)	(0.305)
F*n	−0.149*	−0.0837***	−0.0735***		
	(0.0896)	(0.0286)	(0.0254)		
F*US	−0.118	−0.334***	−0.264**	−0.956***	−1.582***
	(0.410)	(0.104)	(0.103)	(0.241)	(0.564)
ME: US inv	0.3183	−0.1944	−0.1167	−0.7530	−1.0380
ME: non-US inv	0.4363	0.1396	0.1473	0.2030	0.5440
AME	0.214	0.0453	0.0677	0.169	0.500*
	(0.326)	(0.0675)	(0.065)	(0.149)	(0.297)
Observations	545	290	315	508	617

Standard errors in parentheses; *** p $<$ 0.01, ** p $<$ 0.05, * p $<$ 0.1, n: total number of non-OECD TIEAs, US: US dummy, F: refers to the proxy for economic links and corresponds to variable in the column header for each columns, i.e. in column 1 we use FPI as a proxy for economic link, in column 2 FDI etc. ME: non-US inv (marginal effect for non-US investment) is calculated as: $\frac{\partial y}{\partial F} = \beta_1 + \beta_2 \times n$ where β_1, β_2 are coefficients on economic links proxy and interaction term between economic links proxy and total number of non-OECD TIEAs as defined in Equation 1. For US investment (ME: US inv) we add β_3 which is a coefficient on the interaction term between economic links proxy and US dummy. We use average number of non-OECD TIEAs to calculate these effects. We also include average marginal effects (AME) of F_{ij}.

Table 4.3: Marginal effects from probit models with non-OECD treaties, post 2007 TIEAs and DTAs meeting information exchange standards.

Variables	(1) FPI	(2) FDI	(3) FDI_total	(4) OECD_trade	(5) IMF_trade	(1′) FPI	(2′) FDI	(3′) FDI_total	(4′) OECD_trade	(5′) IMF_trade
F	0.0522	0.167***	0.134***	0.0146***	0.0139***	0.903***	0.381***	0.350***	0.180	−0.139
	(0.0381)	(0.0347)	(0.0281)	(0.00538)	(0.00513)	(0.289)	(0.144)	(0.131)	(0.178)	(0.417)
F*n	−0.00557	−0.0171***	−0.0138***			−0.134**	−0.0659**	−0.0574**		
	(0.00424)	(0.00354)	(0.00289)			(0.0527)	(0.0306)	(0.0272)		
F*US	−0.0162	0.00210	0.00222	0.0835***	0.0603***	−0.191	−0.277**	−0.210**	−1.609	−2.839
	(0.0363)	(0.00655)	(0.00545)	(0.0237)	(0.0174)	(0.318)	(0.116)	(0.107)	(1.002)	(2.037)
ME: US inv	0.0154	0.1059	0.0852	0.0981	0.0742	0.2167	−0.1396	−0.0722	−1.4290	−2.9780
ME: non-US in	0.0316	0.1038	0.0830	0.0146	0.0139	0.4077	0.1374	0.1378	0.1800	−0.1390
AME	0.0256	0.0929***	0.0724***	0.0160***	0.0144***	0.259	0.0760	0.0834	0.148	−0.177
	(0.0175)	(0.0199)	(0.0160)	(0.0054)	(0.0596)	(0.216)	(0.0734)	(0.0662)	(0.1759)	(0.413)
Observations	701	337	422	562	764	680	324	406	562	764

Standard errors in parentheses; *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$, n: total number of non-OECD TIEAs, US: US dummy, F: refers to the proxy for economic links and corresponds to variable in the column header for each columns, i.e. in column 1 we use FPI as a proxy for economic link, in column 2 FDI etc. ME: non-US inv (marginal effect for non-US investment) is calculated as: $\frac{\partial y}{\partial F} = \beta_1 + \beta_2 \times n$ where β_1, β_2 are coefficients on economic links proxy and interaction term between economic links proxy and total number of non-OECD TIEAs as defined in Equation 1. For US investment (ME: US inv) we add β_3 which is a coefficient on the interaction term between economic links proxy and US dummy. We use average number of non-OECD TIEAs to calculate these effects. We also include average marginal effects (AME) of F_{ij}. Columns 1-5 use levels of economic link variables. Columns 1'5' use shares of economic links variables.

4.6 The 12 TIEAs threshold

It is interesting to ask whether tax havens become more reluctant to sign additional TIEAs after they have signed the 12 agreements necessary to comply with the threshold defined by the OECD. Investigating this empirically is problematic because the signing of TIEAs started just a few years ago. In order to gain some preliminary insight we have compiled data about the number of days between TIEAs signed by each tax haven. The idea is to check whether the expansion of the treaty network slows down after a country has reached the threshold of 12 countries set by the OECD. Figure 4.6 illustrates the relationship between the number of days required to reach an additional agreement and the number of existing agreements. The graph suggests that, indeed, the process of signing additional TIEAs slows down above the threshold.

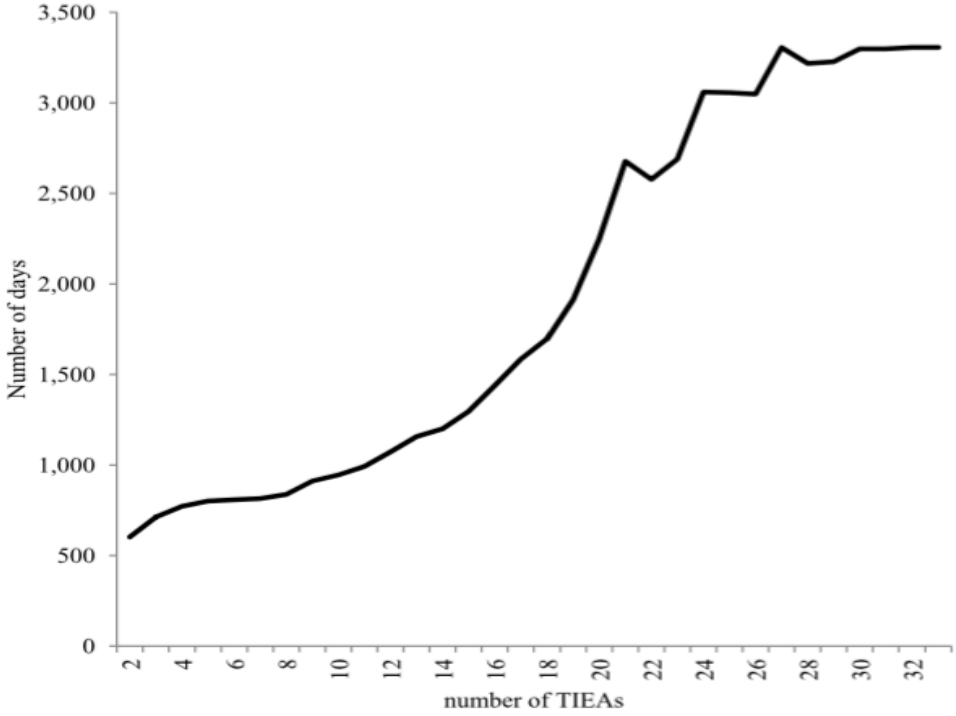
Using this data we have also carried out a simple regression analysis. We regress the number of days required to reach an nth TIEA on the number of TIEAs already concluded at the time of this nth agreement and on the dummy called $below\_12threshold$. The dummy is 1 when the average of TIEAs a tax haven has is below 12 and 0 otherwise. We also interact those two variables.

We find that being below 12 TIEAs threshold significantly decreases the number of days required to reach the nth agreement. In addition the number of TIEAs signed before has a positive impact on the number of days required to reach an nth agreement. In other words the larger the number of TIEAs tax havens have already concluded, the slower is the pace of concluding further agreements. Finally, the impact of the number of existing TIEAs is much larger after the 12 TIEAs were signed than below this threshold.

4.6.1 First 12 TIEAs

Finally, it is interesting to take a closer look at the first 12 TIEAs signed by each tax haven because the process of signing TIEAs below and above the 12 country threshold is likely to differ. To investigate this, we construct a dependent variable called $first\_12\_TIEAs$. There is an issue when a tax haven signs more than one TIEA on the same day and when

Figure 4.6: Average number of days required to reach an nth TIEA.



that happens around the threshold; for example, when a tax haven has 10 TIEAs and then signs four more on one day. We experiment with both including all at the threshold and excluding them. The results here suggest that for the first 12 TIEAs FPI matters far more than for all the TIEAs signed by a given tax haven. In contrast, the impact of FDI and trade are insignificant here. What is interesting here is that in the case of FDI, US investment has a much larger effect on the likelihood of the TIEA than in the full sample. This suggests that US has been pushing for the TIEAs until the first 12 were signed, afterwards its impact got diluted.

The results from Table 4.4 are consistent with the evidence from the data that larger countries—in terms of economic links—seem not to be the first ones to conclude TIEAs with tax havens. Therefore the role of economic links is much weaker than for the whole sample. This suggests that the mere fact of signing 12 agreements does not protect tax havens from being pushed to sign more agreements with large high tax countries such as Germany, France or Canada.

Standard errors in parentheses; *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$, n: total number of non-OECD TIEAs, US: US dummy, F: refers to the proxy for economic links and corresponds

Table 4.4: Marginal effects from probit models with non-OECD treaties for first 12 TIEAs, post 2007 TIEAs.

Variables	(1) FPI	(2) FDI	(3) FDI_total	(4) OECD_trade	(5) IMF_trade
F	0.203***	0.303	0.319	−0.0152*	−0.0178
	(0.0485)	(0.242)	(0.247)	(0.00823)	(0.0363)
F*n	−0.0224***	−0.0530*	−0.0545*		
	(0.00538)	(0.0280)	(0.0287)		
F*US	−0.156***	0.226*	0.225*	0.116***	0.138***
	(0.0470)	(0.119)	(0.119)	(0.0335)	(0.0398)
ME: US inv	−0.0358	0.3331	0.3426	0.1008	0.1202
ME: non-US inv	0.1202	0.1071	0.1176	−0.0152	−0.0178
AME	0.0960***	0.0747	0.0844	−0.013	−0.015
	(0.023)	(0.143)	(0.145)	(0.008)	(0.036)
Observations	425	262	263	438	459

to variable in the column header for each columns, i.e. in column 1 we use FPI as a proxy for economic link, in column 2 FDI etc. ME: non-US inv (marginal effect for non-US investment) is calculated as: $\frac{\partial y}{\partial F} = \beta_1 + \beta_2 \times n$ where β_1, β_2 are coefficients on economic links proxy and interaction term between economic links proxy and total number of non-OECD TIEAs as defined in Equation 1. For US investment (ME: US inv) we add β_3 which is a coefficient on the interaction term between economic links proxy and US dummy. We use average number of non-OECD TIEAs to calculate these effects. We also include average marginal effects (AME) of F_{ij}.

4.7 Conclusion

This paper investigates whether tax havens have signed TIEAs with countries to which they have strong economic links, or whether they have signed agreements with less relevant countries, possibly in order to avoid tax information exchange in cases where it is relevant. The main finding of this paper is that the former seems to hold. The countries classified as tax havens have systematically signed more TIEAs with countries to which they have stronger economic links in the form of foreign direct investment. The results for foreign portfolio investment and trade are weaker, but as we have explained in the paper the portfolio investment data we use is probably less suited for our purposes than the FDI data, mainly because it does not measure investment located in tax havens. However, an important caveat is that this does not mean treaties for information exchange cover all relevant countries. On average tax havens only have treaties with roughly half of their five most important economic partner countries. This means that the network of treaties for information exchange is far from complete.

These results suggests that the OECD initiative for more information exchange in tax matters is successful in that it has induced tax havens, on average, to sign TIEAs with the right countries. Put differently, we find no support for the view that tax havens try to undermine tax information exchange by systematically signing TIEAs with irrelevant countries, where information exchange is unlikely to matter because economic relationships are negligible. However, if the objective is to have information exchange among all countries with significant economic links, there is still some way to go. Another issue raised by our analysis is whether the process of signing TIEAs slows down after the threshold of 12 agreements has been reached. Our findings suggest that this may indeed be the case, but more time has to pass before we can see how robust this result really is.

Of course, the spreading of TIEAs will only lead to effective information exchange if countries also set up the administrative and legal infrastructure required to make this exchange practicable. Also, one would expect taxpayers who try to evade taxes in their countries of residence to react to the spreading of TIEAs. In particular in the case of

highly mobile portfolio investment one can expect that taxpayers who evade taxes might move their assets to tax havens without TIEAs with their residence countries. Thus, even if it is true, as we have suggested, that investment which evades residence based taxation is currently located in tax havens with economic links to the residence country, that correlation may become weaker as taxpayers react to TIEAs. However, the growing network of TIEAs is likely to make tax evasion more difficult and more costly. As the number of TIEAs continues to grow, this relocation of assets is likely to reach its limits.

4.8 Appendices

Table 4.5: List of tax havens together with the total number of Tax Information Exchange Agreements and Double Tax Agreements that meet the OECD standards of information exchange signed by each.

Tax haven	Number of TIEAs	Number of DTAs
Andorra	19	0
Anguilla	17	0
Antigua and Barbuda	19	0
Aruba	21	0
Bahamas	28	0
Bahrain	8	15
Barbados	3	9
Belize	15	0
Bermuda	27	1
Cayman Islands	25	1
Cook Islands	15	0
Cyprus	0	6
Dominica	16	0
Gibraltar	18	0
Grenada	15	0
Guernsey	33	0
Hong Kong	0	15

Table 4.6: Table 4.5 continued.

Tax haven	Number of TIEAs	Number of DTAs
Isle of Man	25	4
Jersey	26	3
Liberia	13	0
Liechtenstein	20	5
Luxembourg	0	11
Maldives	0	0
Malta	1	14
Marshall Islands	12	0
Mauritius	7	2
Monaco	19	3
Montserrat	11	0
Nauru	0	0
Netherlands Antilles	21	0
Niue	0	0
Panama	1	10
Samoa	14	0
San Marino	23	6
Seychelles	9	6
Singapore	0	10
St Kitts and Nevis	19	2
St Lucia	18	0
St Vincent and the Grenadines	20	0
Switzerland	0	9
Tonga	0	0
Turks and Caicos Islands	16	0
Vanuatu	13	0
Virgin Islands, U.S.	0	0
Virgin Islands, British	21	0

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