



**The Impact of Industry Competition on Corporate Tax
Avoidance: Evidence from U.S. Manufacturing Firms**

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Abstract

This paper examines the impact of industry competition on corporate tax avoidance behavior for U.S. listed firms. For three out of four most commonly used tax avoidance proxies in recent literature, empirical results reveal that firms facing higher industry competition are much more likely to engage in tax avoiding behavior than firms facing lower level of industry competition. In contrast, a proxy representing the most aggressive form of tax avoidance shows no significant results. Next, the analysis is extended by introducing the possible effect of significant foreign operations (e.g. multinationals). Results show that the positive effect of industry competition on tax avoidance is enlarged for firms with significant foreign operations. While U.S. regulators often follow dominant and visible firms, this paper finds that firms with significant foreign operations acting in a highly-competitive industry are the ones taking advantage of the tax system.

Keywords

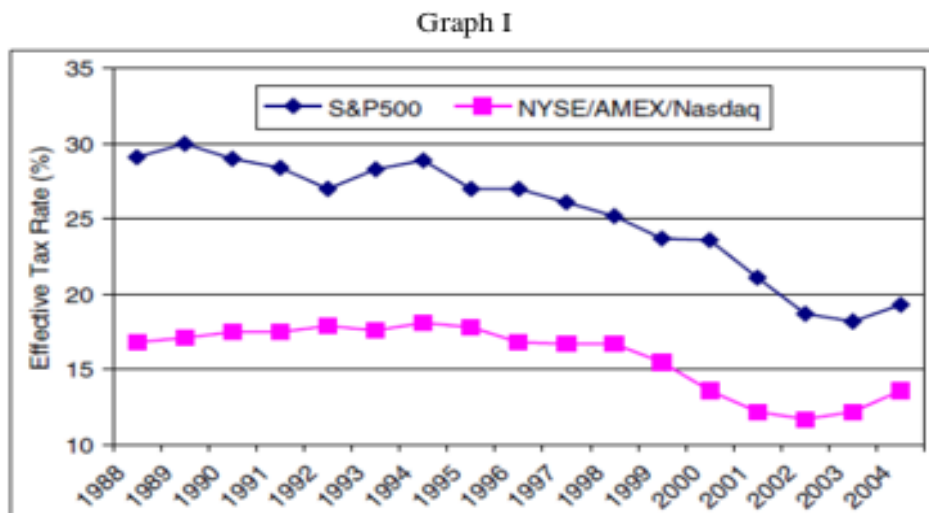
Tax avoidance, industry competition, foreign operations, tax regulators

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I. Introduction

Tax avoidance and evasion receive increasingly attention both in real life cases as academic literature. Over the past decades, several large companies were highlighted in the media for their tax avoiding activities, including McDonald's who were tackled by trade unions for super-sized tax avoidance activities in the EU¹. Recently, president Trump stated decreasing the U.S. corporate tax rate as one of the main pillars in his presidency campaign. He stated that lowering the tax rate would refrain companies from leaving the country and thus stimulate the U.S. economy². Currently, the plan to lower the corporate tax rate from 35% to 21% per cent is promoted by the House and Senate Republicans and passed both chambers of Congress in December 2017. However, implemented in this reform is that U.S. firms face (higher) local state taxation, which leads to an average 25.7% statutory corporate tax rate which is still significantly lower than before. Interestingly is whether this decrease in tax rate will have the proposed effect, since the current effective tax rate appears to be already significantly lower than 35% due to tax planning and loops in the tax law. Graph I, retrieved from the paper examining the effect of tax shelters on capital structure decisions by Graham and Tucker (2006), illustrates the development of corporate effective tax rate and shows that the effective rate is always below the 35% statutory corporate tax rate and even decreases over time.



Source: Graham, J. & Tucker, A. 2006. *Tax shelters and corporate debt policy*, *Journal of Financial Economics*, 81, pp. 563-594.

¹ Bloomberg, 2015. McDonald's Accused by Unions of Super-Sized Tax Avoidance in EU. Retrieved from: <http://www.bloomberg.com/news/articles/2015-02-25/mcdonald-s-accusedby-unions-of-super-sized-tax-avoidance-in-eu>

² <https://www.cnbc.com/2017/12/20/trump-says-corporate-tax-cut-is-biggest-factor-in-gop-tax-plan.html>

This paper continues on previous literature by further elaborating on the question why tax avoidance is relevant for firms and investors and what stimulates firms to be active in tax avoiding behavior. Tax avoidance is considered as legally exploiting the tax system to reduce current or future tax liabilities. On the other hand, tax evasion is the illegal practice of deliberately not paying taxes, by underreporting income or not paying taxes owed. While tax avoidance is often considered as purely beneficial for a firm (Hanlon and Heitzman, 2010), many researchers asserts various downsides and difficulties concerning tax avoiding behavior. For example, tax avoidance appears to be difficult in countries with strong enforcement (Desat et al., 2007). Furthermore, news about tax sheltering activity affects the public image of the firm which, on average, results in a negative stock price reaction (Hanlon and Slemrod., 2009; Kim et al.,2011). Hence, firms operating in the highly competitive and highly regulated U.S. product market are dealing with a trade-off between appearing financially stronger to attract investment, generate excess free cash flows and so posture against rivals, and, on the other end, undertaking the potential risks of engaging in tax avoidance. Previous literature mainly focuses on firm and managerial characteristics that influence tax avoiding behavior, including the effect of incentive compensation for managers and the effect of corporate governance within a firm. Also, there is mostly theoretical literature about the impact of foreign operations. Leblang (1998) argues that multinational corporations may have significantly greater opportunities to escape tax with respect to cross-border investments than with respect to strictly domestic investment. Also, there is general understanding that industry competition affects managerial decision making (Callahan and Ryou, 2013), and thus tax decision making might be influenced as well. Intuitively, a monopolistic firm receives more visibility by regulators and other stakeholders, and therefore makes highly aggressive tax avoiding behavior riskier for them. Regulators often focus their attention on the largest and most dominant firms that operate in a very uncompetitive market (monopolistic), hence this paper examines whether this regulatory strategy is appropriate. Moreover, this paper argues that firms facing limited competition have more incentive to present strong earning numbers without taking significant risks. When a firm is more monopolistic, investors will react more strongly to tax scandals. Firms facing limited attention from different stakeholders, including regulators, might have more opportunities and motives to engage in tax avoiding behavior. Still, there is limited literature available on the effect of industry characteristics on firm-level tax avoidance. Therefore, this paper is motivated by recent corporate tax reforms in the U.S. and focusses on the effect of industry competitiveness on tax avoidance for U.S. publicly

traded firms. Moreover, it aims to provide new insights for regulators and other relevant stakeholders.

This study examines whether there exists a relationship between industry competition and tax avoiding behavior. In order to obtain empirical results, the North American Compustat database is utilized. An empirical analysis is performed using a sample of 8,281 firm-year observations for 2,264 unique firms covering a period of 2007 until 2017. In the model, four proxies of tax avoidance are used that have shown validity in prior research (Desai and Dharmapala, 2006; Hanlon and Heitzman, 2010). The Herfindahl-index captures the industry competition using data from Orbis. This database provides a more reliable measure of industry competition because it includes both listed as non-listed firms. Following among others Chen et al. (2010), regressions include several firm-specific control variables that have proven to impact tax avoiding behavior in previous literature. Next to the main hypothesis in this paper, a heterogeneity analysis is executed that aims to capture the possible effect of significant foreign operations. As before-mentioned, foreign subsidiaries and headquarters might provide firms with noteworthy opportunities to engage in tax planning and avoidance. Next, several robustness checks are performed in order to review the outcomes of the main regressions.

Results from the regression models show that tax avoidance is significantly affected by industry competition. Specifically, firm operating in high-competitive industries are more likely to engage in tax avoidance. This confirms the hypothesis and suggests that firms facing more competition are more concerned with maintaining a strong cash flow in order to keep up or outperform their rivals, whereby tax avoidance is a method to realize this. Moreover, it confirms the argument that firms operating in monopolistic industries are seemingly more concerned with the possible negative impact of tax avoidance, in terms of image loss and potential higher monitoring by regulators. Also, results concerning the second hypothesis show significant (statistically) differences between ‘domestic’ and ‘multinational’ firms (e.g. firms with or without significant foreign operations). Again, this confirms the hypothesis that firms with significant foreign operations have more opportunities to engage in tax avoidance. Overall, these results contribute to both tax avoidance as industry competition literature and provides insights for regulators in determining their monitoring strategy.

The remainder of this paper proceeds as follows. Section II discusses prior research and develops the hypotheses. Section III reflects data, methodology and empirical specifications.

Section IV present the main regression results and robustness checks. Finally, section V concludes and discusses some limitations of this study.

II. Literature Review

Prior corporate tax avoidance literature is rather extensive and therefore can be divided into several theoretical and empirical sections. Part II of this paper focuses on previous literature examining the relation between corporate tax avoidance and several firm and industry characteristics. Utmost corporate tax avoidance literature is based on firm-level characteristics, including the agency problem. Contradictory, the empirical and theoretical relation between industry characteristics and corporate tax avoidance is still at an early stage. While still at this early stage, evidence on this relation might be of great interest for policy makers, competing firms and other governmental parties. First, differences between tax avoidance and evasion are discussed. The following paragraph summarizes previous literature on tax avoidance dealing with firm-level incentives to engage in tax avoidance. The third paragraph describes previous literature on the relation between firm and industry characteristics and tax avoidance. Lastly, hypotheses are described.

2.1 Tax avoidance and evasion

First of all, tax avoidance does not directly imply that firms are engaging in any improper or even illegal activity. There exist several provisions in the tax code that allow, or even encourage, firms to lower their tax liabilities by legitimate tax deductions and sheltering income from taxes. Firms also avoid taxes by loopholes in the tax law system, which sophisticated tax experts can exploit by finding the ‘gray area’ within the tax code. Despite the common negative association when reading about firms avoiding taxes, in most of these cases these activities are perfectly legal and simply used to exploit the law. Therefore, tax consequences can play an important role in corporate decision-making. Managerial behavior focused solely on minimizing corporate tax obligations are thought to be of increasingly importance within U.S corporate activity (Bankman, 2004; Slemrod, 2004; Desai and Dharmapala, 2009). Previous research by Yin (2003) shows that the effective tax rate, which is defined as the average rate at which the pre-tax profit is taxed (Dyreng et al., 2008), for S&P 500 firms declined from 28.9% in 1995 to 24.2% in 2000. Moreover, Leonhardt (2011) shows that 115 firms in the S&P 500 index approximately paid an effective corporate tax rate of 20% or less over the past five years as opposed to the U.S. federal statutory rate of 35%. Literature on corporate tax avoidance

holds the view that positive book-tax differences and low effective tax rates reflect tax avoiding behavior (Kim et al., 2011). Book-tax differences are defined as the difference between reported income to capital markets and the income reported to tax authorities (Manzon and Plesko, 2002; Desai, 2005). Consequently, growing book-tax differences and declining effective tax rates for U.S. public corporations since the mid-1990s resulted in an increase in research on determinants and consequences of corporate tax avoidance activities.

In contrast, tax evasion is always in some way illegal and not coherent with the tax law system. Tax evasion is the illegal practice of deliberately not paying taxes, by not reporting taxable income or by not paying taxes owed. According to Slemrod (2007), tax evasion already goes back to the third century, where wealthy Romans buried their jewelry and gold coins to evade the 'luxury tax'. He defines tax avoidance as 'a case in which a person, through commission of fraud, unlawfully pays less tax than the law mandates'. His data shows a 17% noncompliance rate for the largest businesses in the US, which accounts for approximately \$30 billion in 2001. Next to the corporate tax rate, companies also often carry responsibility for the tax liabilities of their employees. Therefore, businesses play a central role in the tax (evasion) system. This paper will continue on the tax avoidance literature. However, in measuring tax avoidance proxies there might arise some measurement issues due to possible presence of evasion in the used tax avoidance proxy. In line with Hanlon and Heitzman (2010), this paper uses a broad definition of tax avoidance, where tax avoidance is defined as a reduction of taxes paid. Therefore, this definition is not able to separate legal or illegal ways in achieving lower taxation. Based on this definition, this paper uses several measures of tax avoidance which all try to capture a different part of firms' tax avoidance. These measures are further discussed in section III. Section V discusses the implications of combining tax avoidance and evasion into the same proxy.

2.2 Tax avoidance incentives

In accounting literature, Schackelford and Shevlin (2001) and Hanlon and Heitzman (2010) note an extensive number of factors that influence tax avoiding behavior. Most of tax avoidance literature is based on management's incentives to avoid taxes, which generally comprises to achieving superior cash flow for the firm. Moreover, firms are also focusing on impression management, which comes down to putting forth a strong operating image of the firm. As discussed by Davidson et al. (2004), impression management includes one part which is named 'earnings management'. Earnings management is the use of accounting techniques to produce financial reports that present an overly positive view of a company's business activities and

financial position. Earnings management can be accomplished in two ways. First of all, firms can engage in a relatively easy practice of accrual-based earnings management (Jones, 1991), which is simply making use of accounting techniques to show a more desirable net income. This method does not alter the underlying operations of the firm. On the other hand, firms can engage in 'real earnings management', which is behavior that actively changes firms' policy in order to boost net income.

From an investor perspective, managers undertake corporate tax avoidance activities for the sole purpose of reducing corporate tax obligations. From this perspective, corporate tax avoidance activity is value enhancing and managers should be motivated and compensated for engaging in such activities (Kim et al., 2011). Tax spending represent a substantial cost to firms, so a reduction in tax liability leads to a direct increase in free cash flows available to the firm and shareholders. Graham and Tucker (2006) support this view and distinguish several firm characteristics that influence tax avoiding behavior, such as company size and profitability that are positively related with tax avoidance. Also, Philips (2003) finds that compensating managers on an after-tax basis lowers a firm's effective tax rate, and thus provides evidence that firms are more actively engaging in tax avoiding behavior.

Another view on corporate tax avoidance focuses more on dimensions of the principal-agent relationship between managers and investors. This agency view of tax avoidance is increasingly attracting attention in recent literature (Desai, 2005; Desai and Dharmapala, 2006; Hanlon and Heitzman, 2010). The agency problem explains that managers do not always pursue the same goal and interest as investors. Investors solely want to increase the after-tax value of the firm, where managers might seek personal advantages and therefore act in their own best interest. This problem arises due to asymmetric information (i.e. managers having more information), such that investors are not able to directly monitor managers to ensure they are acting in their best interest. This agency dilemma is thoroughly studied in the work of Desai (2005), where three high-profile cases of managerial profit misreporting and corporate tax avoidance activities at Enron, Tyco and Xerox are examined. It reveals how the motivation to improve reported book value profits foster corporate tax avoidance activities and how the drive to limit tax payments increases accounting and managerial malfeasance. Desai (2005) explains that there is a distinction between book and tax profits, which allows managers to mischaracterize tax savings to capital markets and to mischaracterize profits to tax authorities. This may result in incentives for managers to engage in managerial opportunism. The study further provides

evidence how these opportunistic managerial behaviors can be facilitated by corporate tax avoidance activities. In the article of Desai and Dharmapala (2006), they argue that complex tax avoidance transactions can provide management with tools and justifications for opportunistic managerial behavior, such as earnings manipulations, related party transactions, and other resource-diverting activities. This is justified due to development of financial innovations, integration of capital markets, and increasingly complicated corporate tax codes which provide more opportunities for managers and firms to capitalize on differences in corporate tax rates, tax preferences, and tax status. Chen (2010) shows that family firms are less tax aggressive than non-family firms, since family owners are willing to forgo tax benefits to avoid the non-tax cost of a potential price discount, which can arise from minority shareholders' concern with family rent-seeking masked by tax avoidance activity. Also, their results support the idea that family owners are more concerned about the potential penalties and reputational loss than non-family owners, which is similar to the concerns of monopolistic firms. In conclusion, engaging in tax avoidance activities could be a combination of improving firm, and thus shareholder, value and having the opportunity for managers to engage in managerial opportunism. However, these views contain some limitations, since they do not include the effect of firm's reputation or any potential penalties or threats that could harm the firm. Nevertheless, these theoretical limitations are not relevant for the purposes of this paper, since this paper uses data on firm-level and therefore captures the possible effect of reputational risk per firm. Moreover, this paper focuses on total tax avoidance independent of the motivation for the specific tax avoiding activity.

2.3 Industry and firm characteristics

As mentioned beforehand, an extensive number of firm characteristics that influence tax avoidance are examined in literature. The relation between effective tax rates (ETR) and several firm characteristics are mostly consistent throughout literature. Leverage and capital intensity are both negatively related to avoidance, according to Stickney and McGee (1982), Gupta and Newberry (1997), and Mills et al. (1998). Still, more recent papers find fewer significant results for these variables. The relationship between firm size and tax avoidance shows ambiguous results. Theoretically, larger firms should be able to lower their effective tax rate since they have more resources for the most effective tax planning strategy (Siegfried, 1972). On the other hand, larger firms are often subjected to greater governmental scrutiny than smaller firms, which should translate into higher tax burdens for larger firms. Therefore, it is theoretically

predictable that results are ambiguous. Rego (2003) finds that multinational firms with more extensive foreign operations have lower effective tax rates and are more active in tax avoidance. Intuitively, multinational firms have more opportunities to avoid taxes by making use of their foreign subsidiaries or headquarters, since they are able to increase foreign operations in low-tax jurisdictions or through shifting high-tax income to tax havens. Desai et al. (2007) find that large and international firms are most likely to make use of tax havens. Also, firms with extensive intrafirm trade and high R&D intensities are likely candidates. These havens facilitate tax avoidance by allowing firms to reallocate their taxable income away from high-tax jurisdictions and by reducing the burden of home country tax of foreign income.

Unlike the robust stream of literature in the area of tax avoidance and earnings management and the effect of specific firm characteristics, evidence on the possible effect of industry characteristics is rather limited. Intuitively, firms facing greater competition pressure are more likely to actively participate in tax avoidance, so they have more internal possibilities for potential investment opportunities (Cai and Liu, 2009). So, the pressure of industry competition can lead to a competitive advantage through tax avoidance by limiting tax expenditures. Cai and Liu (2009) support their theoretical predictions by empirical results. Specifically, their results show that industry competition enhances firms' incentives to engage in tax avoiding activities. Moreover, Cai and Liu (2009) find that firms in a disadvantageous market position in a competitive market have more incentives to avoid taxes in order to reclaim or strengthen their market position. They find significant results for market competition proxies including number of firms, concentration and industry average profit margin. Also, they show higher tax rates lead to more tax avoidance, since one yuan of un-reported profit saves more tax, hence profit under-reporting is more profitable. Additionally, higher marginal returns of capital lead to more under-reporting, since one yuan of saved tax will generate more future profit. Cai and Liu (2009) use a Chinese sample and conclude that policies intended to promote competition in developing and transition economies must be accompanied by reform which improve the institutional framework in order to limit the opportunity to engage in tax avoidance. This paper is significantly different from the study of Cain and Liu (2009), since they focus on firms taking advantage of China's weak regulatory environment due to industry competition pressure. However, this paper uses data from the United States, which can be defined as a highly-regulatory environment. Consequently, this paper will focus on U.S. firms to limit the possible effect of underdeveloped (tax) infrastructure.

2.4 Hypothesis development

This paper tests the impact of the level of industry competition on various measures of tax avoidance using an U.S. sample. Karuna (2007) shows that competitive pressures from an industry level causes shifts in managerial decision-making. The first hypothesis deals with the impact of industry competition on tax avoidance behavior, controlling for any significant firm characteristics. In line with Callahan and Ryou (2013) and Li (2010), this paper argues that firms operating in highly-competitive industries are focusing on business fundamentals to outperform rivals, including a strong cash flow. Also, firms operating in a less risky competitive environment are more likely to focus on maintaining themselves in the capital market, rather than seeking a small benefit through tax avoidance. Therefore, this paper hypothesizes that tax avoidance plays a part in achieving this maximizing cash flow behavior in order to outperform competition. Based on these assumptions, the first hypothesis is originated:

H1: Firms operating in highly-competitive industries are more likely to engage in tax avoidance.

As the first hypothesis clearly expects a positive relation between industry competition and tax avoidance, a follow-up hypothesis will focus more on the specific firms engaging in tax avoidance. Desai et al. (2006) and Rego (2003) show that multinational firms are more likely to engage in tax avoidance, either through increasing foreign operations in low-tax jurisdictions or through shifting high-tax income to tax havens. According to Desai and Dharmapala (2009), firms use tax avoidance to achieve higher after-tax profit and cash flows. Firms with significant foreign operations have more opportunities to engage in active tax planning by using their foreign subsidiaries or shifting their operations. Also, firms with higher foreign operations have lower domestic reputational risk, since it is clear that their foreign operations lead to different tax outcomes. Therefore, this paper will perform a heterogeneity analysis by separating the sample into firms with and without significant foreign operations. Consequently, hypothesis 2 follows:

H2: The effect of industry competition on tax avoidance is larger for firms with significant foreign operations.

This paper will contribute to existing tax avoidance literature by focusing on the effect of an industry characteristic, namely competition. Moreover, this paper will further contribute by taking the effect of foreign activity into account.

III. Data & Methodology

In order to analyze the impact of industry competitiveness on corporate tax avoidance, this paper combines data from Compustat³ and Orbis database. Compustat is a database of U.S. fundamental and market information on active and inactive publicly held companies. Compustat provides more than 300 annual and 100 quarterly income statements, balance sheets, statement of cash flows, and supplement data items on more than 24,000 publicly held companies. It includes data needed for computing tax avoidance measures, several firm characteristics and SIC (industry) codes. Orbis provides data used to compute the measure for industry competitiveness. Orbis includes both listed and non-listed companies active in a certain industry. Therefore, Orbis data provides a stronger measure for industry competition compared to solely Compustat data. Nevertheless, Compustat data is used for firm-level characteristics due to the availability of data and focus on listed firms⁴. A large sample of U.S. firms is taken into account. This section discusses data, design of the tax avoidance and competition measures and empirical specifications.

3.1 Data

In order to empirically analyze this matter, this paper uses a North American Compustat sample covering a sample period from 2007 throughout 2017. First, incomplete observations are filtered out. Next, all firm-year observations with a negative pre-tax income are excluded. Tax avoidance incentives are expected to be of low priority if a firm is suffering losses, and therefore negative pre-tax income observations are left out (Collin, 1998; Klassen and Laplante, 2012). Only manufacturing firms (SIC 20 – 39) are included in the sample due to data availability and the fact that manufacturing industries are a suitable representation for this study. Manufacturing industries are also recognized as secondary sector, sometimes called production sector. This sector includes all industries of human activities that transform raw materials into products or goods, including processing of food, textile manufacturing and petroleum products. Industry competition is straightforward in these industries due to prices of raw materials and converting costs, so high industry margins would faster lead to new entrants than industries that survive on human capital due to higher entry barriers. Therefore, the effect of industry competition on tax

³ Compustat data is collected from the Wharton database (WRDS). <https://wrds-web-wharton-upenn-edu.eur.idm.oclc.org/wrds/index.cfm>

⁴ Listed and non-listed firms share many comparable characteristics, however it remains hard to combine them into one sample due to unobservable differences, such as firm structure, ownership and governance.

avoidance in this sector is most interesting and representative. Also, different industries within the secondary sector show many similarities and are therefore suitable to compare.

This results in a final sample of 8,281 firm-year observations from 2,264 unique firms covering the period 2007-2017. Table I reports the sample composition. Panel A provides total firm-years observations and number of firms for the full sample, where panel B of table I shows the industry distribution by 2-digit SIC codes.

Table I
Sample composition

This table provides the composition of the sample, which consists of 8,281 firm-year observations from 2,264 firms from the Compustat database covering the period 2007-2017. Panel A describes the full sample, where panel B shows the sample divided into 2-digit SIC codes (industry classification). Only manufacturing industries are included due to data availability and theoretical relevance.

<i>Panel A: Sample composition</i>			
	Number of firm-years	Number of firms	
Full sample	8,281	2,264	
<i>Panel B: Industry distribution of sample firm-years per industry</i>			
Industry classification	2-digit SIC code	Number of firm-years	Number of firms
C. Manufacturing			
Food & Kindred Products	20	730	152
Tobacco Products	21	40	8
Textile Mill Products	22	24	6
Apparel & Other Textile Products	23	214	45
Lumber & Wood Products	24	124	35
Furniture & Fixtures	25	116	23
Paper & Allied Products	26	234	46
Printing & Publishing	27	212	49
Chemical & Allied Products	28	1,746	619
Petroleum & Coal Products	29	297	63
Rubber & Miscellaneous Plastics Products	30	114	34
Leather & Leather Products	31	64	12
Stone, Clay, & Glass Products	32	112	34
Primary Metal Industries	33	283	74
Fabricated Metal Products	34	269	61
Industrial Machinery & Equipment	35	981	234
Electronic & Other Electric Equipment	36	1,131	340
Transportation Equipment	37	627	148
Instruments & Related Products	38	846	240
Miscellaneous Manufacturing Industries	39	117	41

As shown in table I, distribution among industries differ significantly. Principally, statistics from this table already show how particular industries are structured. The tobacco industry, for example, indicates only eight unique firms in the sample period, which already provides a sign

of the intensity of competition within this industry. Hence, table I provides the first indications that there are significant differences in terms of competition between these industries.

3.2 Tax avoidance measures

One of the utmost challenges in tax avoidance literature is constructing an accurate and fully-capturing proxy for tax aggressiveness. The problem arises as companies' tax returns are often confidential. Therefore, income reported to tax authorities is not observed directly but must be estimated using available accounting data, as described in Manzon and Plesko (2002) and implemented in Desai and Dharmapala (2006). As previous literature does not provide one superlative proxy, this paper includes four tax avoidance measures. Following Hanlon and Heitzman (2010), this paper explains the four proxies each measure a slightly different type of tax avoidance behavior. The following paragraphs describe the construction of these proxies.

3.2.1 Book effective tax rate (ETR)

Following among others Dyreng et al. (2010) and Armstrong et al. (2012), the first measure this paper includes is the book effective tax rate ($ETR_{i,t}$). This proxy measures tax avoidance activities that directly influence net income. An advantage of using the effective tax rate is the simplicity of the measure compared to other tax avoidance proxies. In addition, ETR is the most commonly used tax avoidance proxy in previous literature despite its' known limitations. This measure reflects tax planning through permanent book-tax differences. According to Wilson (2009), examples of such tax planning are investments in foreign tax havens, investment in certain tax-favored assets and participation in tax shelters that give rise to losses for tax purposes but not for book purposes. Accordingly, a lower ETR reflects a higher likelihood that the firm is conducting some form of tax avoidance activities. It is a fairly straightforward approach that ignores certain relevant activities, such as deferred taxes.

The effective tax rate (ratio) is composed as follows:

$$ETR_{i,t} = \frac{TTE_{i,t}}{PI_{i,t}}$$

Where $ETR_{i,t}$ is the effective tax rate for firm i in year t ; $TTE_{i,t}$ is the total tax expense for firm i in year t ; and $PI_{i,t}$ is pre-tax income for firm i in year t .⁵

⁵ Following McGuire et al. (2012), ETR's with negative denominators are deleted. Furthermore, the non-missing ETR's are winsorized in order to obtain a lowest value of 0 and higher value of 1.

3.2.2 Cash effective tax rate (CETR)

The second measure for tax avoidance is similar to the ETR, but arguably more robust, because the cash effective tax rate (CETR) reflects both permanent and temporary book-tax differences (Watson, 2015). This measure focuses on cash taxes paid instead of total tax expense, which avoids the overstatement of current tax expense. Managers often treat tax avoidance as a practice of minimizing cash taxes paid (Dyreng et al., 2008). Beyond this reasoning, the CETR also allows for strategies that involve effective tax planning (deferred taxes), even when they do not affect the current period financial statement. Therefore, CETR deals with the above-mentioned limitation of ETR. Similar to the ETR, CETR is widely accepted in literature as proxy for tax avoidance and a lower CETR indicates more tax avoidance behavior.

The cash effective tax rate (ratio) is composed as follows:

$$\text{CETR}_{i,t} = \frac{CTP_{i,t}}{PI_{i,t} - SI_{i,t}}$$

Where $\text{CETR}_{i,t}$ is the effective tax rate for firm i in year t ; $CTP_{i,t}$ is cash tax paid for firm i in year t ; $PI_{i,t}$ is pre-tax income for firm i in year t ; and $SI_{i,t}$ are extraordinary (special) items, which are gains or losses that are infrequent, unusual and significant in size.⁶

3.2.3 Book-tax gap and book-tax residuals

Next to the effective tax rate measures, the book-tax gap, a measure constructed by Desai and Dharmapala (2006), is widely discussed and used in more recent literature. Therefore, in constructing the book-tax gap proxy for tax avoidance, this paper follows Desai and Dharmapala (2006). First, the book-tax gap ($PI - Y^T$) is calculated, which is the difference between the book income reported by a firm to its shareholders and the tax income reported to the IRS. Following the research of Desai and Dharmapala (2009), this paper argues book-tax gap differences are attributable to either earnings management or more aggressive forms of tax avoiding activities. Data on accruals is used to account for the component of the book-tax gap that is attributable to earnings management. The total accruals value is measured as accrual earnings minus cash earnings and used as independent variable in the regression model with

⁶ Following McGuire et al. (2012), CETR's with negative denominators are deleted. Furthermore, the non-missing CETR's are winsorized in order to obtain a lowest value of 0 and higher value of 1.

book-tax gap as dependent variable. The residual model for the book-tax gap is used as a more precise measure of more aggressive tax avoidance activity.

First, the book-tax gap ($PI - Y^T$) is calculated, which is the difference between the book income reported by a firm to its shareholders and the tax income reported to the IRS. Since tax income reported to the IRS (Internal Revenue Service) is confidential, this paper follows the estimation for Y^T developed by Manzon and Plesko (2002).

They use current federal tax expense (CFTE⁷) to estimate Y^T . Assuming that a certain firm faces a tax rate t , they state that:

$$[1] \quad CFTE = t Y^T$$

Where t is the tax rate adjusted for possible progressivity in the tax system. In this paper, the sample concerns only U.S. based listed firms in the highest income brackets, so we can use the US corporate tax rate of 35% for the entire sample.

From [1], it follows that the firms' estimated taxable income \hat{Y}^T is:

$$[2] \quad \hat{Y}^T = \frac{CFTE}{t}$$

This estimated taxable income (\hat{Y}^T) is subtracted from the income reported by the firm to its shareholders, to obtain the book-tax gap:

$$[3] \quad BTD_{i,t} = PI_{i,t} - \hat{Y}^T_{i,t}$$

Where $BTD_{i,t}$ reflects the reported book-tax difference from firm i in year t ; $PI_{i,t}$ is the reported income to shareholders for firm i in year t ; and $\hat{Y}^T_{i,t}$ is the estimated taxable income using the above-mentioned construction for firm i in year t .

Desai and Dharmapala (2006) argue that firms reporting zero or negative taxable income presumed to have lessened incentives to engage in tax avoidance. Therefore, this paper restricts the sample to firms that have a positive estimated taxable income ($\hat{Y}^T > 0$). Another reason for excluding those observations is that for a negative taxable income it is not feasible to calculate the total tax expense due to the fact that the marginal tax rate is unclear (i.e. not

⁷ Following Manzon and Plesko (2002), CFTE is obtained from Compustat item 63 (in 2000): Income taxes - Federal

35%). The BTD reflects activities which create permanent and temporary differences between financial statement and book income. According to Wilson (2009), a larger BTD represents more tax sheltering activity as well as higher probability of a firm receiving audit adjustments from the IRS. Accordingly, higher BTD demonstrates more tax avoiding behavior. Therefore, BTD is used as one of the measures for tax avoidance in this paper.

According to Desai and Dharmapala (2006), an increase or decrease in the book-tax gap does not automatically represent a corresponding change in aggressive corporate tax avoidance. Therefore, the measure of corporate tax avoidance must control for other factors. Existing literature argues that the over-reporting of financial income, also known as earnings management, contributes to the measured book-tax gap value (Lev and Nissim, 2004; Hanlon, 2005). Desai and Dharmapala (2006) state that the aim of earnings management is the smoothing of reported income over time in order to reach bonus targets and avoid reporting losses. Healy (1985) argues that earnings management most likely occurs through the exercise of managerial discretion in determining accounting accruals, which are the adjustments to realized cash flows used in calculating the firms' net income. Therefore, following the work of Desai and Dharmapala (2006), this paper continues on the finding that book-tax gap differences are attributable to either earnings management or more aggressive tax avoidance activity. When determining the degree to which earnings management is responsible for the book-tax gap value, data on accruals is used to isolate the component of the book-tax gap value that is attributable to earnings management.

Total accruals are denoted as TA and defined as follows:

$$[4] \quad \text{Total accruals } [TA] = \text{Accrual earnings} - \text{Cash earnings}$$

Here, accrual earnings are determined as the firms' reported net income on the balance sheet and cash earnings denoted as the reported net cash flow from operating activities.

In deriving the adjusted-measure for tax avoidance, this paper will follow the model of Desai and Dharmapala (2006). The book-tax gap used as dependent variable and total accruals as the independent variable:

$$[5] \quad BTD_{i,t} = \beta_1 TA_{i,t} + \mu_i + \varepsilon_{i,t}$$

Where $BT_{i,t}$ is the book-tax gap for firm i in year t ; $TA_{i,t}$ is the total accruals for firm i in year t ; μ_i is the average value of the residual for firm i ; and $\varepsilon_{i,t}$ is the deviation in year t from firm i 's average residual μ_i . In conclusion, this means that the book-tax gap is dependent on total accruals (earnings management) and a residual part interpreted as measure for tax avoidance. Therefore, the formula for tax sheltering activity is as follows:

$$[6] \quad TS_{i,t} = \mu_i + \varepsilon_{i,t}$$

Because the tax avoidance is estimated as a residual, neither $TS_{i,t}$ or its components can be interpreted as the dollar amount of income sheltered from taxes but can be used to proxy the variations in tax sheltering activity within a firm over time. In this paper, the change in industry competition over time is linked to the change in tax sheltering activity, so this measure is appropriate to use in the regression models. This measure indicates permanent differences between book and tax incomes, so it is considered to be representing highly aggressive tax avoidance (Desai and Dharmapala, 2006). Higher values of TS indicate a higher level of tax avoidance.

Table II shows descriptive statistics for all tax avoidance measures and control variables used. As shown, ETR and CETR have a mean of 28.5% and 25.6%, which is significantly lower compared to the statutory U.S. corporate tax rate of 35%, which could be the first sign of tax avoiding activities. BTD shows a mean of 0.072, which indicates that, on average, the reported income is lower than the estimated income for the entire sample. The BT-gap measure incorporates the residuals after the book-tax gap regression controlled for total accruals, so this measure does not directly provide any signs on the level of tax avoiding behavior. Panel B in table II reports the Pearson correlation matrix between these three measures. All correlations are significantly different from zero: the CETR and ETR show a positive correlation and both a negatively correlation with the BT-gap. The relatively low level of correlation between the measures indicate that they all capture different fragments of tax avoidance and/or contain measurement errors, which is in line with theory. Using different measures of tax avoidance with similar results strengthens a possible conclusion.

Table II
Descriptive statistics of tax avoidance measures

This table presents the descriptive statistics for the four difference tax avoidance measures; Effective tax rate, cash effective tax rate, book-tax difference (BTD) and the book-tax gap proxy (Desai and Dharmapala, 2006). Also, the descriptives statistics for all relevant control variables are included. These variables are winsorized at the 99% level in order to account for outliers. See appendix A for elaboration on the composition of the different measures. Panel B reports the correlations between the different measures, including the two-sided p-values in parentheses.

<i>Panel A: descriptive statistics of tax avoidance measures</i>			
Tax avoidance measure	Mean	Standard deviation	
ETR	0.285	0.106	
CETR	0.256	0.130	
BTD	0.072	0.063	
BTD-residuals	0.074	0.046	
Industry profit	0.148	0.046	
Size	7.579	1.508	
Capex	0.045	0.042	
Market-to-book ratio	0.404	0.140	
PPE	0.225	0.170	
Nol	0.868	0.338	
Leverage	0.209	0.223	
ROA	0.144	0.113	
Deferred taxes	0.004	0.028	
Tax haven dummy	0.015	0.124	

<i>Panel B: Pearson correlation matrix</i>			
	ETR	CETR	BTD
CETR	0.357 (0.000)		
BTD	-0.059 (0.000)	-0.175 (0.000)	
BTD-residuals	-0.067 (0.000)	-0.028 (0.060)	0.385 (0.000)

3.3 Industry competition

Intuitively, firms facing greater competition pressure are more motivated to explore any possibility in order to capture a competitive advantage, including tax-avoiding behavior. In other words, firms acting in relatively competitive industries have stronger incentives to avoid tax. In order to measure industry competition this paper uses data from the Orbis database, since this database includes both listed and non-listed companies active in a certain industry. Therefore, using the Orbis database provides a more robust measure of industry competitiveness compared to using Compustat data. The firms are clustered by their 2-digit SIC

industry in order to calculate the Herfindahl-index; the competition measurement used in this paper. Following existing Industrial Organization literature, this paper uses only the Herfindahl-index because of the high correlation with other competition measures, such as above-scale firms competing in an industry and concentration ratios.

The Herfindahl-index is composed as follows:

$$HHI_{j,t} = \sum_{i=1}^n (MS_{i,t})^2$$

Where $HHI_{j,t}$ is the Herfindahl-index for a specific industry j in year t ; and MS_i is the market share of firm i in year t . In this paper, the market share per firm is calculated as sales divided by total sales by the top 50 firms (U.S.) operating in a 2-digit SIC industry. In the case of less than 50 firms competing in a specific industry, all available firms are included in calculating the HHI.

The Herfindahl-index is negatively correlated with industry competition, since it gives much heavier weight to firms with large market shares than to firms with small shares due to squaring of the shares. This corresponds to the theoretical notion that competition is relatively weak in an industry with high concentration of sales in a limited number of firms (a high HHI). In contrast, a low HHI corresponds to low concentration of sales in an industry spread over a large number of firms with limited market shares, and thus a more competitive market. Table III reports the summary statistics of the Herfindahl-index per industry on the two-digit level.

As shown in table III, there are significant differences between industries. Table I already provides the first signs of competitive structure within industries, which are mostly confirmed by table III. When, for example, considering the monopoly of Altria (former Philip Morris International) in the tobacco industry one would expect a corresponding Herfindahl-index. Indeed, the Herfindahl-index from table III confirms the suspected low level of competition in the tobacco industry reflected as a higher HHI. Overall, industries with more competing firms show lower values for the Herfindahl-index.

Table III
Descriptive statistics of Herfindahl-index

This table provides the descriptive statistics of Herfindahl-index (HHI) for the entire sample divided into 2-digit SIC industries. The Herfindahl-index is defined as the sum of squares of market shares (by sales) of all firms competing in an industry and used as an measurement for industry competitiveness. See appendix A for elaboration on the composition of HHI.

<i>Panel A: Sample composition</i>			
Industry classification	2-digit SIC code	Mean	Standard deviation
C. Manufacturing			
Food & Kindred Products	20	0.080	0.010
Tobacco Products	21	0.374	0.014
Textile Mill Products	22	0.361	0.038
Apparel & Other Textile Products	23	0.187	0.020
Lumber & Wood Products	24	0.164	0.040
Furniture & Fixtures	25	0.130	0.020
Paper & Allied Products	26	0.108	0.012
Printing & Publishing	27	0.147	0.032
Chemical & Allied Products	28	0.050	0.004
Petroleum & Coal Products	29	0.173	0.012
Rubber & Miscellaneous Plastics Products	30	0.182	0.009
Leather & Leather Products	31	0.249	0.049
Stone, Clay, & Glass Products	32	0.328	0.028
Primary Metal Industries	33	0.072	0.007
Fabricated Metal Products	34	0.072	0.005
Industrial Machinery & Equipment	35	0.122	0.019
Electronic & Other Electric Equipment	36	0.063	0.003
Transportation Equipment	37	0.106	0.011
Instruments & Related Products	38	0.057	0.006
Miscellaneous Manufacturing Industries	39	0.172	0.035

3.4 Control variables

In order to infer that the level of industry competitiveness affects tax avoidance activities, a selection of control variables is included in the model to account for firm-specific characteristics. This paper follows and combines the control variables used in prior literature, since most use similar models and include similar relevant control variables. Firm characteristics correlated with tax avoidance are included to ensure that results are not driven by fundamental differences between firms. Controls for firm size (SIZE), capital expenditures (CAPEX), growth opportunities (MTB), capital intensity (PPE) and leverage (LEV) are included, because prior research suggests that economies of scale and firm complexity are linked to tax avoidance (Mills et al., 1998; Chen et al. 2010). Following Chen et al. (2010), controls for firm profitability (ROA), and net operating loss carryforwards (NOL) are included to proxy for firms' need to avoid taxes. Furthermore, average industry profit (INDPROFIT)

must be taken into account as established by prior product market competition literature⁸. Also, deferred taxes (DEFTX) are included to control for any deferral strategies. Finally, a dummy for tax haven headquarters (TH) is included, which accounts for the possibility of a firm having its' headquarters in one of the listed tax havens. Appendix I provides an elaboration on variables used in this paper. Table II provides summary statistics for these control variables.

3.5 Empirical specification

The main statement in this paper concerns the interaction between industry competition and tax avoidance on a firm-level. First, the matter whether tax avoidance increases in highly competitive industries is examined. This paper addresses this first hypothesis by using the following empirical specification:

$$\begin{aligned}
 TA_{i,t} = & \beta_1 HHI_{i,j,t} + \beta_2 INDPROFIT_{i,j,t} + \beta_3 SIZE_{i,t} + \beta_4 CAPEX_{i,t} \\
 & + \beta_5 MTB_{i,t} + \beta_6 PPE_{i,t} + \beta_7 NOL_{i,t} + \beta_8 LEV_{i,t} + \beta_9 ROA_{i,t} \\
 & + \beta_{10} DEFTX_{i,t} + \beta_{11} TH_{i,t} + \varepsilon_{i,t}
 \end{aligned}$$

Where the dependent variable $TA_{i,t}$ represents one of the four proxies for tax avoidance used separately in this model. All other variables are discussed in the previous sections. The main variable of interest is $HHI_{i,j,t}$ representing the Herfindahl-index for a specific firm operating in a specific industry⁹. Firm and year fixed effects are included to account for any unobservable components. Location (state) effects are included in the firm fixed effects and therefore control for the potential Delaware impact¹⁰. Furthermore, robust standard errors are clustered at the firm level.

In order to test H1, the above-mentioned model is used in order to find the relationship between industry competition and tax avoidance, controlled for any relevant firm characteristics. Expected is a positive relationship between HHI and ETR and CETR, indicating that lower competition (higher HHI) leads to higher effective tax rates. The expected sign for HHI and

⁸ Average industry profit is commonly used as competition measure (Cai and Liu, 2009), so a high correlation and multicollinearity issue is expected when using it as control variable together with HHI. Therefore, the Pearson correlation test is executed which shows a significantly low correlation (-0.0975) between average industry profit and HHI. In conclusion, this paper includes average industry profit as control variable.

⁹ Many papers find different industry competition measures to be highly correlated, therefore only the Herfindahl-index is used. However, in section IV a robustness check is performed to find a possible difference in outcome when using another industry competition measure.

¹⁰ Dyreng et al. (2012) investigate the effect of Delaware as a tax haven for domestic and international firms. They find that taxes play an important role for firms in determining to have a subsidiary in Delaware. Moreover, firms incorporated in Delaware have between 0.7 and 1.1 percent point lower effective tax rates.

BT-gap and BT-residuals is negative, where lower competition (larger HHI) leads to smaller book-tax differences and smaller upward deviation from the firm-specific residual.

In order to test the second hypothesis, the same model is used, however the sample is split into ‘domestic’ and ‘multinational’ operations. This so-called heterogeneity analysis allows to find whether significant foreign operations affect the results in the main regression. Furthermore, it ensures the robustness of the main model if the results show similarity. As mentioned in section II, foreign operations might influence the level of tax avoidance since it provides significant opportunities for firms to engage in tax avoiding behavior. Since the focus of this model lies in finding the effect of multinational operations, the first step is identifying whether a firm has significant foreign operations. To identify multinationalism of a firm, this study uses Compustat’s *idbflag* variable. This variable indicates whether a company operates Internationally, Domestically, or Both. Observations who are either operating Internationally or Both are defined as ‘multinational’ in this model, while Domestically operating observations are defined as ‘domestic’¹¹. In order to check the robustness of this proxy for foreign income, a different definition for significant foreign operations is included as a robustness check in paragraph 4.2.

IV. Results

In this section, the empirical part of the research is executed and analyzed. The first paragraph provides all output tables for the different regression performed to answer the hypotheses and research question. First of all, results for the main regression are tabulated and discussed. Next, a heterogeneity-analysis is performed in order to capture the effect of significant foreign operations. Following the main outputs, multiple robustness checks are executed and discusses in order to reinforce results from the main model and identify any misspecification errors.

4.1 Regression results

In this paragraph the main tests of the paper are tabulated and discussed. Table IV presents the results of estimating the main model to test the impact of industry competition on all four measures of tax avoidance.

¹¹ As author of this paper, I contacted the Compustat service desk in order to verify the usage of this classification. They confirmed, by email, the use of this variable in classifying multinational activity.

Table IV
Association between industry competition and tax avoidance

This table represents the main regression of this paper. The dependent variables are ETR, CETR, BT-gap and BT-residuals as described in section III. Furthermore, the industry competition measure is the Herfindahl-Index (HHI). The sample over the 2007-2017 period was drawn from Compustat and combined with competitiveness data from Orbis. Companies with missing values or potential outliers are restricted from the model. Robust standard, clustered at the firm level, are presented in the parentheses; *, ** and *** denote significance at the 10%, 5% and 1% levels, respectively.

<i>Independent variable</i>	<i>Dependent variable</i>			
	ETR	CETR	BT-gap	BT-residuals
	(1)	(2)	(3)	(4)
HHI	0.149*** (0.034)	0.172*** (0.044)	-0.031** (0.015)	0.016 (0.016)
Industry profit	0.035 (0.036)	0.171*** (0.048)	-0.025 (0.019)	0.021 (0.016)
Firm size	-0.007*** (0.001)	-0.002 (0.001)	0.004*** (0.001)	-0.002*** (0.001)
Capex	0.001 (0.046)	0.057 (0.070)	0.026 (0.035)	-0.053 (0.048)
Market-to-book ratio	-0.001*** (0.000)	-0.001 (0.000)	0.001** (0.000)	-0.001* (0.000)
PPE	0.016 (0.015)	0.002 (0.021)	-0.015 (0.010)	-0.026*** (0.007)
NOL	-0.019*** (0.005)	-0.029*** (0.005)	0.025*** (0.003)	0.004 (0.003)
Leverage	0.019** (0.009)	-0.007 (0.010)	-0.007 (0.006)	-0.003 (0.005)
ROA	-0.037** (0.016)	-0.092*** (0.022)	0.323*** (0.027)	0.069*** (0.017)
Deferred Taxes	0.188*** (0.018)	-0.032** (0.014)	0.002 (0.002)	-0.055*** (0.004)
Tax haven dummy	-0.024 (0.028)	-0.048* (0.032)	0.011 (0.018)	0.001 (0.001)
Year fixed effect	yes	yes	yes	yes
Firm fixed effect	yes	yes	yes	yes
Number of firm-year observations	5,977	5,616	4,010	4,010
R-squared	0.208	0.123	0.406	0.191

Consistent with the first hypothesis, table IV shows positive coefficient for ETR and CETR. The coefficient for the effective tax rates are highly significant. Moreover, a significant negative relationship between industry competition and book-tax gap is shown. These significant signs are in line with expectations, where higher competition leads to more tax avoidance. On the other hand, the relationship between industry competition and BT-residuals is unexpected. However, the coefficient for BT-residuals is not significant at any significance level. Thus, three out of four measures of tax avoidance significantly indicate that increased

industry competition pushes firms into engaging more in tax avoiding behavior. Though, the proxy including the most aggressive form of tax avoidance, BT-residuals, does not show any significant results. Interestingly, firm size shows signs that indicate larger firms are more engaged in tax avoiding behavior for the first three measures. However, firm size decreases tax avoiding behavior when looking at the most aggressive tax avoidance proxy; BT-residuals. This might be due to firms recognizing and valuing the potential downsides more when engaging in this type of aggressive tax behavior. This adds to the ongoing discussion about the ambiguous relation between size and tax avoidance. Also, higher lagged profitability leads to more tax avoiding behavior, which is in line with existing literature. Surprisingly, the tax haven dummy only shows a significant result for ETR, which is unexpected and not completely in line with existing literature that show highly significant relationships for tax haven dummies. However, this could be explained by the country fixed effects implemented in the model. In line with more recent papers, capital expenditures show insignificant results.

As discussed in section III, in order to test H2 the initial sample is divided into ‘domestic’ and ‘multinational’. This model analyzes the effect of significant operations on the relationship between industry competition and tax avoiding behavior.

In line with the second hypothesis, table V shows significant lower coefficients for domestic firms compared to multinational firms when looking at the effective tax rates and book-tax gap. Also, ETR and CETR coefficients for multinational firms are larger than for the initial sample (Table IV). Again, the measure dealing with the most aggressive form of tax avoidance does not provide significant results on this matter, whereas the relationship between industry competition and book-tax gap for multinational firms is higher than for domestic firms, but insignificant. Similar to table IV, firm size and profitability show similar significant signs. Interestingly, the tax haven dummy is strongly significant and positive for the book-tax gap when splitting the sample. Multinational firms with a tax haven headquarters show a stronger relationship, which could be due to having more operations in this specific tax haven compared to domestic firms.

Table V

Association between industry competition and taxes avoidance controlling for foreign activity

This table represents the second regression of this paper, where the effect of having significant international operations is accounted for. The sample is split into "domestic" and "international", which is defined in the Compustat database under *idflag*. Firms with foreign operations, described as headquarters or other sufficient offices, are considered as "international", otherwise firms are denoted as "domestic". Again, the dependent variables are ETR, CETR, BT-gap and BT-residuals as described in section III. Furthermore, the industry competition measure is the Herfindahl-Index (HHI). The sample over the 2007-2017 period was drawn from Compustat and combined with competitiveness data from Orbis. Companies with missing values or potential outliers are restricted from the model. Robust standard, clustered at the firm level, are presented in the parentheses; *, ** and *** denote significance at the 10%, 5% and 1% levels, respectively.

Independent variable	Dependent variable							
	ETR Domestic	ETR International	CETR Domestic	CETR International	BT-gap Domestic	BT-gap International	BT-residuals Domestic	BT-residuals International
HHI	0.094*** (0.040)	0.301*** (0.062)	0.120** (0.060)	0.386*** (0.082)	-0.032*** (0.012)	-0.066 (0.045)	0.024** (0.012)	-0.002 (0.030)
Industry profit	0.041 (0.042)	0.028 (0.065)	0.132*** (0.065)	0.407*** (0.097)	-0.031* (0.017)	0.006 (0.064)	0.016 (0.014)	0.067* (0.038)
Firm size	-0.006*** (0.002)	-0.006** (0.002)	-0.002 (0.002)	-0.003 (0.003)	0.003*** (0.001)	0.007*** (0.002)	-0.002*** (0.001)	-0.003** (0.001)
Capex	0.039 (0.057)	-0.112 (0.089)	-0.006 (0.002)	0.185 (0.143)	-0.009 (0.030)	0.198*** (0.081)	-0.067 (0.042)	-0.049 (0.017)
Market-to-book ratio	-0.003*** (0.001)	-0.001 (0.000)	-0.0002 (0.000)	-0.009 (0.007)	0.001 (0.001)	0.001 (0.000)	-0.001** (0.000)	0.001 (0.000)
PPE	-0.003 (0.016)	0.081** (0.037)	0.002 (0.024)	0.016 (0.048)	-0.015** (0.007)	0.039** (0.017)	-0.026*** (0.006)	-0.016 (0.019)
NOL	-0.024*** (0.005)	0.002 (0.010)	-0.028*** (0.007)	0.009 (0.011)	0.027*** (0.003)	-0.009 (0.010)	0.004* (0.002)	0.004 (0.007)
Leverage	0.015 (0.011)	0.044** (0.020)	0.008 (0.014)	-0.027 (0.024)	0.006 (0.004)	-0.052** (0.024)	0.006 (0.005)	-0.002 (0.010)
ROA	-0.037** (0.016)	-0.071** (0.038)	-0.082*** (0.029)	-0.126*** (0.075)	0.034*** (0.026)	0.267*** (0.058)	0.076*** (0.019)	0.051** (0.020)
Deferred Taxes	0.186*** (0.020)	0.210*** (0.037)	-0.019* (0.017)	-0.182*** (0.031)	0.002 (0.005)	0.002 (0.020)	-0.056*** (0.004)	-0.037** (0.016)
Tax haven dummy	-0.015 (0.039)	0.015 (0.026)	-0.051 (0.045)	-0.007 (0.023)	0.033** (0.018)	0.103*** (0.028)	0.003 (0.011)	-0.064** (0.029)
Year fixed effect	yes	yes	yes	yes	yes	yes	yes	yes
Firm fixed effect	yes	yes	yes	yes	yes	yes	yes	yes
Number of firm-year observations	4,331	1,646	3,168	1,425	3,425	585	3,425	585
R-squared	0.142	0.101	0.099	0.238	0.423	0.426	0.280	0.184

Overall, these results show that multinational firms show a higher significant relationship between industry competition and tax avoidance. In order to compare these coefficients and to test whether these coefficients are actually statistically different from each other, Stata provides a test called *suest*. This test is performed for all significant coefficients of HHI and shows a significant difference between the coefficients of the different tax avoidance measures. Thus, the results of table V show significant differences for domestic and multinational firms which is in line with the expectations of the second hypothesis.

4.2 Additional robustness checks

Results from table IV are based on a single variable for industry competition, namely the commonly used Herfindahl-index. However, following Cai and Liu (2009), to improve the robustness of this relationship another measure of industry competition is introduced. Cai and Liu (2009) use four measures in their paper, including the number of above-scale firms, Herfindahl-index, the market share accounted for by the largest four firms and the industry average profit margin. In this paper, the fourth measure is used as a control variable¹². The first measure is relatively simple and less strict, since determining whether a firm is above-scale causes some difficulties. Therefore, the alternative measure of the Herfindahl-index is the market share accounted for by the largest four firms in the industry. The following empirical specification is used for the robustness check:

$$\begin{aligned}
 TA_{i,t} = & \beta_1 TopFourFirms_{i,j,t} + \beta_2 INDPROFIT_{i,j,t} + \beta_3 SIZE_{i,t} + \beta_4 CAPEX_{i,t} \\
 & + \beta_5 MTB_{i,t} + \beta_6 PPE_{i,t} + \beta_7 NOL_{i,t} + \beta_8 LEV_{i,t} + \beta_9 ROA_{i,t} \\
 & + \beta_{10} DEFTX_{i,t} + \beta_{11} TH_{i,t} + \varepsilon_{i,t}
 \end{aligned}$$

As shown, Table VI provides additional evidence on the relationship between industry competition, measured as the market share accounted for by the top four firms, and tax avoidance. The results present confirmation of the positive relationship between competition and tax avoidance for both the effective tax rate measurements. In line with table IV, control variables for these measures show similar results. Nevertheless, table VI present a challenging output, since the coefficient between the alternative industry competition measure and book-tax gap becomes positive and insignificant, which is not in line with previous findings. This

¹² As mentioned before, average industry profit is used as a control variable since it shows low correlation with HHI and can therefore be used as control. The correlation between TopFourFirms and industry profit is -0.273 and significant, which is larger than the correlation for HHI but still relatively limited. Again, industry profit is therefore considered as control variable.

shift might be explained by a well-known concentration ratio issue. Concentration ratios may provide misleading results, because a four-firm ratio of 80% (highly uncompetitive) may mean that one firm accounts for 70% of the market and the other 3 firms account for the remaining 10%. In this case, the industry is even less than competitive than the 80% would suggest. Therefore, it is more difficult to draw a conclusion of the market situation solely based on this four-firm concentration ratio. The advantage of the Herfindahl-index is that it takes the largest 50 firms (or all firms available if $n < 50$) and squares each market share, so it provides a more robust classification of industry competitiveness, because it sums up all firms (top 50) separately. Nonetheless, table VI does provide additional evidence since it shows similar outcomes for both effective tax rate measures, which are most commonly used proxies for tax avoidance.

Table VI
Robustness test: Association between industry competition and tax avoidance

This table represents a robustness test for the main regression of this paper, since a different competition measure is included. The dependent variables are ETR, CETR, BT-gap and BT-residuals as described in section III. Furthermore, the industry competition measure is the Top Four Firms (sales) measure, which shows the combined market share, in terms of sales, of the largest four firms in the industry. The sample over the 2007-2017 period was drawn from Compustat and combined with competitiveness data from Orbis. Companies with missing values or potential outliers are restricted from the model. Robust standard, clustered at the firm level, are presented in the parentheses; *, ** and *** denote significance at the 10%, 5% and 1% levels, respectively.

<i>Independent variable</i>	<i>Dependent variable</i>			
	ETR	CETR	BT-gap	BT-residuals
	(1)	(2)	(3)	(4)
Top Four Firms (sales)	0.031*** (0.010)	0.047*** (0.014)	0.003 (0.005)	-0.001 (0.006)
Industry profit	0.046 (0.037)	0.192*** (0.050)	-0.022 (0.020)	0.019 (0.017)
Firm size	-0.006*** (0.001)	-0.002 (0.002)	0.004*** (0.001)	-0.002*** (0.001)
Capex	-0.001 (0.047)	0.055 (0.070)	0.025 (0.035)	-0.052 (0.048)
Market-to-book ratio	-0.004*** (0.000)	-0.002 (0.000)	0.004** (0.000)	-0.002* (0.000)
PPE	0.019 (0.015)	0.002 (0.022)	-0.007 (0.007)	-0.026*** (0.007)
NOL	-0.021*** (0.005)	-0.030*** (0.006)	0.026*** (0.003)	0.003 (0.003)
Leverage	0.019** (0.010)	-0.007 (0.011)	-0.008 (0.007)	-0.001 (0.004)
ROA	-0.036** (0.015)	-0.089*** (0.022)	0.323*** (0.027)	0.069*** (0.017)
Deferred Taxes	0.188*** (0.018)	-0.032** (0.014)	0.001 (0.005)	-0.055*** (0.004)
Tax haven dummy	-0.022 (0.027)	-0.046 (0.031)	0.011 (0.018)	0.001 (0.001)
Year fixed effect	yes	yes	yes	yes
Firm fixed effect	yes	yes	yes	yes
Number of firm-year observations	5,977	5,616	4,010	4,010
R-squared	0.204	0.124	0.405	0.263

To test the robustness of the second hypothesis – the impact of significant foreign operations – the model is adjusted by altering the way these operations are labelled as ‘multinational’ or ‘domestic’. The model used for testing the second hypothesis uses a variable from the Compustat database, which indicates whether a firm operates domestically, internationally, or both. Some question marks can be put to this classification when looking at the data, so an alternative measure is used to check the robustness of the outcomes in table V. Only CETR and BT-gap are included in this robustness check, since both effective tax rate proxies show somewhat similarity and the book-tax residuals measure does not show any significant results.¹³. Essentially, a new classification for significant foreign operations is used. Rego (2003) finds that more extensive foreign operations leads to more tax avoiding behavior. Moreover, Rego (2003) uses a ratio of foreign operations to total operations, which is not suitable for the heterogeneity test in this model. However, Rego (2003) finds a mean of approximately 20% foreign operations for U.S. multinational corporations in a sample covering the period 1990 till 1997. Since economic globalization is extensively noticeable in the years following this period, this paper uses the following classification: a firm is labeled as ‘multinational’ when at least 25% of total operations follow from foreign operations, otherwise a firm is labeled ‘domestic’. Next to data on total income, Compustat separates data on income into domestic and foreign income. Therefore, in this case foreign operations are calculated by foreign income divided by total income.

Table VII presents results in line with the second hypothesis. There is a significant difference between the HHI and CETR for firms with more than 25% foreign income, which is in line with the expected effect of foreign tax avoiding opportunities. Moreover, the industry competition and book-tax gap relation even become positive for firms with less than 25% foreign income, while it remains negative for firms with more than 25% foreign income. Though, the first relation does not show any significance, while the latter relation is highly significant. Looking at the number of observations in the separate regression, this paper argues that it seems more probable that this classification is more suitable in determining significant foreign operations. Hence, table VII confirms and strengthens the findings used in table V that verify the second hypothesis.

¹³ Regressions performed with both the ETR as the BT-residuals show similar results as table V presents. Therefore, these are not included in table VII.

Table VII

Association between industry competition and tax avoidance

This table represents a robustness test for the second hypothesis of this paper, since a different classification for foreign operations is used. The sample is split into firms reporting 'more' or 'less' than 25% foreign income of total income (e.g. Yes or No). Again, the dependent variables are ETR, CETR, BT-gap and BT-residuals as described in section III. Furthermore, the industry competition measure is the Herfindahl-index (HHI). The sample over the 2007-2017 period was drawn from Compustat and combined with competitiveness data from Orbis. Companies with missing values or potential outliers are restricted from the model. Robust standard, clustered at the firm level, are presented in the parentheses; *, ** and *** denote significance at the 10%, 5% and 1% levels, respectively.

<i>Independent variable</i>	<i>pendent variable</i>			
	CETR		BT-gap	
	<i>No</i>	<i>Yes</i>	<i>No</i>	<i>Yes</i>
<i>Foreign income > 25%</i>				
HHI	0.140*** (0.034)	0.154*** (0.045)	0.003 (0.023)	-0.046*** (0.014)
Industry profit	0.035 (0.036)	0.134** (0.061)	0.022 (0.033)	-0.067*** (0.019)
Firm size	-0.007*** (0.001)	-0.003 (0.002)	-0.001 (0.001)	-0.0003 (0.001)
Capex	0.001 (0.046)	0.200* (0.116)	-0.002 (0.041)	-0.083* (0.050)
Market-to-book ratio	-0.011*** (0.000)	-0.001 (0.000)	0.001* (0.006)	-0.001 (0.000)
PPE	0.016 (0.015)	-0.010 (0.031)	0.003 (0.007)	-0.016* (0.008)
NOL	-0.019*** (0.005)	-0.017 (0.011)	0.020*** (0.003)	0.009** (0.004)
Leverage	0.019** (0.009)	0.029* (0.016)	0.004 (0.008)	-0.002 (0.005)
ROA	-0.037** (0.016)	-0.289*** (0.034)	0.254*** (0.032)	0.546*** (0.022)
Deferred Taxes	0.188*** (0.018)	-0.060** (0.026)	-0.002 (0.006)	-0.029*** (0.009)
Tax haven dummy	-0.024 (0.028)	-0.049** (0.024)	-0.008 (0.027)	0.007 (0.013)
Year fixed effect	yes	yes	yes	yes
Firm fixed effect	yes	yes	yes	yes
Number of firm-year observations	3,005	2,611	1,898	2,112
R-squared	0.124	0.121	0.314	0.723

Overall, robustness checks performed in this paragraph are consistent with the finding in paragraph 5.1 and therefore add value to conclusions of the main regressions in this paper.

V. Concluding remarks

Finally, this section combines all results and concludes. In line with previous literature, this paper acknowledges the difficulties working with data when examining tax avoidance, because at this moment there is still no complete proxy that captures all aspects of tax avoiding behavior. Therefore, a discussion paragraph is presented that describes this and other possible limitations, but also constructs suggestions for future research.

5.1 Conclusion

The aim of this study is to analyze whether industry competition affects tax avoiding behavior. Results show significant relationship between these variables for three out of four tax avoidance proxies. Specifically, firms facing higher industry competition are much more likely to engage in tax avoiding behavior than firms facing lower level of industry competition. Moreover, results support the claim cited in section I that firms competing in dominated uncompetitive (monopolistic) industries are less likely to engage in tax avoidance due to greater possible downsides of this behavior. It confirms that firms are responding to threat of competition by avoiding taxes in order to increase their cash flows which helps them outperform their rivals. Unfortunately, results using the proxy that captures the most aggressive form of tax avoidance does not show any significant results. From an U.S. regulator perspective, this conclusion results in significant and long-term revenue loss unless their strategy is altered. According to these results, their current strategy, targeting dominant and large firms, seems obsolete. Furthermore, results demonstrate the importance of significant foreign operations in this relationship. The effect of industry competition on tax avoidance of 'multinational' firms is larger than 'domestic' firms, which can be explained by foreign tax sheltering opportunities. This finding suggests that U.S. tax regulators should shift their focus on U.S. firms with substantial multinational activity active in competitive industries. In contradiction with prior literature, results do not show an expected significant relationship for the tax haven dummy, which could be explained by fixed effects in the model. This study adds to prior research by examining the relationship between industry competition and tax avoidance for a sample located in a high-regulatory environment.

5.2 Limitations and further research

This paper follows prior research in forming proxies for tax avoidance. Despite abundant use of these measures, this paper admits the limitations of each proxy. Unfortunately, there is not one solid proxy that captures all aspects of tax avoiding behavior. Proxies used in this paper all capture a slightly different aspect of tax avoidance ranging from earnings management to aggressive tax planning. Therefore, using four different proxies improves the robustness of the outcomes and therefore any conclusions drawn. Still, duplicating this research with different tax avoidance proxies might alter the results, although those proxies are not yet available. Also, the model included several firm-specific control variables that have shown to be of importance when studying tax avoidance. Nevertheless, it is feasible that one or more imperative controls are left out, which makes the outcome less trustworthy. Additionally, examining tax avoidance is the main target of this paper. However, the used tax avoidance proxies do not fully capture any differences between legal tax avoidance and illegal tax evasion, so caution is needed when interpreting the final conclusions. Lastly, this paper uses a sample of U.S. manufacturing firms (SIC 20 – 39) due to data restrictions and since these industries are a good representation in this matter, because competition is more straightforward and important compared to human capital-intensive industries. Still, it is not possible using manufacturing industries as a representation for the entire market which forms a limitation for future research. Another limitation is the industry classification used in this study. Firms are classified using 2-digit SIC codes, which is quite a broad classification, especially because most firms are large and global corporations. Therefore, future studies might classify industries less broad if data availability allows them to.

On the other hand, this paper provides an interesting foundation for future research in the tax avoidance area. Focusing on industry characteristics in relation to tax avoidance is relatively new, and therefore provides opportunities. As a new corporate tax law is introduced in the U.S., it might be particularly interesting to recreate this research with a sample covering a period of years following this tax reform. Particularly, such a research would show whether significant foreign operations are still so meaningful, since the ‘local’ corporate tax rate will be lower and therefore incentives to invest and operate abroad might alter. Also, in line with this paper, it is interesting to go deeper into the strategy of regulators in classifying tax avoiding behavior and the law system coping with it.

VI. References

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APPENDIX

Appendix I Definitions of variables

Variable definitions.

<i>Variable</i>	<i>Definition</i>
ETR	Effective tax rate calculated by dividing a firm's total tax expense by their pre-tax book income. ETR's with negative denominators are excluded. Moreover, ETR's are winsorized so that no ETR exceeds 1 or is less than 0.
CETR	Cash effective tax rate calculated by dividing a firm's cash taxes paid by pre-tax book income less special items. CETR's with negative denominators are excluded. Moreover, CETR's are winsorized so that no CETR exceeds 1 or is less than 0.
BTD	Book-tax differences calculated by taking pre-tax income subtracting estimated taxable income (scaled by lagged total assets). Firms with negative reported pre-tax income are excluded. BTD's are winsorized at the 99% level.
BTD-residuals	BTD-residuals are the residuals of a regression of permanent book-tax differences on total accruals.
Industry Profit	Industry profit composed as average industry return on assets.
Size	Firm size calculated as the natural logarithm of sales.
Capex	Capital expenditures calculated as firm's total capital expenditures (R&D expenses) divided by lagged total assets.
Market-to-book Ratio	Market to book ratio calculated as the market value of equity divided by the book value of equity.
PPE	Property, plant and equipment calculated as net property, plant and equipment divided by lagged total assets
NOL	Net operating loss used a dummy variable that equals '1' if there is a tax loss carry forward.
Leverage	Financial debt as percentage of total shareholders' equity and liabilities scaled by lagged total assets.
ROA	Return on assets calculated as income before extraordinary items divided by total assets.
Deferred taxes	Deferred taxes calculates as firm's lagged deferred taxes divided by lagged total assets.
Tax haven dummy	Taks haven dummy used as a dummy variable that equals '1' if a firm's headquarters is in a reported taks haven, including Luxembourg, Cayman islands and Ireland.