Empirical Essays on Tax Planning and Transfer Pricing

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Zusammenfassung

Diese Dissertation beinhaltet drei empirische Studien, die sich mit der Steuerplanung von multinationalen Unternehmen und Verrechnungspreisen befassen.

Die erste Studie untersucht den Einfluss der Besteuerung auf die geographische Allokation von Markenrechten großer Unternehmen innerhalb der USA. Die Studie belegt, dass der US-Bundesstaat Delaware hierbei eine führende Rolle einnimmt und die Mehrheit der Markenrechte dort registriert wird. Außerdem analysiert die Studie die Effektivität einer Gruppenkonsolidierung („Combined Reporting“) und zeigt, dass mit diesem Regime ein Rückgang des Anteils der in Delaware registrierten Markenrechte einhergeht. Dennoch scheint das steuerplanerische Gestaltungspotential, das Delaware bietet, nicht vollends beseitigt zu sein.

Die zweite Studie analysiert die Nutzung von Informationstechnologien innerhalb des unternehmensinternen Verrechnungspreissystems. Die Studie analysiert insbesondere die Rolle solcher Informationstechnologien für den Fall, dass die Ziele, die durch das Verrechnungspreissystem in Bezug auf die Steuerplanung sowie die Unternehmenssteuerung verfolgt werden, innerhalb des Unternehmens konfligieren. Die Studie belegt empirisch, dass bei Unternehmen mit einem solchen Zielkonflikt die intensivere Nutzung von Informationstechnologien mit einer gesteigerten Steuereffizienz und Profitabilität einhergeht.

Die dritte Studie analysiert, ob ein strikteres Regelwerk für Verrechnungspreise sowie die striktere Durchsetzung dieses Regelwerks einen messbaren Effekt auf den konzerninternen Handel multinationaler U.S.-Unternehmen hat. Sie belegt, dass striktere Regeln für Verrechnungspreise die Steuer-Sensitivität des konzerninternen Handels senken und somit die damit verbundenen Steuerplanungspotentiale reduzieren.

Summary

This dissertation consists of three empirical studies contributing to the literature on tax planning and transfer pricing.

The first study investigates the impact of U.S. state taxation on the geographical allocation of the intra-U.S. trademark ownership of large U.S. multinationals. The study documents that the U.S. State of Delaware has a leading position as a trademark holding location and that the majority of trademarks are registered there. Moreover, it contains an analysis of the effectiveness of group consolidation (*combined reporting*) and provides evidence that combined reporting significantly reduces the share of trademarks allocated to Delaware. Nevertheless, the identified effects indicate that Delaware-based trademark strategies have not been entirely abandoned.

The second study examines the use of information technologies in a firm's transfer pricing system. In particular, it investigates the role of firms' information environment in mitigating the conflict of managerial and tax objectives in transfer pricing. The study provides empirical evidence that if firms facing conflicting objectives make intensive use of information technologies, they are more profitable, report lower effective tax rates, and face lower tax risk.

The third study analyzes whether the strictness of transfer pricing regulations and their enforcement affect intrafirm trade of U.S. multinational firms. In particular, the results suggest that stricter transfer pricing in a country decrease the tax rate sensitivity of bilateral U.S. intrafirm trade. Thus, the possibilities of U.S. multinationals to engage in transfer pricing related tax planning schemes are effectively reduced.

Keywords

Delaware, Tax haven, Tax avoidance, Trademarks, Intangibles, State taxation, Transfer pricing, Information technology, Digitalization, Management control, Tax planning, Intrafirm trade, Transfer pricing regulations

Schlagwörter

Delaware, Steueroase, Steuervermeidung, Markenrechte, Immaterielle Wirtschaftsgüter, Verrechnungspreise, Informationstechnologie, Digitalisierung, Controlling, Steuerplanung, Konzerninterner Handel, Verrechnungspreis-Regulierungen.

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Chapter 1: Introduction

1.1. Motivation

A firm's central goal is to maximize its after-tax profits. Besides optimizing operational efficiency and exploiting additional sources of revenue, reducing the tax bill is an effective way to achieve this objective as tax liabilities represent one of the largest blocks of costs at most firms. Thus, many multinational firms engage in tax planning activities and shift shares of their group profit to subsidiaries facing relatively low corporate income tax rates (e.g., Hines and Rice 1994; Huizinga and Laeven 2008).

One of the main channels of tax-induced profit shifting is transfer pricing. When goods, licenses or services are transferred between affiliated subsidiaries of the same multinational group, these related-party transactions need to be priced to ensure that each legal entity can file its individual taxable profits. The prices charged for these transactions are referred to as transfer prices. The strategic use of transfer pricing enables multinational firms to utilize tax rate differentials by charging affiliates in low-tax countries with the lowest possible prices while the highest possible transfer prices are applied for intrafirm transactions with affiliates located in high-tax countries. As a result, a higher share of the multinational's overall profits is subject to lower tax rates. Heckemeyer and Overesch (2017) find in a meta-study that transfer pricing is a dominant profit-shifting channel.

Clausing (2006) shows that international tax avoidance and the exploitation of tax rate differentials is a determining factor for intrafirm trade patterns and transfer pricing of U.S. multinationals. To limit the tax planning potential stemming from transfer pricing, a large majority of countries implemented transfer pricing regulations governing how affiliated companies set prices for the intrafirm transfer of goods, services, or licenses. According to most of these regulations, transfer prices must comply with the *arm's length principle* requiring an intrafirm transaction among related companies to be placed on par with transfers among unre-

lated, uncontrolled firms. However, there is substantial variation across countries and time with respect to their transfer pricing regulations, the level of enforcement, and the countries' transfer pricing audit practices. So far, there is not yet any empirical study investigating the impact of this heterogeneity of transfer pricing strictness on intrafirm trade.

Besides intrafirm trade, intangibles are frequently used for tax planning purposes. Intangibles such as patents and trademarks are essential drivers of firm value (Hall et al. 2005; Sandner and Block 2011). They are often related to product innovation and marketing and, thus, are typically referred to as a key for efficient corporate production processes and competitive success (e.g., Hall 2001; Edmans 2011). Concerning tax planning, valuable intangibles offer high potential as they can produce mobile income through licensing. In combination with the intransparent transfer pricing and valuation process of intangibles, trademark licensing models constitute a major source of income shifting opportunities in multinational firms. A rich body of empirical literature investigates such tax avoidance behavior and finds that the location of intangibles is biased towards low-tax affiliates and that the tax rate in a specific jurisdiction exerts a negative effect on the allocation of intangibles in the respective jurisdiction (Dischinger and Riedel 2011; Karkinsky and Riedel 2012; Griffith et al. 2014; Pfeiffer and Voget 2016; Heckemeyer et al. 2018). However, in addition to federal taxation, corporations in the U.S. are subject to state corporate income taxation with state-specific tax codes and tax rates, varying between 0 and 12 percent. This considerable variation entails a substantial potential for corporate tax avoidance. Anecdotal and previous empirical evidence suggests that U.S. firms particularly focus on the State of Delaware in their strategic tax planning due to its attractive tax and legal environment. Despite great public attention on this issue, the empirical literature has, so far, not gathered any direct quantitative evidence on Delaware's role as a location for intangibles. Moreover, the effects of anti-avoidance policies, such as the group consolidation regime *combined reporting*, which was implemented by many states to curb Delaware-based tax strategies, on these allocation patterns are not investigated yet.

However, transfer pricing is not exclusively important for tax planning activities. Another core function of transfer pricing is the coordination of internal trade between business units in decentralized firms. Therefore, transfer pricing is used to establish levels of intrafirm trade and resource allocation that maximize firm-wide profits. This coexistence of managerial and tax objectives carries a substantial potential for conflicts within multinational firms and leads to an immanent trade-off between strategies that achieve the highest tax efficiency and those that establish profit-maximizing levels of production and intrafirm trade. When divisional managers act to maximize pre-tax KPIs but tax managers strive to lower a firm's global tax burden, the central management may benefit from a better information environment to balance these objectives. Adopting advanced information and communication technologies is a common strategy to improve the firms' information environment. Despite the rising uptake of digitalization and the increasing data availability and relevance in the digital economy, there is no empirical evidence on the role of information technology in transfer pricing and its effectiveness in improving managerial decision-making.

1.2. Summary of main contributions and findings

This thesis consists of three separate essays. Table 1.1 provides an overview of these essays' titles, co-authors (if any), and their current status of publication.

Table 1.1: Essay overview.

Ch.	Title	Co-authors	Status of publication
2	*Closing the 'Delaware Loophole'? The Impact of Group Consolidation on the Location of U.S. Trademarks*	Jost Heckemeyer, Michael Overesch	Preparation for submission
3	*Effective Transfer Pricing and Information Technology – Evidence from the Field*	Sven-Eric Bärsch, Marcel Olbert	Under review: *The Accounting Review*
4	*Transfer Pricing Strictness and Cross-Border Intrafirm Trade: Evidence from U.S. Multinational Firms*	-	Working Paper

Notes: This table presents the essays of the thesis with the corresponding chapter (ch.), the title, the co-authors (if any) as well as the current status of publication.

The first study of this dissertation (*Closing the 'Delaware Loophole'? The Impact of Group Consolidation on the Location of U.S. Trademarks*) presented in chapter 2 investigates whether U.S. state taxation determines the intra-U.S. allocation of trademark ownership within large U.S. multinationals listed in the Standard & Poor's 500 (S&P 500) index. We center our analysis on the State of Delaware and examine its role as a domestic U.S. state tax haven. In particular, we investigate whether combined reporting which has recently been introduced by several U.S. states as a countermeasure against Delaware-based tax planning schemes reduces the use of Delaware as trademark location. We find that large U.S. firms indeed locate their U.S. trademarks in Delaware with a disproportionally high frequency. 53.7 percent of our sample U.S. trademarks owned by the S&P 500 firms are registered in Delaware. Our analysis also reveals that combined reporting significantly reduces the share of trademarks allocated to Delaware. Nevertheless, Delaware maintains its dominant position as trademark holding location.

The second study of this dissertation (*Effective Transfer Pricing and Information Technology – Evidence from the Field*) presented in chapter 3 examines the role of firms' information environment in mitigating the conflict of managerial and tax objectives within a firm's transfer pricing system. Specifically, we utilize unique survey data to investigate whether a more intensive use of information technology improves transfer pricing efficiency when the underlying objectives conflict. We find that firms facing conflicting objectives are generally less profitable and less successful in tax planning. If such firms, however, use information technology more intensely, these associations are attenuated as the firms are, on average, more profitable, report lower effective tax rates, and report more sustainable tax positions. Moreover, we also provide first evidence supporting theory that predicts higher financial performance under cost-based transfer pricing in case of a superior information environment. Altogether, our analyses indicate that an intensive use of information technology facilitates transfer pricing strategies that reconcile managerial control with tax efficiency.

The third study of this dissertation (*Transfer Pricing Strictness and Cross-Border Intrafirm Trade: Evidence from U.S. Multinational Firms*) presented in chapter 4 investigates the role of transfer pricing regulations on intrafirm trade of U.S. multinational firms. For this analysis, I utilize country data on intrafirm trade of U.S. multinational firms collected by the U.S. Bureau of Economic Analysis. I match these data with an index variable proxying the degree of strictness of a country's transfer pricing regulations and enforcement across time which was provided by Kenneth Klassen and Devan Mescall. This allows me to examine whether the enforcement of stricter transfer pricing regulations is associated with a reduced tax rate sensitivity of intrafirm trade. In line with prior research, I find that U.S. multinationals conduct, on average, more intrafirm trade with low-tax countries. Additionally, I find that U.S. intrafirm imports are particularly high and, accordingly, intrafirm trade balances lean towards imports with low-tax countries. However, my analyses suggest that these relationships are driven by affiliates resident in countries that have particularly lenient transfer pricing regimes. If stricter transfer pricing regulations are enforced, those associations are mitigated as the sensitivity to tax rate changes is significantly reduced.

Chapter 2: Closing the 'Delaware Loophole'? The Impact of Group Consolidation on the Location of U.S. Trademarks

Abstract

This study investigates whether tax factors determine the intra-U.S. allocation of trademark ownership within large U.S. multinationals. In particular, we focus on the state of Delaware and its role as a domestic U.S. state tax haven. We are interested in whether group consolidation in the form of *combined reporting*, which has been implemented by a large number of U.S. states to protect against tax base erosion, show identifiable consequences for trademark allocation. Utilizing rich trademark data, we empirically document that Delaware's known dominance in parent and subsidiary incorporations carries over to a leading position in trademark ownership. However, an explorative analysis and regression results reveal that group consolidation significantly reduces the share of trademarks allocated to the state of Delaware. Nevertheless, the identified effects do not suggest that Delaware-based trademark strategies have been entirely abandoned. Delaware maintains its key role in the allocation of intangible property ownership. In an additional analysis, we find that investors reward the trademark allocation to Delaware as it increases firm value.

This chapter is joint work with Jost H. Heckemeyer and Michael Overesch.

2.1. Introduction

We investigate the impact of state taxes on the allocation of trademark ownership within large U.S. multinationals. We empirically document that Delaware's known status as a domestic U.S. state tax haven translates into dominance in trademark allocation. Moreover, we analyze the effectiveness of combined reporting that has been implemented by the majority of U.S. states to protect against base erosion.

Corporations doing business in the United States are, in addition to federal taxation, subject to state corporate income taxes with rates varying between zero and 12 percent. This considerable intra-U.S. tax rate variation entails substantial potential for corporate tax avoidance. Anecdotal and previous empirical evidence suggests that U.S. firms particularly focus on one state, Delaware, and its attractive tax and legal environment in their strategic planning. Delaware offers a beneficial tax regime that exempts so-called *passive investment companies* (PICs), i.e., entities generating income related to intellectual property (IP), from state corporate income taxation. Delaware-based state tax avoidance strategies involving PICs have been in the media spotlight for a long time. In 2002, the *Wall Street Journal* published a front-page story on corporate state tax planning schemes using Delaware trademarks and provided a list of 49 firms who evidently applied the PIC strategy (Simpson 2002). Additionally, the *New York Times* repeatedly pointed out Delaware's role as a domestic tax haven in several articles (Browning 2009; Wayne 2012).

As Delaware-based IP tax planning schemes come with substantial tax revenue losses for other U.S. states, they have been a thorn in some states' sides for decades. California was the first state to address this issue in the 1930s. Hollywood filmmakers sold their California-made movies to out-of-state distribution subsidiaries and eroded taxable income in California significantly (Huddleston and Sicilian 2008). To fight this tax-avoiding behavior, California implemented a so-called *combined reporting system* that is seen today as potentially the most effective countermeasure against the PIC strategy (see, e.g., Fox and Luna 2011; Cline 2008;

Mazerov 2009). Under this reporting system, related companies that form a unitary business are required to file one single return to determine state tax liability in the combined reporting state. Therefore, intragroup transactions are effectively eliminated. This feature of combined reporting removes the incentive to allocate profits to a no-tax state such as Delaware since those profits are still taxable in the high-tax state. Many other states followed California and implemented combined reporting provisions. There was an unprecedented wave of combined reporting adoptions among the states, especially between 2005 and 2011, when the number of combined reporting states grew from 16 to 23. In total, combined reporting was proposed in 13 states during 2009 and 2010 (Fox and Luna 2011). Since 2011, a majority of states that levy corporate income taxes have used a combined reporting system.

Considering the great media and public attention Delaware has attracted as a U.S. domestic tax and legal haven, the empirical literature has gathered surprisingly little direct quantitative evidence about Delaware's role as a location for intangible assets and the effect that policies targeted to curb Delaware-based tax strategies have had on these allocation patterns. Bebchuk and Cohen (2003) show that almost 60 percent of U.S. parent firms are incorporated in Delaware. Dyreng et al. (2013) focus on subsidiary location. They empirically document that Delaware's status as a combined domestic tax and legal haven has turned it into the preferred place for subsidiary incorporations. Moreover, they are able to show that combined reporting negatively impacts the probability of locating subsidiaries in Delaware.

In this study, we utilize a dataset containing the U.S. Patent and Trademark Office's (USPTO) case files with matched corporate group structures of the Standard & Poor's 500 (S&P 500) firms. We investigate the allocation of trademark rights towards Delaware by large U.S. multinational enterprises (MNEs) during the period from 2003 to 2012. As essential drivers of firm value, trademarks carry a particularly high potential for tax planning. The tax rate elasticity of trademark allocation has turned out to be generally high in an international setting (Pfeiffer and Voget 2016). Interestingly, however, our data show that 95 percent of the

U.S. trademarks owned by S&P 500 firms are held in the U.S. rather than offshore. This strong *home bias* in the location of U.S. trademarks, which has previously been documented by Heckemeyer et al. (2018), raises the still unanswered question of which domestic tax considerations are actually decisive for the intra-U.S. allocation of trademarks.

Considering our results, we find that large U.S. firms indeed locate their U.S. trademarks in Delaware with a disproportionally high frequency. A total of 53.7 percent of our sample U.S. trademarks owned by the S&P 500 firms are registered in Delaware, while it only contributes to the U.S. national GDP with approximately 0.5 percent. However, Delaware's share in the U.S. trademark portfolio diminished from 2004 to 2012 by approximately 12 percent. Strikingly, the marked declines coincide well with waves of combined reporting adoption during our sample period. Our regression estimates show a negative association between the probability of registering a trademark in Delaware and the registrant's business activity in combined reporting states. Quantitatively, our results suggest that a 10 percent increase in business activity under combined reporting reduces the probability of filing a trademark in Delaware by 0.36 percentage points. While the response to the spread of combined reporting is statistically significant, the magnitude does not suggest that Delaware-based trademark strategies have been fully abandoned. Accordingly, our estimation results identify a robust positive effect of a firm's weighted average statutory corporate state tax rate across the group on the probability of choosing Delaware as a trademark holding location. The probability is higher for those firms that are particularly well placed for effective PIC strategies due to low business activity in combined reporting states, a high presence in Delaware, and high marketing intensity. Taking the skewed distribution of trademark values into account, we find that firms are particularly likely to locate their valuable trademarks in Delaware. Moreover, we find in an additional analysis that investors reward the decision to allocate trademarks to Delaware as it increases firm value, particularly if those trademarks allocated to Delaware carry higher value.

Our study contributes to the literature on corporate income shifting. A rich body of empirical literature examines the effects of corporate taxation on the international allocation of intangible assets. Grubert and Slemrod (1998) and Desai et al. (2006) show that U.S. MNEs with high IP intensity are likely to invest in tax haven affiliates. Dischinger and Riedel (2011) provide empirical evidence that the location of IP within European MNEs is biased towards low-tax affiliates. Karkinsky and Riedel (2012) and Griffith et al. (2014) show that the tax rate in a specific jurisdiction exerts a negative effect on the number of patent registrations in the respective jurisdiction. To the best of our knowledge, we are the first to empirically investigate the pattern of domestic U.S. IP allocation within U.S. firms as well as the impact of state tax incentives and countermeasures. Our research is informative to the ongoing debate on national state tax planning strategies by U.S. firms involving trademarks. U.S. state policymakers have increasingly raised concerns about state tax avoidance strategies and the allocation of intangible assets to low-tax states due to the decline in states' corporate tax revenues over the last decades. While the percentage of state tax revenue sourced by corporate income tax was stable at almost 10 percent in the 1970s, it is now halved to 5 percent.[1]

Moreover, our results also push forward the current debate in the European Union on introducing an apportionment system formula among their member states, as its design and general idea resemble the combined reporting mechanism within the U.S. state tax system. Prior literature finds that tax systems based on formula apportionment are, compared to *traditional* systems based on separate accounting rules, less vulnerable to tax base manipulation (Clausing et al. 2011), particularly for those tax avoidance strategies using a tax-efficient transfer pricing system (Hellerstein 2005) or intragroup financing (Mintz and Smart 2004). However, there has been no study prior to ours that empirically investigates the effect of group consolidation on the allocation of the ownership of intangibles.

[1] The Bureau of the Census provides historical tax revenue data on its website (https://www.census.gov/programs-surveys/qtax/data/tables.html). For instance, in 1977, the share was 9.7 percent while it decreased to 5 percent in 2016.

The remainder of this paper is structured as follows. Section 2.2 reviews the fundamentals of the U.S. corporate income state tax system, explains the Delaware-based tax planning strategy, and describes combined reporting as an effective countermeasure against this form of tax avoidance. Moreover, it demonstrates our data and presents a comprehensive exploratory analysis. Section 2.3 explains our research design to examine determinants of the probability of filing a trademark in Delaware, i.e., a discrete choice analysis at the level of individual trademarks, and presents our empirical results. Moreover, it contains several robustness tests. Section 2.4 contains an additional analysis whether the allocation of trademarks to Delaware has implications for firm value. Section 2.5 concludes the paper.

2.2. U.S. state corporate income taxation and trademark ownership

2.2.1. Context and prior literature

Through successful marketing and brand building, trademarks can carry substantial value reflecting reputation and consumer recognition (Cohen 2008). If a firm launches a new trademark, it has to decide whether it will be registered and to which group entity trademark ownership is allocated. Registering a trademark at the USPTO publicly documents the registrant's claim and creates the legal presumption of ownership, establishing a right of priority covering the entire United States. Consider, for example, that a firm's new trademark is registered at the USPTO by one of its affiliates that is a resident in a low-tax U.S. state. Consequently, this affiliate becomes the legal owner of the trademark. Since legal ownership and the trademark's actual use in commerce are separable, the affiliate can license the right to use the trademark to other operating units of the firm. Considerable state tax benefits are achieved if the royalties paid for the license to use the trademark are deductible from the operating unit's state tax base, while the associated royalty income is subject to comparably low state taxation at the level of the affiliate holding the trademark (Mazerov 2007).

It is an empirically well-documented fact that intangible assets carry a high potential for tax planning as they are, at the same time, essential drivers of firm value and can produce mo-

bile income through licensing (Grubert and Slemrod 1998; Dischinger and Riedel 2011). Previous empirical studies find that the geographical allocation of patent ownership within multinational enterprises indeed reflects international tax incentives (Karkinsky and Riedel 2012; Griffith et al. 2014). Considering the existing empirical evidence, IP-related income-shifting techniques involving tax-efficient transfer pricing and licensing are the dominant profit-shifting channels (Heckemeyer and Overesch 2017). Hence, even small cross-jurisdictional tax rate differences can entail significant shifts in the allocation of IP ownership. Karkinsky and Riedel (2012) estimate that a one-percentage-point decrease in the corporate tax rate increases the number of patent applications by 3.5 percent. Under certain conditions, the international tax effects for trademarks can be at least as high (Pfeiffer and Voget 2016). Considering the U.S. context, however, Heckemeyer et al. (2018) find that the majority of U.S. trademarks owned by the S&P 500 firms is actually held in the U.S. and not in foreign tax havens.

Actually, there is considerable variation in state corporate income tax rates in the U.S. In addition to federal income taxation, 44 U.S. states and the District of Columbia levy a corporate income tax with top tax rates ranging from 4.6 percent in Colorado to 12.0 percent in Iowa. In Delaware, the general state tax rate is 8.7 percent. However, Delaware's *Passive Investment Company (PIC)* regime fully exempts so-called *investment companies* from corporate income taxation under Section 1902(b)(8) of the Delaware Code. An investment company is defined as a company that confines its activities to the maintenance and management of its intangible investments. Section 1902(b)(8) of the Delaware Code explicitly includes trademarks in intangible investments. Underscoring the important role of these intangible assets, Mazerov (2007, p. 23) generally refers to Delaware's passive investment companies as *trademark holding companies*. In this study, we conduct an in-depth microdata analysis while focusing on strategic patterns of trademark allocation.

Table 2.1: Overview of U.S. state tax rates (as of 2012).

State	CIT (2012)	State	CIT (2012)	State	CIT (2012)
Delaware	**0.0%**[a]	Montana	6.8%	California	8.8%
Colorado	4.6%	No. Carolina	6.9%	Maine	8.9%
Mississippi	5.0%	Arizona	7.0%	Connecticut	9.0%[b]
S. Carolina	5.0%	Kansas	7.0%	New Jersey	9.0%
Utah	5.0%	New York	7.1%	Rhode Island	9.0%
No. Dakota	5.2%	Idaho	7.6%	Alaska	9.4%
Florida	5.5%	New Mexico	7.6%	Illinois	9.5%[c]
Georgia	6.0%	Oregon	7.6%	Minnesota	9.8%
Kentucky	6.0%	Nebraska	7.8%	Pennsylvania	10.0%
Michigan	6.0%	W. Virginia	7.8%	Distr. of Col.	10.0%
Oklahoma	6.0%	Wisconsin	7.9%	Iowa	12.0%
Virginia	6.0%	Louisiana	8.0%	Nevada	-
Missouri	6.3%	Massachusetts	8.0%	S. Dakota	-
Hawaii	6.4%	Maryland	8.3%	Wyoming	-
Alabama	6.5%	Indiana	8.5%	Ohio	-[d]
Arkansas	6.5%	N. Hampshire	8.5%	Texas	-[d]
Tennessee	6.5%	Vermont	8.5%	Washington	-[d]

Notes: In this table, we present the top corporate income tax rates as of 2012.

[a] The statutory tax rate is 8.7%. However, in Section 1902(b)(8) of the Delaware Code, so-called *investment companies* (companies that confines its activities to the maintenance and management of its intangible investments, such as trademarks) are fully exempt from the corporate income tax.

[b] Includes a 20% surcharge which is levied on companies with an annual gross income of more than $100mil.

[c] Includes two separate corporate income taxes, one at a 7% rate and one at a 2.5% rate.

[d] Ohio, Texas, and Washington do not levy corporate income taxes. Instead, these states levy a corporate gross receipts tax

To illustrate the achievable tax benefits, for example, through licensing, Table 2.1 shows the U.S. state CIT rates as of 2012. Firms likely to have a Delaware-based PIC strategy in place, labeled by some as *the most well-known aggressive tax planning technique* with respect to U.S. state-level CIT rates (Bankman 2007, p. 778), are able to reduce their state-level income taxes by between 15 and 24 percent relative to other firms (Dyreng et al. 2013). Importantly, these state tax savings have always been permanent while tax savings from cross-border tax planning under the former U.S. system of worldwide taxation with foreign dividend tax credits were temporary and reversed upon repatriation of foreign profits to the U.S.[2]

[2] The U.S. indirect tax credit mechanism applied until 2017 to foreign dividends received by U.S. parent corporations leveled up the tax burden on foreign profits from low-tax countries to the U.S. tax rate. As the national tax system does not have such a mechanism, state tax savings from profit shifting strategies within the U.S. have always been definite.

Delaware stands out not only for the tax advantages it offers but also for the significant legal and governance benefits available to firms incorporated there (Bebchuk et al. 2002; Roe 2003). In 1899, Delaware liberalized its corporate law code to attract business to generate franchise fees and tax revenues (Larcom 1937). Today, Delaware has well-developed case law and many precedents. In particular, parent firms are attracted by Delaware's body of anti-takeover case law that allows for the flexible use of defense tactics. Its legal efficiency also results from the Court of Chancery system with experienced judges specialized in corporate matters and without a jury (Roe 2003). Altogether, Delaware's status as a combined domestic tax and legal haven has turned it into the preferred place for parent (Bebchuk and Cohen 2003) and subsidiary (Dyreng et al. 2013) incorporations.[3] These circumstances also add to the state's attractiveness as a holding location.

2.2.2. Data

The data required to analyze the patterns of U.S. trademark allocation are obtained from the USPTO.[4] The USPTO database contains information about the legal owner of any registered trademark[5], including its name, its address, and the U.S. state where it has its legal domicile. The USPTO case files also document, among other things, the registration date and further trademarks cited in the application. Specifically, we consider successful USPTO trademark registrations that took place between January 2003 and December 2012.[6]

Next, we combine this information on legal trademark owners with data covering the group structures of U.S. companies listed in the S&P 500 Index. The required information is obtained from Exhibit 21 of Form 10-K, which the companies must publicly file with the U.S.

[3] Bebchuk and Cohen (2003) show that almost 60 percent of U.S. parent firms are incorporated in Delaware, while Dyreng et al. (2013) find that approximately 58 percent of U.S. domestic subsidiaries are incorporated there.

[4] The full dataset of all historic trademark filings in the U.S. (from January 1870 to February 2018) is made available for download by the USPTO at https://www.uspto.gov/learning-and-resources/electronic-data-products/trademark-case-files-dataset-0.

[5] A trademark application at the USPTO needs to be filed by the trademark's legal owner (Graham et al. 2013). According to the USPTO manual, the data coverage is 100 percent from 1982 on.

[6] We exclude renewal registrations because trademark renewal often follows the primary filing, potentially leading to a strong dependence of the respective data points and problems of double counting. We also exclude intrafirm reallocations of an already registered trademark.

Securities and Exchange Committee (SEC).[7] Exhibit 21 discloses information about a company's significant subsidiaries and their countries of incorporation.[8] For this information, we refer to the fiscal year 2007, which is the median year of our sample. We include all U.S. subsidiaries. To match the subsidiary data with the trademark data obtained from the USPTO, we use the trademarks' legal owners and the Exhibit 21 subsidiary names with the respective states of incorporation as identifiers.

A detailed description of the data collection and matching process is given in Appendix 2.2. In total, our final dataset includes 81,488 new trademarks registered by U.S. entities of the S&P 500 for use in United States commerce by 497 S&P firms during the time period from 2003 to 2012.

2.2.3. Delaware's dominance as a trademark holding location

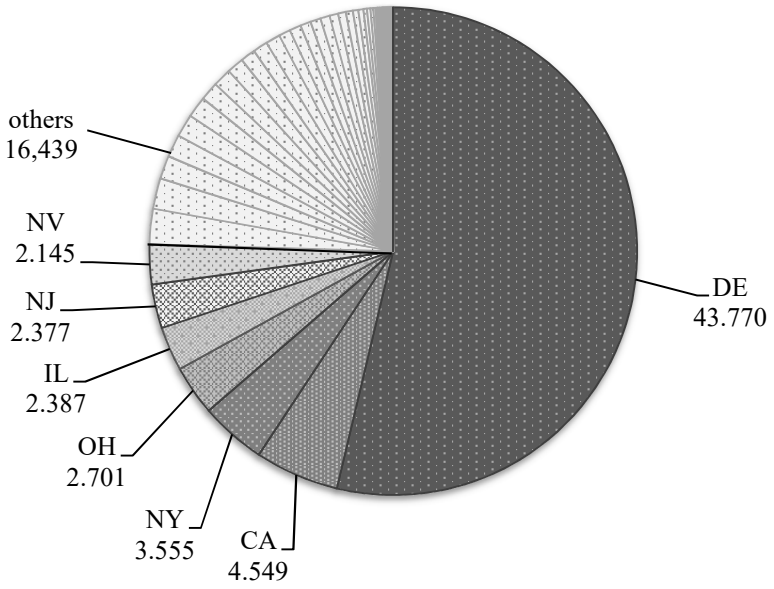
In the following, we will provide first descriptive statistics exploring the role of Delaware as a dominant holding location for U.S. trademarks. Figure 2.1 illustrates the regional distribution of our sample trademarks and shows that Delaware by far dominates all other U.S. states with respect to U.S. trademark registrations. In aggregate, the S&P 500 firms registered 53.7 percent of their U.S. trademarks in Delaware during our sample period from 2003 to 2012.[9]

[7] Data extracted from Exhibit 21 has been used previously, for example, by Dyreng and Lindsey (2009), Lindsey and Wilson (2015), Dyreng et al. (2013), and Heckemeyer et al. (2018). The data are available from the SEC's database EDGAR: https://www.sec.gov/edgar/searchedgar/ companysearch.html.

[8] According to SEC Regulations (17 CFR 210.1-02(w)), a subsidiary can be deemed not to be a significant subsidiary if all of the following three conditions are met: (1) the parent company's and its other subsidiaries' investments in the subsidiary do not exceed ten percent of the parent company's total assets; (2) the parent company's and its other subsidiaries' proportionate share of the assets of the subsidiary do not exceed ten percent of the consolidated firm's total assets; and (3) the parent company's and its other subsidiaries' proportionate share of the subsidiary's pre-tax income from continuing operations does not exceed ten percent of the consolidated income from continuing operations.

[9] This share is much higher in our sample than for the total USPTO dataset of all trademarks located in the U.S. where the ratio of Delaware-trademarks is only 24 percent in the sample period.

Figure 2.1: State distribution of trademarks registered by S&P 500 firms from 2003 to 2012.



Notes: This figure presents the total number of successful trademark registrations filed by affiliates of S&P 500 firms aggregated per U.S. state between 2003 and 2012 for the top seven states. We obtain the location of each firm's subsidiaries from the USPTO case file dataset.

Table 2.2: Aggregated frequency of trademark ownership location choice of S&P 500 firms by state (2003-2012) in relation to GDP contribution.

State	N Trademarks	%Total (I)	GDP ($ Bill.)	%Total (II)	Ratio of %Total: (I) / (II)	Difference (I) – (II)
Delaware	43,770	53.7%	55	0.4%	136.2	53.3%***
California	4,549	5.6%	1,880	13.4%	0.4	-7.8%
New York	3,555	4.4%	1,110	7.9%	0.6	-3.5%
Ohio	2,701	3.3%	486	3.5%	1.0	-0.2%
Illinois	2,387	2.9%	628	4.5%	0.7	-1.6%
New Jersey	2,377	2.9%	471	3.4%	0.9	-0.5%
Nevada	2,145	2.6%	118	0.8%	3.1	1.8%
Minnesota	1,908	2.3%	258	1.8%	1.3	0.5%
Washington	1,656	2.0%	332	2.4%	0.9	-0.3%
Florida	1,252	1.5%	715	5.1%	0.3	-3.6%
Michigan	1,222	1.5%	392	2.8%	0.5	-1.3%
…	…	…	…	…	…	…
Total	81,488	100.0%	14,016	100.0%	0.3 *(median)*	-0.7% *(median)*

Notes: In this table, we examine the frequency of trademark registrations by S&P 500 firms from 2003 to 2012 aggregated on state-level and put it in relation to the GDP contribution of each state. In column (I), we present each state's percentage of the total count of our sample trademarks. We obtain the trademark information from the USPTO case file dataset. In column (II), we present each state's average percentage of total U.S. GDP between 2003 and 2012. Real average GDP by state between 2003 and 2012 (measured in 2009 USD) is taken from the Bureau of Economic Analysis (BEA). In the two rightmost columns, we present the ratio of columns (I) and (II) and the difference between columns (I) and (II). Moreover, we assess the statistical significance of the difference by dividing the difference for each state by the standard deviation of the differences for all the states. ***, **, and * represent statistical significance at the 1%, 5%, and 10% levels, respectively.

In Table 2.2, we compare the respective proportion of trademark registrations to the state's share of the total GDP for Delaware and ten other top U.S. states. We find that Delaware accounts for more than 136 times the number of trademarks we would expect based upon its relative share of the U.S. GDP.[10] The state that comes second in this ranking is Nevada – with a proportion of trademark registrations exceeding its proportion of GDP by a factor of three. Like Delaware, Nevada also refrains from taxing royalty income. In the last column of Table 2.2, we report the differences in means between the trademark share and the GDP contribution as well as the statistical significance of these differences using *t*-statistics.

We observe that Delaware strongly dominates the other states as a trademark filing location. The difference between the proportion of trademarks located in Delaware and its proportion of the total GDP is highly significant at the 1 percent level. Altogether, these bivariate statistics provide the first evidence that the frequency of Delaware-owned trademarks is disproportionally high relative to what Delaware's economic size would predict. We conclude that, at least to some extent, this evidence is consistent with tax considerations rather than economic factors motivating trademark allocation to Delaware.

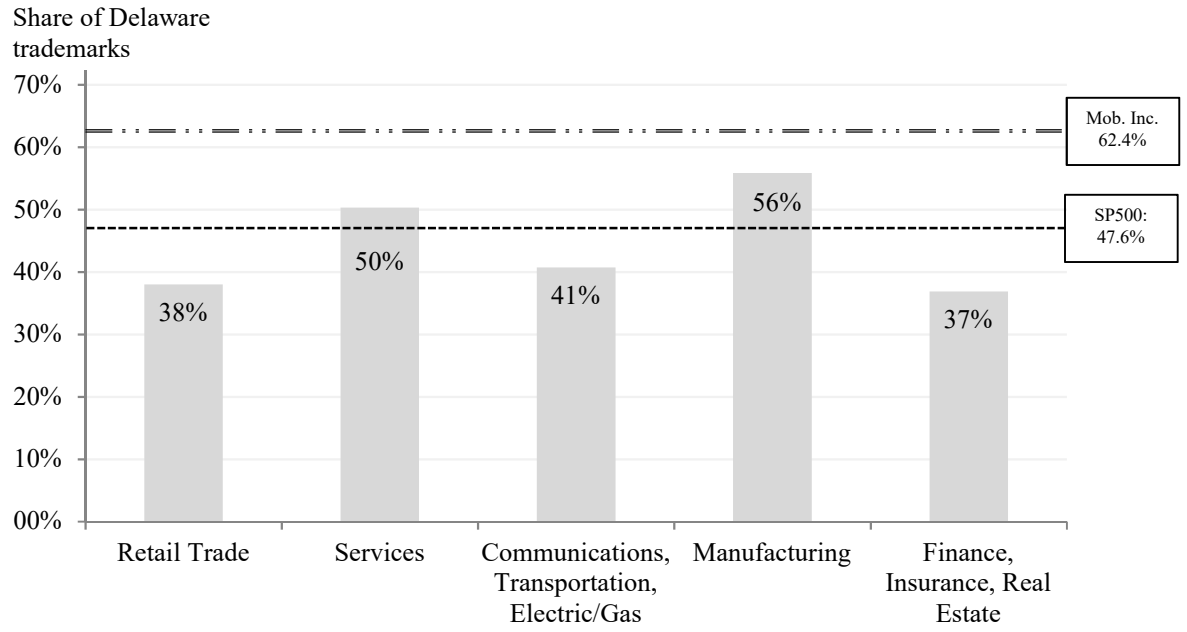
Figure 2.2 shows industry differences in the importance of Delaware as a trademark holding location. Specifically, this figure provides an industry breakdown of the average percentage share of trademarks that firms allocated to Delaware between 2003 and 2012.[11] The overall industry average share of trademarks held in Delaware is highest for the manufacturing industry (56 percent), while it is lowest for the finance, insurance and real estate industries (37 percent). Moreover, we compute the overall sample mean of trademarks allocated to Delaware (lower dotted line) as well as the average share of Delaware trademarks for firms active in industries that turn out to be particularly functional for profit shifting (upper dotted line)

[10] Interestingly, this dominance of Delaware seems to be more pronounced by far with respect to trademarks than with respect to patents. Dyreng et al. (2013) showed a ratio of only 4.58 in a similar comparison for patents.

[11] The industries are grouped according to their industry divisions (https://www.naics.com/sic-codes-industry-drilldown/).

according to research by De Simone, Mills and Stomberg (2014).[12] The average Delaware share of trademarks for these mobile-income industries is indeed approximately 15 percentage points higher than the overall average, i.e. 62.4 percent vs. 47.6 percent.

Figure 2.2: The use of Delaware as trademark location across industries.



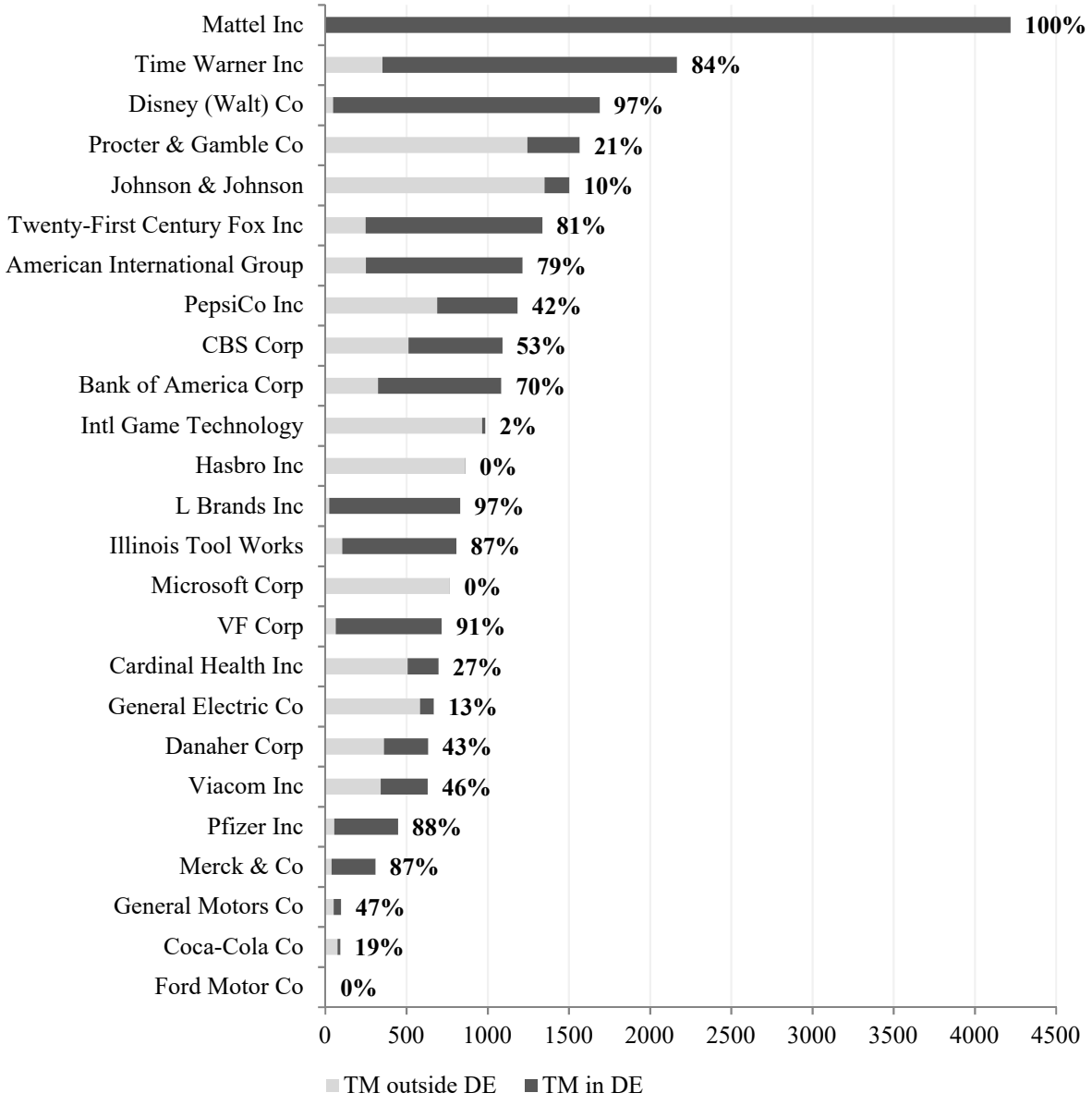
Notes: This figure shows a SIC division breakdown of the firms' average percentage share of trademarks allocated to Delaware between 2003 and 2012. The lower dotted line is the overall firm average share of trademarks that firms allocated to Delaware between 2003 and 2012. The upper dotted line is the firm average share of Delaware-trademarks for firms from specific industries that turn out to be particularly functional for profit shifting according to research by De Simone, Mills and Stomberg (2014), i.e. firms which have one the following three-digit SIC codes: 283 (Pharmaceutical), 357, 367, 737 (Computers) and 738 (Services).

Figure 2.3 illustrates the apportionment of trademark registrations for a selection of 30 S&P 500 firms. Figure 2.3 shows considerable variation in the total number of U.S. trademarks that S&P 500 firms have registered between 2003 and 2012 as well as in the fraction of registrations that they have filed from Delaware. For example, we identify 4,216 U.S. trademarks that have all been registered by the toy manufacturer *Mattel Inc*. from its Delaware-based entities. Moreover, according to our data, fashion retailer *L Brands Inc*. registered 831 U.S. trademarks during the sample period, of which the ownership of 97 percent (i.e., 807) was allocated to Delaware subsidiaries. This is in line with anecdotal evidence published in

[12] These are firms which have one the following three-digit SIC codes: 283 (Pharmaceutical), 357, 367, 737 (Computers) and 738 (Services).

the *Wall Street Journal*[13], presenting this company as one of the most striking examples of a Delaware-based tax strategy that inflicts tax revenue losses on other U.S. states, considering that *L Brands* holds trademarks for its famous *Limited* chains, such as *Bath & Body Works* and *Victoria's Secret*, in its Delaware PICs.

Figure 2.3: Trademark portfolios of selected S&P 500 firms.



Notes: This figure shows the fractions of the U.S. trademark portfolios allocated to Delaware (vs. other U.S. states) between 2003 and 2012 for the Top-20 firms in terms of trademark registrations and, if not already in that group, the Top-10 firms in terms of average advertising expenditure.

[13] See Simpson (2002). The article lists further examples of extensive Delaware-owned trademark registrations that we can confirm on the basis of our data. These are TJX Companies Inc., Staples Inc., Sherwin Williams Co., Kimberly Clark Corp., Honeywell International Inc., Tyson Food Inc., Snap-on Inc., ConAgra Foods Inc., and McCormick & Co. Inc. According to our data, these firms feature a Delaware-share of trademark registrations that ranges between 60 and 99 percent.

2.2.4. Combined reporting as a countermeasure

U.S. states are well aware of the tax revenue shortfalls associated with Delaware-centered intangible licensing models. The most prominent method to fight this type of state tax avoidance strategy is the adoption of mandatory combined reporting for state tax purposes (see, e.g., Fox and Luna 2011; Cline 2008; Mazerov 2009).[14] Combined reporting is a filing method that requires a group of related affiliates to act as one taxpayer and file only one combined tax return for state tax purposes. Consequently, the consolidated income of the group, instead of each separate legal entity, is apportioned among the states where the group has business activity. In line with the state tax guidelines recommended by the Multistate Tax Commission, most jurisdictions apply a formula consisting of three factors to apportion the firms' state tax income among the states: property (which usually does not include intangible property), payroll and sales (Swenson et al. 2004).[15] Importantly, the consolidation of tax returns eliminates intercompany transactions. Thus, it defeats the PIC strategy by netting out trademark-related royalty payments within the group. In this case, interposing a Delaware-based affiliate no longer shields income from taxation in the states of operating activity because the group profit is apportioned to the operational parts of the unitary business. As a consequence, a trademark holding does not lower the state taxable income of the group, and the incentive to allocate trademarks and associated royalty income to Delaware should be eliminated by this countermeasure (Fox and Luna 2011).

[14] Other countermeasures against Delaware-based state tax avoidance strategies are, for example, the economic nexus approach, expense disallowance provisions, sham transactions laws, discretionary combination authority, and transfer pricing audits. According to the literature, most of those other countermeasures are watered down or applied very heterogeneously, so we focus on combined reporting (Mazerov 2007). In a robustness check, we test the effectiveness of the economic nexus doctrine.

[15] In those formulas, each factor is expressed in a fraction where the numerator is the amount of each factor in a state, while the denominator is the firm's overall amount of each factor. The weightings of each factor, however, are not consistent. While some states weight each factor in equal parts, some states put more emphasis on (or exclusively consider) the sales factor. The Federation of Tax Administrators provides an overview of each state's weightings (https://www.taxadmin.org/assets/docs/Research/Rates/apport.pdf).

Table 2.3: Combined reporting and separate reporting states in the U.S.

Combined reporting states (year of adoption)		**Separate reporting states**	
California (1963)	Illinois (1993)	Alabama	New Jersey
Oregon (1975)	Utah (1993)	Arkansas	New Mexico
Montana (1977)	Hawaii (1995)	Delaware	North Carolina
N. Hampshire (1981)	Vermont (2006)	Florida	Ohio
Minnesota (1982)	New York (2007)	Georgia	Oklahoma
Idaho (1984)	Michigan (2008)	Indiana	Pennsylvania
Kansas (1984)	Massachusetts (2009)	Iowa	South Carolina
Nebraska (1984)	W. Virginia (2009)	Kentucky	South Dakota
Colorado (1985)	Wisconsin (2009)	Louisiana	Tennessee
Arizona (1986)	Washington D.C. (2011)	Maryland	Texas
Maine (1986)	Rhode Island (2015)	Mississippi	Virginia
North Dakota (1990)	Connecticut (2016)	Missouri	Washington
Alaska (1993)		Nevada	Wyoming

Notes: In this table, we present the year of implementation of a combined reporting regime in each state, if applicable (source: own research). Adoptions that lie within our sample period 2003-2012 are marked in grey.

As Table 2.3 shows, combined reporting has become increasingly popular among the U.S. states. Between 2003 and 2012, the number of states that have mandatory combined reporting in place has risen by 44 percent, i.e., from 16 to 23 percent. As of 2012, the market size of combined reporting states represents 45 percent of the national U.S. GDP. The seven jurisdictions that adopted combined reporting between 2003 and 2012 are the states of Vermont, New York, Michigan, Massachusetts, West Virginia, Wisconsin, and the District of Columbia.[16] These seven combined reporting adopters contribute 17 percent to U.S. national GDP. Table 2.3 shows which states have implemented combined reporting provisions and the year of implementation.

According to empirical findings presented in Dyreng et al. (2013), firms with business activity in combined reporting states feature an increased state income tax burden, which might be explained by their reduced leeway to exploit Delaware-based tax avoidance strategies. Consistently, the likelihood of a firm having at least one subsidiary in Delaware is positively related to the number of its subsidiaries in separate (vs. combined) reporting states. Mukherjee et al. (2017) find that a corporate income tax increase is associated with less inno-

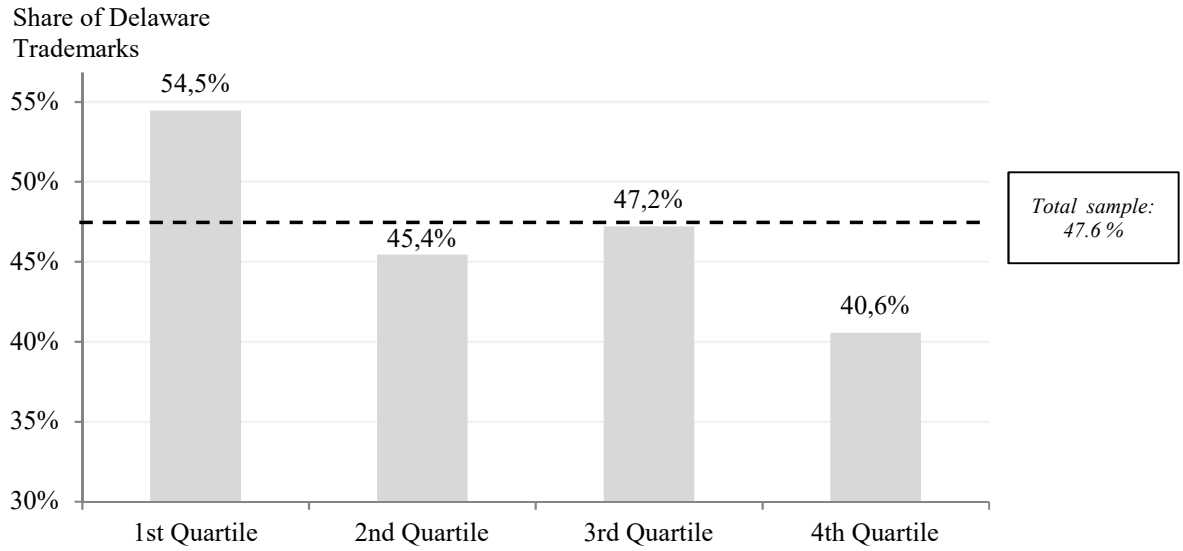
[16] Moreover, nine other states considered adoption (see, e.g., Fox and Luna 2011).

vative activities, as measured by patent filings, only for firms headquartered in a combined reporting state. The innovation of firms domiciling in separate filing states is not permanently hindered. The authors interpret their findings as evidence for the reduced effectiveness of patent shifting towards low-tax states under combined reporting.

Previous findings thus indirectly support the view that the expansion of combined reporting has reduced the effectiveness of Delaware-based tax strategies involving intangible investment. Yet, we expect the effects of combined reporting on these schemes to be most *directly* observable at the level of intangible asset allocation. Precisely, we hypothesize that the substantial expansion of combined reporting during our sample period has negatively affected the allocation of S&P 500 trademark ownership to Delaware. To the best of our knowledge, no study has analyzed this direct effect of combined reporting on the intangible asset allocation towards Delaware.

To provide first graphical evidence of the impact combined reporting has on trademark allocation to Delaware, Figure 2.4 relates the average share of trademarks held in Delaware to the number of a firm's subsidiaries in combined reporting states. Firms in the first sample quartile, i.e., with a relatively low business presence in combined reporting states, have a Delaware concentration of trademark ownership of 54.5 percent. This number is considerably higher than the 40.6 percent share of Delaware-owned trademarks in the group of firms with a relatively high presence in combined reporting states. Firms that have a number of subsidiaries within the second and third quartiles of the count of subsidiaries in combined reporting states feature shares of Delaware ownership that lie in between these numbers.

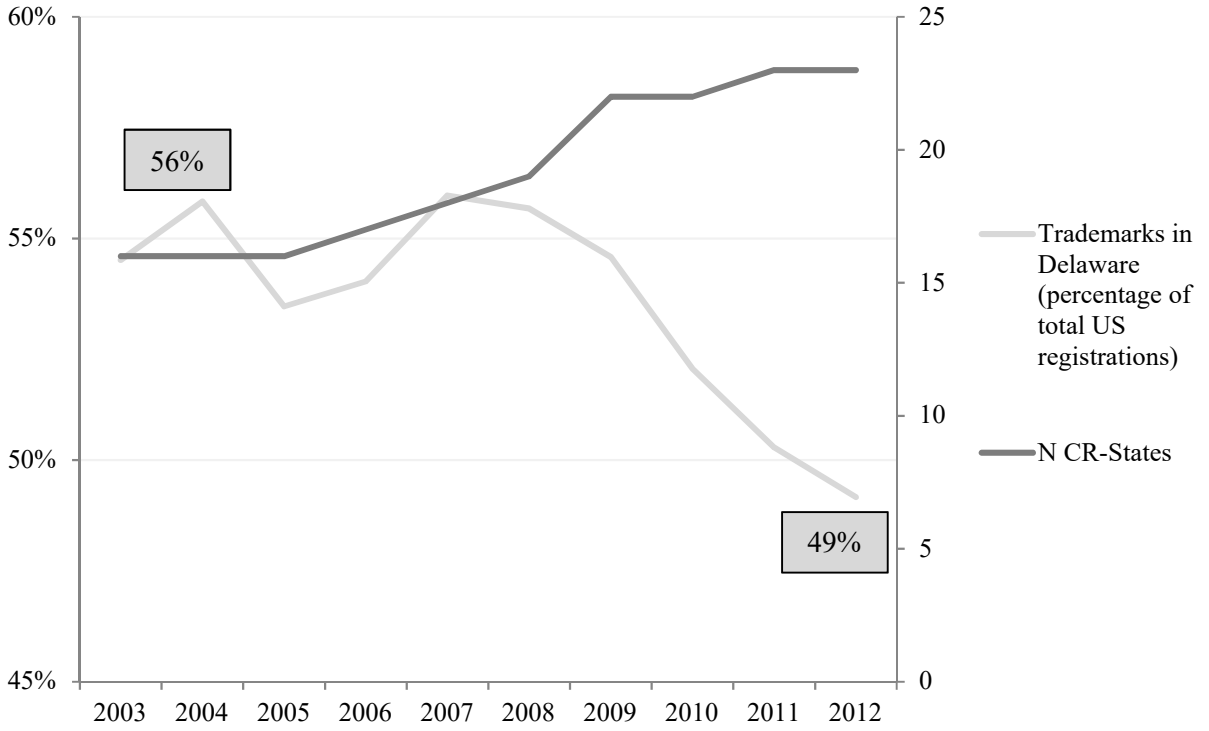
Figure 2.4: Degree of firms' business presence in combined reporting states and the use of Delaware as trademark location.



Notes: This figure shows the average ratios of trademarks that firms allocated to Delaware between 2003 and 2012 in percent for firms in the 1st to the 4th quartiles with respect to the average number of subsidiaries a firm has in combined reporting states over the sample period. The dotted line is the overall firm average ratio of trademarks that firms allocated to Delaware between 2003 and 2012. We obtain the trademark information from the USPTO case file dataset. Firms' state-level subsidiary information based on their Exhibit 21 disclosures is collected from Scott Dyreng's website (https://sites.google.com/site/scottdyreng/).

Figure 2.5 shows that the overall share of Delaware-owned trademark registrations decreases between 2004 and 2012 by approximately 12 percent, decreasing from 56 to 49 percent. Noticeably, this decline correlates strongly with the rise of combined reporting among U.S. states. During our sample period, the share of the total U.S. GDP that combined reporting states contribute increased from 29 to 45 percent. The strongest rise occurred after 2009 when Massachusetts, West Virginia, Wisconsin and the District of Columbia adopted the new regime. According to the graph in Figure 2.5, the rise of combined reporting coincides with Delaware's most significant drop in the frequency of trademark assignment. The correlation coefficient of Delaware's share of trademark registrations and the number of combined reporting jurisdictions is -0.70. These aggregate patterns are consistent with the conjecture that combined reporting indeed bears fruit and, to a certain extent, represses state tax avoidance strategies involving Delaware-held trademarks.

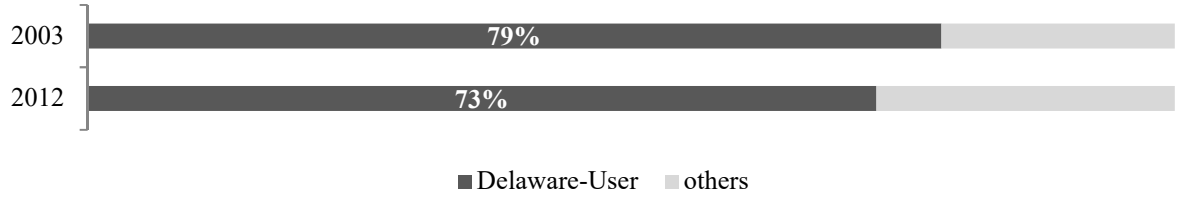
Figure 2.5: The rise of combined reporting and the use of Delaware as trademark location.



Notes: This figure presents the part of the sample trademark that is registered in Delaware relative to the total U.S. registrations per year in percent. We obtain the trademark information from the USPTO case file dataset. Moreover, it shows the number of U.S. states which have implemented combined reporting provisions in the respective year.

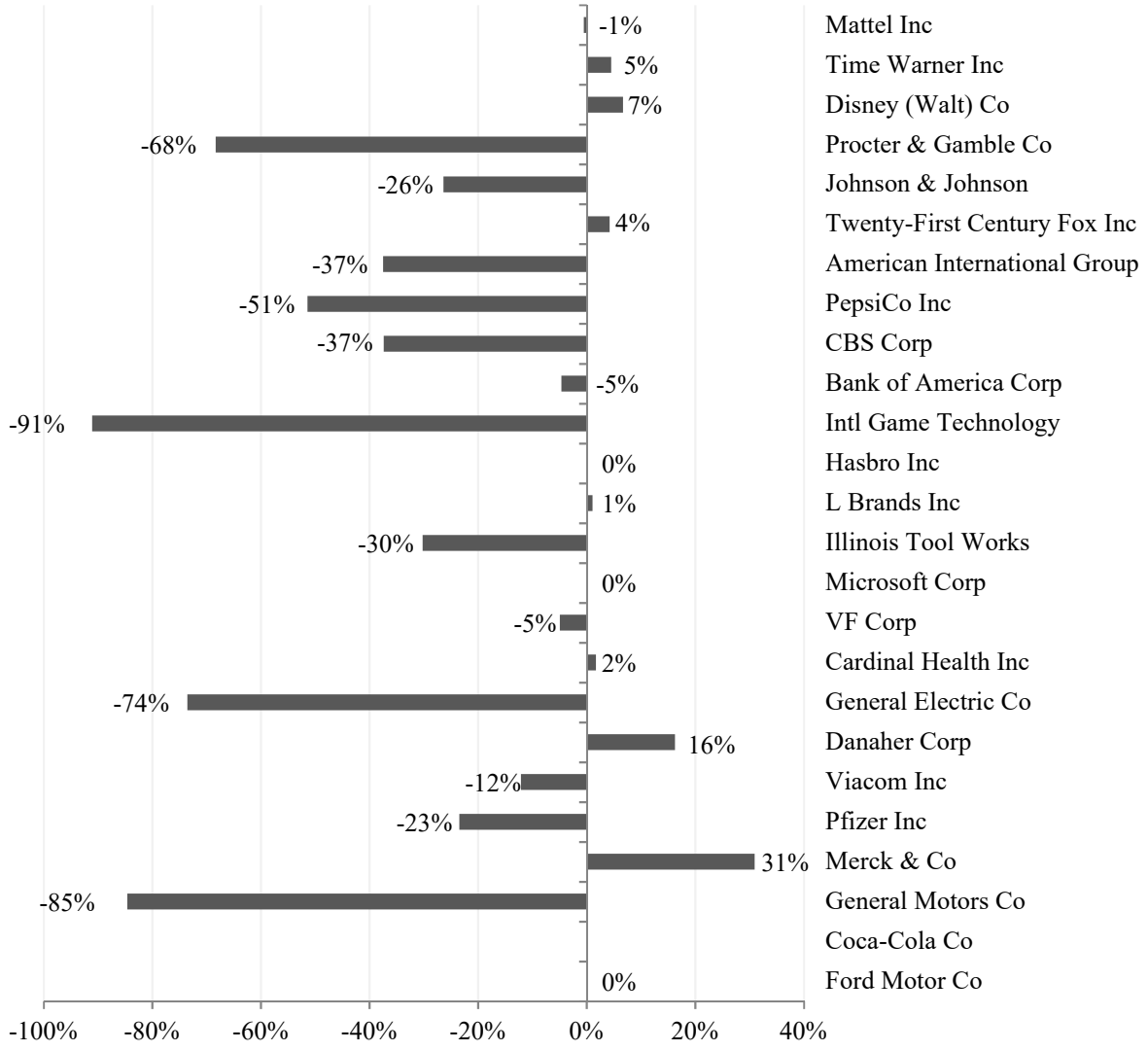
Consistent with the decrease in the aggregate share of Delaware-owned trademark registrations shown in Figure 2.5, we see in Figure 2.6 that the share of S&P 500 firms that have registered at least one new trademark in Delaware drops from 79 percent in 2003 to 73 percent in 2012.

Figure 2.6: The share of firms using Delaware as trademark holding location (2003 vs. 2012).



Notes: This figure shows the percentage of S&P 500 firms that filed at least one of their trademark registrations in Delaware (vs. firms that filed trademark registrations, but none of those at a Delaware subsidiary) for the years 2003 and 2012.

Figure 2.7: Change in the percentage of Delaware-trademarks (2003 vs. 2012) of selected S&P 500 firms.



Notes: This figure shows the percentage change of the share of the trademarks allocated to Delaware in relation to all registered U.S. trademarks (2003 vs. 2012) at the Top-20 firms in terms of trademark registrations and the Top-10 advertising firms in terms of the average advertising expenditures between 2003 and 2012 (five firms meet both criteria). Coca-Cola Co has 0 percent in 2003, so its value is actually not defined.

Interestingly, considering once again the selection of firms presented in Figure 2.3, we find in Figure 2.7 that the developments in trademark registrations over time turn out to be somewhat heterogeneous. On the one hand, we observe sharp decreases in Delaware shares for the majority of firms. For example, *International Game Technology Plc,* had a 91 percent drop in Delaware registrations. On the other hand, other firms feature constant or even slightly increasing fractions of Delaware ownership. Thus, in Section 2.3, we utilize a regression analysis of the determinants affecting the S&P 500 firms' decision to assign their trademarks

to Delaware subsidiaries with special focus on the effect that results from the expansion of combined reporting among U.S. states.

2.3. Multivariate analysis

We aim to investigate the determinants that affect and drive the S&P 500 firms' decision to use Delaware-based tax strategies involving their trademarks. We are particularly interested in the impact that combined reporting has on this choice. For this purpose, we utilize 81,488 trademark registrations at the USPTO and investigate the binary choice whether to locate trademark ownership in Delaware or elsewhere in the U.S.[17]

2.3.1. Methodology

To assess potential determinants of the binary decision whether to locate trademark ownership in Delaware or elsewhere in the U.S., we specify the following linear probability model (LPM).

$$\begin{aligned} Delaware_{jkt} = {} & \beta_0 + \beta_1\, Log(N\ Subs.in\ CR\ States)_{kt} + \beta_2\, Log(N\ Subs.in\ for.TH)_{kt} \\ & + \beta_3\ Avg.\ state\ CIT_{kt} + \beta_4\, Size_{kt} + \beta_5\, Marketing\ Intensity_{kt} \\ & + \beta_6\, Profitability_{kt} + \beta_7 PIC_k + \beta_8\, Valuable_j + Parent\ State\ FE_{kt} \\ & + Year\ FE_t + Industry\ FE_k + \varepsilon \end{aligned} \qquad \text{(Eq. 2.1)}$$

$Delaware_{jkt}$ is the binary dependent variable and takes on the value of one if firm *k* assigns the ownership of a new trademark *j* in year *t* to a Delaware subsidiary and zero otherwise. The explanatory variables included also encompass factors that reflect the tax incentives to allocate trademarks to Delaware but also restrictions to this type of strategy. In particular, we consider the count of firm *k*'s subsidiaries in combined reporting states (Log(*N Subs. in CR States*)). Combined reporting impedes profit shifting with royalty payments for trademarks. Accordingly, we expect that the more a firm's business activity takes place in combined reporting states, the more the firm may refrain from locating its trademarks in Delaware.

[17] Only 4.7 percent of the trademarks the S&P 500 firms have registered at the USPTO during our sample period are owned by offshore affiliates.

Moreover, we consider the natural logarithm of the number of subsidiaries in foreign tax haven countries, Log(*N Subs.in for. TH).*[18] The variable reflects a firm's presence in offshore tax havens outside the U.S. While only a small fraction of U.S. trademarks is owned outside the U.S. (Heckemeyer et al. 2018), the use of offshore tax havens may still be a substitute for Delaware in a company's tax avoidance scheme.

Avg. state CIT is a variable capturing the weighted average of the statutory state tax rates across all locations of a corporate group.[19] We expect that a higher average state CIT rate provides incentives for firms to engage in Delaware-based tax strategies. A higher tax level implies a higher tax-saving potential using PIC schemes. Thus, we predict a positive influence of a firm's weighted average state CIT rate on the decision to locate trademark ownership in Delaware.

Moreover, we follow Dyreng et al. (2013) and construct a binary variable *PIC* to identify firms that are likely to be using a Delaware-based PIC strategy. According to our definition, this indicator takes the value of one for a firm *k* if three conditions are cumulatively fulfilled: (1) the firm has a relatively large proportion of subsidiaries incorporated in Delaware, (2) the firm has a relatively small proportion of subsidiaries incorporated in combined-reporting states, and (3) the firm has a relatively high marketing intensity.[20] We expect the coefficient on the PIC indicator variable to be positive.

Furthermore, we include a proxy for trademark value. A broad body of literature documents that the value distribution of intellectual property rights is highly skewed. This holds true for patents (e.g., Hall et al. 2007; Griffith et al. 2014), and it is also true for trademarks

[18] Countries are defined as tax havens when three of the following four sources list them as a tax haven: (1) Organization for Economic Cooperation and Development (OECD), (2) the U.S. Stop Tax Havens Abuse Act, (3) The International Monetary Fund (IMF), and (4) the Tax Research Organization. This categorization is in line with Dyreng and Lindsey (2009).

[19] For each firm, state CIT rates are weighted by the proportion of its subsidiaries domiciled in that particular state, proxying for the state's share in the firm's business activity. We exclude Delaware subsidiaries when calculating the weights.

[20] Dyreng et al. (2013) use the market-to-book ratio instead of marketing intensity to capture firms with relatively high intangible assets. As we focus on trademarks, we modified this proxy and use marketing intensity. In an untabulated robustness test, we also estimate a specification with a proxy using the market-to-book ratio and find comparable results.

(see, e.g., Sandner and Block 2011; Barth et al. 1998). If companies employ tax avoidance strategies involving royalty payments, the tax savings correlate with the value of the underlying IP. Thus, we predict that Delaware-based strategies particularly involve valuable trademarks.

To proxy for the value of a trademark, we consider two features. First, we check whether the mark has been cited by other subsequent trademarks. Citations have been frequently used as value indicators in patent research (Hall et al. 2005; Ernst et al. 2014). Graham et al. (2013) consider forward citations as an indication of trademark value. We thus argue that trademarks that are cited in subsequent registrations are an indication of umbrella brands.[21] Second, we check whether a trademark has been filed for global protection. As filing for international trademark protection through a Madrid International Registration signals global use in commerce, a trademark that is protected worldwide might be more valuable than a local one (Griffith et al. 2014; Ernst et al. 2014). Eventually, our indicator variable *Valuable* takes a value of one if the mark is cited[22] and/or internationally protected.

Finally, we control for a set of firm characteristics that may have an impact on the decision to allocate trademark ownership to Delaware. Specifically, we include *Size*, defined as the natural logarithm of the firm's total assets, *Marketing Intensity*, defined as the firm's advertising expenses divided by its total assets, and *Profitability*, defined as the firm's gross profits divided by its total sales. Moreover, we include fixed effects for the year, the state of parent incorporation, and the industry. We compute standard errors that are robust to clustering of trademark choices within firms. Summary statistics for all variables used in equation (1) are reported in Table 2.4.

[21] For example, the sample trademark protecting the use of the slogan *Made for iPhone* (Serial No. 85025627, registered in 2010) cites the sample trademark for the product name *iPhone* (Serial No. 77975076, registered in 2009), which is a valuable umbrella trademark and the basis for many other trademarks. Another illustrative example is the filing for the sample trademark protecting the product name *Apple TV* (Serial No. 77152380, registered in 2007), which cites the trademark *Apple* (Serial No. 73120444, registered in 1977) as its prior mark.

[22] We consider trademark citations until 2015.

Table 2.4: Summary statistics**.**

Variable	Obs	Mean	Std. Dev.	Min	Max
Delaware	63,436	0.54	0.50	0	1
N Subs. in CR-states	63,436	17.68	46.36	0	650
N Subs. in EN-states	63,436	28.63	58.72	0	758
N Subs. in for. TH	63,436	37.74	71.20	1	801
Avg. state CIT	63,436	0.06	0.02	0.00	0.10
Size	63,436	10.15	1.62	5.21	14.67
Marketing intensity	63,436	0.03	0.04	0.00	0.20
Profitability	63,436	0.41	0.59	-9.52	2.11
PIC	63,436	0.09	0.23	0	1
PIC (EN)	63,436	0.13	0.34	0	1
Valuable	63,436	0.25	0.43	0	1

Notes: This table shows descriptive statistics for all variables included in the regression model presented in Table 2.5. All variables are defined in Appendix 2.1.

2.3.2. Results

Table 2.5 reports the results of our empirical analysis. Specification (1) puts a focus on the firm-specific tax factors, with Log(*N Subs. in CR states*) as our main explanatory variable of interest. In column (2), we augment the specification and include our *PIC* indicator as well as our trademark value indicator *Valuable*. In the subsequent specification (3), we test for potential nonlinearities in the influence of value on the decision to locate trademark ownership in Delaware. Specifically, we test whether firms prone to Delaware PIC strategies are especially likely to assign their most valuable trademarks to Delaware. In columns (4) and (5), we check for the robustness of our results to alternative estimation techniques. Specifically, we estimate our baseline specification using nonlinear logit and probit estimation.

Table 2.5: Determinants of the probability to choose Delaware as trademark location.

	Combined Reporting					Economic Nexus	
Dep. Var.:	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Delaware	LPM	LPM	LPM	Logit	Probit	LPM	LPM
Log(N Subs. in CR states)	-0.038**	-0.027*	-0.027*	-0.208**	-0.122***		
	(0.015)	(0.014)	(0.014)	(0.081)	(0.046)		
Log(N Subs. in EN states)						-0.036***	-0.033***
						(0.012)	(0.011)
Log(N Subs. in for. TH)	-0.016*	-0.018*	-0.018*	-0.103*	-0.058*	-0.014	-0.009
	(0.010)	(0.010)	(0.010)	(0.060)	(0.033)	(0.010)	(0.012)
Avg. state CIT	1.125**	1.304***	1.312***	6.096**	3.647**	1.336***	1.437***
	(0.466)	(0.474)	(0.474)	(2.776)	(1.624)	(0.491)	(0.477)
Size	0.046**	0.044**	0.044**	0.267**	0.148**	0.041**	0.033*
	(0.018)	(0.019)	(0.019)	(0.109)	(0.061)	(0.018)	(0.019)
Marketing intensity	0.721	0.354	0.350	3.751	2.324	0.715	0.778
	(0.831)	(0.825)	(0.826)	(4.618)	(2.566)	(0.830)	(0.820)
Profitability	-0.030*	-0.029*	-0.029*	-0.145**	-0.088*	-0.029*	-0.031*
	(0.017)	(0.017)	(0.017)	(0.073)	(0.046)	(0.017)	(0.018)
PIC		0.272***	0.258***				
		(0.096)	(0.098)				
Valuable		0.028***	0.024***				0.023**
		(0.009)	(0.009)				(0.010)
PIC x Valuable			0.059*				
			(0.033)				
PIC (EN)							0.067
							(0.049)
PIC (EN) x Valuable							0.038*
							(0.022)
Constant	-0.697***	-0.680***	-0.677***	-2.903***	-1.638***	-0.615***	-0.589***
	(0.221)	(0.238)	(0.239)	(0.985)	(0.556)	(0.219)	(0.227)
Observations	63,436	63,436	63,436	63,108	63,108	63,422	63,422
R^2	0.38	0.39	0.39			0.38	0.38
Year Dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry Dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Parent-State Dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: This table presents the results of estimating a linear (1-3, 6-7), a logit (4) and a probit (5) regression model on trademark level with a binary dependent variable taking the value of one if a trademark is filed in Delaware (*Delaware)*. All variables are defined in Appendix 2.1. Standard errors are clustered by firm and reported in parentheses. *, **, and *** represent statistical significance at the 10, 5, and 1 percent levels (all two-tailed), respectively.

Turning to the estimation results, we consistently identify a negative coefficient of Log(*N Subs.in CR States*). Hence, combined reporting effectively reduces the attractiveness of Delaware as a trademark holding location. The more a firm's business activity takes place in states with combined reporting, the less likely it is to choose a Delaware subsidiary to own its trademark rights. This empirical finding confirms our expectation and the explorative analysis illustrated with Figures 2.4 and 2.5 in Section 2.2.

Taken at face value, the estimated coefficient of Log(*N Subs.in CR States*) presented in column (1) suggests that, on average, a 10 percent increase in business activity under com-

bined reporting reduces the probability that a firm will file a trademark in Delaware by 0.36 percentage points ($= \ln(1.1) * 0.038$).[23] While statistically significant, the direct effect from the number of subsidiaries subject to regimes of combined reporting empirically explains only part of the 12 percent drop in the aggregate share of Delaware-owned trademark registrations (see Figure 2.5), which is also absorbed by the set of further observable and unobservable factors controlled for in our regressions.

Furthermore, the probability that a firm assigns a Delaware entity to own a trademark registration turns out to be significantly reduced if a firm is present in offshore tax havens. The estimates for the variable Log(*N Subs.in for. TH)* are negative and significant at a 10 percent level. Interpreted at face value, the coefficient in column (1) suggests that one additional subsidiary in a foreign tax haven decreases the probability of choosing Delaware as a trademark location by approximately 0.1 percentage points at the average S&P 500 firm. This result suggests that domestic and offshore tax havens, to a certain degree, act as substitutes in firms' tax planning considerations.

Moreover, we consider potential determinants that favor the use of Delaware-based tax strategies. An increasing savings potential of state taxes, as reflected by the group's average tax level, seems to incite firms to choose Delaware as a holding location for trademarks. Referring to columns (1) to (3) of Table 2.5, an increase in a group's weighted tax rate by one percentage point is, on average, associated with a 1.1 to 1.3 percentage point increase in the probability to locate trademark rights in Delaware. Moreover, we estimate a positive coefficient of the binary *PIC* indicator marking firms that are particularly prone to implement a Delaware-based state tax avoidance strategy. Quantitatively, the estimated coefficients of *PIC* in Table 2.5 suggest that the probability of locating trademark ownership in Delaware in-

[23] The log-transformation for zero values is not defined. In an untabulated robustness check, we add a small constant (=0.1) to avoid losing firms that do not show any business presence in combined reporting states. This approach is in line with previous studies (e.g., Plassmann and Tideman 2001; Hilary and Lennox 2005; Weichenrieder 2009; Dischinger and Riedel 2011). The results remain comparable to our baseline results.

creases by 26 to 27 percentage points if a firm is positioned to benefit from a PIC strategy. This effect is consistently significant at the 1 percent level.

Considering the estimated coefficients of our value indicator *Valuable* in columns (2) and (3) of Table 2.5, we find that a higher trademark value significantly increases the probability of locating trademark ownership in Delaware. Quantitatively, the probability to register it in Delaware is increased by approximately 2.4 to 2.8 percentage points if the trademark is considered valuable.

Finally, we investigate whether the relationship between trademark value and its ownership location in Delaware is particularly strong for firms that are more exposed to the PIC strategy. Including an interaction of the binary variables *Valuable* and *PIC*, we find in column (3) of Table 2.5 that the positive effect of trademark value more than triples in the case of *PIC* firms. More specifically, the coefficients suggest that the probability of filing a trademark in Delaware is 8.3 percentage points higher for *PIC* firms.

With respect to the remaining firm-level control variables, we find that larger firms are significantly more likely to choose Delaware subsidiaries to own their trademarks. Profitability has a negative effect, and marketing intensity has no statistically significant influence on trademark allocation.

Considering our robustness checks, the results from both the logit and the probit estimations in columns (4) and (5) of Table 2.5 confirm our main inferences from the linear probability model. Considering, for example, the results from the logit estimation, the coefficient of -0.208 suggests that a 10 percent increase in business activity under combined reporting reduces the probability of filing a trademark in Delaware by 0.32 percentage points. This estimated effect is very similar to our baseline specification using LPM.

In columns (6) and (7) of Table 2.5, we extend our analysis and consider the effects of the so-called *economic nexus doctrine* on Delaware-based tax avoidance strategies involving the use of trademarks. In states with this type of state tax regime, the liability to state tax de-

pends on a firm's *economic footprint* in the jurisdiction. Thus, nexus might already be established by the generation of revenues, whereas the usually required physical presence, for example, embodied by property or employees, is not necessary. If nexus is given, the applying state may deny the deduction of royalty expenses and include the income associated with trademark use in its state tax base.[24] To investigate the effect of the nexus approach on trademark allocation to Delaware, we adjust the count of subsidiaries in combined reporting states to additionally take into account affiliates active in economic nexus states, i.e., *Log(N subs in EN-states)*. The estimated coefficient of such a modified subsidiary count reported in columns (6) and (7) is slightly more negative than that in our baseline approach (column (1)) and highly significant. This finding suggests that the additional restriction adds to the suppression of Delaware-based trademark strategies.

2.3.3. Robustness test: Poisson estimation at the firm-year level

In a further robustness check, we redefine our general data structure. Instead of considering observations at the trademark level, we take a firm-level perspective and consider trademark counts. In this redefined dataset, the dependent variable is the number of trademarks located in Delaware for each firm-year included in our data.

To acknowledge the count nature of these data, we use a Poisson regression model, which is a natural starting point for analyzing count data (Cameron and Trivedi 2013), for our investigation.[25] To control for time-constant, unobservable, firm-specific factors as well as to control for aggregate fluctuations over time, we estimate a fixed-effect Poisson model with firm and time-fixed effects. As a consequence, time-invariant explanatory variables such as our *PIC* indicator are omitted in this specification.

[24] In addition to the states that already enforced combined reporting that, by definition, follow this doctrine, Arkansas, Florida, Indiana, Iowa, Maryland, New Jersey, North Carolina, Rhode Island, and South Carolina assert an economic nexus doctrine throughout the entire sample period. During the sample period, Louisiana, Ohio (both 2004), Oklahoma (2005), Kentucky (2007), Alabama (2008), and Connecticut (2010) adopted this doctrine.

[25] We follow, for instance, Papke (1991), who uses a Poisson model to investigate the impact of tax rate differences within the U.S. on the location decisions of companies.

Table 2.6: Firm-level robustness test.

Dep. Var.:	(1)	(2)
Delaware_count	Poisson FE	Poisson FE
N Subs. in CR states	-0.0014***	
	(0.001)	
Ratio of Subs. in CR states		-0.287**
		(0.144)
N Subs. in for. TH	0.001*	-0.000
	(0.000)	(0.000)
Avg. state CIT	1.311	1.791
	(1.197)	(1.236)
Size	0.007	0.012
	(0.083)	(0.082)
Marketing intensity	1.176	1.204
	(2.126)	(2.075)
Profitability	-0.038***	-0.038***
	(0.007)	(0.007)
Observations	3,585	3,585
Year FE	Yes	Yes
Firm FE	Yes	Yes

Notes: This table presents the results of estimating a Poisson fixed effects model on firm-year level with a Delaware-trademark count as dependent variable (*Delaware_count)*. All variables are defined in Appendix 2.1. Standard errors are clustered by firm and reported in parentheses. *, **, and *** represent statistical significance at the 10, 5, and 1 percent levels (all two-tailed), respectively.

Table 2.6 presents the regression results for this count data model. As shown in column (1), we can generally confirm our main finding. The number of trademarks that a firm allocates to Delaware decreases when its number of subsidiaries in combined reporting states increases. Quantitatively, ten more subsidiaries in combined reporting states lead to a decrease of 1.4 percent (i.e., $e^{10*-0.0014} - 1$) in the number of trademarks allocated to Delaware in the respective year.

Additionally, we analyze a modified proxy measuring the business presence in combined reporting states and take into account the *share* (instead of the count) of subsidiaries located in combined reporting states in column (2). Our results suggest that a one-percentage-point increase in this ratio brings about a 0.29 percent decrease in the number of trademarks allocated to Delaware.

2.4. Additional analysis: Firm value implications of Delaware trademarks

2.4.1. Methodology

A large body of research examines the firm value implications of patents and trademarks (e.g., Hall et al. 2005; Hall et al. 2007; Sandner and Block, 2011). Moreover, Dharmapala (2009) finds that corporate tax avoidance has firm value implications. Thus, we examine in an additional analysis if the choice to locate its trademark stock in Delaware is a determinant of the registering firm's value. Therefore, we estimate an OLS model of the following form.

$$Log(Tobin's\ Q)_{kt} = \beta_0 + \beta_1\ TM\ Stock/Assets_{kt} + \beta_2\ R\&D\ Stock/Assets_{kt} + \beta_3\ Sales_{kt} + Firm\ FE + Year\ FE + \varepsilon_{kt} \quad \text{(Eq. 2.2)}$$

The dependent variable of this analysis is the natural logarithm of *Tobin's Q* which we calculate as the market value of assets divided by the book value of assets.[26] Originally, this approach stems from the corporate finance literature which uses Tobin's Q as the most common measure to capture firm value.[27] However, Tobin's Q has also proven to be a suitable proxy for firm value in studies related to our setting. In particular, we follow Hall et al. (2005) and Hall et al. (2007) which focus on the effects of capitalized research and development (R&D) expenses and patent stocks on firm value.[28]

Marketing activity can be considered as an investment activity in a firm's brand and trademark stock value. Thus, investors should positively account for a firm's trademark stock and its trademark investments. To capture this, we construct several variables measuring input and output of marketing activities, i.e., the capitalized advertising expenses *Marketing Stock* and the trademark stock *TM Stock*, each scaled by the firm's total assets. Moreover, we com-

[26] Market value of assets is the book value of assets plus the market value of common equity less the sum of the book value of common equity (Desai and Dharmapala, 2009).
[27] Desai and Dharmapala (2009) call it the commonly accepted 'standard' in corporate finance literature since Demsetz and Lehn (1985) to use Tobin's Q as measure for firm value.
[28] Moreover, Sandner and Block (2011) tested firm value implications of trademark stocks in general. Desai and Dharmapala (2009) use Tobin's Q to analyze the value implications of corporate tax avoidance.

pute the firm's cumulated R&D activity which represents an investment activity of the firm to gain a valuable patent as an output. As a patent contributes positively to the firm's observed market value, investors should positively account for a firm's R&D investments and capitalize it in the firm value.[29]

In our analysis, we mainly focus on the trademark stock variables. First, we determine the total stock of U.S. trademarks a firm holds in a given year. In line with Sandner and Block (2011), we predict that firms increase their firm value with generally increased trademark intensity. Second, we split the stock and distinguish between trademarks located in Delaware and trademarks located in any other state. We expect that the positive effect on firm value is higher for Delaware-located trademarks than for those located in other states. This is based on the assumption that (i) firms locate their most valuable trademarks to Delaware, and that (ii) the location choice Delaware enables the firm to use the PIC strategy to reduce state tax liabilities which may increase the market value of the firm (Dyreng et al., 2013). Third, we only consider the firm's stock of *valuable* U.S. trademarks and distinguish between those held by a U.S. subsidiary incorporated in Delaware and those held in any other state. We also expect that the positive effect on firm value is higher for Delaware-located trademarks than for those located in other states. Compared to the previous measure, the positive effect of Delaware-based valuable trademarks should be stronger.

Our empirical model includes a full set of firm fixed effects. This controls for unobserved heterogeneity constant over time. Moreover and in line with Hall et al. (2007), we include the natural logarithm of the firm's sales as a control for size. Additionally, we include a full set of year dummies. We compute standard errors that are robust to clustering within firms. Summary statistics for all variables used in Equation 2.2 are reported in Table 2.7.

[29] See Appendix 2.3 for a detailed variable description.

Table 2.7: Summary statistics**.**

Variable	Obs	Mean	Std. Dev.	Min	Max
Log(Tobin's Q)	2,246	0.67	0.44	-0.53	2.62
TM (US) stock / assets	2,246	0.04	0.08	0.00	1.15
TM (DE) stock / assets	2,246	0.02	0.07	0.00	1.15
TM (non-DE) stock / assets	2,246	0.02	0.04	0.00	0.62
Valuable TM (DE) stock / assets	2,246	0.01	0.02	0.00	0.34
Valuable TM (non-DE) stock / assets	2,246	0.00	0.01	0.00	0.14
R&D stock / assets	2,246	0.23	0.28	0.00	2.33
Marketing stock / assets	1,346	0.43	0.66	0.00	6.46
Sales	2,246	8.94	1.31	5.08	13.05

Notes: This table shows descriptive statistics for all variables included in Equation (2). Variables are defined in the Appendices 2.1 and 2.3.

2.4.2. Results

Table 2.8 reports our regression results for the analysis of whether the decision to locate (valuable) trademarks in Delaware influences the firm value of the registering S&P 500 company. We first test some general value implications of input factors for the creation of intangible assets. We focus on (i) R&D activity as an input factor for patents and on (ii) marketing activity as an input factor for trademarks. As shown in column (1), a company's firm value is, on average, positively associated with an increase in each, R&D and marketing stock scaled by total assets. Thus, it confirms Hall et al. (2005) and Hall et al. (2007) who find this association with the R&D expenditure stock. Moreover, it extends their findings because we show that this association also exists with the capitalized advertising expenditure stock.

As we are primarily interested in the effects of the output of marketing activity, namely successful trademark registrations, we replace the input factor *marketing stock* by the total stock of U.S. trademarks that the firm registered at its U.S. subsidiaries scaled by total assets. We find that, on average, firm value is positively associated with an increase in a firm's trademark stock. This finding is in line with Sandner and Block (2011) who also show that trademarks have a positive effect on firm value.

To analyze whether the effect is different if there is a concentration of Delaware-trademarks, we split the stock of trademarks and provide regression results of the estimated effect of the stock of trademarks located in Delaware and the stock of trademarks located in any other U.S. state. We report the corresponding regression results in columns (3) and (4) of Table 2.8. We find that the positive effect of Delaware-trademarks on firm value is 16 to 18 percent stronger than the one of total trademarks. This finding is in line with our expectations and indicates that (i) firms tend to locate those trademarks to Delaware which contribute the most to firm value, and that (ii) investors value the decision to use Delaware as trademark location due to state tax avoidance opportunities. Interestingly, we cannot find that the stock of non-Delaware trademarks has a positive effect. This suggests that the Delaware-trademarks might be the driver for the overall positive effect trademarks have on firm value.

Table 2.8: Firm value implications of the trademark allocation to Delaware.

Dep. Var.: *Log(Tobin's Q)*	(1)	(2)	(3)	(4)	(5)
TM (US) stock / assets		1.212*			
		(0.633)			
TM (DE) stock / assets			1.432*	1.403*	
			(0.860)	(0.849)	
TM (non-DE) stock / assets				0.572	
				(1.749)	
Valuable TM (DE) stock / assets					3.671*
					(2.185)
Valuable TM (non-DE) stock / assets					-3.701
					(3.129)
R&D stock / assets	0.266**	0.255***	0.273***	0.264***	0.287***
	(0.106)	(0.0901)	(0.0874)	(0.0895)	(0.0893)
Marketing stock / assets	0.207***				
	(0.0674)				
Sales	-0.0548	-0.111**	-0.120***	-0.114***	-0.138***
	(0.0576)	(0.0428)	(0.0420)	(0.0436)	(0.0394)
Constant	1.398***	1.871***	1.970***	1.912***	2.167***
	(0.509)	(0.377)	(0.365)	(0.392)	(0.341)
Observations	1,346	2,246	2,246	2,246	2,246
R-squared	0.300	0.309	0.309	0.309	0.306
Year FE	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes

Notes: This table presents the results of estimating a pooled OLS regression with the dependent variable *Log(Tobin's Q)*. All variables are defined in the Appendices 2.1 and 2.3. Standard errors are clustered by firm and reported in parentheses. *, **, *** represent statistical significance at the 10, 5, and 1 percent levels (all two-tailed), respectively.

In a last step, we aim to identify the effect that state tax avoidance opportunities have on the investor's perceived value. Therefore, we analyze the effect of valuable trademark stocks and provide the results in column (5). We gain two insights from this regression. First, we find that valuable trademarks located in Delaware have a positive effect on firm value, while we cannot show that the number of valuable trademarks located in other states significantly influences firm value. This implies that the investors particularly value the decision to go to Delaware, additionally to the finding that firms primarily locate their valuable trademarks to Delaware. This might result from the increased tax planning potential stemming from this trademark stock. Second, the effect of valuable trademarks in Delaware is 2.6 times higher than the effect of all trademarks in Delaware. The tax planning potential which might be responsible for this increase in value is higher when using valuable trademarks. Thus, these results also conform to our expectations.

2.5. Conclusion

In this study, we explore the impact of tax considerations on the geographical allocation of the ownership of the trademarks of U.S. multinationals within the U.S. In particular, we shed light on the question of whether group consolidation, which has recently been adopted in several U.S. state tax codes (i.e., *combined reporting*), is an effective countermeasure against Delaware-based state tax avoidance strategies.

We empirically show that the U.S. state of Delaware strongly dominates in the allocation of trademark ownership. Overall, 53.7 percent of all trademarks successfully registered by the S&P 500 firms between 2003 and 2012 are allocated to a subsidiary located in Delaware. However, Delaware's share in the U.S. trademark portfolio diminishes from 2004 to 2012 by approximately 12 percent. The decline coincides with waves of combined reporting adoption by some major U.S. states such as New York and Michigan during our sample period. We document that a high business presence in combined reporting states negatively affects the probability of choosing Delaware as a trademark holding location. Quantitatively,

our results suggest that, on average, a 10 percent increase in business activity under combined reporting reduces the probability of filing a trademark in Delaware by 0.36 percentage points. In an additional analysis, we moreover find that investors reward the decision to allocate trademarks to Delaware as it increases firm value.

While statistically significant, the empirical estimates explain only part of the observed aggregate trend. After all, while the negative effect from the uptake of combined reporting and correlating downward trends in Delaware registrations are remarkable, the magnitude of these developments does not suggest that Delaware-based tax avoidance strategies using intangible assets have been fully abandoned.

Our study contributes to the existing literature in several ways. The study underlines Delaware's role as a domestic U.S. state tax haven. Therefore, we complement the finance and legal literature regarding Delaware's dominance in parent and subsidiary incorporations by providing direct evidence at the intangible assets level, which ultimately are the vehicle for tax strategies that are used to generate tax savings. We also provide quantitative evidence of the impact of group consolidation that is informative to the public finance and international taxation literature. Specifically, we inform the ongoing debate over the adoption of a CCCTB in the European Union comprising a system of formula apportionment based on group-consolidated profits. Policy makers in the European Union might draw conclusions regarding the potential effect of such a reform from this study's results and derive a prediction that the consolidation of a groups' tax base might effectively reduce, though not entirely eliminate, the allocation of intangible property to tax havens.

Appendix Chapter 2

Table 2.9: Appendix 2.1: Variable definitions**.**

Delaware	1 if trademark ownership is assigned to an affiliate of the MNE located in the U.S. state Delaware; 0 otherwise **Source**: USPTO
N Subs. in CR-states	The number of subsidiaries located in combined reporting states **Sources**: - Firms' state-level subsidiary information based on their Exhibit 21 disclosures: Scott Dyreng's website[a] - State tax system: own research
N Subs. in EN-states	The number of subsidiaries located in combined reporting or economic nexus states **Sources**: - Firms' state-level subsidiary information based on their Exhibit 21 disclosures: Scott Dyreng's website[a] - State tax system: own research, Dyreng et al. (2013).
N Subs. in for. TH	The number of subsidiaries located in foreign tax havens **Sources**: - Firms' state-level subsidiary information based on their Exhibit 21 disclosures: Scott Dyreng's website[a] - See Dyreng and Lindsey (2009) for a country classifications
Avg. state CIT	The weighted-average statutory tax rate of states (excl. Delaware) in which the MNE discloses subsidiaries, in decimals: [stat. tax rate for given state * count(subs. in that state)] / [count(total US subs.) − count(subs. in DE)] **Sources**: - Firms' state-level subsidiary information based on their Exhibit 21 disclosures: Scott Dyreng's website[a] - Statutory tax rates: own research
Size	The natural logarithm of the amount of the MNE's total assets (log (*at*)) **Source**: Compustat
Marketing intensity	The amount of the MNE's advertising expenses, scaled by total assets (*xad/at*) **Source**: Compustat
Profitability	The ratio of the MNE's gross profit to total sales (*gp/sale*) **Source**: Compustat
PIC	Binary variable indicating if a firm is suitable to implement a Delaware-based PIC strategy with trademarks or not: 1 for firms in the upper tercile of the ratio of *N Subs. in DE* to *N Subs. in US*, in the lower tercile of the ratio of *N Subs. in CR-states* to [*N Subs. in US – N Subs. in DE*], and in the upper half of *Marketing intensity*; 0 otherwise **Sources**: - Firms' state-level subsidiary information based on their Exhibit 21 disclosures: Scott Dyreng's website[a] - Firms' cons. financial statement information: Compustat - State tax system: own research

(The appendix is continued on the next page.)

Table 2.9: Appendix 2.1 (continued).

PIC (EN)	Modified version of *PIC*: 1 for firms in the upper tercile of the ratio of *N Subs. in DE* to *N Subs. in US*, in the lower tercile of the ratio of *N Subs. in EN-states* to [*N Subs. in US – N Subs. in DE*], and in the upper half of *Marketing intensity*; 0 otherwise **Sources**: - Firms' state-level subsidiary information based on their Exhibit 21 disclosures: Scott Dyreng's website[a] - Firms' cons. financial statement information: Compustat - State tax system: own research
Valuable	1 if the trademark is cited by subsequently registered trademarks (until 2015) or if the trademark is registered worldwide using the *Madrid Protocol*; 0 otherwise **Source**: USPTO

[a] Scott Dyrengs website is available at https://sites.google.com/site/scottdyreng/.

Appendix 2.2: Sample Selection.

The data on the trademarks registered by the S&P 500 firms is obtained from the USPTO case file dataset. The group structures of S&P 500 firms are publicly disclosed in Exhibit 21 of Form 10-K which every U.S. company has to file to the U.S. Securities and Exchange Committee (SEC). We consider all trademarks that were successfully registered for the first time between January 2003 and December 2012 by a U.S. subsidiary. We then match these trademark data with that SEC Exhibit 21's subsidiary data of the year 2007 (i.e., the median year of our sample). As identifiers, we use the entities' legal names and their countries of incorporation. To be considered a match, we require the country of incorporation in the trademark registration data and the in Exhibit 21 data to be perfectly identical. Subsidiary names of Exhibit 21 entities and legal trademark owners have to match to 99 at least percent.

In the data, there are some human errors such as minor misspellings or a lack of standardization. To overcome those obstacles of the unstandardized usage of abbreviations for legal forms in company names, we replaced all commonly used abbreviations of legal forms by its written out forms. Moreover, we deleted space characters from the spelling and changed it to the use of small letters only.

In total, we matched the trademark data to 497 different U.S. multinationals. After excluding all trademarks held offshore, our final dataset contains 81,488 observations representing all trademarks that have been successfully registered between 2003 and 2012 by any S&P 500 U.S. affiliate for use in U.S. commerce.

Appendix 2.3: Variable construction for additional analysis (firm value).

In line with Hall et al. (2005) and Hall et al. (2007), we compute the *R&D stock* by applying a declining balance formula of the following form, i.e. scale the firm's R&D expenditure history by the firm's total assets and depreciate the resulting stock to account for (i) inherent obsolescence which occurs over time for knowledge assets and (ii) the limited time of legal protection of knowledge due to the regular expiration of patents.

$$R\&D\ Stock_t = R\&D\ Stock_{t-1} * (1 - Depr.rate) + R\&D\ Expenditure_t$$

(Eq. 2.3)

Following Hall (2007) and others, we use a commonly accepted 15 percent depreciation rate. As the initial stock, we apply the following formula assuming that prior to the sample R&D expenditure has been increasing at a constant annual growth rate of 8 percent (Hall et al. 2007).

$$R\&D\ stock_0 = R\&D\ expenses_1/(Depr.rate + growth\ rate)$$

(Eq. 2.4)

Second, we construct a corresponding measure capturing the capitalized advertising expenses (*Marketing Stock*) scaled by the firm's total assets to test if this figure follows the same pattern. To calculate *Marketing Stock*, we use a similar approach as for the *R&D Stock*.[30] The corresponding formula is the following.

$$Marketing\ Stock_t = Marketing\ Stock_{t-1} + Advertising\ Expenditure_t$$

(Eq. 2.5)

As initial *Marketing Stock*, we consistently use the following formula, again with a constant annual growth rate of 8 percent.

$$Marketing\ Stock_0 = Advertising\ expenses_1/growth\ rate$$

(Eq. 2.6)

[30] The only difference is that we refrain from depreciating this stock. This is in line with Sandner and Block (2011) who argue that trademarks do not become obsolete due to technological progress. They even tend to become more valuable over time. Moreover, trademark protection is infinitely valid as it does not expire as patents do. In an untabulated robustness test, we use a depreciated measure and come to similar results.

Next, we construct several variables measuring the output of marketing activities, i.e. trademark stocks. This enables us to analyze if different types of trademarks have different firm value implications. In line with Hall et al. (2005), Hall et al. (2007), and Sandner and Block (2011), we use a similar approach for the computation of the measures of input and output factors and scale it by the firm's total assets. Thus, we apply the following formula to compute the different trademark stocks.

$$TM\ Stock_t = TM\ Stock_{t-1} + TM\ Registrations_t$$

(Eq. 2.7)

Again, we need an approximation for an initial value of *TM stock*. Therefore, we use the average growth rate of the total trademark stock in the USPTO trademark database from 1963 on, which is 11.8 percent per year.[31] The initial stock is accordingly calculated under the use of the following formula.

$$TM\ stock_0 = TM\ Registrations_1 / 0.118$$

(Eq. 2.8)

[31] This is the year when the trademark data coverage considerably improved to a rate of over 70 percent in the USPTO database. In prior years, it was only 16 percent.

Chapter 3: Effective Transfer Pricing and Information Technology – Evidence from the Field

Abstract

Managerial and tax objectives of transfer pricing typically conflict within multinational firms. We examine the role of firms' information environment in mitigating that conflict. We exploit unique survey data to study whether a more intensive use of information technology (IT) improves transfer pricing outcomes when the underlying objectives conflict. We document that firms with conflicting objectives are less profitable and less successful tax planners. If firms facing conflicting objectives make intensive use of IT, they are more profitable, report lower effective tax rates, and face lower tax risk. These findings are consistent with theory suggesting that in the extreme case of perfect information, firms circumvent the trade-off between tax efficiency and optimal resource allocation. We also find support for theory predicting higher profits under cost-based transfer pricing if the information environment is superior. Overall, our results suggest that IT facilitates transfer pricing strategies that reconcile managerial control with tax efficiency.

This chapter is joint work with Sven-Eric Bärsch and Marcel Olbert.

3.1. Introduction

International transfer pricing refers to the valuation of transactions between affiliated entities of the same multinational firm. Its core function is to facilitate internal trade between business units in decentralized firms to maximize overall firm profit (Eccles 1985; Horngren et al. 2015, 862). Thus, transfer pricing is a key instrument of managerial control and affects performance measurement. Transfer pricing also allows shifting pre-tax profits to low-taxed subsidiaries to minimize a firm's overall tax burden (Sansing 2014; Klassen et al. 2017).[32] For both purposes, firms typically determine only one transfer price (Labro 2019),[33] leading to an immanent trade-off between strategies that achieve the highest tax efficiency and those that establish profit-maximizing levels of production and intrafirm trade (Shackelford and Shevlin 2001; Baldenius et al. 2004; Cools et al. 2008; Labro 2019).[34] Göx and Schiller (2007) formalize that perfect information might resolve the tension between managerial and tax objectives in the transfer pricing function resulting from this trade-off. Our paper builds on this prediction and examines the association between the intensity of multinational firms' use of information technology (IT) within the transfer pricing function and the effectiveness of transfer pricing systems.

To overcome the limited observability of firms' internal transfer pricing systems, we exploit unique survey data collected from transfer pricing managers at 166 multinational firms in 2017. In particular, we study whether the intensity of IT use within the transfer pricing function is associated with better transfer pricing outcomes from a managerial and tax perspective when the respective objectives conflict. Despite its limitations, we consider our survey as an appropriate instrument to study the black-box of transfer pricing which allows us to

[32] See Dharmapala (2014) and Heckemeyer and Overesch (2017) for reviews of the empirical literature.

[33] See also Baldenius et al. (2004), Cools et al. (2008), Nielsen and Raimondos-Moller (2012), Hiemann and Reichelstein (2012), Klassen et al. (2017). For recent evidence based on a similar survey sample as used in this paper, see Bärsch, Heckemeyer, and Olbert (2019).

[34] Baldenius et al. (2004) also show that even if firms use two distinct prices for managerial and tax purposes, emphasizing tax-minimizing prices can have adverse outcomes on profitability and only focusing on optimal managerial incentives might come at the cost of a higher tax burden.

test theoretical predictions and to address research questions that are not possible to answer with archival data (Hanlon and Heitzman 2010; Bloomfield et al. 2016). The focus of our study lies in the intensity of IT use within a firm's transfer pricing function. We measure such intensity with a questionnaire item directly asking to what extent a firm's typical transfer pricing processes are supported by IT. We directly observe the extent to which firms use IT to support their processes of determining tax-compliant price ranges, calculating prices, documenting prices, maintaining databases, transmitting and reporting information internally and to tax authorities, and defending prices during tax audits.

Studying the design and the outcomes of transfer pricing is economically important as the volume of transactions within multinational firms account for more than 50 percent of global trade (OECD 2013a; Sansing 2014). The economic importance of intrafirm trade and its implications for tax authorities and firms' financial performance have led to continuous calls for research on how firms implement their transfer pricing strategies (Shackelford and Shevlin 2001; Hanlon and Heitzman 2010; Sansing 2014; Dyreng and Maydew 2018). Our study particularly builds on the well-known fact that optimal transfer pricing strategies balance the trade-off between managerial and tax objectives (Scholes et al. 2014; Labro 2019) and we aim to extend prior research that has studied managerial and tax aspects of transfer pricing mostly separately (Labro 2019).[35]

In transfer pricing, information on intrafirm transactions is revealed and communicated to decision-makers at varying rates, creating varying degrees of information friction (Swieringa and Waterhouse 1982; Holmstrom and Tirole 1991; Dikolli and Vaysman 2006). Consistent with prior theoretical and empirical work (Dikolli and Vaysman 2006; Bloom et al. 2012), we view the extent of a firm's use of IT as an attempt to overcome informational frictions, potentially improving the internal information quality that supports optimal decision

[35] Exceptions are Baldenius et al. (2004) and Hiemann and Reichelstein (2012) who show that one single price cannot achieve both optimal tax outcomes and efficient resource allocation. Baldenius et al. (2004) explicitly model the interdependency of transfer prices for tax and managerial purposes under a two-book system.

making (Gallemore and Labro 2015). Transfer pricing managers' intensive use of IT facilitates information flow within a firm (i.e., across business units, geographical regions, and hierarchical levels) and to its external stakeholders (such as consultants and tax authorities). Moreover, it enables the use of information that would be otherwise unobservable or not transmittable. Thus, IT systems support managers to quantify costs, set internal prices, benchmark those against market prices, monitor and document internal prices, and defend them during tax audits. Consequently, a better information environment in transfer pricing through more intensive use of IT should be associated with superior firm performance if the additional information makes an incremental contribution to the decision-making process. This is typically the case when a firm is dispersed and information asymmetries between functional departments are high (Chenhall and Morris 1986; Gallemore and Labro 2015).

We consider conflicting managerial and tax objectives within a firm's transfer pricing function as a particular example of such an information asymmetry that could be alleviated through using IT to a greater extent. We argue that the tension due to conflicting objectives is particularly prevalent if firms only employ pre-tax key performance indicators (KPIs) for performance evaluation and managerial control purposes. As managers generally aim to maximize their incentive-based performance indicators and act accordingly (Balachandran 2006), they might neglect the consequences of their decisions for a firm's tax strategy. Since these managers have no incentive to integrate tax-related outcomes in their decisions because they are compensated based on pre-tax KPIs, firms are less likely to implement successful tax strategies, plausibly due to the conflicting objectives and the lack of cooperation between divisional managers (Phillips 2003; Holzhacker et al. 2019). The firm's tax department, however, typically aims at optimal tax outcomes (Armstrong et al. 2012) and might ignore the consequences of their decisions on firm-wide operational profits on a pre-tax basis.

When divisional managers act to maximize pre-tax KPIs but tax managers strive to lower a firm's global tax burden, the central management should benefit from a better information

environment through more intensive use of IT to balance these objectives. The theoretical model in Göx and Schiller (2007) explicitly states that managers can mandate optimal resource allocation through intrafirm trade despite setting tax-efficient prices if they have access to perfect information about internal costs and tax planning opportunities. We therefore expect transfer pricing to be more effective in terms of better non-tax and tax outcomes if firms with conflicting transfer pricing objectives use IT more intensively.

The explorative analysis of our survey data reveals that the use of IT within the transfer pricing function is premature and expected to become more intensive in the future, with firms in the automotive and engineering sectors currently being the frontrunners in the intensity of IT support. Calculating transfer prices is the task that is most intensively supported by IT, followed by maintaining a database to capture relevant information for pricing intrafirm trade. We also enquire firms about specific KPIs that are used for managerial control purposes. In our sample, 54 percent of our sample firms do not use any form of after-tax KPIs to measure and evaluate performance, suggesting a stronger tension between tax and managerial transfer pricing objectives within these firms. The prevalence of such tension is equally distributed among firms that do or do not intensively use IT.

In our regression analysis, we control for firm size, international exposure, age, and industry-year specific shocks and find that firms which rely only on pre-tax KPIs for performance evaluation have, on average, 1.5 percentage points lower pre-tax returns on assets (ROA). Holding common tax planning opportunities constant, we also document that these firms report 3.2 percentage points higher GAAP effective tax rates (ETRs). These results suggest that a conflict of tax and managerial transfer pricing objectives is associated with adverse non-tax and tax outcomes. Lower profitability plausibly mirrors suboptimal investment decisions because tax managers favor tax-efficient prices for intrafirm trade, which distort efficient capital allocation (Baldenius et al. 2004; De Simone et al. 2018). Higher tax burdens are potentially the consequence of non-tax managers' incentive to price intrafirm trade to maxim-

ize operational profits on a pre-tax basis that can result in a higher share of firm-wide profits attributed to legal entities in countries with high tax rates (Baldenius et al. 2004; Johnson 2006). The finding is consistent with compensation schemes affecting financial outcomes (Balachandran 2006) and the lack of incentives for business unit managers to participate in tax planning efforts in the presence of pre-tax compensation schemes (Phillips 2003).

We then find support for our hypothesis that the intensive use of IT attenuates the association between adverse transfer pricing outcomes and conflicting tax and managerial objectives. Our results suggest that this relationship is driven by firms that do not intensively use IT within their transfer pricing function. Our proxy of conflicting objectives is associated with 2.2 (2.7) percentage points lower pre-tax (after-tax) profitability and 7 percentage points higher ETRs while these associations are completely attenuated for firms that use IT intensively. While an intensive use of IT in transfer pricing-related decision-making might not necessarily establish a *perfect* information environment, this finding is consistent with the view that firms can establish tax-efficient transfer pricing schemes and profit-maximizing levels of intrafirm trade if sufficient information on internal costs and transactions is available (Göx and Schiller 2007).

We also study tax risk as an outcome because effective transfer pricing does not only lower tax burdens but should also establish sustainable tax strategies at lower risk (Dyreng et al. 2019). Consistent with high-quality information for transfer pricing purposes allowing firms to identify sustainable tax planning strategies (Gallemore and Labro 2015) and to prepare high-quality documentation for tax authorities, we find that the intensive use of IT within the transfer pricing function is associated with lower tax risk. Furthermore, we find that firms exclusively using pre-tax KPIs for performance evaluation face, on average, significantly higher tax risk. The intensive use of IT for transfer pricing processes attenuates this result. We conclude that firms in which managers have no incentives to support tax planning not only forgo tax benefits but also lack focus on tax-compliant transfer prices.

Our data also allows us to test the effectiveness of cost-based transfer pricing depending on the intensity of IT use within firms' transfer pricing function as modeled in Dikolli and Vaysman (2006). We document that the cost-plus method is the most frequently applied transfer pricing method in our sample among the methods recommended in internationally accepted tax guidelines (OECD 2017). Consistent with the notion that cost-based pricing is informationally demanding (Dikolli and Vaysman 2006), we find a more frequent use of the cost-plus method among firms intensively using IT. The regression results provide novel empirical evidence on the theoretical prediction of Dikolli and Vaysman (2006) and suggest that these firms report, on average, 2 percentage points higher pre-tax profits.

We conduct several robustness tests. First, we validate our measure of conflicting managerial and tax transfer pricing objectives. In particular, we show that it is not associated with a cashflow-based financial outcome that should be unaffected by the conflict as cashflow does not proxy for (accounting) profitability or tax benefits due to its non-accrual nature. We further acknowledge that observations are not randomly assigned to firms with and without intensive use of IT. We address potential bias arising from this selection by an instrumental variables (IV) approach.[36] We use the appearance of a firm and its transfer pricing managers on the professional online network platform LinkedIn.com as instruments for the propensity to invest in IT for transfer pricing. We argue that the affinity towards IT proxied by the LinkedIn profiles is a valid instrument in that it affects financial outcomes only through a firm's use of IT.[37] The two stages least squares (TSLS) results are in line with the main findings based on OLS regressions. We still caution the reader when interpreting our results since it is not possible to address all the shortcomings of our survey data and the limited sample

[36] We acknowledge the design of a compensation system, including the definition of pre- or after-tax KPIs, is also a non-random choice of the firm (Phillips 2003). We find pre-tax only KPI users are more intangible intensive, slightly larger, and somewhat more international. However, we interpret this feature of the management control system as given and stickier and focus on the (potentially) recent adoption of IT systems in the transfer pricing function. Therefore, we particularly address endogeneity concerns of the IT variable with our outcome variables.

[37] Although we discuss this approach thoroughly in Section 3.4, we caution the reader when interpreting our results because our cross-sectional survey data does not allow us to exploit true exogenous variation in the use of IT.

size.[38] While we address several endogeneity issues, we view our results as valuable in-depth descriptive evidence on a largely unexplored but fundamental aspect of accounting research (Gow et al. 2016).

Our findings contribute to the accounting literature in several ways. First, we provide direct evidence on the intensity of IT use within multinational firms' transfer pricing function. Such insights are typically unobservable to researchers and shed light on the relevant question of how information supports decision-making from a managerial accounting perspective (Labro 2015). We argue that investing in IT for transfer pricing produces higher quality information on intrafirm trade, fostering the decision-facilitating role of management accounting information (Dierynck and Labro 2018). Our study also validates theory that firms particularly benefit from the use of IT when using cost-based transfer pricing (Dikolli and Vaysman 2006).

Second, we show that the decision-facilitating role of IT is valuable within the transfer pricing function. By studying both tax and non-tax outcomes, we not only offer novel insights that help to understand transfer pricing as part of the black-box of tax planning (Hanlon and Heitzman 2010; Klassen et al. 2017; Dyreng and Maydew 2018) but we also bridge the gap between two inherently interrelated disciplines in accounting research (Shackelford and Shevlin 2001; Labro 2015). Our evidence suggests that investments in IT for transfer pricing might resolve the tension between managerial and tax objectives. We thus provide one possible answer to a fundamental research question which has so far only been studied in theory (Baldenius et al. 2004; Baldenius 2009). Our results are of interest to consultants and managers that currently view investments in technology-enabled transfer pricing solutions a pressing concern with ambiguous costs and benefits (Deloitte 2018).

[38] We also confirm the robustness of our results when estimating a seemingly unrelated regressions (SUR) model to account for the correlation of residuals in our regression models since we relate multiple transfer pricing outcomes to the use of IT and other characteristics of the same firm.

Finally, we contribute to the recent tax literature suggesting that a firm's overall quality of internal information is positively associated with profit shifting (McGuire et al. 2018) and overall global and state tax avoidance (Gallemore and Labro 2015; Laplante et al. 2017; Hamilton and Stekelberg 2017),[39] all of which possibly capture some extent of tax-efficient transfer pricing. Our paper complements these studies as we focus on the specific role of IT in transfer pricing from both a managerial and a tax perspective. Unlike prior studies, we directly observe the extent to which firms' different transfer pricing processes are supported by IT and document how the extent of such support enhances effective transfer pricing strategies. In supplemental tests, we find that the intensive use of IT within the transfer pricing function drives tax efficiency through reporting and defending transfer prices vis-à-vis tax authorities. Higher profitability seems to be driven by intensive IT support of several operational aspects such as calculating, documenting, and reporting of internal prices. Overall, our findings suggest that firms might use IT more intensively to avoid the unintended consequences of purely tax-motivated transfer pricing strategies that can lead to suboptimal resource allocation and lower investment efficiency (De Simone et al. 2018).

3.2. Background and hypothesis development

3.2.1. The conflicting objectives of transfer pricing

The managerial goal of transfer pricing is to establish levels of intrafirm trade and resource allocation that maximize firm-wide profits. There is a large body of literature modeling optimal pricing in a tax-free world. However, counterfactual trades between external parties rarely exist and the world is not tax-free. As transfer prices affect the profits of each company within a multinational firm (separate entity accounting and taxation), they also have a direct impact on the taxable income of each affiliated entity and, thus, the firm's global tax burden.

[39] While Hamilton and Stekelberg (2017) use an indicator variable for a firm's inclusion in the *InformationWeek* 500 list, all other listed studies use proxies for internal information quality based on publicly available accounting data.

Given the international tax rate differentials, firms have an incentive to price intrafirm trade to shift profits from high- to low-tax jurisdictions (see, e.g., Sansing 2014). Despite the diverging managerial and tax objectives, firms typically do not decouple managerial from tax-compliant transfer prices (Baldenius et al. 2004; Labro 2019). If firms set transfer prices that are tax-motivated, resource allocation might be distorted (Baldenius et al. 2004; De Simone et al. 2018) and the effectiveness of management control systems might be deteriorated (Cools et al. 2008). A transfer price that optimizes resource allocation, however, can lead to unfavorably high tax burdens because profits are allocated to a firm's divisions in high-tax countries. As transfer pricing are typically organization-wide (in particular with respect to tax planning), it is challenging to design a pricing schemes with a high scope of customization that allowing optimal performance measurement of divisional units (Holzhacker et al. 2019). Thus, those coexisting objectives of transfer pricing possibly create a substantial tension among divisional and functional managers within the same firm.

One way to align conflicting objectives is the strategic use of KPIs for performance evaluation and compensation (Lambert and Larcker 1987; Sloan 1993). Divisional managers typically respond to explicit incentives that KPIs create and act to maximize the respective financial figures (Guidry et al. 1999; Balachandran 2006). Consistently, Phillips (2003) finds that using after-tax KPIs in accounting-based bonus plans of divisional managers is associated with lower ETRs. Thus, compensation plans that factor in a firm's tax liabilities should incentivize divisional managers to consider tax outcomes of transfer pricing. If, in contrast, managers are solely evaluated on a pre-tax basis, tension is likely to arise when determining transfer prices for at least two reasons. First, operational managers aim to maximize pre-tax KPIs and might refrain from supporting the central tax management in making transfer pricing decisions that lead to an optimized ETR. Second, pre-tax profitability should suffer under exclusive pre-tax compensation since tax managers still have an interest to emphasize transfer pricing strategies that distort efficient intrafirm trade that would otherwise have maximized firm

profits (Baldenius et al. 2004; De Simone et al. 2018). As a consequence of both divisional and tax managers' behavior, a firm's ETR might increase and profitability might decrease.

3.2.2. The role of IT in transfer pricing

Decision makers require internal information to formulate and pursue firm-wide organizational goals through transfer pricing (Hirshleifer 1956; Swieringa and Waterhouse 1982; Horngren et al. 2015). Theory in industrial organization and management science commonly assumes that the quality and flow of internal information are central to corporate decision-making since they determine managers' ability to exert authority and base decisions on more accurate information (Aghion and Tirole 1997; Siggelkow and Rivkin 2005). Maximizing the revelation of information (Holmstrom and Tirole 1991) and reducing the cost of processing relevant information (Swieringa and Waterhouse 1982) are considered essential for optimal transfer pricing. Dikolli and Vaysman (2006) formalize that perfect information on intrafirm trade increases the capability of generating and communicating to the decision-makers which ultimately leads to higher profitability. From a tax perspective, recent empirical evidence suggests that higher quality of a firm's overall internal information environment can translate into more successful tax planning (Gallemore and Labro 2015; Laplante et al. 2017; Hamilton and Stekelberg 2017), part of which is the result of transfer pricing such as profit shifting strategies (McGuire et al. 2018).

Adopting advanced information and communication technologies is a common strategy to improve the firms' information environment (Dorantes et al. 2013; Chae et al. 2014). We base our view of the role of using IT to a greater extent in transfer pricing on Bloom et al. (2014) who find that IT can unfold two effects on corporate decision-making. First, it improves *information acquisition* and enables the incremental use of information. Intensive IT support of the typically very data- and fact-intensive transfer pricing analyses can facilitate data processing and enables the typically small transfer pricing workforce to handle large datasets, reveal inefficiencies, identify opportunities, and develop relevant insights. Moreover, it

can enable managers to understand issues which are not in their field of expertise. For instance, non-tax managers can detect tax-planning opportunities related to transfer pricing and assist the tax department in establishing tax-efficient transfer prices if advanced IT tools exist (Gallemore and Labro 2015). Second, Bloom et al. (2014) find that IT enhances *communication* by facilitating the flow of relevant private information across legal entities, business units, and hierarchical levels. Advanced transfer price reporting tools increase the accuracy and frequency of the local managers' reports and reduce the cost of transferring knowledge (Dikolli and Vaysman 2006). Moreover, transfer pricing departments typically consist of globally dispersed teams that need to collaborate in a way that the central department can make strategic decisions (KPMG 2018a). Therefore, more intensive use of IT within firms' transfer pricing function can make decision-relevant information accessible in a complete and accurate manner when needed and where needed.

Practitioners report that IT in transfer pricing particularly supports the compilation of input data (e.g., collecting and processing supporting documents such as transaction types and financial amounts), analysis of data (e.g., analyzing cost centers, calculating profit level indicators, benchmarking studies), creation of output data (e.g., preparing transfer pricing reports, using modular text blocks, archiving), and workflow management (e.g., notifications, reminders, and communication tools) by means of standardization, automation and implementation.[40] Examples of IT tools for transfer pricing are relational databases, business intelligence applications, and tax data warehouses that allow combined access to relevant data from the firms' multiple general ledger systems and country-specific regulation.[41]

[40] An expert interview by the World Finance Magazine exemplifies these management and tax-related benefits of IT in transfer pricing. For instance, "Technology further improves data gathering and quality of information which supports the enhanced integrity and monitoring of inter-company transactions" and "Benefits can include improved data quality and enhanced monitoring and reporting capabilities, which can enable companies to promptly identify and mitigate areas of risk". See https://www.worldfinance.com/markets/transfer-pricing-using-technology-to-avoid-the-pitfalls.

[41] See, e.g., https://www.pwc.com/gx/en/tax/publications/transfer-pricing/perspectives/assets/tp-16-analytics.pdf.

3.2.3. Using IT to resolve the conflict between transfer pricing objectives

Greater availability of information driven by the intensive use of IT in a firm's accounting system does not necessarily lead to improved decision-making and better financial outcomes at the firm level (Dierynck and Labro 2018; Li and Sandino 2018). A positive association between firm-level outcomes and IT requires that firms use IT appropriately, managers are capable of processing the additional information, or that additional information can make an incremental contribution to the decision-making process, for example when a firm is dispersed and information asymmetries between functional departments are high (Chenhall and Morris 1986; Gallemore and Labro 2015).

We consider conflicting managerial and tax objectives within a firm's transfer pricing function as a particular example of such information asymmetry. Specifically, the theoretical framework in Göx and Schiller (2007) suggests that complete information of the central management and unlimited communication between central and divisional management can solve the problem of conflicting managerial and tax objectives of transfer pricing. Perfect information would enable central managers to determine tax-optimal transfer prices and to instruct divisions to implement production and sales policies that maximize after-tax profits. While perfect information is an extreme, unrealistic scenario, we argue that a more intensive use of IT within the transfer pricing function at least enhances the information environment and, thus, might alleviate the problem of conflicting transfer pricing objectives.

If the transfer pricing function is more intensively supported by IT which improves *information acquisition* and *communication* (Bloom et al. 2014), firms should be able to increase the effectiveness of transfer pricing in that both the managerial objective of efficient resource allocation and the tax objectives of lower tax burdens can be reconciled. From a managerial perspective, a more intensive IT use within a firm's transfer pricing function should be associated with higher pre-tax profitability through more efficient resource allocation and better investment decisions. If internal prices are set at a tax-optimal level because of

the tax management's objectives, central managers can use IT to back out tax-induced pricing and mandate levels of intrafirm trade that maximize a firm's pre-tax profit, thereby circumventing the drawbacks of one-book systems (Göx and Schiller 2007). More intensive IT use might also enable managers to formalize inventive criteria that are not financially affected by transfer prices if those are largely tax-driven and thus restore efficient resource allocation (Cools et al. 2008). Also, anecdotal evidence suggests that the intensive use of IT within a firm's transfer pricing function, even if implemented for tax purposes, will improve the quality of decision-making concerning the allocation of resources and global investment policy across a firm's operations (PwC 2016; Deloitte 2018; Thomson Reuters 2018).

For tax planning purposes, firms depend on divisional knowledge to identify intrafirm transactions that generate tax benefits. Given the pre-tax-based compensation scheme, divisional managers typically have this information but possibly lack incentives to support the realization of these tax benefits (Holzhacker et al. 2019). However, central managers might still be able to exploit tax planning opportunities if they use IT more intensively as they can access more and more accurate divisional data in real-time and integrate the relevant information in their decision-making. The following hypothesis summarizes our conjectures.

More intensive use of IT within the transfer pricing function mitigates the association between conflicting managerial and tax objectives and adverse transfer pricing outcomes.

3.3. Survey data on transfer pricing and IT

3.3.1. Survey methodology and sample test

We draw on confidential survey data of multinational firms in the German-speaking market.[42] Our survey methodology overcomes the challenge that transfer pricing systems are typically unobservable to outside parties and researchers. This approach enables us to contextualize data on managers' practices about previously unobserved facts and to explore the intensity of IT use within firms' transfer pricing function (Hanlon and Heitzman 2010; Graham

[42] We conducted the survey in collaboration with the management accounting consultancy firm Horváth & Partners and the tax law firm Flick Gocke Schaumburg. The questionnaire was developed by the authors as well as tax and management accounting consultants with practical transfer pricing experience.

et al. 2014; Bloomfield et al. 2016). Our data comes from a questionnaire with 26 questions. The survey opened on June 6, 2017, with an e-mail request to transfer pricing managers at 1,979 firms and closed on October 31, 2017.[43] 166 firms provided usable responses. The response rate of 8.4 percent is comparable to those in other studies that survey executives.[44] We match hand-collected consolidated financial data for the period from 2011 to 2016.[45]

Figure 3.1: Survey respondents by functional departments and industries.

Notes: This figure shows to which functional department within a firm the responding transfer pricing managers belong to on the y-axis (tax department or managerial/other) and to which industries the companies belong to on the x-axis (Automotive/Engineering, Chemical/Pharmaceutical, Industrial Goods/Energy, Consumer Goods, and Others). The fractions are the percentages of all respondents to the respective questions (N=134 for the functional department, N=165 for the industries). The sample mean of survey responders working in the tax department is 53.71.

[43] After several feedback rounds among academics, consultants, and practitioners, the questionnaire was programmed by an external service provider specialized in field surveys. A reminder was sent on September 16.

[44] For instance, Graham et al. (2015) analyze the extent to which executives delegate financial decisions based on two surveys with response rates of 6 and 11 percent, respectively. Klassen et al. (2017) report a response rate of 8.1 percent. Yet, our response rate lies behind that of Graham et al. (2014) (26.5 percent).

[45] This data collection is limited to firms that willingly disclosed their identity for this study (i.e., 81 firms). The data is handled strictly confidential and the data collection process was handled at Flick Gocke Schaumburg.

Figure 3.1 shows that survey respondents are distributed among the tax and accounting departments with a slightly higher share of tax managers (53.7 percent). The figure also shows that sample firms are distributed across all major industries. Our sample includes firms listed in the German blue chip stock market index (DAX) and other large and medium-sized firms. 40 of the responding firms generated revenues of more than 5 billion euros in 2016, and 12 firms have more than 100,000 employees (untabulated).

Although survey data can provide unique insights, there are several caveats to our research methodology (Graham et al. 2014). In particular, our survey sample might not be representative of the total population of firms. Also, firms deciding to participate in the study might be systematically different from firms that do not respond, leading to biased results. We thus test for representativeness and for systematic differences between responders and non-responders. To this end, we use consolidated financial information of all companies in the corporate universe in Germany with consolidated financial statement information available in the Orbis database provided by Bureau van Dijk.

Table 3.1 presents descriptive statistics of (1) the average German firm, (2) the average firm contacted for the survey, and (3) the average non-respondent and (4) respondent firm. Columns 5 and 6 compare our average contacted and responding firm with the average German Orbis firm and reveal that both our average contacted and our average responding firm are more profitable, larger, have a higher ETR and also differ across several other dimensions. However, the Orbis database also contains smaller domestic and financially distressed firms. While our findings might not generalize towards the corporate universe, it should be representative of the average large or medium-sized non-distressed firm with major operations in Germany.

Table 3.1: Tests on representativeness, sample selection bias, and non-response bias.

	(1)		(2)		(3)		(4)		(5)		(6)		(7)	
	All German Orbis Firms		All Contacted Firms with Available Data		Survey Non-Responders with Available Data		Survey Responders with Available Data		1 vs. 2		1 vs. 4		3 vs. 4	
	N	Mean	N	Mean	N	Mean	N	Mean	Diff.	p-value	Diff.	p-value	Diff.	p-value
Pre-tax ROA	24,836	0.05	1,538	0.07	1,096	0.07	442	0.07	-0.02***	(0.00)	-0.01**	(0.01)	0.00	(0.70)
After-tax ROA	24,441	0.03	1,483	0.05	1,041	0.05	442	0.05	-0.02***	(0.00)	-0.01**	(0.01)	0.00	(0.31)
ETR	24,238	0.23	1,452	0.28	1,040	0.28	412	0.29	-0.05***	(0.00)	-0.05**	(0.03)	-0.01	(0.64)
ETR_Vola	19,664	0.37	1,134	0.26	859	0.28	275	0.18	0.12***	(0.00)	0.19***	(0.01)	0.09	(0.11)
Cashflow/Assets	24,216	0.08	1,475	0.09	1,035	0.09	440	0.09	-0.01***	(0.00)	-0.00	(0.43)	0.01	(0.18)
Log(Assets)	25,374	18.66	1,601	20.63	1,127	20.33	474	21.35	-2.10***	(0.00)	-2.74***	(0.00)	-1.02***	(0.00)
Leverage	24,941	0.18	1,520	0.16	1,073	0.16	447	0.17	0.02***	(0.00)	0.01	(0.44)	-0.01	(0.22)
Intangibles	24,943	0.07	1,547	0.09	1,073	0.08	474	0.10	-0.02***	(0.00)	-0.04***	(0.00)	-0.02***	(0.01)
Log(Age)	24,708	3.05	1,686	3.49	1,152	3.20	534	4.13	-0.48***	(0.00)	-1.11***	(0.00)	-0.93***	(0.00)

Notes: This table presents descriptive statistics of the following samples:
Column (1): all firms on Bureau von Dijk Orbis incorporated in Germany and available consolidated financial information in any year between 2011 and 2016.
Column (2): all firms contacted for the survey with available financial information in the databases that we could match to Orbis and available consolidated financial information in any year between 2011 and 2016.
Column (3): all firms contacted for the survey that did not respond with available financial information in the databases that we could match to Orbis and available consolidated financial information in any year between 2011 and 2016
Column (4): all firms that responded and provided their firm name.
Columns (5) to (7) provide the p-values of a t-test for differences in means.
For Columns (1) to (3), we use the data from the Orbis databases of consolidated financial information for the years 2011 to 2016. For column (4), we use hand-collected data (each firm's consolidated financial statement) for the years 2011 to 2016. All variables are winsorized at 1 percent and 99 percent of the distribution. *, **, and *** denote significance using a t-test at the $p < 0.10$, 0.05, and 0.01 levels (all two-tailed), respectively. All variables are defined in Appendix 3.1.

To mitigate concerns of non-response bias, we compare our survey respondents to the non-respondents and present the results in column (7). We find that the average respondent firm is statistically no different than the average non-respondent firm in terms of *Pre-tax ROA*, *After-tax ROA*, *ETR*, *ETR_Vola*, *Cashflow/Assets*, and *Leverage*. Participating firms are larger, have a higher share of intangibles assets, and are older. We do not expect these (economically modest) differences to cause sample selection bias in our empirical estimates.[46] Yet, to the extent that responding and non-responding firms differ, our findings do not generalize to all firms.

Another concern is that respondents may provide false answers. This concern was addressed by explicitly avoiding questions involving potential reputational issues such as tax avoidance and ensuring the confidential use of the data. Moreover, we asked some questions for which we could check the answers on their validity, such as the firm's total sales, the share of foreign sales, or the number of employees and affiliates. We compared the answers with publicly available data and found no evidence for a false answers bias by examining the untabulated t-statistics. To prevent survey participants from misunderstanding questions or expressing beliefs that are not necessarily in line with actions (Graham and Harvey 2001), we emphasized clarity by providing a glossary on all topics covered in the questionnaire and by integrating practical examples in many of the questions.

3.3.2. Exploratory analysis

We start our analysis by providing novel descriptive evidence on firm's design of transfer pricing systems. We directly ask transfer pricing managers to what extent they use IT to support specific processes within the transfer pricing function. The questionnaire covers seven relevant processes which constitute regular tasks within the transfer pricing function: (1)

[46] In untabulated results, we test for non-response bias by examining differences in responses between early and late responders because late responses proxy for non-participation (Klassen et al. 2017). Results suggest that a possible non-response bias is minimal since there is only weak statistically significant evidence that late responding firms are, on average, less leveraged than early responding firms.

search for benchmark data, (2) calculation of transfer prices, (3) documentation of the arm's lengths nature of those prices, (4) compliance with external reporting obligation for transfer prices, (5) internal reporting of transfer prices, (6) management of transfer pricing audits, and (7) operation of internal transfer pricing databases. Possible answers to this ordinal scale question regarding the intensity of IT support for those seven specific transfer pricing processes were: very low (1), low (2), high (3), or very high (4) intensity.

As depicted in Table 3.2, we observe that our sample firms are most likely to use IT intensively when calculating transfer prices, while most firms defend their transfer prices in tax audits without intensive use of IT. Less than a third of our sample firms intensively use IT support for processes which are most relevant for complying with regulation of reporting and documenting internal prices. We observe a large and statistically significant difference between the current and future (expected) use of IT support for transfer pricing. This finding stresses the relevance of our research questions. It is also consistent with recent reports by accounting firms that suggest that updating and managing transfer pricing-related IT systems is a key pressure area (EY 2017; Deloitte 2018). We find the largest difference for the external reporting and documentation of transfer prices, which is consistent with the preparation, filing, and exchange of Country-by-Country Reports mandated by both the European Union and the OECD for financial years beginning on or after 1 January 2016 as well as the preparation and filing of a master file and local file elements of the transfer pricing documentation standard recommended by the OECD only in 2015 (OECD 2015).

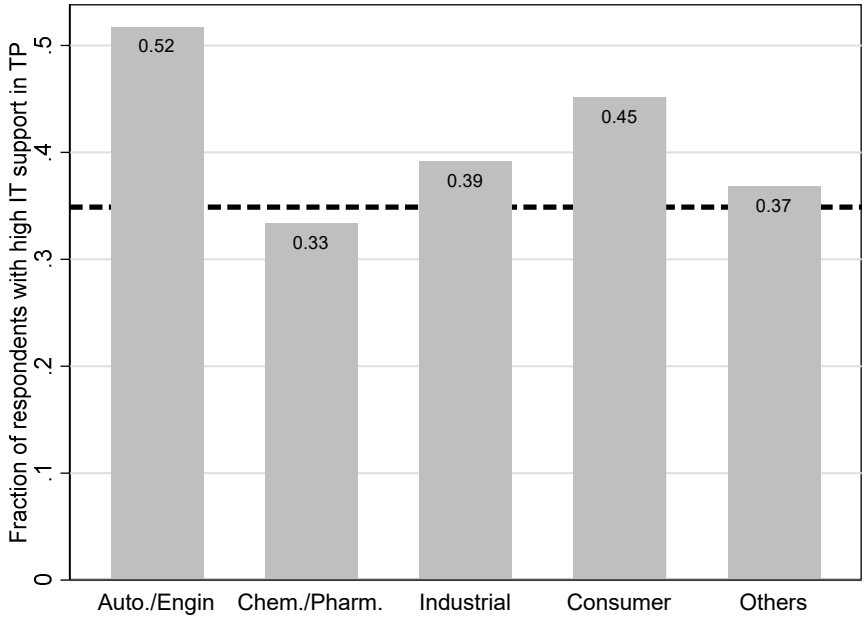
We use responses to the question on the current use of IT to construct our primary variable of interest *TP_IT* as follows. We measure the degree of the use of IT with an index ranging from 7 to 28 which is the sum of the ordinal values of the seven responses to the questions

Table 3.2: Current and future use of IT in transfer pricing processes.

	Current use		Future use		Δ in means	
TP_IT Process	Rank	% High	Rank	% High		
Comp. Search	6	21.01%	7	57.69%	36.68%	***
Calculation	**1**	**37.78%**	**1**	**78.46%**	40.68%	***
Documentation	5	24.26%	**1**	**78.46%**	54.20%	***
External Reporting	3	29.41%	**1**	**78.46%**	49.05%	***
Internal Reporting	4	27.61%	4	73.85%	46.24%	***
TA Enforcement	7	10.45%	6	61.24%	50.79%	***
TP Database	2	30.08%	5	71.54%	41.46%	***

Notes: This table presents the answers to the survey questions 'Which transfer pricing management processes are currently supported by IT systems in your organization?' (Current IT support, N=138), and 'To what extent should your transfer pricing management processes be supported by IT systems in the future?' (Future IT support, N=130). For both questions, the survey provides a four-point ordinal scale ranging from 1 to 4 with a rating of 1 labeled 'Very low support' and a rating of 4 labeled 'Very high support'. This table presents the percentages of firms that gave a rating of 3 or 4 for each factor. The last column reports the differences in means between the answers to the two questions and the statistical significance of these differences with t-statistics in parentheses. *, **, *** Denote two-tailed statistical significance at the 10, 5, and 1 percent levels, respectively.

Figure 3.2: Use of IT in transfer pricing in different industries.



Notes: This figure describes the fractions of responding firms that use IT more extensively in the transfer pricing functions (i.e., *TP_IT*=1. For a definition, see Appendix 3.1) across different industries (N=133). For the industry classifications, we use the information retrieved from the survey. The dashed line is the overall sample average of firms that use IT more extensively in the transfer pricing functions (i.e., *TP_IT*=1).

outlined above. *TP_IT* then takes the value 1 if this index measure is above the median (i.e., 14).[47] We interpret this variable as a proxy for the overall degree of IT intensity in the transfer pricing function and argue that variation across firms might explain financial outcomes. As Figure 3.2 shows, firms in the automotive and engineering sectors seem to be at the IT frontier.

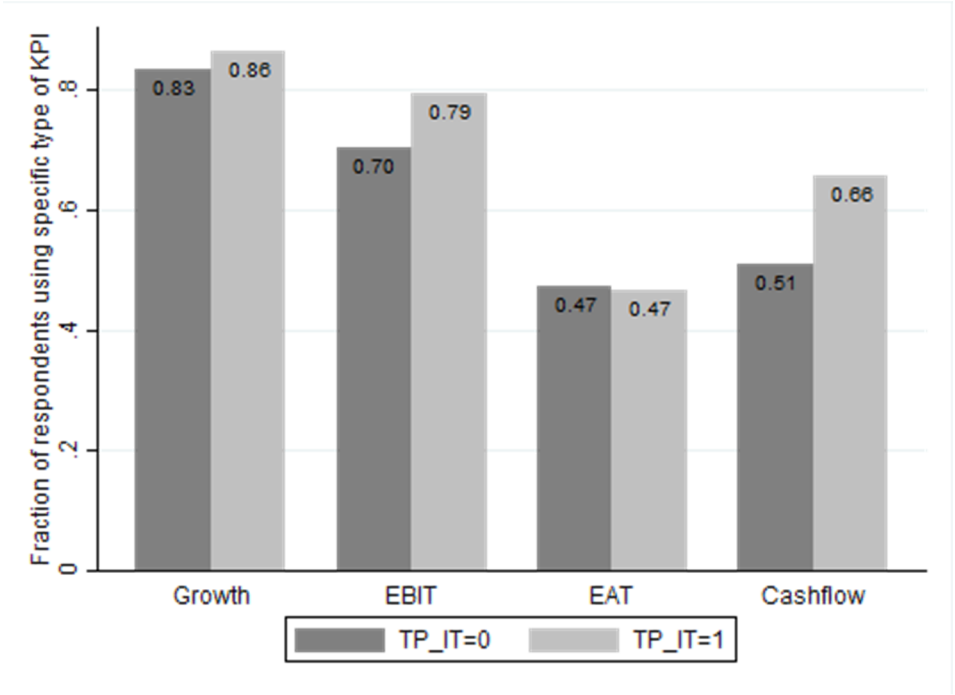
Figure 3.3 presents differences in the use of KPIs and transfer pricing methods between sample firms which intensively rely on IT support and those that do not. We observe which KPIs firms use for management control. Panel A illustrates the use of different KPIs depending on the intensity of IT support. We generally note that firms use growth- and EBIT-based KPIs most frequently for evaluating divisional managers, while KPIs based on after-tax earnings (EAT) are used the least. We find no systematical difference in the use of EAT-based KPIs if we split the sample firms by our indicator variable *TP_IT*. However, our sample firms relying on intensive IT support employ, on average, all other types of KPIs more often than firms that do not rely on intensive IT support, consistent with evidence that firms relying on more IT employ more sophisticated contemporary performance management systems (Franco-Santos et al. 2012). We also observe which of the transfer pricing methods recommended by the OECD firms apply for different types of intrafirm transactions, i.e., (1) primary products, (2) end products, (3) commodities (trade), (4) service, (5) IP development and (6) IP exploitation. Panel B presents the relative frequency of the use of cost-based transfer pricing methods depending on the intensity of IT support.[48] Dikolli and Vaysman (2006) argue that fewer limitations of a firm's information systems are associated with higher expected firm profits, particularly under cost-based transfer pricing. Consistently, we observe a higher fraction of firms using cost-based methods among those firms that intensively rely on IT support.

[47] While dichotomizing is a simplified partitioning of the sample, it allows us to rely on the OLS assumptions and to produce interpretable regression results based on linear probabilities.

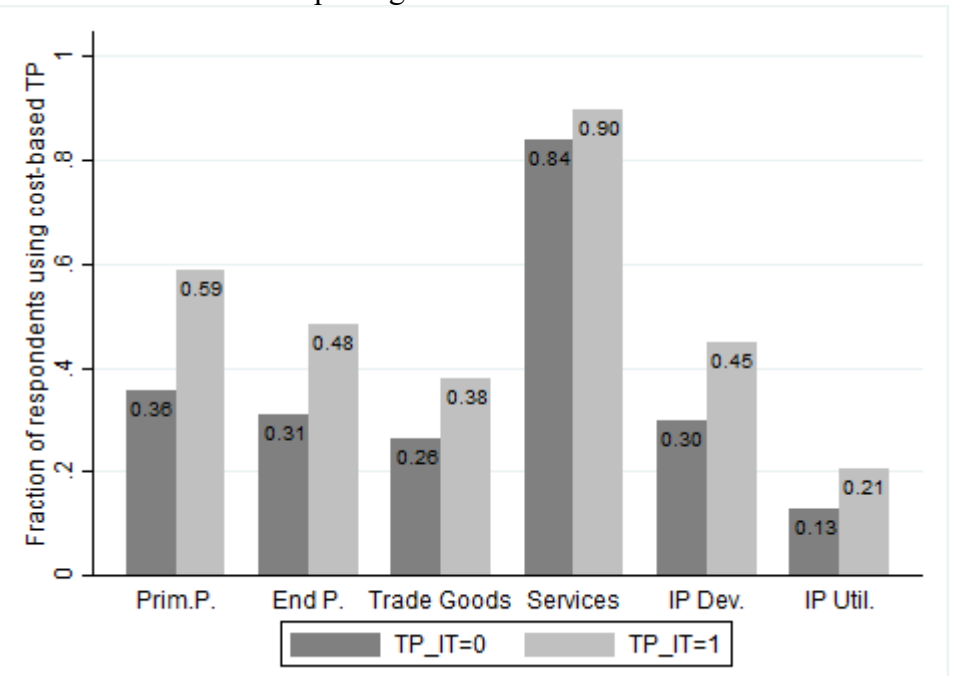
[48] In untabulated results, we find that the cost-based transfer pricing methods are, by far, used most frequently.

Figure 3.3: Use of IT in transfer pricing and firm characteristics.

Panel A: Use of KPIs



Panel B: Use of transfer pricing methods



Notes: Panel A presents the answers to the survey question "Which of the following KPIs is used at your firm to pursue managerial control?" The survey provides four types of KPI (growth-, EBIT-, EAT-, and cashflow-based) on three different consolidation levels (legal entity, business unit, and consolidated group level). This figure presents the percentages of firms that indicated the use of a specific type of KPI on any consolidation level, depending on the level of IT support of the transfer pricing function (TP_IT=1/0. For a definition, see Appendix 3.1). Panel B presents the answers to the survey question "Which transfer pricing methods are used at your firm for the following types of transaction?" For this question, the survey provides six types of transaction (primary products, end products, commodities (trade), service, IP development, and IP exploitation) and five transfer pricing methods (cost-plus, resale, comparable uncontrolled price, transactional net margin method, and profit split method). It provides the percentages of firms that indicated the use of the cost-plus method for each type of transaction depending on the level of IT support of the transfer pricing function (TP_IT = 1/0).

3.4. Multivariate analysis

3.4.1. Empirical model

To gauge the relationship between transfer pricing outcomes and IT, we follow Klassen et al. (2017) and estimate several versions of a pooled cross-sectional model using ordinary least squares for firm *i* in year *t* for the period 2011-2016.

$$TP\ Outcome_{i,t} = \beta_0 + \beta_1 TP\_Tension_i + \beta_2\, TP\_IT_i + \beta_3\, TP\_Tension_i * TP\_IT_i + \sum_k^K \beta_k\, X_{i,t} + \sum_j^J \beta_j\, Ind_i * Year_t + \epsilon_{i,t} \quad \text{(Eq. 3.1)}$$

In our main test, we focus on dependent variables measuring financial performance and tax avoidance. All variables are defined in Appendix 3.1. Our dependent variable to proxy for financial performance is the return on assets (before and after taxes) which is *one of the most commonly used measures of financial performance* (Robinson and Stocken 2013). The ROA-measures *Pre-tax ROA* and *After-tax ROA* are defined as earnings before and after taxes scaled by total assets and express pre- or after-tax profitability at the consolidated level. To measure tax avoidance, we use the GAAP ETR (*ETR*) as transfer pricing strategies map into permanent tax savings (or reversals) (compare, e.g., Hanlon and Heitzman 2010, Graham et al. 2014).

The first variable of interest is *TP_Tension.* Similar to Phillips (2003), we define *TP_Tension* as a binary variable taking the value of one if the firm's KPIs do not take EAT into account to proxy for the presence of conflicting objectives of transfer pricing. Our second variable of interest is the indicator *TP_IT* as defined in the previous section.[49] To test our hypothesis, we include the interaction term of *TP_Tension* and *TP_IT*. When one of the two profitability measures is the dependent variable, we follow Robinson and Stocken (2013) and include *Size* (i.e., the natural logarithm of the firm's total assets), *Age* (measured as the natural

[49] This approach neglects the use of IT in a specific transfer pricing process. In supplemental analyses, we use the answers on the individual questions as variables of interests to work out the associations with the digitalization of specific transfer pricing processes. In untabulated tests, we find that all those proxies are positively correlated, consistent with these variables capturing the same construct.

logarithm of the firm's age), and *Foreign sales* (a categorical variable indicating the percentage of foreign sales over total sales) as control variables. When *ETR* is the dependent variable, we additionally include long-term debt scaled by total assets (*Leverage*) and intangible assets scaled by total assets (*Intangibles*) as common drivers of tax avoidance. All regression specifications also include a set of industry-specific year dummies to control for all observable and unobservable industry-, time-, and industry-time-specific factors that potentially correlate with characteristics of a firm's transfer pricing system as well as performance and tax avoidance.

3.4.2. Empirical results

We report summary statistics for the dependent and independent variables in Table 3.3. All hand-collected continuous variables are winsorized at the 1 percent level, except ETR which is winsorized at 0 and 1 to ensure a reasonable economic interpretation.[50] The average (median) is 6.5 (6.0) percent for *Pre-tax ROA*, 4.7 (4.7) percent for *After-tax ROA*, 28.9 (26.4) percent for *ETR*, and 18.2 (4.1) percent for *ETR Vola*. Table 3.4 contains the Pearson correlations for all variables.

[50] This procedure is in line with Gallemore and Labro (2015) and Guenther et al. (2017).

Table 3.3: Summary statistics for main regression.

	N	Mean	SD	Min	p10	Median	p90	Max
Outcome Variables								
Pre-tax ROA	430	0.07	0.06	-0.14	0.01	0.06	0.14	0.21
After-tax ROA	430	0.05	0.05	-0.17	0.00	0.05	0.10	0.15
ETR	400	0.29	0.18	0.00	0.13	0.26	0.42	1.00
ETR Vola	267	0.18	0.42	0.00	0.00	0.04	0.45	2.56
Cashflow/Assets	428	0.09	0.06	-0.17	0.02	0.09	0.15	0.33
Variables of Interest								
TP_IT	430	0.46	0.50	0.00	0.00	0.00	1.00	1.00
TP_Tension	430	0.54	0.50	0.00	0.00	1.00	1.00	1.00
Cost_method	430	0.47	0.50	0.00	0.00	0.00	1.00	1.00
Control Variables								
Log(Assets)	430	21.24	2.20	17.13	18.66	20.97	24.50	26.58
Leverage	415	0.17	0.17	0.00	0.01	0.13	0.35	1.01
Intangibles	430	0.10	0.12	0.00	0.01	0.05	0.28	0.56
Foreign sales	430	2.76	1.10	1.00	1.00	3.00	4.00	4.00
Log(Age)	430	4.20	0.82	2.20	2.94	4.38	5.14	5.33
Instrumental Variables								
LinkedIn1	348	0.69	1.34	0.00	0.00	0.00	3.00	5.00
LinkedIn2	348	0.79	0.41	0.00	0.00	1.00	1.00	1.00

Notes: This table presents descriptive statistics for the variables used in the empirical analysis. The summary statistics are based on the baseline regression of the ROA (Column (1) in Table 3.5). All variables are defined in Appendix 3.1 and are either hand-collected from the firms' consolidated financial statements from 2011 to 2016 or drawn from this study's survey conducted in 2017. Hand-collected continuous variables are winsorized at the 1 percent level, except *ETR* which is winsorized at 0 and 1.

Table 3.4: Correlation matrix.

Variables		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Pre-tax ROA	1	1.00														
After-tax ROA	2	0.90***	1.00													
ETR	3	-0.12	-0.18**	1.00												
ETR Vola	4	-0.17*	-0.25***	0.43***	1.00											
Cashfl./Assets	5	0.49***	0.50***	-0.10	-0.13*	1.00										
TP_IT	6	-0.21**	-0.13*	-0.05	-0.17*	-0.07	1.00									
TP_Tension	7	-0.20**	-0.13	-0.02	0.08	-0.08	0.12	1.00								
Cost_method	8	0.10	0.17**	0.05	-0.09	0.19**	0.32***	0.16*	1.00							
Log(Assets)	9	-0.33***	-0.20**	-0.18**	-0.23***	-0.21**	0.40***	0.32***	0.12	1.00						
Leverage	10	-0.30***	-0.35***	-0.07	-0.01	-0.11	-0.05	0.16*	0.06	0.11	1.00					
Intangibles	11	-0.00	0.12	-0.10	-0.12	0.05	0.34***	0.31***	0.27***	0.43***	0.02	1.00				
Foreign sales	12	0.10	0.14*	0.00	-0.08	0.16*	0.25***	0.23***	0.48***	0.16*	0.02	0.32***	1.00			
Log(Age)	13	0.15*	0.17*	0.01	-0.02	0.10	0.38***	0.08	0.31***	-0.01	-0.25***	0.26***	0.24***	1.00		
LinkedIn1	14	-0.08	-0.00	-0.10	-0.16*	-0.01	0.31***	0.18**	0.10	0.45***	-0.05	0.48***	0.24***	-0.06	1.00	
LinkedIn2	15	-0.20**	-0.18**	-0.06	-0.19**	-0.07	0.14*	0.06	0.08	0.16*	0.17*	-0.07	-0.09	0.01	-0.14*	1.00

Notes: This table presents the Pearson correlations for the variables used in the empirical analysis. All variables are defined in Appendix 3.1 and are either hand-collected from the firms' consolidated financial statements from 2011 to 2016 or drawn from this study's survey conducted in 2017. *, **, *** represent statistical significance at the 10, 5, and 1 percent levels, respectively.

Table 3.5 reports the results of our main analysis. We find a significantly negative association between *TP_Tension* and profitability both before and after taxes (columns (1) and (3)). Firms that do not consider after-tax earnings for their managers' evaluation, our proxy for firms facing conflicting managerial and tax objectives in the transfer pricing function, have, on average, 1.5 percentage points lower pre-tax and a 1.2 percentage points lower after-tax returns than firms that do use after-tax KPIs. In these baseline specifications, we do not find that firms with a more intensive use of IT within their transfer pricing function are more or less profitable. This result indicates that the availability of an information sharing system alone is not associated with an increase in financial performance consistent with the view that the impact of information depends on cross-sectional differences of firms' decision makers (Dierynck and Labro 2018).[51] In columns (2) and (4), we test our hypothesis whether the negative association between conflicting transfer pricing objectives and profitability is attenuated by the intensive use of IT. After including an interaction term of *TP_Tension* and *TP_IT*, we document baseline coefficients on *TP_Tension* that are almost twice as large as compared to the coefficient in column (1) and (3). The statistically significant and positive interaction coefficients of 0.024 (column 2) and 0.022 (column 4) suggest that the negative association between *TP_Tension* and both ROA-measures is completely attenuated for firms with *TP_IT* equal to one. Thus, our results support our hypothesis with respect to managerial outcomes of transfer pricing as pre-tax profitability is not mechanically affected by lower ETRs due to tax efficient transfer pricing.

We then look at tax avoidance as transfer pricing outcome. Column (5) reports the baseline specification when *ETR* is the dependent variable. Consistent with our expectation, the coefficient on *TP_Tension* is statistically significant and positive. The point estimate suggests that firms that do not incentivize their divisional managers to maximize after-tax

[51] This finding is in line with the recent experimental evidence in Li and Sandino (2018). Despite its different context (information sharing in sales stores), the study shows that there is not necessarily a causal link between better or more information and performance for the average firm.

Table 3.5: Conflicting objectives, IT, and transfer pricing outcomes.

		Pre-tax ROA			After-tax ROA			ETR	
Variables	Pred.	(1)	(2)	Pred.	(3)	(4)	Pred.	(5)	(6)
TP_Tension	-	-0.015**	-0.027***	-	-0.012**	-0.022***	+	0.032*	0.070**
		(-2.51)	(-3.36)		(-2.20)	(-3.24)		(1.67)	(2.50)
TP_IT		-0.008	-0.022***		0.001	-0.013*	-	-0.025	0.022
		(-1.09)	(-2.75)		(0.09)	(-1.87)		(-1.13)	(0.70)
*TP_Tension*TP_IT*	+		0.024**	+		0.022**	-		-0.082**
			(2.26)			(2.35)			(-2.20)
Log(Assets)		-0.006***	-0.006***		-0.003**	-0.002**	-	-0.011**	-0.012***
		(-4.63)	(-4.40)		(-2.33)	(-2.09)		(-2.52)	(-2.78)
Foreign sales	+	0.010***	0.011***	+	0.008***	0.009***	-	0.004	0.002
		(4.63)	(4.86)		(4.26)	(4.48)		(0.38)	(0.21)
Log(Age)		0.003	0.003		0.001	0.002		0.016	0.016
		(0.61)	(0.69)		(0.33)	(0.41)		(1.21)	(1.22)
Leverage							-	-0.146***	-0.153***
								(-2.72)	(-2.76)
Intangibles							-	-0.050	-0.051
								(-0.64)	(-0.67)
Observations		430	430		430	430		391	391
adj. R2		0.0870	0.0962		0.0540	0.0648		0.0237	0.0335
Ind-Year FE		Yes	Yes		Yes	Yes		Yes	Yes

Notes: This table presents the results of estimating a pooled OLS regression of *Pre-tax ROA*, *After-tax ROA,* and *ETR* on a set of independent variables. All variables are defined in Appendix 3.1 and are either hand-collected from the firms' consolidated financial statements from 2011 to 2016 or drawn from this study's survey conducted in 2017. The regressions are based on a panel on the level of firms and year. Constants are untabulated but included. Standard errors are robust and t-statistics are reported in parentheses. *, **, *** represent statistical significance at the 10, 5, and 1 percent levels (all two-tailed), respectively.

profits have, on average, a 3.2 percentage points higher ETR. The baseline coefficient on *TP_IT* is not significant at the conventional levels but directionally consistent with evidence in Gallemore and Labro (2015). In column (6), we test our hypothesis on the role of intensive IT usage for firms' tax avoidance when transfer pricing objectives conflict. After including the interaction of *TP_Tension* and *TP_IT*, we find that conflicting transfer pricing objectives are associated with 7.0 percentage points higher ETRs if firms do not rely on intensive IT support within their transfer pricing function. However, the strongly positive relationship between *ETR* and *TP_Tension* is fully attenuated by the intensive use of IT, as the statistically significant coefficient on the interaction term of -0.082 suggests. This result is consistent with our hypothesis concerning the ETR as the major tax-related outcome of transfer pricing.

3.4.3. Supplemental analyses

3.4.3.1. Tax risk and IT

Aggressive transfer pricing strategies for income shifting purposes are associated with significant tax risk (Dyreng et al. 2019; Towery 2017; KPMG 2018b). Companies thus typically aim to balance the financial benefits of a low ETR and the risk of unsustainable tax positions that likely result in disputes with tax authorities, penalties, adjustments of transfer prices and, thus, double taxation (Scholes et al. 2014; Towery 2017; Dyreng et al. 2019).

IT in transfer pricing is important to manage such risk given the increasingly important documentation and reporting function (see OECD 2017 for tightening regulation). Tax compliance in transfer pricing depends on the quality of local information and the transmission of this information to the central tax department. Particularly if divisional managers are not incentivized to support activities related to tax compliance aspects of transfer pricing, IT enables firms to gather the information necessary to defend tax-motivated transfer prices during tax audits by local authorities. In this context, IT might help firms to enhance the persuasiveness of the arm's lengths nature of a firm's transfer prices as tax positions are typically risky

if they are supported by a weak set of facts (Frischmann et al. 2008; Mills et al. 2010).[52] However, tax risk could also increase if firms use more IT as tax authorities are typically granted access to the firm's enterprise system during tax audits. They might use the more detailed transaction-based information to challenge companies' tax positions more frequently and more aggressively (Deloitte 2018).

To explore this empirical question, we follow Gallemore and Labro (2015) and Guenther et al. (2017) and examine the tax rate volatility as a proxy of tax risk. We use *ETR Vola* as the firm's standard deviation of the annually reported ETRs over a three-year period as the dependent variable to study the association between *TP_IT* and tax risk. We apply the same model as for the ETR-regression and use a three-year average matching the period over which we calculate *ETR Vola* of each control variable based on financial information from the companies' consolidated accounts. We present the results of this model in Table 3.6. We find a significant negative association between *TP_IT* and *ETR Vola* (column (1)). Directionally and quantitatively consistent with Gallemore and Labro (2015), this finding suggests that intensive IT use particularly within the transfer pricing function supports firms in their tax risk management. *TP_IT* firms face, on average, a 14.5 percentage points lower tax rate volatility. Moreover, we observe a positive association between *TP_Tension* and *ETR Vola*, complementing our finding that tension in the transfer pricing objectives is associated with a higher tax burden and further consistent with our proxy for *TP_Tension* capturing firms in which managers have little incentives to optimize tax outcomes. In column (2), we include the interaction term of *TP_Tension* and *TP_IT*. The baseline coefficient on *TP_Tension* is significantly

[52] In its Draft Handbook on Transfer Pricing Risk Assessment, the OECD (2013b) explicitly states: *Where taxpayers are compliant, readily provide the tax administration with the relevant information, documents and analysis, engage principally in routine and readily understood commercial transactions, and make reasonable efforts to implement appropriate transfer pricing policies, they generally need not be subjected to a thorough transfer pricing audit every year*. In its current update of the Practical Manual on Transfer Pricing for Developing Countries, the United Nations (2019) further note: *Such documentation should demonstrate that the transfer pricing method and its application provide the most reliable measure of an arm's length price. This represents the first opportunity for the taxpayer to persuade the examiners that the transfer pricing is appropriate. Incomplete or inaccurate contemporaneous documentation may provide the examiners with a "road map" for their transfer pricing audit*.

positive and larger than in column (1), indicating that this positive association is driven by sample firms with a non-intensive IT support for their transfer pricing processes. In line with our expectation, the coefficient on the interaction term is negative (-0.246) and statistically significant. This result indicates that IT does not only help firms to implement successful tax avoidance strategies but also to establish tax certainty, particularly when facing conflicting transfer pricing objectives.

Table 3.6: IT and tax risk in transfer pricing.

		ETR Vola.	
Variables	Pred.	(1)	(2)
TP_Tension	+	0.183***	0.297***
		(3.22)	(2.93)
TP_IT	-	-0.145***	-0.004
		(-2.71)	(-0.07)
*TP_Tension*TP_IT*	-		-0.246**
			(-2.15)
Log(Assets_3)		-0.033***	-0.035***
		(-3.10)	(-3.19)
Leverage_3		0.040	-0.003
		(0.34)	(-0.03)
Intangibles_3		-0.436*	-0.463*
		(-1.83)	(-1.95)
Foreign sales		0.006	0.001
		(0.25)	(0.05)
Log(Age)		0.085**	0.086**
		(2.43)	(2.42)
Observations		264	264
adj. R2		0.0919	0.1083
Ind-Year FE		Yes	Yes

Notes: This table presents the results of estimating a pooled OLS regression of *ETR Vola* on a set of independent variables. All variables are defined in Appendix 3.1 and are either hand-collected from the firms' consolidated financial statements from 2011 to 2016 or drawn from this study's survey conducted in 2017. Constants are untabulated but included. The regressions are based on a panel on the level of firms and year. Standard errors are robust and t-statistics are reported in parentheses. *, **, *** represent statistical significance at the 10, 5, and 1 percent levels (all two-tailed), respectively.

3.4.3.2. Profitability under cost-based transfer pricing methods and IT

The choice of transfer pricing methods for different types of intrafirm transactions is a crucial transfer pricing system design decision as it directly influences the determination of prices and, thus, the effectiveness of performance management (e.g., Baldenius 2009; Hie-

mann and Reichelstein 2012). While firms can choose among a range of transfer pricing methods, the literature has predominantly studied the merits transfer prices based on costs, negotiations, or market prices. Dikolli and Vaysman (2006) formalize that the ability to communicate knowledge from local managers to the central management and the accuracy of transmitted information determine the preferred transfer pricing method. Although transfer prices set by the central management based on internal costs typically avoids the drawbacks of negotiated pricing such as haggling costs and delayed decision-making, cost-based transfer pricing is typically associated with suboptimal decision-making. Common reasons are double-marginalization problems (Baldenius 2009) misallocating indirect costs, failing to calculate normal or budgeted costs, incorrectly identifying intrafirm activities, failing to factor in inefficiencies and idle capacities, and accounting inconsistencies (Horngren et al. 2015, 53, 874). However, as Dikolli and Vaysman (2006) show, perfect IT overcomes these drawbacks of cost-based transfer pricing. The quicker and less costly relevant information on intrafirm transactions can be transmitted, the more accurately costs are estimated. Managers can then mandate optimal levels of intrafirm trade which increases profitability (Dikolli and Vaysman 2006).

Our data allows us to empirically test if a more intensive use of IT is indeed associated with the higher profitability under cost-based transfer pricing as predicted in Dikolli and Vaysman (2006). We observe which transfer pricing method a firm uses for different types of intrafirm transactions.[53] If the firm applies cost-based transfer pricing in more than two of six transactions (i.e., above the sample median), we define it as a frequent user of the cost-based transfer pricing method and the indicator variable *Cost_method* takes on the value of 1 and 0 otherwise. We use the same model as presented in equation (1) with *Pre-tax ROA* as depend-

[53] We asked firms about intrafirm transactions concerning (1) primary products, (2) end products, (3) commodities (trade), (4) service, (5) IP development, and (6) IP exploitation. As potential methods, we offered five transfer pricing methods recommended in the OECD guidelines (OECD 2017): three traditional transaction-related methods, the comparable uncontrolled price method (CUP), the resale price method, and the cost plus method; and two transactional profit-related methods, the transactional net margin method (TNMM) and the profit split method.

ent variable and include *Cost_method* and the interaction term of *Cost method* and *TP_IT* as independent variables.

Table 3.7: Profitability, IT, and cost-plus methods in transfer pricing.

		Pre-tax ROA		
Variables	Pred.	(1)	(2)	(3)
TP_Tension	-	-0.015**	-0.017***	-0.018***
		(-2.55)	(-2.81)	(-2.83)
TP_IT		-0.009	-0.020**	-0.034***
		(-1.45)	(-2.53)	(-2.79)
Cost_method		0.008	-0.002	
		(1.31)	(-0.26)	
*Cost_method*TP_IT*	+		0.020*	
			(1.88)	
Cost_method_count				-0.004
				(-1.39)
*Cost_method_count**	+			0.009**
TP_IT				(2.49)
Log(Assets)		-0.006***	-0.006***	-0.006***
		(-4.62)	(-4.39)	(-3.38)
Foreign sales	+	0.009***	0.009***	0.010***
		(3.94)	(3.89)	(3.05)
Log(Age)		0.002	0.003	0.004
		(0.48)	(0.76)	(0.95)
Observations		430	430	430
adj. R2		0.0886	0.0929	0.0956
Ind-Year FE		Yes	Yes	Yes

Notes: This table presents the results of estimating a pooled OLS regression of *Pre-tax ROA* on a set of independent variables. All variables are defined in Appendix 3.1and are either hand-collected from the firms' consolidated financial statements from 2011 to 2016 or drawn from this study's survey conducted in 2017. The regressions are based on a panel on the level of firms and year. Constants are untabulated but included. Standard errors are robust and t-statistics are reported in parentheses. *, **, *** represent statistical significance at the 10, 5, and 1 percent levels (all two-tailed), respectively.

We report results in Table 3.7. We find that *Cost_method* is, on average, not significantly associated with a firm's profitability (column (1)). In line with theory, we document a coefficient of 0.02 on the interaction term which is significant at the 10 percent level (column (2)). Given a baseline coefficient of -0.002 on *Cost_method*, the use of cost-based transfer pricing methods is associated with a 1.8 percentage point higher *Pre-tax ROA* if firms use IT inten-

sively to support the transfer pricing function.[54] In column (3), we replace the binary variable *Cost_method* capturing the intensity of the use of the cost-based method by the count variable we used to construct *Cost_method* indicating the number of transaction types for which the firm frequently applies the cost-plus method and find consistent results.

3.4.3.3. IT in specific transfer pricing processes

In the main analysis, we use a proxy aggregating the overall use of IT within the transfer pricing function. This approach does not explicitly capture which specific transfer pricing processes are supported by IT. To investigate which process-specific IT most likely drives our results on the different outcomes, we run separate regressions coding the *TP_IT* variable separately for the seven transfer pricing processes discussed in Section 3.3 and reported in Table 3.2.[55]

Table 3.8 presents the regression results that are based on this detailed breakdown. Panels A and B show the results for the regressions with the dependent variables *After-tax ROA* and *ETR* including the interaction of *TP_Tension* and the process-specific *TP_IT* variable. Panel C and D replicate the analyses of tax risk and of profitability under cost-based transfer pricing. The results of our main tests are reported as baseline in each panels' column (1). Columns (2) to (8) report the results of our process-specific regressions.

In Panel A, the coefficients on the interaction term *TP_Tension*TP_IT* suggest that intensive IT support for the calculation of transfer prices, documentation, and the external and internal reporting seem to drive the attenuation of the relationship between the conflicting objectives and lower profitability. This result is intuitive given that more accurately calculated and well-documented prices as well as sophisticated reporting tools should increase the decision-usefulness for managers dealing with conflicting transfer pricing objectives.

[54] In untabulated robustness tests, we do not find significant associations between the other transfer pricing methods and profitability, for instance the CUP method.

[55] The respective variables are binary. They take the value of one if the respondent answers the questions regarding the intensity of IT support on the scale of 1 to 4 with either 3 ("high") or 4 ("very high").

When *ETR* is the dependent variable (Panel B), empirical results suggest that the positive association between *TP_Tension* and *ETR* is only significantly attenuated when the process of external reporting of transfer prices is supported by the intensive use of IT (Column (5)). Thus, our main finding on tax avoidance is most likely driven by firms with a generally intensive IT support within their transfer pricing function (baseline result). However, we find that external reporting being supported by IT helps firms to report lower ETRs under conflicting transfer pricing objectives. This result suggests that convincingly reporting arm's-length transfer prices to the tax authorities is essential for the success of tax-motivated transfer pricing strategies, particularly when managerial objectives might not be aligned with tax-motivated transfer prices. This finding is consistent with anecdotal evidence on the increasing scrutiny in international tax audits, tighter documentation requirements, and on well-documented prices avoiding transfer pricing adjustments in the course of tax audits that ultimately increase a firm's ETR (KPMG 2018b; Baker McKenzie 2018). Moreover, the analysis reveals negative baseline coefficients on *TP_IT* particularly when the transfer pricing process is most relevant for gaining acceptance for pricing schemes by tax authorities (using IT during tax audits and maintaining a database). This finding sheds light on which specific aspects of a firm's information environment help to implement successful tax strategies as documented, on average, in Gallemore and Labro (2015) and McGuire et al. (2018).

We also find intuitive results when studying process-specific IT and tax risk (Panel C). Our main result is most likely driven by intensive IT support for the documentation of transfer prices. Such documentation is relevant for tax risk management as tax authorities typically audit transfer pricing schemes for several past years at once and if prices are not documented appropriately, price adjustments will have one-time effects on the ETR and, thus, increase its volatility. Also, sound documentation enhances the persuasiveness of tax positions and decreases their risk of being challenged by auditors (Frischmann et al. 2008; Mills et al. 2010).

Table 3.8: IT support of specific transfer pricing processes and transfer pricing outcomes.

Panel A: Dependent Variable: After-tax ROA								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	(Baseline)	Comp. Search	Calculation	Docu.	Ext. Rep.	Int. Rep.	TA Enf.	TP Database
TP_Tension	-0.022***	-0.012**	-0.021***	-0.016***	-0.019***	-0.019***	-0.011**	-0.013**
	(-3.24)	(-2.07)	(-3.10)	(-2.66)	(-2.97)	(-2.95)	(-1.98)	(-2.13)
TP_IT Process	-0.013*	-0.006	-0.005	-0.011	-0.015**	-0.010	0.004	-0.009
	(-1.87)	(-0.95)	(-0.81)	(-1.56)	(-2.15)	(-1.62)	(0.51)	(-1.41)
*TP_Tension*TP_IT Process*	0.022**	-0.001	0.030***	0.016*	0.023***	0.022***	-0.006	0.002
	(2.35)	(-0.13)	(3.29)	(1.74)	(2.78)	(2.73)	(-0.57)	(0.24)
Observations	430	430	430	430	430	424	430	430
adj. R2	0.0648	0.0554	0.0868	0.0565	0.0642	0.0595	0.0522	0.0574
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Ind-Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Panel B: Dependent Variable: ETR								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	(Baseline)	Comp. Search	Calculation	Docu.	Ext. Rep.	Int. Rep.	TA Enf.	TP Database
TP_Tension	0.070**	0.043*	0.049**	0.053**	0.056**	0.040	0.025	0.037
	(2.50)	(1.84)	(2.02)	(2.21)	(2.35)	(1.54)	(1.09)	(1.42)
TP_IT Process	0.022	0.039	0.000	0.031	0.028	-0.046*	-0.080**	-0.052**
	(0.70)	(1.09)	(0.01)	(0.86)	(0.70)	(-1.91)	(-2.47)	(-2.08)
*TP_Tension*TP_IT Process*	-0.082**	-0.015	-0.057	-0.073	-0.078*	-0.020	0.014	-0.006
	(-2.20)	(-0.34)	(-1.43)	(-1.43)	(-1.74)	(-0.52)	(0.32)	(-0.18)
Observations	391	391	391	391	391	385	391	391
adj. R2	0.0335	0.0232	0.0278	0.0233	0.0285	0.0265	0.0356	0.0374
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Ind-Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Panel C: Dependent Variable: ETR Vola								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	(Basline)	Comp. Search	Calculation	Docu.	Ext. Rep.	Int. Rep.	TA Enf.	TP Database
TP_Tension	0.297***	0.221***	0.183**	0.258***	0.240***	0.211**	0.200***	0.194**
	(2.93)	(2.99)	(2.34)	(3.12)	(2.99)	(2.40)	(2.95)	(2.50)
TP_IT Process	-0.004	0.082	-0.039	0.103*	0.066	0.026	0.018	-0.096**
	(-0.07)	(1.51)	(-0.81)	(1.71)	(1.15)	(0.58)	(0.33)	(-2.17)
*TP_Tension**	-0.246**	-0.037	0.041	-0.215*	-0.134	-0.034	0.094	0.018
TP_IT Process	(-2.15)	(-0.38)	(0.43)	(-1.93)	(-1.40)	(-0.31)	(0.87)	(0.22)
Observations	264	264	264	264	264	260	264	264
adj. R2	0.1083	0.0711	0.0677	0.0759	0.0720	0.0694	0.0706	0.0756
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Ind-Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Panel D: Dependent Variable: Pre-tax ROA								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	(Basline)	Comp. Search	Calculation	Docu.	Ext. Rep.	Int. Rep.	TA Enf.	TP Database
Cost_method	0.008	0.000	-0.007	-0.002	-0.006	-0.005	0.003	0.008
	(1.31)	(0.04)	(-0.84)	(-0.31)	(-0.75)	(-0.52)	(0.47)	(1.01)
TP_IT Process	-0.020**	-0.030***	-0.016*	-0.026***	-0.024***	-0.013	-0.012	-0.012
	(-2.53)	(-3.02)	(-1.94)	(-3.35)	(-3.63)	(-1.60)	(-1.36)	(-1.59)
*Cost_method**	0.020*	0.028**	0.032***	0.036***	0.036***	0.026**	0.022*	0.001
TP_IT Process	(1.88)	(2.30)	(2.88)	(3.51)	(3.65)	(2.40)	(1.79)	(0.12)
Observations	430	430	430	430	430	424	430	430
adj. R2	0.0886	0.1008	0.0981	0.1018	0.1058	0.0830	0.0852	0.0894
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Ind-Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: These tables present the results of estimating a pooled OLS regression of *After-tax ROA* (Panel), *ETR* (Panel B), *ETR Vola* (Panel C), and *Pre-tax ROA* (Panel D) on a set of independent variables. The definition of the variable *Process* differs in columns (2) to (8); it is a binary variable capturing all firms that use "high" (3) or "very high" (4) IT support for each of the seven transfer pricing processes we consider in the survey, each as indicated in the specification title. All other variables are defined in Appendix 3.1 and are either hand-collected from the firms' consolidated financial statements from 2011 to 2016 or drawn from this study's survey conducted in 2017. The regressions are based on a panel on the level of firms and year. Standard errors are robust and t-statistics are reported in parentheses. *, **, *** represent statistical significance at the 10, 5, and 1 percent levels (all two-tailed), respectively.

In Panel D, we repeat this process-specific analysis to test which kind of IT support enables more profitable cost-based transfer pricing. Again, we are particularly interested in the coefficients of the interaction term of *Cost method*TP_IT*. Consistent with the argumentation in Dikolli and Vaysman (2006), IT support of the calculation of transfer prices and internal reporting seem to be the drivers of our main findings.

3.4.4. Robustness tests

3.4.4.1. Validating the proxy for conflicting transfer pricing objectives

Capturing the different and even conflicting objectives within the transfer pricing function is not a trivial and might be prone to measurement error. We therefore assess the plausibility of the baseline result based on our proxy for conflicting tax and managerial objectives (*TP_Tension*). First, we exploit an additional survey question asking whether transfer pricing managers think that the transfer pricing system within their firm integrates the tax function and the managerial control system to a sufficient extent. We code the indicator variable *GAP TP-MCS* as one if their answer was no. We interpret *GAP TP-MCS* as an alternative measure to *TP_Tension* since a firm with a transfer pricing system that poorly integrates the tax planning and managerial control should be likely to face conflicting transfer pricing objectives. Consistent with this conjecture, the result reported in column (1) of Table 3.9 is in line with the main result when *TP_Tension* is the variable of interest. Second, we look at cash-flow scaled by total assets as an alternative outcome measure. While cash-flows might be correlated with effective tax rates and profitability, we interpret it as a placebo outcome and do not expect to replicate the significant baseline results. Our proxy *TP_Tension* is supposed to capture conflicting objectives stemming from managers aiming to minimize either the ETR or the accounting-based profitability. Both measures are affected by accrual accounting while cash-flows are not. Consistently, we document no statistically significant relationship between *TP_Tension* or the interaction of *TP_Tension*TP_IT* and the placebo outcome.

Table 3.9: Cross-sectional validation of main results.

	After-tax ROA	Cashflow/Assets	
Variables	(1)	(2)	(3)
TP_Tension	-0.010**	-0.004	-0.011
	(-2.04)	(-0.67)	(-1.12)
TP_IT	-0.007	0.004	-0.004
	(-0.97)	(0.62)	(-0.41)
*TP_Tension*TP_IT*			0.013
			(1.16)
GAP TP-MCS	-0.021**		
	(-1.97)		
*GAP TP-MCS*TP_IT*	0.052***		
	(4.84)		
Observations	430	428	428
adj. R2	0.0946	0.0779	0.0784
Controls	Yes	Yes	Yes
Ind-Year FE	Yes	Yes	Yes

Notes: This table presents the results of estimating a pooled OLS regression of *After-tax ROA* and *Cash-flow/Assets* on a set of independent variables. All variables are defined in Appendix 3.1 and are either hand-collected from the firms' consolidated financial statements from 2011 to 2016 or drawn from this study's survey conducted in 2017. The regressions are based on a panel on the level of firms and year. Standard errors are robust and t-statistics are reported in parentheses. *, **, *** represent statistical significance at the 10, 5, and 1 percent levels (all two-tailed), respectively.

3.4.4.2. Instrumental variables approach to address potential endogeneity of the use of IT

We acknowledge that our proxy for the intensity of IT use is a potentially endogenous variable. Selection bias might arise since firms are not randomly sorted into "low" and "high" intensity IT users (Lennox et al. 2011).[56] If unobserved determinants of intensive IT use also affect profitability and tax planning outcomes, regression results might be biased (Larcker and Rusticus 2010). We do not claim that our results based on OLS regressions and the cross-sectional survey data allow for a causal interpretation. However, we validate our results and aim to address selection-into-IT and reverse causality concerns by an instrumental variables (IV) approach. IV methods can, if they meet certain requirements, eliminate the bias stemming from simultaneity, selection, or omitted variables (Larcker and Rusticus 2010).

[56] We interpret such selection bias to possibly arise due to unobserved factors that drive firms' decision to employ IT and also influence transfer pricing outcomes. In untabulated tests, we find that firms scoring 1 on TP_IT are, on average, larger, more intangible-intensive, more internationalized, and more mature (older).

One requirement is to find variables that are correlated with the endogenous regressor (*TP_IT*) but uncorrelated with the error in the structural equation ($\varepsilon_{i,t}$ in (1)). We use hand-collected information from the professional social online network platform LinkedIn.com to construct two variables as instruments for *TP_IT*. First, we code a binary variable as one if firms have a corporate profile on LinkedIn. Second, we search for LinkedIn profiles of employees that work at firms' transfer pricing departments and capture the number of these employees in a continuous variable. We use both variables in our first stage regressions to predict the use of IT in our sample firms.[57] We expect and find that the LinkedIn variables are positively associated with a firm's use of IT in transfer pricing as the first stage regressions results in Panel B of Table 3.10 show. The significant and directionally expected coefficients on our LinkedIn variables, relatively high partial R-squared, and an F-statistics between 6 and 23 for all specifications suggest that the instruments should be relevant and not weak (Larcker and Rusticus 2010).

The IV approach then uses the predicted values of *TP_IT* in the second stage regression and considers the variation of this variable exogenous. The economic justification for the underlying exclusion criterion to be fulfilled (Larcker and Rusticus 2010; Lennox et al. 2011) in our analysis requires that the LinkedIn variables have no direct influence on the transfer pricing outcomes such as the profitability, ETR, and tax risk. A counterargument is that technology-intensive firms differ in profitability and are more tax aggressive and that (probably younger) employees who are more open-minded towards IT are also better tax planners and decision makers. Yet, firms striving for high profits and an aggressive tax strategy might avoid being on LinkedIn to avoid public scrutiny. Also, older employees whose working experience can be a driving factor of favorable firm outcomes (Simsek 2007) are less likely to

[57] When the second stage includes an interaction term of the *TP_IT* variable and another variable, we also instrument for these interaction terms with the interactions of the LinkedIn variables and the other variable of interest.

have a LinkedIn profile.[58] Importantly, we intend to capture variation in terms of transfer pricing managers' affinity with IT rather than the size of the transfer pricing department.[59] We implicitly assume that the variation in the LinkedIn variables is itself exogenous to the use of IT within the firm's transfer pricing function. However, we cannot formally test this assumption. Nevertheless, we can follow the recommendation in Larcker and Rusticus (2010) and test over-identifying restrictions as we include more than one instrumental variables. Conditional on our model including at least one valid instrument, results of the tests suggest that our instruments seem appropriate, at least when *After-tax ROA* and *ETR* are the dependent variables.[60]

We finally report the second stage regression results when validating the specifications of our main analysis using TSLS in Panel A of Table 3.10. Overall, we confirm our main findings based on OLS which is consistent with the industrial economics literature that has documented only a small IT selection bias, if any (Tambe and Hitt 2012).[61]

[58] For the age distribution of LinkedIn users in the US, statistics suggest that almost half of the LinkedIn users are between 25 and 45 years old, while only 25 percent are older than 55 (https://www.statista.com/statistics/192700/ age-distribution-of-us-users-on-linkedin/).

[59] Our interpretation and the use of the LinkedIn data is thus different compared to the setting of Chen, Cheng, Chow, and Liu (2017) who look at the number of employees in the tax department as their variable of interest.

[60] Results of the Hausman test further suggest that bias, if any, from endogeneity of the *TP_IT* variable appears to be most severe in our analysis of tax risk (columns (6) and (7)).

[61] However, some TSLS estimates differ in magnitude from the OLS results and the TSLS estimate seems unreasonably large when the outcome variable is *ETR.* These results might be due to low power of the instruments (Larcker and Rusticus 2010) when studying the relationship between *TP_IT* and tax avoidance and tax risk. We again stress the IV approach only serves as a robustness test of our main empirical approach and provides comforting evidence in terms of the sign and the significance of the estimates.

Table 3.10: Robustness tests: TSLS IV regressions.

Panel A: Second stage (TSLS results)							
	After-tax ROA			ETR		ETR Vola.	
Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)
TP_Tension	-0.018***	-0.041***	-0.022***	0.017	0.172**	0.126**	0.699***
	(-2.87)	(-2.91)	(-3.61)	(0.72)	(2.57)	(1.96)	(3.02)
TP_IT	0.008	0.010	-0.022	-0.118	-0.009	-0.669**	-0.271
	(0.27)	(0.43)	(-1.28)	(-1.30)	(-0.14)	(-2.28)	(-0.94)
*TP_Tension**		0.057*			-0.341**		-1.249***
TP_IT		(1.87)			(-2.57)		(-2.75)
Cost_method			-0.043***				
			(-2.67)				
*Cost_method**			0.070***				
TP_IT			(2.93)				
Observations	348	348	348	340	340	229	229
adj. R2	0.0593	.	0.0059	.	.	.	.
Over-id. Chi2	0.82	5.21	5.38	0.00	1.72	4.22	6.26
Over-id. p	0.3648	0.0739	0.0680	0.9814	0.4232	0.0401	0.0438
Hausman F	0.86	5.72	3.90	2.16	4.86	7.00	9.78
Hausman p	0.3532	0.0572	0.1420	0.1417	0.0880	0.0082	0.0075
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Ind-Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Panel B: First stage results and diagnostics							
	TP_IT			TP_IT		TP_IT	
Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)
LinkedIn1	0.163***	0.041**	-0.033**	0.079***	0.181***	0.076***	0.173***
	(4.71)	(2.04)	(-2.24)	(4.55)	(5.23)	(3.52)	(3.99)
LinkedIn2	0.087	0.392***	-0.036	0.150***	0.034	0.151**	0.064
	(1.21)	(6.00)	(-0.97)	(2.72)	(0.44)	(2.26)	(0.71)
Observations	348	348	348	340	340	229	229
partial R2	0.0542	0.0758	0.1286	0.0566	0.0884	0.0525	0.0793
F	13.83	10.87	23.27	11.75	10.23	7.09	6.22
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
IV-Interactions	No	Yes	Yes	No	Yes	No	Yes
Ind-Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: This table presents the second (Panel A) and first (Panel B) stage results of estimating TSLS IV-regression model of the baseline specifications with After-tax *ROA*, *ETR*, and *ETR Vola* as dependent variables and the same set of independent variables as in Tables (5) to (7). The instruments for *TP_IT* are *LinkedIN1* and *LinkedIn2*. All variables are defined in Appendix 3.1 and either hand-collected from the firms' consolidated financial statements from 2011 to 2016, from LinkedIn in 2018, or drawn from this study's survey conducted in 2017. When the models include interactions of the instrumental variables (given that the variables of interests *TP_*Tension and *TP_IT* are interacted in the baseline models) the partial R squared and F-statistics from the first stage are based on the baseline instruments for *TP_IT*. Standard errors are robust and t-statistics are reported in parentheses. *, **, *** represent statistical significance at the 10, 5, and 1 percent levels (all two-tailed), respectively.

3.4.4.3. Seemingly unrelated regression framework

In our regression analysis, we relate multiple transfer pricing outcomes to the use of IT and other transfer pricing system characteristics of the same firm. In doing so, we use more than one regression model while each equation explains variation in a different economic

phenomenon (outcome variable) for a given firm. Our main transfer pricing outcome variables (*ROA* vs. *ETR*) and their residuals might be correlated across the various regressions at a given firm. We thus test the robustness of our main results based on a seemingly unrelated regressions (SUR) model established by Zellner (1962) to account for the correlation of the potentially interdependent residuals and potentially improve our models' estimation efficiency (Aitchison 1986; Abernethy et al. 2013). Results are reported in Table 3.11 and are quantitatively and qualitatively comparable to the main OLS results.

Table 3.11: Robustness tests: Seemingly unrelated regressions model.

	After-tax ROA		ETR	
Variables	(1)	(2)	(3)	(4)
TP_Tension	-0.021***	-0.026***	0.031	0.070***
	(-4.46)	(-4.19)	(1.64)	(2.78)
TP_IT	-0.008	-0.015**	-0.024	0.024
	(-1.52)	(-2.00)	(-1.15)	(0.80)
*TP_Tension*TP_IT*		0.012		-0.084**
		(1.31)		(-2.32)
Log(Assets)	-0.001	-0.001	-0.013**	-0.013***
	(-1.21)	(-1.11)	(-2.52)	(-2.69)
Foreign sales	0.009***	0.009***	0.004	0.002
	(3.95)	(4.06)	(0.40)	(0.21)
Log(Age)	0.005	0.005	0.011	0.011
	(1.62)	(1.60)	(0.88)	(0.90)
Leverage			-0.204***	-0.209***
			(-3.80)	(-3.91)
Intangibles			0.014	0.011
			(0.16)	(0.13)
Observations	391	391	391	391
R2	0.1884	0.1919	0.1884	0.1919
P-value	0.0000	0.0000	0.0000	0.0000
Ind-Year FE	Yes	Yes	Yes	Yes

Notes: This table presents the results of estimating a pooled OLS regression of the seemingly unrelated regressions (Zellner 1962) using *After-tax ROA* and *ETR* as dependent variables and the respective set of independent variables. All variables are defined in Appendix 3.1 and are either hand-collected from the firms' consolidated financial statements from 2011 to 2016 or drawn from this study's survey conducted in 2017. The regressions are based on a panel on the level of firms and year. Constants are untabulated but included. Standard errors are robust and t-statistics are reported in parentheses. *, **, *** represent statistical significance at the 10, 5, and 1 percent levels (all two-tailed), respectively.

3.5. Conclusion

Multinational firms use transfer pricing to maximize overall profits but also to shift pre-tax profits to low-tax jurisdictions. A fundamental, yet empirically unexplored question is how firms implement transfer pricing strategies that balance the often-underlying conflict between managerial control and tax efficiency within their transfer pricing function. We find that the intensive use of IT within firms' transfer pricing function helps to achieve higher profitability, lower ETRs, and lower tax risk if managerial and tax objectives likely conflict. Moreover, our evidence confirms theory that more intensive IT use is associated with higher profitability under cost-based transfer pricing. Our results suggest that investments in IT can increase the effectiveness of transfer pricing strategies in particular when decision-making is difficult because of a high tension between the tax and managerial accounting department and when granular information is necessary to determine optimal prices based on internal costs.

Our study contributes to several lines of research and offers implications for the practice of transfer pricing. To our knowledge, we are the first to provide empirical evidence on the use of IT within firms' transfer pricing function and its association with non-tax and tax-related outcomes, thereby bridging the gap between managerial and tax accounting research. Our findings are of primary interest to practitioners and researchers alike given the rising up-take of specific IT solutions and the increasing data availability and relevance in the digital economy.

Appendix Chapter 3

Table 3.12: Appendix 3.1: Variable definitions**.**

Outcome Variables	
Pre-tax ROA	Return on assets before taxes in year t, defined as firm's earnings before taxes scaled by total assets, acc. to cons. fin. statements
After-tax ROA	Return on assets after taxes in year t, defined as firm's earnings after taxes (EAT) scaled by total assets, acc. to cons. fin. statements
ETR	Effective tax rate in year t, defined as tax expense over earnings before taxes, acc. to cons. fin. statements
ETR Vola	Standard deviation of ETR over three-year period ending in t
Cashflow/Assets	Cash flow from operating activities scaled by total assets in year t, acc. to cons. fin. statements
Variables of Interest	
TP_IT	1 if index measuring the degree of the firms' use of IT for transfer pricing (ranging from 7 to 28) is above median, 0 otherwise
TP_Tension	1 if MNE uses no KPI based on EAT
Cost_method	1 if MNE uses cost-based transfer pricing methods for more than two (out of nine) types of transactions (i.e., above median), 0 otherwise
Control Variables	
Log(Assets)	Natural logarithm of firm's total assets in year t, acc. to cons. fin. statements
Log(Assets_3)	Natural logarithm of firm's average total assets over three-year period ending in t
Leverage	Firm's long-term debt scaled by its total assets in year t, acc. to cons. fin. statements
Leverage_3	Average firm's long-term debt scaled by its total assets over three-year period ending in t
Intangibles	Firm's intangible assets scaled by its total assets in year t, acc. to cons. fin. statements
Intangibles_3	Average firm's intangible assets scaled by its total assets over three-year period ending in t
Foreign sales	Share of firm's foreign revenue, as indicated in survey; 1 if < 25%, 2 if 25%-50%, 3 if 50%-75%, 4 if > 75%
Log(Age)	Natural logarithm of firm's age in year 2017 (year of the survey)
GAP TP-MCS	1 if managers do not think that the transfer pricing system within their firm integrates the tax function and the managerial control system to a sufficient extent, 0 otherwise
Instrumental Variables	
LinkedIn1	1 if MNE has a corporate LinkedIn profile
LinkedIn2	No. of the MNE's transfer pricing managers with a LinkedIn profile

Figure 3.4: Appendix 3.2: Questions from the survey instrument used in this study [translated from German].

1.1. Which key financial ratios are primarily used for steering and managing in your organization? [Multiple choices possible]

	No usage	Yes, use in terms of legal entities (individual financial statement – financial figures)	Yes, use in terms of management-units (e.g. business units)	Yes, use in terms of group level (consolidated financial figures)
Growth indicators	☐	☐	☐	☐
EBIT-based key figures	☐	☐	☐	☐
Earnings-After-Tax (EAT)-based key figures	☐	☐	☐	☐
Cash Flow-based key figures	☐	☐	☐	☐
Other (please specify)	_____			

1.5. Which transfer pricing methods are used in your organization for the following transactions? [Multiple choices possible]

	Unfinished products	Sales (Finished products)	Sales (Merchandise)	Services	Development of IP	Use of IP
Cost-plus method	☐	☐	☐	☐	☐	☐
Resale price method	☐	☐	☐	☐	☐	☐
Comparable uncontrolled price method	☐	☐	☐	☐	☐	☐
Transactional net margin method	☐	☐	☐	☐	☐	☐
Transactional profit split method	☐	☐	☐	☐	☐	☐

Figure 3.4: Appendix 3.2 (continued)

3.1. To what extent are your transfer pricing management processes currently supported by IT systems?

	Support with very low intensity	Support with low intensity	Support with high intensity	Support with very high intensity
Search of comparables	☐	☐	☐	☐
Calculation of transfer prices	☐	☐	☐	☐
Documentation of transfer prices	☐	☐	☐	☐
External reporting of transfer prices (incl. CbCR)	☐	☐	☐	☐
Internal reporting of transfer prices	☐	☐	☐	☐
Enforcement of transfer prices vs. tax authorities	☐	☐	☐	☐
Transfer of transfer pricing data within organization	☐	☐	☐	☐

3.2. To what extent should your transfer pricing management processes be supported by IT systems in the future?

	Support with very low intensity	Support with low intensity	Support with high intensity	Support with very high intensity
Search of comparables	☐	☐	☐	☐
Calculation of transfer prices	☐	☐	☐	☐
Documentation of transfer prices	☐	☐	☐	☐
External reporting of transfer prices (incl. CbCR)	☐	☐	☐	☐
Internal reporting of transfer prices	☐	☐	☐	☐
Enforcement of transfer prices vs. tax authorities	☐	☐	☐	☐
Transfer of transfer pricing data within organization	☐	☐	☐	☐

Figure 3.4.: Appendix 3.2 (continued)

3.3. For which topics do you see a need for change in your organization in the next five years?

	Very little change	Little change	Strong change	Very strong change
Transfer pricing system for established products and services	☐	☐	☐	☐
Transfer pricing system for digital products and services	☐	☐	☐	☐
Linkage of transfer pricing and steering system	☐	☐	☐	☐
IT-support of transfer pricing processes	☐	☐	☐	☐
Enforcement of transfer pricing system vs. tax authorities	☐	☐	☐	☐
Others (please specify)	_____			

5.1. In which department are you currently working?

Controlling	☐
Accounting	☐
Tax	☐
Others:	_____

Figure 3.4.: Appendix 3.2 (continued)

5.2. To which industry does your group/group division primarily belong?

Automotive	☐	Trade	☐	Public Administration	☐
Ban-king/Insurance/Finance	☐	IT	☐	Pharmaceuticals	☐
Construction/Facility Management	☐	Industrial Goods	☐	Telecommunications	☐
Biotechnology	☐	Consumer Goods and Groce-ries	☐	Transportation/Logistics	☐
Chemicals	☐	Media	☐	Engineering	☐
Energy	☐	Medical Technology	☐	Other (please specify)	____

5.4. In the past financial year, what share of external turnover did your group generate abroad (i.e. outside the state of residence of the parent company)?

≤ 25 %	☐	> 25% to 50%	☐	> 50% to 75%	☐	> 75%	☐

Chapter 4: Transfer Pricing Strictness and Cross-Border Intrafirm Trade: Evidence from U.S. Multinational Firms

Abstract

International tax rate incentives are important determinants of U.S. multinationals' cross-border intrafirm trade patterns and transfer pricing strategies. This study examines the role of the heterogeneity across countries' transfer pricing strictness for this determination. Utilizing a panel dataset containing aggregate intrafirm trade flows of U.S. multinational firms, I investigate whether a higher transfer pricing strictness is associated with a reduced tax rate sensitivity of intrafirm trade. Confirming prior literature, I document that U.S. multinationals conduct more intrafirm trade with low-tax countries. Moreover, I find that particularly U.S. intrafirm imports are higher and intrafirm trade balances lean to imports with low-tax countries. However, if stricter transfer pricing applies, those associations are mitigated as the sensitivities of these measures of intrafirm trade to tax rate incentives are significantly reduced.

4.1. Introduction

Intrafirm trade is of high economic importance. For instance, the volume of transactions within multinational firms is estimated to account for more than 50 percent of global trade (OECD 2013a; Sansing 2014). Given this magnitude, a thorough understanding of the determinants of intrafirm trade is essential. Thus, this study analyzes whether transfer pricing strictness of countries affects intrafirm trade patterns and transfer pricing strategies of U.S. multinational firms. Utilizing intrafirm trade data of U.S. multinational firms aggregated at the country-level and matching it to a measure capturing the countries' transfer pricing strictness over time, I investigate whether stricter transfer pricing reduces the tax rate sensitivity of intrafirm trade.

Until the *Tax Cuts and Jobs Act* passed in 2017, the U.S. imposed a corporate income tax rate of 35 percent making it a high-tax jurisdiction relative to most other countries. Although the U.S. traditionally applied a credit system eliminating tax savings from cross-border profit shifting upon distribution of foreign profits, the U.S. taxation of worldwide profits can be avoided by the deferral of these foreign profits. Thus, from a tax perspective, U.S. multinational firms have a strong incentive to generate and report the highest possible share of its group-wide profits in low-tax jurisdictions. A large body of literature empirically documents that U.S. multinational firms engage in cross-border income shifting (e.g., Grubert and Mutti 1991; Klassen and Laplante 2012).

There are two main types of income shifting that multinational firms engage in. First, there is *artificial* income shifting. One way to achieve this is the strategic manipulation of transfer prices to allocate a larger share of their profits to low-tax jurisdictions (De Simone et al. 2017; Blouin et al. 2018). In fact, a meta-study by Heckemeyer and Overesch (2017) finds that transfer pricing is a predominant income shifting channel. Second, there is *real* income shifting which can be achieved by an allocation of production facilities, sales forces, or service centers to countries with lower tax rates (e.g., Hines 1999; Overesch 2009; Feld and

Heckemeyer 2011). This increasing business activity in low-tax countries is typically associated with a higher volume of intrafirm trade (Clausing 2006). Thus, intrafirm trade and transfer pricing play a key role in both types of income shifting. Consistently, prior literature shows that international tax avoidance and the exploitation of tax rate differentials is indeed a determining factor for intrafirm trade patterns of U.S. multinationals (Clausing 2006).

Given this tax planning potential that intrafirm trade carries and its economic importance, the regulation of transfer pricing is very high on the international tax policy agenda, especially since the base erosion and profit shifting (BEPS) initiative put forward by the *Organisation for Economic Co-operation and Development* (OECD). In this plan of actions, the fight against transfer pricing schemes which are purely tax-driven is a central concern, putting countries with lenient transfer pricing under pressure (OECD 2015).

However, independently of the BEPS initiative, a large number of jurisdictions have introduced regulations explicitly governing the way how multinational firms have to set prices for their intrafirm transactions to limit the tax planning potential of transfer pricing. Already in 1928, Sweden was the first country to ever establish transfer pricing regulations. Australia was the first to follow as it developed transfer pricing regulations in 1981. Since then, there was a large wave of such introductions. Nowadays, almost all OECD countries and many developing countries have transfer pricing regulations in place.

Those regulations typically postulate that transfer prices must comply with the *arm's length principle* requiring transfer prices to mirror prices set for transactions between independent parties.[62] Although the arm's length principle is a common ground for the various transfer pricing regimes in the world's international tax system, national transfer pricing strictness is very heterogeneous across countries and time. The regulations vary in their design, scope, and flexibility. Moreover, the level of enforcement is diverging. Tight regulations

[62] This principle is, for instance, positioned in Article 9 of the *Model Tax Convention on Income and on Capital* of the OECD. Moreover, the OECD has developed its *Transfer Pricing Guidelines* to shape a worldwide standard of the arm's length principle and to enhance the countries' implementation.

which are consequently audited and enforced constitute high transfer pricing strictness, while lax regulations or a low degree of auditing and enforcement establish a lower transfer pricing strictness. This study exploits the heterogeneity of transfer pricing strictness and investigates its impact on intrafirm trade of U.S. multinational firms.[63]

Therefore, I draw upon the theoretical considerations of Clausing (2006) who elaborates on the potential effects of tax rate incentives on intrafirm trade, i.e., a *location effect*, a *price effect*, and a *quantity effect*. I extend her predictions and add the important dimension of transfer pricing strictness. In particular, I predict that the tax rate sensitivity of intrafirm trade depends on the transfer pricing strictness of the foreign affiliate's home country. Based on these considerations, I measure the effects of those important tax characteristics (i.e. the tax rate, the transfer pricing strictness, and the interaction of both) on different dimensions of the intrafirm trading patterns of U.S. multinationals in the subsequent empirical analysis. To capture transfer pricing strictness, I use an index variable developed by Klassen and Mescall (2018) that measures the transfer pricing strictness of countries by evaluating a country's transfer pricing regulations and the level of the enforcement of these regulations based on 15 dimensions over time.

I find empirical support for the prediction that transfer pricing strictness is a determinant for the intrafirm trading behavior of U.S. multinational firms. My results confirm prior literature that U.S. multinationals trade more with affiliates resident in low-tax countries and that U.S. intrafirm trade balances with low-tax countries are leaning towards imports (Clausing 2006). In an additional analysis, I find that imports are more tax-sensitive than exports. However, my analyses suggest that all of these relationships seem to be primarily driven by affiliates resident in countries that have particularly lenient transfer pricing regimes and that the associations are mitigated for countries with higher transfer pricing strictness.

[63] Throughout this paper, I use the term *transfer pricing strictness* to refer to the countries' overall level of strictness, considering their transfer pricing regulations, their level of enforcement, and the countries' transfer pricing audit practices.

This study supports the understanding of the determinants of intrafirm trade patterns and transfer pricing strategies of U.S. multinationals. Thereby, it contributes to the literature on tax-induced multinational income shifting and the impact of anti-avoidance measures. In particular, prior empirical evidence indicates that higher transfer pricing strictness reduces profit shifting to low-tax countries (e.g., Klassen and Laplante 2012; Beer and Loeprick 2015; Breuselinck et al. 2015; Riedel et al. 2015; Saunders-Scott 2015; Marques and Pinho 2016). In their analyses, these studies all focus on profit measures (i.e., earnings before interest and taxes) which are likely to be also affected by other profit shifting channels, such as intragroup financing.[64] None of those studies investigate whether the heterogeneity of transfer pricing strictness directly affects intrafirm trade patterns and transfer pricing of multinational firms. I argue that parts of the intrafirm trade volumes that are disproportionate to the respective country's economic size may directly result from tax-motivated transfer pricing strategies and may thus be a more direct proxy to measure these strategies compared to the profit-measures used in prior literature. Hence, this study extends this strand of literature by providing novel empirical evidence of the effects of transfer pricing strictness on tax avoidance using intrafirm trade and transfer pricing.

The remainder of the paper is structured as follows. Section 4.2 provides some institutional background on transfer pricing strictness and the role of taxation for international trade. Against this background, it develops a set of hypotheses on the effects of transfer pricing strictness on intrafirm trade. Section 4.3 presents the data and provides a descriptive analysis. Section 4.4 contains multivariate analyses testing the study's hypotheses. Section 4.5 concludes.

[64] For instance, Grubert (2003) finds that U.S. multinationals use financial and non-financial profit shifting techniques to a similar extent.

4.2. Background and hypothesis development

4.2.1. Tax rate differentials and intrafirm trade

From a tax perspective, a multinational firm has an incentive to shift profits from high-tax to low-tax countries to maximize its overall after-tax profitability. Accordingly, U.S. multinationals typically aim to shift profits out of their home country as it was a high-tax jurisdiction relative to most other countries for the study's sample period (2000 to 2015).[65] Since intrafirm trade has a substantial impact on each entity's profit and, consequently, on a multinational's overall tax burden, tax considerations play an important role in determining cross-border intrafirm trade patterns and transfer pricing of U.S. multinationals. Clausing (2006) theoretically identifies three main mechanisms through which tax rate differentials influence cross-border intrafirm trade volumes.

First, the *location effect* implies that low-tax jurisdictions are more attractive locations for foreign direct investments as compared to high-tax countries because subsequent profits resulting from such investments are subject to a lower tax rate. This effect is well-documented in the empirical literature (e.g., Hines 1999; Overesch 2009; Feld and Heckemeyer 2011; Buettner et al. 2018; De Mooij and Liu 2018).[66] However, the consequences of this investment-related location effect on cross-border intrafirm trade are ambiguous. On the one hand, foreign direct investments may decrease intrafirm trade by substituting production in the home country (Dunning 1981; Markusen 1984; Markusen 1995). On the other hand, foreign direct investments may also increase intrafirm trade. For instance, a vertical integration of the production process can increase the trade flows of components produced in the home country.

[65] The U.S. corporate tax rate was set to 35 percent in 1993 and remained unchanged until the recent reform passed in 2017, i.e. the *Tax Cuts and Jobs Act*, when the tax rate was adjusted to 21 percent. The sample's average corporate income tax rate varied between 24.2 (2015) and 28.9 (2000), see Section 4.3.1 for detailed information on my data. Until the reform, the U.S. applied a credit system which ultimately eliminates the tax saving potential of international income shifting. However, as worldwide taxation can be avoided by deferral of these profits, firms under this tax system also engage in cross-border income shifting (Grubert and Mutti 2001; Klassen and Laplante 2012; Markle 2015).

[66] Theoretically, a counterargument against this notion is that investments in high-tax countries lead to tax-deductible expenses in that high-tax country and, when distributed, capital income in low-tax countries. However, empirical evidence clearly documents that this effect is outweighed.

Moreover, the relocation of the production for the home market can increase intrafirm trade. Additionally, multinational firms may enter new markets through foreign direct investments (Lipsey and Weiss 1984; Rugman 1990). Prior empirical evidence suggests that the complementary relationship of investment and trade outweighs the substitution effect.[67] Accordingly, the location effect leads to more intrafirm trade with affiliates located in low-tax countries compared to affiliates which are resident in high-tax jurisdictions.

Second, a *price effect* may influence intrafirm trade patterns. The strategic use of transfer prices enables firms to exploit tax rate differentials by charging affiliates in low-tax countries with the lowest possible prices while the highest possible transfer prices are applied for intrafirm transactions with affiliates located in high-tax countries. Thereby, a higher share of the multinational's overall profits is subject to lower tax rates. This manipulation of transfer prices is a common way to shift profits to low-tax countries. For instance, a meta-study by Heckemeyer and Overesch (2017) shows that transfer pricing is a dominant profit-shifting channel. Moreover, extant literature investigates the prevalence of tax-related transfer pricing. These studies particularly analyze if there are systematical price differences between prices set for transactions among unrelated parties and transfer prices used for transactions among related affiliates, and if such price differences depend on tax rate differentials. For instance, Clausing (2003) examines U.S. intrafirm trade prices by exploiting a dataset collected by the *Bureau of Labor Statistics* (BLS). She finds that exports to affiliates in low-tax countries are under-invoiced while imports to the U.S. high-tax affiliates are over-invoiced. Complementary, Bernhard et al. (2006) analyze the *Linked/Longitudinal Firm Trade Transaction Database* (LFTTD) and find that prices U.S. exporting firms set for their unaffiliated customers are

[67] With respect to U.S. exports, already Horst (1978) and Lipsey and Weiss (1981) both find support for such a complementarity relationship with foreign affiliate activity and foreign direct investments. Resulting from an investigation of overall trade statistics of U.S. multinationals, Grubert and Mutti (1991) show that U.S. firms conduct more trade with trading partners located in low-tax countries This complementary effect has been confirmed by several subsequent studies, also for intrafirm trade, e.g. by Graham (2000) or Clausing (2000) using aggregate data or Head and Ries (2001), Belderbos and Sleuwaegen (1998), Swedenborg (2000), or Blonigen (2001) using firm-level data.

significantly higher than the prices set for their related affiliates, particularly those that are resident in low-tax countries. Additionally, several other studies back the intuition of tax-motivated transfer pricing and multinational profit shifting with supportive empirical evidence analyzing transaction data from the U.S. (Flaaen 2017), Denmark (Cristea and Nguyen 2016), the United Kingdom (Liu et al. 2017), or France (Vicard 2015; Davies et al. 2018).

Third, a *quantity effect* directly arises from the *price effect*. As outlined above, a multinational firm derives tax savings from strategic transfer pricing. These tax savings are scalable. For instance, if a multinational firm increases the number of goods traded internally from affiliates in high-tax countries to related affiliates in low-tax countries charging an artificially high transfer price, it can generate higher tax savings. Thus, multinational firms are incentivized to engage in more intrafirm trade between two countries in case of a prevailing tax rate differential.[68]

4.2.2. Transfer pricing strictness

Tax legislators are aware of the tax revenue losses stemming from tax-related transfer pricing strategies (compare, e.g., OECD 2015). To curtail corporate tax planning and tax avoidance, transfer pricing regulations have been implemented in the tax codes of a vast majority of countries. In Table 4.1, I provide an overview of countries that implemented such transfer pricing regulations and the respective year of implementation.

Transfer pricing regulations limit the opportunities of transfer pricing for tax planning and profit shifting. However, there is substantial variation across countries and time with respect to the transfer pricing regulations' design, scope, and flexibility. For instance, the country-specific transfer pricing regulations specify different methods permitted to determine arm's length transfer prices, define documentation requirements to validate the arm's lengths

[68] In addition to tax planning, transfer pricing is also used for coordination of decentralized firms. If a firm uses one set of books, i.e. uses the same transfer price for both internal and tax purposes, the quantity and price decisions may also be driven by managerial control considerations which are not considered here.

Table 4.1: Effective years of adoption of transfer pricing regulations in sample countries.

Country	TP Regulation	Country	TP Regulation	Country	TP Regulation
Argentina	1998	Greece	1994	Peru	2001
Australia	1981	Hong Kong	2009	Philippines	2013
Austria	1996	Hungary	1992	Poland	1997
Belgium	2004	India	2001	Portugal	2002
Brazil	1997	Indonesia	1984	Russia	2012
Canada	1998	Ireland	2011	Singapore	2006
Chile	1997	Israel	2006	South Africa	1995
China	2008	Italy	1986	Spain	1995
Colombia	2004	Japan	1986	Sweden	1928
Czech Republic	1993	Korea	1996	Switzerland	-
Denmark	1998	Luxembourg	2011	Taiwan	2004
Ecuador	2005	Malaysia	2003	Thailand	2002
Egypt	2005	Mexico	1997	Turkey	2007
Finland	2007	Netherlands	2002	United Kingdom	1999
France	1996	New Zealand	1997	Venezuela	2001
Germany	1983	Norway	1999		

Notes: This table presents the effective years of adoption of transfer pricing regulations for all countries included in the study's sample until 2015 (i.e., the end of the sample period). For more detailed information on my sample, see Section 4.3.1.The years are collected from various sources (PwC (2013); PwC (2015); Deloitte (2008); KPMG (2016)).

nature of the transfer price,[69] and determine penalties for non-compliant behavior with respect to mispricing or inadequate documentation. Additionally, the tax authorities' auditing practices and their level of enforcement vary substantially. In case of a detected non-compliance, tax authorities can modify the filed taxable income and, thus, the tax liability in their country which may ultimately lead to double taxation.[70]

Generally, theory suggests that arm's lengths prices are not necessarily optimal and efficient and that it distorts managerial decision-making (Baldenius et al. 2004; Keuschnigg and Devereux 2013). A broad strand of literature examines the effects of differences in the strictness of transfer pricing. The empirical literature has primarily focused on the impact of trans-

[69] Intrafirm transfers are frequently very firm-specific, particularly for cases involving unfinished goods or intangibles. Thus, it can be difficult to gather data on similar transactions to document the arm's length nature of transfer prices (Durst and Culbertson 2003).

[70] Firms can call for a so-called *competent authority relief* from double taxation which is part of several tax treaties. However, double taxation is a severe problem in transfer pricing. Therefore, a large majority of firms focuses on tax compliance in their transfer pricing system instead of tax minimization (Klassen et al. 2017; Cools and Slagmulder 2008).

fer pricing strictness on profit- and investment-related measures. In the profit-shifting literature, Beer and Loeprick (2015), Breuselinck et al. (2015), Riedel et al. (2015), Saunders-Scott (2015), and Marques and Pinho (2016) provide empirical evidence that stricter transfer pricing in a low-tax country (i) decrease a firm's profit allocation to that country and/or (ii) have a mitigating effect on the responsiveness of profit shifting to tax incentives in that country, i.e. decrease the sensitivity of profits (earnings before interest and taxes) to tax rate differentials. Moreover, Klassen and Laplante (2012) show that a decrease in the strictness of the U.S. transfer-pricing regulation leads to more profit shifting by U.S. multinationals to foreign low-tax affiliates.

Concerning investments, there are several studies examining the question of whether transfer pricing strictness has an effect on investment decisions. In particular, a theoretical framework presented in De Mooij and Liu (2018) indicates that transfer pricing regulations increase the costs of shifting profits to low-tax jurisdictions. As a consequence, the optimal supply of intermediate products and the return on investment in the foreign affiliate are reduced. Buettner et al. (2018) and De Mooij and Liu (2018) empirically investigate whether transfer pricing strictness in a country affect investments of foreign multinationals in affiliates there. While the former study cannot confirm a statistically significant effect of countries' transfer pricing strictness on foreign direct investment, the latter shows that multinationals decrease, on average, investment in countries that implement transfer pricing regulations or when transfer pricing strictness increases.[71]

The impact of transfer pricing strictness on intrafirm trade patterns has not been empirically identified yet. Solely theoretical research by Schjelderup and Weichenrieder (1999)

[71] Büttner et al (2018) examine the value of property, plant, and equipment (PPE) of German multinational firms, measured at the firm-level by exploiting the MiDi dataset. De Mooij and Liu (2018) investigate on investment spending divided by lagged capital stock of multinationals from 27 countries, measured at the firm-level by exploiting the Orbis database.

states that transfer pricing regulations lead to an *anti-trade bias* and reduce intrafirm trade. Moreover, they predict that the trade-reducing effect is stronger for imports than for exports.[72]

4.2.3. Hypotheses development

In this study, I extend existing literature that investigates cross-border intrafirm trade and examine the implications of transfer pricing strictness. Therefore, I draw upon theory established by Clausing (2006) who derives three hypotheses on the influence of international taxation on U.S. international trade flows. Specifically, she predicts the influence of a country's low tax rate on its total bilateral intrafirm trade with the U.S., the share of intrafirm trade relative to total trade, and the intrafirm trade balance.[73] In her hypotheses, she takes into account the effects of tax rate differentials, i.e. the *location effect*, the *quantity effect*, and the *price effect*. However, her predictions focus solely on tax rate differentials and do not consider the impact of the heterogeneity of transfer pricing strictness across countries. Since strict transfer pricing restricts tax planning possibilities and prior work has stated that firms put a high emphasis on complying with tax law (e.g., Klassen et al. 2017, Cools and Slagmulder 2009), stricter transfer pricing may change the implications of tax rate differentials for cross-border interfirm trade. Therefore, I add another important dimension by also considering the level of transfer pricing strictness as a determinant of U.S. international trade.

First, Clausing (2006) predicts and empirically confirms that intrafirm trade flows are higher with countries levying a lower tax rate than the U.S. This prediction is based on the *quantity effect* and the *location effect* as outlined in Section 4.2.1.[74] However, transfer pricing strictness in a country may have an impact on this association. First, transfer pricing discretion is reduced by stricter transfer pricing. Accordingly, the tax-saving potential of mispricing intrafirm transactions is, in the extreme case of perfect anti-avoidance legislation, eliminated.

[72] In their analysis, they differentiate the case of price-related and profit-related transfer pricing regulations. However, the trade-reducing effect is predicted for both types of regulation using the arm's length principle.
[73] See Section 4.3.1 for detailed variable descriptions.
[74] For the total intrafirm trade flows, the implications of the *price effect* are ambiguous as it works in different directions for imports and exports. Thus, it does not generate a prediction.

Hence, the incentive to boost intrafirm transactions to scale tax savings (i.e., the *quantity effect*) decreases when transfer pricing strictness increases. Second, a low-tax jurisdiction becomes less attractive for multinationals' investment activity when transfer pricing strictness increases. Although the general notion of the *location effect* still holds if a multinational has no possibility to use tax-induced transfer pricing strategies, prior empirical literature suggests that foreign investments and operations of U.S. multinationals in tax attractive locations are typically associated with income shifting (e.g., Hines and Rice 1994; Grubert and Slemrod 1998; or Desai et al. 2006). Specifically, stricter transfer pricing reduces the attractiveness of low-tax countries for investment (De Mooij and Liu 2018). Consequently, I expect lower volumes of intrafirm trade.[75] Thus, I hypothesize the following.

Hypothesis 1: Stricter transfer pricing mitigates the association between lower tax rates and higher intrafirm trade flows.

Complementary to this conjecture, Clausing (2006) predicts and shows that the *shares* of U.S. intrafirm trade flows relative to total trade flows are higher for countries with a lower tax rate compared to high-tax countries. This prediction is, again, based on (i) the *quantity effect* which constitutes only an incentive for intrafirm trade and not for total trade, and (ii) the *location effect* which leads to disproportionally high intrafirm trade volumes with countries levying a lower tax rate as literature suggests that particularly intrafirm trade is complementary to multinational activity (Clausing 2000). However, stricter transfer pricing may reduce those effects in the same way as described above. Therefore, I predict the following.

Hypothesis 2: Stricter transfer pricing mitigates the association between lower tax rates and higher shares of intrafirm trade flows relative to total trade.

[75] To see this, imagine a U.S. multinational firm that considers two countries with a lower tax rate, A and B, for a foreign direct investment. Both countries are identical except that country A has not enacted any transfer pricing regulation while country B requires transfer prices to be set in line with the arm's length principle, determines specific valuation methods to set prices, frequently audits compliance, and imposes high penalties for non-compliance. Although income resulting from this investment is taxed at an equally low rate, the firm might choose country A over B as investment location as the firm is able to implement profit-shifting strategies using tax-optimal transfer pricing there which is not possible in country B and saves compliance costs. This investment decision may, in turn, lead to an increase of intrafirm trade between the U.S. and country A.

Third, Clausing (2006) hypothesizes and finds that intrafirm trade balances are lower with countries levying a lower tax rate than the U.S. due to the *price effect*. These intrafirm trade balances are measured as the bilateral U.S. intrafirm exports minus imports relative to the total bilateral U.S. intrafirm trade. As firms aim to under-invoice exports and over-invoice imports when trading with countries from low-tax jurisdictions, the intrafirm trade balance should lean to imports for low-tax countries and, accordingly, turn negative. The trade balance measures the *relative* importance and magnitude of exports vs. imports, irrespective of the *absolute* volumes of total intrafirm trade. Thus, neither the *location effect* nor the *quantity effect* applies here. However, if stricter transfer pricing applies, the range of possible transfer prices gets narrower (Reineke and Weiskirchner-Merten 2018) and the profit shifting potential of transfer prices is reduced. Consequently, I conjecture the following.

Hypothesis 3: Stricter transfer pricing mitigates the association between lower tax rates and lower intrafirm trade balances.

In the first three hypotheses, I directly draw on the predictions and findings of Clausing (2006). In addition to her work, I moreover investigate the effects of tax considerations on imports and exports separately.

Similar to the gross intrafirm trade flows, the *location effect* and the *quantity effect* foster both intrafirm exports and intrafirm imports. However, the *price effect* works in different directions for import and export flows. It constitutes an incentive for multinational firms to set low prices for intrafirm exports and high prices for intrafirm imports if the multinational is resident in a high-tax country like the U.S. and the affiliate is located in a low-tax country. For imports, it thus further supports the *location effect* and the *quantity effect*. Accordingly, I expect that imports are higher with low-tax countries. For exports, the *price effect* generates an incentive to decrease the transfer price with trading partners in low-tax countries which, consequently, reduces the export flows as they are calculated as the product of price and quantity. This incentive is contrary to the positive incentive resulting from the *location effect*

and the *quantity effect*. Thus, ultimately, it is an empirical question which of the effects is prevalent. Altogether, the tax rate sensitivity of imports is stronger than of exports.

When considering transfer pricing strictness, stricter transfer pricing reduces the tax attractiveness of low-tax countries for multinational activity and, in turn, for high volumes of intrafirm imports and exports (*location effect*). Furthermore, the leeway in setting transfer prices is reduced which reduces the *price effect* and the *quantity effect*. Thus, I expect the tax rate sensitivity of intrafirm trade with low-tax countries to be weakened by an increasing transfer pricing strictness for both directions of trade flows. Following theoretical findings of Schjelderup and Weichenrieder (1999), I moreover expect that the effect of stricter transfer pricing on intrafirm trade is particularly strong for imports.

Hypothesis 4: Due to the price effect, the tax rate sensitivity of U.S. multinationals is higher for imports than for exports. Stricter transfer pricing mitigates the tax rate sensitivities of both types of intrafirm trade flows.

4.3. Data and exploratory analysis

4.3.1. Data

To analyze this set of hypotheses, I utilize the *Outward Activities of Multinational Enterprises* (Outward AMNE) intrafirm trade statistics which are published by the U.S. Bureau of Economic Analysis (BEA).[76] This dataset includes bilateral country data on cross-border intrafirm trade of goods between U.S. multinational parent firms and their majority-owned foreign affiliates[77] and is based on the answers of U.S. parent firms on the mandatory BE–11A survey form; thus, the dataset includes the full universe of U.S. multinationals and their foreign majority-owned affiliates. The database constitutes an unbalanced panel for 63 countries. Using this data, I construct the dependent variables I need to test my hypotheses: *Int. Trade*$_{it}$ as the total amount of exports shipped from U.S. multinational parent firms to foreign

[76] For each year, a report on the multinational activity of U.S. multinationals is made available for download at https://www.bea.gov/international/di1usdop. The dataset is retrieved from each year's report.

[77] *Majority-owned foreign affiliates* are foreign affiliates in which U.S. parents have (direct or indirect) ownership of at least 50 percent.

affiliates in country *i* (*Int. Exports*$_{it}$) plus U.S. imports shipped by the foreign affiliates in country *i* to U.S. multinational parent firms (*Int. Imports*$_{it}$) within year *t*;[78] *Int. Trade Share*$_{it}$ as *Int. Trade*$_{it}$ relative to the total bilateral trade between the U.S. and country *i* in year *t*; and *Int. Trade Balance*$_{it}$ as *Int. Exports*$_{it}$ minus *Int. Imports*$_{it}$ relative to *Int. Trade*$_{it}$.[79]

Since the countries' transfer pricing strictness varies across countries and time, I capture the heterogeneity of transfer pricing strictness by utilizing an index modeled by Kenneth Klassen and Devan Mescall.[80] They developed this measure by regressing expert assessments of strictness and potential sources of risk related to transfer pricing on quantifiable characteristics of countries' transfer pricing system. Using a survey instrument, they extract an assessment of 15 characteristics of transfer pricing regulations and their enforcement from 76 Big Four employees on management and partner level working in 33 countries that provide consulting services on tax-related transfer pricing issues. Building on that survey data from 2010, they develop a model that weights each regulatory factor and apply those weights over time on observable transfer pricing characteristics taken from the *Deloitte Strategy Matrix for Global Transfer Pricing* and the *EY Transfer Pricing Global Reference Guides* reporting transfer pricing country characteristics in a standardized format over time.[81] As a result, they obtain a time-variant index ranging from -0.37 to 5.08 that measures a country *i*'s transfer

[78] Thus, the terms *import* and *export* are both defined from the U.S. perspective.

[79] These variable descriptions are consistent with those used by Clausing (2006) who also derives her data covering the period 1982-2000 from this dataset.

[80] They developed this model 'which incorporates and weights strictness of transfer pricing policy and aggressiveness of transfer pricing enforcement' to investigate whether the premiums paid for targets of mergers and acquisitions located in countries with stricter transfer pricing (as a source of risk) are significantly lower (Klassen and Mescall 2018). Kenneth Klassen shared an updated and extended version of their measure with me via e-mail (Dec. 20th, 2018).

[81] The transfer pricing characteristics that Klassen and Mescall (2018) consider are information on whether: (1) rules are adopted and the age of the rules (not part of the survey); (2) advance pricing agreements are allowed; (3) benchmark data are available to taxpayers; (4) contemporaneous documentation is required; (5) cost-contribution arrangements are allowed; (6) commissionaire arrangements are allowed; (7) foreign comparables to determine transfer prices are allowed; (8) related party setoffs (bundling of transactions) are allowed; (9) the payment of the tax assessment before going to competent authority is required; (10) the government dictates an order of transfer pricing methods to use; (11) disclosure on the tax return concerning related party transactions is required; (12) self-initiated adjustments are allowed; (13) specific transfer pricing documentation is required; (14) the government has discretion over penalty reduction; (15) proprietary tax data to calculate a 'revised' transfer price is used; and (16) the assessed degree of transfer pricing enforcement.

pricing strictness in year *t* for an unbalanced panel of 61 countries for the years 2000 to 2015 ($TP\ Strict_{it}$).

I match these data on intrafirm trade and transfer pricing strictness resulting in an unbalanced panel of 47 countries between 2000 and 2015.[82] In addition to $TP\ Strict_{it}$, the statutory corporate income tax rate of country *i* in year *t* in percent (CIT_{it}) is the second variable of interest. The tax rates are taken from the OECD database and, if not available there, from KPMG.[83] Moreover, I include additional country characteristics in my dataset.[84]

Table 4.2 reports summary statistics of all dependent and independent variables that the study's final dataset contains. It turns out that the intrafirm trade statistics *Int. Trade*, *Int. Imports*, *Int. Exports*, and *Int. Trade Share* are all positively skewed as the means are substantially larger than the median. Table 4.3 presents a pairwise Pearson correlation matrix for all used variables. As expected, *CIT* is negatively correlated with the absolute and with the relative intrafirm trade statistics, with statistically significant correlation coefficients ranging between -0.153 and -0.436. Moreover, there is a negative correlation between *TP Strict* and *Int. Trade Share*.

[82] See Table 4.1 for a list of all sample countries.

[83] The OECD provides data on the combined corporate income tax rate which presents the central and sub-central corporate income tax rates minus deductions for sub-national taxation plus the sub-central rate and is made available for download at https://stats.oecd.org/index.aspx?DataSetCode=TABLE_II1#. KPMG has a comparable offer downloadable at https://home.kpmg/dk/en/home/insights/2016/11/tax-rates-online/corporate-tax-rates-table.html.

[84] For a full list of variable definitions and the respective data sources, see Appendix 4.1.

Table 4.2: Summary statistics.

	N	Mean	SD	Min	Median	Max
Dependent Variables						
Int. Trade (in th)	431	13,875,053	28,391,510	10,000	4,568,000	178,941,002
Int. Trade Share	431	0.18	0.16	0.01	0.12	0.93
Int. Trade Balance	431	0.04	0.41	-0.89	0.07	1.00
Int. Imports (in th)	431	7,613,297	16,862,429	0	1,782,000	105,742,000
Int. Exports (in th)	431	6,261,756	11,865,589	6,000	1,520,000	73,199,000
Variables of Interest						
TP Strict	431	2.34	1.17	-0.37	2.55	5.08
CIT	431	26.37	7.24	8.50	28.00	42.20
Control Variables						
Log(GDP)	431	26.94	1.14	24.20	26.75	29.46
Log(GDP pc)	431	10.03	0.92	6.92	10.31	11.66
FTA	431	0.17	0.37	0.00	0.00	1.00
Log(Ext. Trade)	431	23.78	1.37	18.97	23.67	26.93
Unemployment	431	7.46	4.52	0.66	6.78	27.48
Log(Distance)	431	8.81	0.62	6.31	8.75	9.69
Overall Non-Int. Trade Balance	426	0.00	0.46	-0.94	-0.02	1.00
Unaffiliated Trade Balance	431	-0.13	0.59	-0.86	-0.22	9.43

Notes: This table presents descriptive statistics for the variables used in the empirical analysis. The summary statistics are based on a regression of *Log(Int. Trade)* (Column (1) in Table 4.5). All variables are defined in Appendix 4.1.

Table 4.3: Correlation matrix.

Variables		1	2	3	4	5	6	7
Int. Trade	1	1						
Int. Trade Share	2	0.301***	1					
Int. Trade Balance	3	-0.164***	-0.295***	1				
Int. Imports	4	0.992***	0.328***	-0.241***	1			
Int. Exports	5	0.983***	0.254***	-0.0499	0.952***	1		
TP	6	0.244***	-0.252***	0.0397	0.221***	0.270***	1	
CIT	7	-0.190***	-0.436***	0.274***	-0.213***	-0.153**	0.208***	1

Notes: This table presents the pairwise Pearson correlations for all dependent and independent variables of interest. *, **, *** represent statistical significance at the 10, 5, and 1 percent levels (all two-tailed), respectively. A full pairwise Pearson correlation matrix for all variables used in the empirical analysis as well as a definition of all variables are presented in the Appendix.

4.3.2. Exploratory analysis

In the following, I provide descriptive and graphical evidence on the impact of the countries' tax and transfer pricing characteristics on intrafirm trade. Table 4.4 shows several average univariate statistics of intrafirm trade activity and tax characteristics for the top intrafirm trading countries in my sample between 2000 and 2015.[85] Intrafirm trade activity is

[85] The full table including all sample countries is provided in Appendix 4.2.

highly skewed among the study's sample countries. For instance, column (1) shows that the total intrafirm trade flows between U.S. multinationals and their affiliates located in the two U.S. neighboring states Canada and Mexico have been almost as large as the combined intrafirm trade flows with affiliates located in all other 45 sample countries. While this fact might be explained by factors derived from classic trade literature, such as two countries' large economic sizes, relatively small distances to the U.S., or the free trade agreement NAFTA which was in place for the entire sample period, (e.g., Isard 1954; Santos Silva and Tenreyro 2006) the top positions of Singapore and Ireland in this shortlist are remarkable and are likely to result from different reasons. For example, when setting their intrafirm trade volumes in relation to the countries' gross domestic product (GDP) as displayed in column (2), the respective ratios of Singapore or Ireland are approximately 30 (60) times the ratio of Germany (China). Particularly the U.S. intrafirm import statistics with Ireland as displayed in column (3) are salient as they are comparable in size to the combined value of the U.K., Japan, Germany, and China. Consistently, this is reflected in an intrafirm trade balance heavily leaning to imports in Ireland (compare column (6)).

Since Ireland and Singapore are both known as corporate tax havens, these findings indicate a considerable impact of the respective countries' tax systems.[86] Ireland has, on average, the sample's lowest tax rate (column (7)) and the second-lowest *TP Strict* score (column (8)). Thus, U.S. multinational firms face a suitable environment to overprice goods sold by the Irish affiliate to increase the tax base in the low-tax country Ireland (*price effect*) and boost those intrafirm sales to scale the tax savings (*quantity effect*). Moreover, the *location effect* attracts multinational activity and intrafirm trade.

Altogether, the four least strict transfer pricing countries (i.e., Hong Kong, Ireland, Singapore, and Switzerland) are all part of the shortlist provided in Table 4.4. Moreover, they are

[86] Both countries are on the "Big-7" list of the most important tax havens (Hines and Rice 1994). Moreover, Ireland has long been suitable for intangible licensing models (e.g., Fuest et al. 2013)

all low-tax countries as they rank among the top ten countries of the lowest average CIT rates in my sample (1st Ireland, 2nd Hong Kong, 5th Singapore, and 9th Switzerland) and have an extraordinarily high share of intrafirm U.S. trade relative to their total trade with the U.S. Thus, intrafirm trade patterns are likely to be affected by tax-induced transfer pricing behavior.

Table 4.4: Intrafirm trade and tax characteristics.

Country	(1) Int. Trade (in m)	(2) Int. Tr. / GDP (in %)	(3) Int. Imports (in m)	(4) Int. Exports (in m)	(5) Int. Trade Balance	(6) Int. Tr. Share (in %)	(7) CIT (in %)	(8) TP Strict (K/M)
Canada	136,284	10.17	79,270	57,013	-0.165	26.53	32.37	3.73
Mexico	70,266	7.09	42,132	28,134	-0.193	20.57	30.94	2.95
Singapore	24,054	12.61	12,798	11,256	-0.073	56.91	18.62	0.86
Ireland	23,410	11.03	20,311	3,497	-0.706	62.00	13.91	0.81
United Kingdom	20,971	0.85	9,713	11,257	0.077	21.79	27.38	2.74
Switzerland	14,657	2.92	6,828	7,829	0.176	39.61	22.22	0.92
Netherlands	14,249	1.96	4,656	9,593	0.413	29.37	28.85	2.91
Japan	12,658	0.26	2,397	10,261	0.627	6.52	39.09	2.88
Germany	11,998	0.39	5,197	6,801	0.137	9.44	34.86	3.44
China	10,071	0.20	5,144	4,928	-0.068	2.67	28.08	2.87
Hong Kong	8,688	4.00	4,649	4,039	-0.073	29.31	16.77	0.68
All others (Ø)	1,946	0.38	945	1,025	0.13	9.4	28.39	2.33

Notes: In this table, I present the average values from 2000 to 2015 of the top eleven intrafirm trading countries and the average of the remaining 36 countries of the sample for the following variables: (1) *Int. Trade*, (2) *Int. Trade / GDP*, (3) *Int. Imports*, (4) *Int. Exports*, (5) *Int. Trade Balance*, (6) *Int. Trade Share*, (7) *CIT*, and (8) *TP Strict*. All variables are defined in Appendix 4.1. The full table including all sample countries is provided in Appendix 4.2.

In Figure 4.1, I show the association between intrafirm activities and the countries' tax characteristics. In particular, I aim at the interaction between a tax rate incentive and the transfer pricing strictness.[87] Therefore, I create four two-way plots consisting of each country-year observation of two dependent variables of my analysis, i.e. the countries' natural logarithm of intrafirm trade (*Log (Int. Trade)*) on the y-axis and the share of intrafirm trade relative to their total U.S. trade (*Int. Trade Share*) on the x-axis. I group each country-year observation into four categories with each combination of two dimensions: (1) country-years with a CIT rate

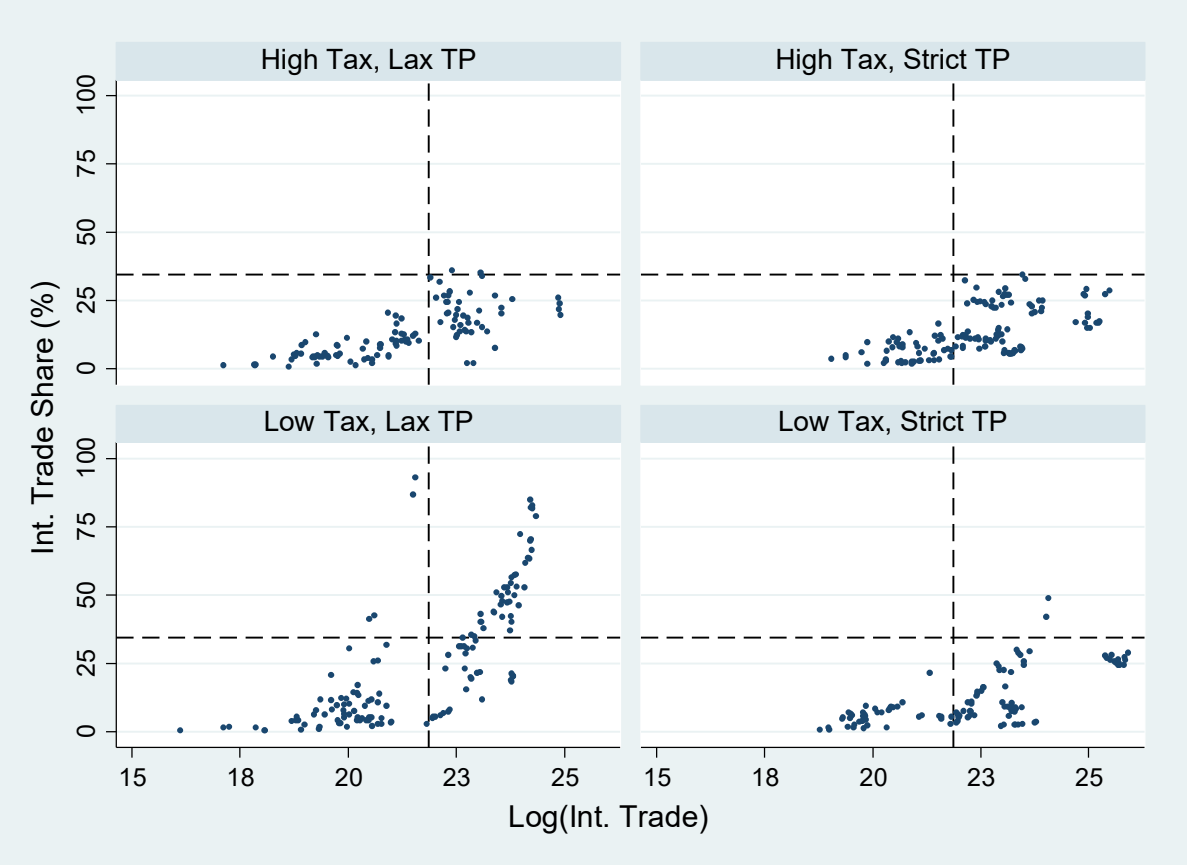
[87] In Section 4.2.3, I argue that, due to the *location effect* and the *quantity effect*, firms are incentivized to have higher trading volumes in terms of absolute and relative values with low-tax countries. However, this effect should be particularly evident for countries with lenient transfer pricing.

below and above the median representing low-tax and high-tax countries and (2) country-years with a transfer pricing strictness index below and above the median representing countries with lenient and strict transfer pricing. Then, I plot them across the countries' *Log (Int. Trade)* and *Int. Trade Share*.

Figure 4.1 suggests that affiliates in countries with relatively low tax rates (i.e., country-year observations in the lower two plots) are more likely to have high intrafirm trade with their U.S. parents. In absolute terms, the total intrafirm trade flow of U.S. multinationals with their affiliates in low-tax countries amounts to, on average, 1.5 times the intrafirm trade flow with affiliates in high-tax countries (i.e., 15.1 bn USD vs. 10.1 bn USD).[88] Those increased volumes are reflected in relative shares of U.S. intrafirm trade as compared to the countries' total U.S. trade (i.e., 19.6 percent vs. 13.0 percent). Interestingly, considering the transfer pricing dimension, Figure 4.1 shows that this attractiveness of low tax rates for intrafirm trade is reduced if the country enforces strict transfer pricing (i.e., the bottom right vs. the bottom left quadrant). This finding provides first descriptive evidence that strict transfer pricing attenuates the positive association of a low CIT rate with intrafirm trade.

[88] This relationship is disproportional to economic size. An untabulated analysis reveals that the average GDP of the country-years defined as observations of low-tax countries is twelve percent lower than the average GDP of observations labeled as high-tax countries, i.e. 869 bn USD vs. 983 bn USD.

Figure 4.1: Relation between intrafirm trade and tax characteristics.



Notes: This figure depicts the distribution of two intrafirm trade variables, i.e., the natural logarithm of each sample country's bilateral gross intrafirm trade with the U.S. (*Log(Int. Trade)*) and its share of U.S. intrafirm trade relative to total U.S. trade (*Int. Trade Share*). Each dot represents one country-year observation. I group observations into four groups: country-year observations with a relatively high or low corporate tax rate (*CIT* above or below sample median) and country-year observations with a high or a low level of transfer pricing strictness (*TP Strict* above or below sample median). The dotted lines mark the mean of Log(Int. Trade) and the 90th percentile of Int. Trade Share on their respective axis. All variables are defined in Appendix 4.1.

4.4. Multivariate analysis of intrafirm trade patterns

4.4.1. Intrafirm trade volumes, level of taxation, and transfer pricing strictness

In the first part of the empirical analysis, I test *Hypothesis 1* predicting that stricter transfer pricing mitigates the association between higher intrafirm trade flows and lower tax rates. To assess this relationship, I follow Clausing (2006) and estimate a linear cross-sectional model using ordinary least squares for country *i* in year *t* for the period of 2000 to 2015.

$$Log(Int.Trade_{it}) = \beta_0 + \beta_1\, CIT_{it} + \beta_2\, TP\ Strict_{it} + \beta_3\ CIT_{it} * TP\ Strict_{it} + \beta_k\, V_{it} + Year\ FE_t + \varepsilon_{it}$$

(Eq. 4.1)

As the dependent variable, I use the natural logarithm of *Int. Trade*.[89] I expect negative coefficients on *CIT* (compare Clausing 2006) and *TP Strict* (compare De Mooij and Liu 2018). To test *Hypothesis 1*, I include the interaction term between *CIT* and *TP Strict*. Thus, I can jointly test the effects of both the level of taxation and transfer pricing on intrafirm trade. Stated in a formal way, the marginal effect of *CIT* on *Log(Int. Trade)* dependent on the level of *TP Strict* can be interpreted as

$$\frac{\partial Log(Int.Trade_{it})}{\partial CIT_{it}} = \beta_1 + \beta_3 * TP\ Strict_{it}.$$

(Eq. 4.2)

I predict a positive coefficient β_3 to provide evidence for a mitigating effect of transfer pricing strictness on the association between higher intrafirm trade flows and lower tax rates. This tax-sensitivity is, for a particularly low level of transfer pricing strictness, expressed by a coefficient β_1 which I predict to turn out negative.

Moreover, I control for a set of further country characteristics that might have an impact on intrafirm trade volumes between the U.S. and country *i* in year *t* depicted by the vector V_{it}. Specifically, I include the natural logarithms of GDP_{it} and $GDP\ pc_{it}$ (per capita) for country *i* in year *t*, FTA_{it} as a binary variable capturing whether country *i* has a foreign trade agreement with the U.S. in year *t*, the natural logarithm of $Ext.\ Trade_{it}$ as the total trade between country *i* and the U.S. in year *t* minus intrafirm trade between country *i* and the U.S. in year *t*, $Unemployment_{it}$ as the unemployment rate of country *i* in year *t*, and $Distance_i$ as the natural logarithm of the distance between country *i* and the U.S. in kilometers. All regression specifications include a set of year dummies to control for all observable and unobservable time-specific trends and factors which potentially correlate with intrafirm trade statistics, the evolu-

[89] All variables are defined in the Appendix.

tion of tax rates, and transfer pricing strictness. I compute standard errors that are robust to clustering within countries.

Table 4.5 presents the results of my empirical analysis of intrafirm trade flows. Panel A reports the regression estimates. In line Clausing (2006), I find a significantly negative association between the tax rate and the intrafirm trade volume (column (1)). In particular, a one percentage point lower tax rate is associated with 3.7 percent (i.e., $e^{-0.038} - 1$) more intrafirm trade.[90] Unlike my prediction based on the theoretical and empirical evidence provided by De Mooij and Liu (2018), I do not find that intrafirm trade is generally lower with countries that have stricter transfer pricing in this baseline specification, irrespective of the tax rate.

In column (2), I test whether stricter transfer pricing mitigates the association between higher intrafirm trade flows and lower tax rates (*Hypothesis 1*). After including the interaction term of *CIT* and *TP Strict*, I document a baseline coefficient on *CIT* that is more than doubled as compared to the coefficient reported in column (1). This indicates that the tax rate semi-elasticity of intrafirm trade volumes is particularly strong for trading partner countries with lenient transfer pricing. However, the statistically significant and positive coefficient on the interaction term of 0.032 suggests that the negative association between *CIT* and *Log(Int. Trade)* is weaker for countries with stricter transfer pricing.

Panel B takes a closer look at the interaction and reports the marginal effects of *CIT* on *Log(Int. Trade)* at different levels of *TP Strict*. This reveals that a low tax rate is only associated with high intrafirm trade flows with a statistical significance at the conventional levels when the respective transfer pricing strictness is in the lowest quartile.[91] This finding provides evidence suggesting that favorable levels of taxation only attract, on average, more intrafirm trade if U.S. multinationals face a certain degree of discretion to manage transfer prices in a way to exploit these tax rate differentials.

[90] This association is 1.8 percentage points higher than the results in Clausing (2006).
[91] The 25th percentile value of *TP Strict* is 1.5474.

Table 4.5: Regressions explaining intrafirm trade.

Panel A: Estimate results.

	Int. Trade		
	(1) OLS	(2) OLS	(3) Poisson
CIT	-0.038*	-0.093***	-0.073***
	(0.021)	(0.026)	(0.027)
TP Strict	-0.124	-0.935***	-0.627***
	(0.109)	(0.238)	(0.166)
*TP Strict * CIT*		0.032***	0.023***
		(0.009)	(0.007)
Log(GDP)	-0.345	-0.320	-0.398*
	(0.240)	(0.222)	(0.214)
Log(GDP pc)	0.395**	0.325*	0.368**
	(0.180)	(0.167)	(0.152)
FTA	0.071	0.119	0.483**
	(0.473)	(0.442)	(0.240)
Log(Ext. Trade)	1.389***	1.326***	0.996***
	(0.241)	(0.225)	(0.182)
Unemployment	-0.015	-0.021	-0.015
	(0.039)	(0.035)	(0.064)
Log(Distance)	0.160	0.005	-0.119
	(0.259)	(0.262)	(0.166)
Constant	-5.547	-1.326	8.807***
	(5.449)	(5.373)	(3.239)
Observations	431	431	431
R^2	0.74	0.76	
Year Dummies	Yes	Yes	Yes

Panel B: Marginal effects of *CIT* on *Log(Int. Trade)* at different levels of *TP Strict*.

	Marginal effect *of CIT* on *Log(Int. Trade)* – Column (2)	
TP Strict	*dy/dx*	*p-value*
-0.5	**-0.109*** **	0.001
0	**-0.093*** **	0.001
0.5	**-0.077*** **	0.002
1	**-0.061*** **	0.006
1.5	**-0.045** **	0.025
2	-0.029	0.128
2.5	-0.013	0.504
3	0.004	0.86
3.5	0.020	0.373
4	0.036	0.15

Notes: Panel A presents the results of estimating a pooled OLS regression of the natural logarithm of *Int. Trade* in columns (1) and (2) and of *Int. Trade* in column (3) on a set of independent variables. The regressions are based on a panel on the level of countries and years. Panel B presents the estimated overall effect of *CIT* on *Log(Int. Trade)* at different levels of *TP Strict*, based on results presented in column (2) of Panel A. All variables are defined in Appendix 4.1. Robust standard errors clustered at the country level are reported in parentheses. *, **, *** represent statistical significance at the 10, 5, and 1 percent levels (all two-tailed), respectively.

To assure the robustness of these results, I re-estimate the coefficients by using a Poisson model as Poisson is commonly used in trade and investment literature (Santos Silva and Tenreyro 2006, Santos Silva and Tenreyro 2011).[92] For this specification, I use the original Dollar values of the bilateral intrafirm trade flows as the dependent variable instead of log-transforming *Int. Trade*. The results are presented in column (3). The results of the coefficients of interest turn out to be robust to this alternate econometric approach.

4.4.2. Share of intrafirm trade, level of taxation, and transfer pricing strictness

In *Hypothesis 2*, I predict that stricter transfer pricing attenuates the association between a higher share of trade that is conducted internally and a low tax rate. To gauge this relationship, I employ a linear cross-sectional regression model using ordinary least squares for country *i* in year *t* for the period of 2000 to 2015 which is similar to the one presented in Section 4.4.1.

$$Int.Trade\ Share_{it} = \beta_0 + \beta_1\, CIT_{it} + \beta_2\, TP\ Strict_{it} + \beta_3\ CIT_{it} * TP\ Strict_{it} + \beta_k\, W_{it} + Year\ FE_t + \varepsilon_{it} \quad \text{(Eq. 4.3)}$$

The dependent variable of this model is *Int. Trade Share*, i.e. the intrafirm trade relative to the total bilateral trade between the U.S. and country *i*. I expect negative coefficients for *CIT* and *TP Strict*. I include the interaction term of *CIT* and *TP Strict* to test *Hypothesis 2*. I predict a positive interaction coefficient to provide evidence for a mitigating effect of stricter transfer pricing on the association between higher intrafirm trade flows and lower tax rates. The vector of control variables W_{it} is the same as vector V_{it} as included in the model explaining intrafirm trade volumes described in Section 4.4.1, except for $Ext.\ Trade_{it}$ to avoid an endogeneity issue. I include a full set of year dummies.

[92] See, e.g., Head and Ries (2008), Fally (2015), or Dudar et al. (2015). Wooldridge (2002, Ch. 19) discusses the characteristics of Poisson models with nonnegative continuous dependent variables and its robustness and efficiency in case of a violation of the Poisson variance assumption.

Table 4.6: Regressions explaining intrafirm trade shares.

	Int. Trade Share	
	(1)	(2)
	OLS	OLS
CIT	-0.007*	-0.015***
	(0.004)	(0.005)
TP Strict	-0.020	-0.141***
	(0.017)	(0.040)
*TP Strict * CIT*		0.005***
		(0.001)
Observations	431	431
R^2	0.32	0.39
Controls	Yes	Yes
Year Dummies	Yes	Yes

Notes: This table presents the results of estimating a pooled OLS regression of *Int. Trade Share* on a set of independent variables. The remaining coefficients on the controls are reported in Appendix 4.3. The regressions are based on a panel on the level of countries and years. All variables are defined in Appendix 4.2. Robust standard errors clustered at the country level are reported in parentheses. *, **, *** represent statistical significance at the 10, 5, and 1 percent levels (all two-tailed), respectively.

Table 4.6 displays the regression estimates of my empirical examination of *Hypothesis 2*.[93] I find a negative association between the tax rate and the intrafirm trade share which is statistically significant (column (1)). The point estimate suggests that a one percentage point higher tax rate is associated with a 0.7 percentage points lower intrafirm trade share. Complementary to Clausing (2006), this result provides further evidence for a *location effect* and a *quantity effect*. With respect to transfer pricing strictness, I do not find that the share of intrafirm trade is lower at countries with stricter transfer pricing.

In column (2), I include the interaction term of *CIT* and *TP Strict*. The baseline coefficient on *CIT* is significantly negative. Taken at face value, a one percentage point higher tax rate is associated with a 1.5 percentage points lower intrafirm trade share for countries with a particularly low transfer pricing strictness. This result is substantially larger than in column (1), indicating that the negative association of tax rates and intrafirm trade shares is driven by sample countries with lenient transfer pricing. Matching my prediction, the coefficient on the interaction term is positive (0.005) and statistically significant. This result indicates that trans-

[93] For brevity, I present a short version of the regression table showing only the coefficients of interest. The full regression results table is provided in Appendix 4.3.

fer pricing strictness mitigates the tax rate sensitivity of intrafirm trade shares relative to total trade. This finding provides evidence confirming *Hypothesis 2*.

4.4.3. Intrafirm trade balance, level of taxation, and transfer pricing strictness

Hypothesis 3 predicts that stricter transfer pricing mitigates the association between a lower intrafirm trade balances and lower tax rates as shown by Clausing (2006). To formally test this prediction, I use the following linear cross-sectional regression model using ordinary least squares.

$$Int.Trade\ Balance_{it} = \beta_0 + \beta_1\ CIT_{it} + \beta_2\ TP\ Strict_{it} + \beta_3\ CIT_{it} * TP\ Strict_{it} + \beta_m\ X_{it} + Year\ FE_t + \varepsilon_{it} \quad \text{(Eq. 4.4)}$$

The dependent variable of this model is *Int. Trade Balance*.[94] I predict a positive coefficient on *CIT*, as intrafirm trade balances should be lower (i.e., leaning to imports) with low-tax countries. To test *Hypothesis 3*, I include the interaction term of *CIT* and *TP Strict* and expect a negative interaction coefficient hinting at a mitigating effect of strict transfer pricing. Moreover, I control for a set of other country characteristics that may have an impact on intrafirm trade balances between the U.S. and country *i* in year *t* (X_{it}). As in the previous models, this vector includes the natural logarithms of *GDP* and *GDP pc*, *FTA*, and the natural logarithm of *Distance*. Additionally, I follow Clausing (2006) and include the *Overall Non-Int. Trade Balance* and the *Unaffiliated Trade Balance* into the model as possible controls to capture general macroeconomic factors and characteristics of affiliates that may have an impact on their U.S. trade balance. Both regression specifications also include a full set of year dummies.

Table 4.7 reports the regression results of this model. In line with Clausing (2006), I find a positive association between the tax rate and the intrafirm trade balance (column (1))

[94] That is, the amount of U.S. exports shipped from parent firms to their foreign affiliates minus the amount of U.S. imports by those affiliates to their U.S. parents, relative to the total amount of trade between the U.S. parents and the foreign affiliates.

Table 4.7: Regressions explaining intrafirm trade balances.

	Int. Trade Balance	
	(1)	(2)
	OLS	OLS
CIT	0.006*	0.015**
	(0.003)	(0.006)
TP	-0.017	0.116**
	(0.021)	(0.059)
TP CIT*		-0.005**
		(0.002)
Overall Non-Int. Trade Balance	0.218***	0.221***
	(0.047)	(0.047)
Unaffiliated Trade Balance	0.092	0.092
	(0.070)	(0.069)
Log(GDP)	0.115***	0.120***
	(0.022)	(0.022)
Log(GDP pc)	0.016	0.024
	(0.026)	(0.026)
FTA	0.035	0.036
	(0.052)	(0.053)
Unemployment	0.012***	0.013***
	(0.004)	(0.004)
Log(Distance)	0.158***	0.179***
	(0.027)	(0.027)
Constant	-4.729***	-5.347***
	(0.592)	(0.614)
Observations	426	426
R^2	0.29	0.30
Year Dummies	Yes	Yes

Notes: This table presents the results of estimating a pooled OLS regression of *Int. Trade Balance* on a set of independent variables. The regressions are based on a panel on the level of countries and years. All variables are defined in Appendix 4.1. Robust standard errors are reported in parentheses. *, **, *** represent statistical significance at the 10, 5, and 1 percent levels (all two-tailed), respectively.

which is statistically significant. The coefficient on *CIT* indicates that a one percentage point higher tax rate is associated with a 0.6 percentage points higher intrafirm trade balance.[95] This finding provides evidence for the *price effect*. The coefficient of *TP Strict* in the baseline specification is insignificant.

In column (2), I include the interaction term of *CIT* and *TP Strict*. The baseline coefficient on *CIT* is significant and amounts to -0.015. This suggests that a one percentage point higher tax rate is associated with a 1.5 percentage points lower intrafirm trade balance in case

[95] The result is consistent with Clausing (2006) who finds a 0.2 percentage points lower response.

of a particularly low transfer pricing strictness. The coefficient of *CIT* is substantially larger than in column (1), indicating that the countries with lenient transfer pricing are the drivers of this positive association. Confirming *Hypothesis 3*, the coefficient on the interaction term is negative (-0.005) and statistically significant.

4.4.4. Intrafirm imports and exports, level of taxation, and transfer pricing strictness

Hypothesis 4 states the conjecture that the tax sensitivity of U.S. multinationals should be higher for imports than for exports. However, stricter transfer pricing should mitigate the tax sensitivity for both cases. To estimate these associations, I apply the same linear cross-sectional regression model for country *i* in year *t* for the period of 2000 to 2015 as for the gross intrafirm trade flows presented in 4.4.1 with the natural logarithms of *Int. Imports* and *Int. Exports* instead of *Int. Trade* as dependent variables.[96]

$$Log(T_{it}) = \beta_0 + \beta_1\, CIT_{it} + \beta_2\, TP\ Strict_{it} + \beta_3\ CIT_{it} * TP\ Strict_{it} + \beta_k\, V_{it} + Year\ FE_t + \varepsilon_{it} \quad \text{(Eq. 4.5)}$$

The results are reported in Table 4.8.[97] In the baseline specifications displayed in columns (1) and (4), both coefficients describing the tax rate semi-elasticity are negative. While they are directionally consistent, the coefficient measuring the tax rate sensitivity of imports is considerably larger than the one of exports (-0.048 vs. -0.026). Moreover, it is insignificant in the exporting case. Thus, the *price effect* on exports seems to substantially weaken the positive *location* and *quantity effects*. Overall, the results suggest that the positive association between a low tax rate and high gross intrafirm trade flows as presented in 4.4.1 stems to a larger extent from increased import flows. Transfer pricing strictness, however, is neither associated with statistically lower imports nor lower exports.

[96] In equation 4.5, the dependent variable is depicted as the natural logarithm of T_{ik} which stands for either *Int. Imports* or *Int. Exports*.
[97] I present the full regression results table in Appendix 4.4.

When considering the interaction between both tax variables by including an interaction term of *CIT* and *TP Strict*, I document a similar pattern compared to the overall intrafirm trade setting presented in 4.4.1. The baseline coefficients on *CIT*, as displayed in columns (2) and (5), are higher compared to the coefficients reported in columns (1) and (4). For both forms of intrafirm trade, this means that the tax rate semi-elasticity is particularly strong for countries with lenient transfer pricing. The statistically significant and positive coefficients on the interaction terms, 0.038 and 0.028, suggest that the negative association between *CIT* and both intrafirm trade variables is weaker for countries with stricter transfer pricing. Overall, this analysis confirms *Hypothesis 4*.

Table 4.8: Regressions explaining imports and exports.

	Int. Imports			*Int. Exports*		
	(1)	(2)	(3)	(4)	(5)	(6)
	OLS	OLS	Poisson	OLS	OLS	Poisson
CIT	-0.048*	-0.113***	-0.101***	-0.026	-0.074***	-0.038*
	(0.025)	(0.036)	(0.035)	(0.021)	(0.026)	(0.021)
TP Strict	-0.093	-1.044***	-0.784***	-0.153	-0.862***	-0.452***
	(0.150)	(0.336)	(0.198)	(0.096)	(0.235)	(0.148)
*TP Strict * CIT*		0.038***	0.031***		0.028***	0.014**
		(0.011)	(0.009)		(0.009)	(0.006)
Observations	430	430	431	431	431	431
R^2	0.65	0.68		0.74	0.75	
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Year Dummies	Yes	Yes	Yes	Yes	Yes	Yes

Notes: This table presents the results of estimating a pooled OLS regression of the natural logarithm of *Int. Imports* in columns (1) and (2) and of the natural logarithm of *Int. Exports* in columns (4) and (5), and the results of estimating a Poisson regression of *Int. Imports* in column (3) and of *Int. Exports* in column (6) on a set of independent variables. The remaining coefficients on the controls are reported in Appendix 4.4. The regressions are based on a panel on the level of countries and years. All variables are defined in Appendix 4.1. Robust standard errors clustered at the country level are reported in parentheses. *, **, *** represent statistical significance at the 10, 5, and 1 percent levels (all two-tailed), respectively.

4.5. Conclusion

This study investigates whether transfer pricing strictness affects intrafirm trade patterns of U.S. multinational firms. First, I provide evidence confirming prior literature that U.S. multinationals trade more with affiliates resident in low-tax countries. In addition, I find that the tax rate sensitivity is higher for imports than for exports. Correspondingly, the intrafirm trade

balance of low-tax countries leans towards imports. However, my results also show that countries with particularly lenient transfer pricing regimes seem to drive the tax rate sensitivity of intrafirm trade and that these associations are mitigated under stricter transfer pricing.

Intrafirm trade accounts for a substantial share of overall global trade (OECD 2013a; Sansing 2014), a thorough understanding of the main determinants is especially important. Besides this contribution to the trade literature, this study adds to a growing literature on profit shifting and public finance by providing direct evidence that transfer price regulations have some effectiveness in limiting the exploitation of tax rate differentials via intrafirm trade. It highlights an important factor for policymakers to consider when developing tax legislation. Thus, my findings are relevant for researchers and policymakers alike.

Appendix Chapter 4

Table 4.9: Appendix 4.1: Variable definitions**.**

Variables	Definition	Source
Dependent Variables		
Int. Trade	Total amount of *Int. Exports* plus *Int. Imports* between U.S. multinational parents and foreign affiliates in country *i* in year *t*.	BEA
Int. Imports	Total amount of imports shipped to U.S. multinational parent firms by foreign affiliates in country *i* in year *t.*	BEA
Int. Exports	Total amount of exports shipped from U.S. multinational parent firms to foreign affiliates in country *i* in year *t.*	BEA
Int. Trade Share	*Int. Trade* relative to the total (unaffiliated and affiliated) bilateral trade between the U.S. and country *i* in year *t*.	BEA, IMF
Int. Trade Balance	*Int. Exports* minus *Int. Imports* relative to *Int. Trade* in country *i* in year *t.*	BEA
Variables of Interest		
TP Strict	A country- and year-specific index measuring the strictness of transfer pricing regulations and their enforcement in country *i* in year *t* with a value from -0.37 to 5.08, where a high value indicates a high degree of transfer pricing risk and strictness.	Ken Klassen (Klassen/ Mescall 2018)
CIT	Statutory corporate income tax rate in percent in country *i* in year *t*.	OECD (if missing, KPMG)
Control Variables		
GDP	Gross domestic product in country *i* within year *t*.	Word Bank
GDP pc	Gross domestic product per capita in country *i* within year *t*.	Word Bank
FTA	Binary variable, 1 if there is a regional trade agreement in place between the U.S. and country *i* in year *t*, 0 otherwise.	WTO, CEPII
Ext. Trade	External bilateral trade between the U.S. and country *i* in year *t*, i.e. total trade minus intrafirm trade.	IMF, BEA
Unemployment	Unemployment rate in percent in country *i* in year *t*.	IMF
Distance	Distance between country *i* and the U.S. (from each's most populated city) in kilometers	CEPII GeoDist
Overall Non-Int. Trade Balance	Total trade balance between country *i* and the U.S. excluding intrafirm trade [i.e. (overall exports – *Int. Exports*) – (overall imports – *Int. Imports*) / *Ext. Trade*] in country *i* in year *t.*	BEA, IMF
Unaffiliated Trade Balance	trade balance between foreign affiliates of U.S. multinationals in country *i* and non-affiliated persons in the U.S. in year *t.*	BEA

Table 4.10: Full correlation matrix (Table 4.3)

Variables		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Int. Trade	1	1														
Int. Trade Share	2	0.301***	1													
Int. Trade Balance	3	-0.164***	-0.295***	1												
Int. Imports	4	0.992***	0.328***	-0.241***	1											
Int. Exports	5	0.983***	0.254***	-0.0499	0.952***	1										
TP	6	0.244***	-0.252***	0.0397	0.221***	0.270***	1									
CIT	7	-0.190***	-0.436***	0.274***	-0.213***	-0.153**	0.208***	1								
Log(GDP)	8	0.283***	-0.146**	0.230***	0.223***	0.360***	0.539***	0.167***	1							
Log(GDP pc)	9	0.118*	0.315***	-0.0304	0.0951*	0.148**	0.0568	-0.285***	0.323***	1						
FTA	10	0.622***	0.228***	-0.0595	0.610***	0.622***	0.0270	-0.103*	0.0496	0.0187	1					
Log(Ext. Trade)	11	0.626***	0.00232	0.0343	0.581***	0.671***	0.515***	0.0961*	0.773***	0.103*	0.397***	1				
Unemployment	12	-0.147**	-0.234***	0.149**	-0.125*	-0.174***	-0.0641	0.200***	-0.0166	-0.228***	-0.176***	-0.252***	1			
Log(Distance)	13	-0.773***	-0.0760	0.187***	-0.776***	-0.747***	-0.132**	0.154**	-0.222***	-0.220***	-0.291***	-0.374***	-0.0704	1		
Overall Non-Int. Trade Balance	14	-0.0195	0.00497	0.349***	-0.0361	0.00457	-0.0344	0.0931	0.0958*	-0.0722	-0.0379	0.00902	0.127**	0.0770	1	
Unaffiliated Trade Balance	15	0.0453	0.423***	0.143**	0.0280	0.0687	-0.0866	-0.00717	-0.112*	0.136**	0.170***	-0.169***	-0.0509	0.0316	0.187***	1

Notes: This table presents the pairwise Pearson correlations for the variables used in the empirical analysis. All variables are defined in Appendix 4.1. *, **, *** represent statistical significance at the 10, 5, and 1 percent levels (all two-tailed), respectively

Table 4.11: Appendix 4.2: Full table of intrafirm trade and tax characteristics (Table 4.4).

Country	(1) Int. Trade (in m)	(2) Int. Tr. / GDP (in %)	(3) Int. Imports (in m)	(4) Int. Exports (in m)	(5) Int. Trade Balance	(6) Int. Tr. Share (in %)	(7) CIT (in %)	(8) TP Strict (K/M)
Canada	136,284	10.17	79,270	57,013	-0.165	26.53	32.37	3.73
Mexico	70,266	7.09	42,132	28,134	-0.193	20.57	30.94	2.95
Singapore	24,054	12.61	12,798	11,256	-0.073	56.91	18.62	0.86
Ireland	23,410	11.03	20,311	3,497	-0.706	62.00	13.91	0.81
United Kingdom	20,971	0.85	9,713	11,257	0.077	21.79	27.38	2.74
Switzerland	14,657	2.92	6,828	7,829	0.176	39.61	22.22	0.92
Netherlands	14,249	1.96	4,656	9,593	0.413	29.37	28.85	2.91
Japan	12,658	0.26	2,397	10,261	0.627	6.52	39.09	2.88
Germany	11,998	0.39	5,197	6,801	0.137	9.44	34.86	3.44
China	10,071	0.20	5,144	4,928	-0.068	2.67	28.08	2.87
Hong Kong	8,688	4.00	4,649	4,039	-0.07	29.3	16.8	0.68
Malaysia	8,392	4.09	6,619	1,772	-0.53	20.3	25.9	3.98
France	7,711	0.33	3,888	3,823	0.02	12.3	35.9	2.92
Australia	6,972	0.74	1,797	5,175	0.48	24.6	30.3	2.79
Belgium	6,966	1.66	2,676	4,782	0.26	19.6	35.3	2.14
Brazil	6,220	0.42	2,098	4,122	0.30	12.2	34.0	3.37
Taiwan	4,054	-	1,572	2,483	0.23	6.7	21.3	1.88
Thailand	3,750	1.40	2,719	1,054	-0.37	11.6	27.2	3.10
Sweden	3,608	0.83	2,577	461	-0.65	23.1	26.5	2.33
Korea	3,098	0.32	1,164	2,052	0.35	3.9	26.9	2.70
Italy	3,057	0.16	1,664	1,393	-0.06	6.6	35.0	3.27
Philippines	1,878	1.13	678	1,338	0.28	10.7	31.7	1.23
Argentina	1,687	0.49	816	1,010	0.11	19.4	35.0	2.40
Spain	1,672	0.14	684	988	0.19	9.3	32.2	1.86
India	1,352	0.11	667	683	0.13	3.3	34.3	3.18
Venezuela	1,041	0.42	115	904	0.76	3.2	34.0	2.66
Israel	1,016	0.51	883	219	-0.61	3.5	29.9	1.10
Chile	948	0.56	334	687	0.27	7.6	17.8	1.89
Colombia	910	0.41	251	737	0.48	6.4	31.9	1.93
Luxembourg	904	2.00	399	475	0.28	43.4	30.5	1.23
Norway	874	0.24	629	378	-0.28	10.0	27.9	2.49
South Africa	823	0.30	212	680	0.50	6.7	34.1	3.24
Hungary	623	0.55	464	154	-0.41	14.6	18.5	1.14
Dom. Republic	482	1.09	347	203	-0.25	5.0	26.7	2.18
Poland	462	0.12	199	263	0.17	9.3	21.3	2.00
New Zealand	438	0.34	115	330	0.46	8.0	30.9	2.97
Austria	396	0.11	168	217	0.17	4.1	27.8	2.46
Denmark	379	0.13	199	206	-0.03	5.2	26.9	2.60
Peru	323	0.27	164	179	0.11	5.6	29.6	2.08
Finland	319	0.14	186	114	-0.22	4.8	26.0	1.95
Indonesia	309	0.06	131	169	0.25	1.8	27.5	2.51

Table 4.11: Appendix 4.2 (continued).

Country	(1) Int. Trade (in m)	(2) Int. Tr. / GDP (in %)	(3) Int. Imports (in m)	(4) Int. Exports (in m)	(5) Int. Trade Balance	(6) Int. Tr. Share (in %)	(7) CIT (in %)	(8) TP Strict (K/M)
Russia	281	0.02	29	327	0.96	1.0	21.9	1.71
Ecuador	280	0.48	203	84	-0.34	6.6	24.1	1.84
Czech Republic	271	0.17	191	92	-0.34	7.3	23.8	2.67
Turkey	230	0.04	53	181	0.58	2.1	24.5	3.76
Portugal	155	0.08	62	92	0.12	4.3	29.8	1.84
Egypt	55	0.03	2	42	0.80	1.3	24.7	1.06
Greece	51	0.02	4	49	0.78	2.3	29.0	1.78

Notes: In this table, I present the average values from 2000 to 2015 of his study's sample for the following variables: (1) *Int. Trade*, (2) *Int. Trade / GDP*, (3) *Int. Imports*, (4) *Int. Exports*, (5) *Int. Trade Balance*, (6) *Int. Trade Share*, (7) *CIT*, and (8) *TP Strict*. All variables are defined in Appendix 4.1.

Table 4.12: Appendix 4.3: Full regression table explaining intrafirm trade shares (Table 4.6).

	Int. Trade Share	
	(1)	(2)
	OLS	OLS
CIT	-0.007*	-0.015***
	(0.004)	(0.005)
TP Strict	-0.020	-0.141***
	(0.017)	(0.040)
*TP Strict * CIT*		0.005***
		(0.001)
Log(GDP)	-0.013	-0.018
	(0.020)	(0.018)
Log(GDP pc)	0.047**	0.040*
	(0.021)	(0.021)
FTA	0.078	0.076
	(0.063)	(0.058)
Unemployment	-0.004	-0.004
	(0.004)	(0.004)
Log(Distance)	0.010	-0.009
	(0.029)	(0.029)
Constant	0.217	0.779
	(0.539)	(0.538)
Observations	431	431
R^2	0.32	0.39
Year Dummies	Yes	Yes

Notes: This table presents the results of estimating a pooled OLS regression of *Int. Trade Share* on a set of independent variables. The regressions are based on a panel on the level of countries and years. All variables are defined in Appendix 4.1. Robust standard errors clustered at the country level are reported in parentheses. *, **, *** represent statistical significance at the 10, 5, and 1 percent levels (all two-tailed), respectively.

Table 4.13: Appendix 4.4: Full regression table explaining imports and exports (Table 4.8).

	Int. Trade Imports			Int. Trade Exports		
	(1)	(2)	(3)	(4)	(5)	(6)
	OLS	OLS	Poisson	OLS	OLS	Poisson
CIT	-0.048*	-0.113***	-0.101***	-0.026	-0.074***	-0.038*
	(0.025)	(0.036)	(0.035)	(0.021)	(0.026)	(0.021)
TP Strict	-0.093	-1.044***	-0.784***	-0.153	-0.862***	-0.452***
	(0.150)	(0.336)	(0.198)	(0.096)	(0.235)	(0.148)
*TP Strict * CIT*		0.038***	0.031***		0.028***	0.014**
		(0.011)	(0.009)		(0.009)	(0.006)
Log(GDP)	-0.557*	-0.531*	-0.721**	-0.021	0.001	-0.035
	(0.300)	(0.284)	(0.288)	(0.228)	(0.215)	(0.204)
Log(GDP pc)	0.460**	0.386*	0.311*	0.315	0.254	0.427**
	(0.217)	(0.201)	(0.188)	(0.195)	(0.192)	(0.172)
FTA	-0.173	-0.114	0.277	0.365	0.407	0.722***
	(0.552)	(0.516)	(0.321)	(0.468)	(0.447)	(0.253)
Log(Ext. Trade)	1.499***	1.428***	1.181***	1.203***	1.148***	0.766***
	(0.274)	(0.253)	(0.232)	(0.238)	(0.235)	(0.168)
Unemployment	-0.026	-0.033	0.019	-0.015	-0.021	-0.067*
	(0.047)	(0.044)	(0.076)	(0.037)	(0.033)	(0.040)
Log(Distance)	-0.011	-0.186	-0.151	0.222	0.087	-0.148
	(0.307)	(0.304)	(0.188)	(0.280)	(0.292)	(0.147)
Constant	-2.364	2.490	13.524***	-10.548*	-6.864	3.033
	(7.000)	(6.881)	(4.248)	(5.407)	(5.514)	(3.267)
Observations	430	430	431	431	431	431
R^2	0.65	0.68		0.74	0.75	
Year Dummies	Yes	Yes	Yes	Yes	Yes	Yes

Notes: This table presents the results of estimating a pooled OLS regression of the natural logarithm of *Int. Imports* in columns (1) and (2) and of the natural logarithm of *Int. Exports* in columns (4) and (5), and the results of estimating a Poisson regression of *Int. Imports* in column (3) and of *Int. Exports* in column (6) on a set of independent variables. The regressions are based on a panel on the level of countries and years. All variables are defined in Appendix 4.1. Robust standard errors clustered at the country level are reported in parentheses. *, **, *** represent statistical significance at the 10, 5, and 1 percent levels (all two-tailed), respectively.

Chapter 5: Concluding Remarks

In this dissertation, I explore several dimensions of corporate tax planning and the role of transfer pricing. In particular, I examine the effectiveness of selected countermeasures against the use of intrafirm transactions on the use of those tax planning strategies which I identify by observing the allocation of intangibles to and the engagement of intrafirm trade with low-tax jurisdictions. Moreover, I provide first empirical evidence on the association between the intensity of multinational firms' use of information technology within the transfer pricing function and the effectiveness of transfer pricing systems. Thereby, this dissertation contributes to the existing tax, accounting and public finance literature in several ways by providing novel evidence on important and, so far, unexplored fields of research.

The first study investigates the impact of tax considerations on the intra-U.S. allocation of trademark ownership. In particular, we show that the State of Delaware strongly dominates in the allocation of trademark ownership. We also document that a high business presence in combined reporting states negatively affects the probability of choosing Delaware as trademark holding location. However, the magnitude of the identified effect does not indicate that Delaware-based tax avoidance strategies using intangible assets have been abandoned. In addition to the focus of this paper, there are several other related aspects of interest. For instance, less is known about the effects of combined reporting on the allocation patterns of intangibles in the states that enacted this regime. Moreover, state taxation and combined reporting exerts pressure on the allocation of 'real' economic activity and the factors considered in the apportionment formulas. Thus, future research may further investigate on these effects.

The second study analyzes the fundamental, yet empirically unexplored question how firms implement transfer pricing strategies that balance the often-underlying conflict between managerial control and tax efficiency within their transfer pricing function. Our results sug-

gest that investments in IT can increase the effectiveness of transfer pricing strategies when decision-making is difficult due to a high tension between the tax and managerial accounting department and when granular information is necessary to determine optimal prices based on internal costs. In particular, we find that the intensive use of IT within firms' transfer pricing function helps to achieve higher profitability, lower ETRs, and lower tax risk if managerial and tax objectives likely conflict. Moreover, our evidence confirms theory that more intensive IT use is associated with higher profitability under cost-based transfer pricing. In general, research on the firms' internal transfer pricing systems is important but scarce, mainly due to the issue of limited observability. Despite its limitations, survey data is an appropriate instrument to study the black-box of transfer pricing which allows researchers to address research questions that are not possible to answer with archival data. Thus, future research might explore other related research questions to ensure a thorough understanding of a fundamental aspect of accounting research.

The third study investigates whether transfer pricing strictness affects intrafirm trade patterns and transfer pricing of U.S. multinational firms. I confirm prior literature that U.S. multinationals trade more with affiliates resident in low-tax countries and add to this literature by finding that the tax rate sensitivity is higher for imports than for exports. My results show, however, that countries with a particularly low transfer pricing strictness seem to drive the tax rate sensitivity of intrafirm trade and that these associations are mitigated under stricter transfer pricing. This finding provides evidence on aggregate level considering bilateral trade flows at the country-level. Due to confidentiality issues, the access to underlying transfer price data is restricted. However, there had been several collaborations between researchers and tax authorities in the past. Thus, future research might explore the effects of transfer pricing strictness on transfer price data.

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