

Customer-Supplier Relationships and Corporate Tax Avoidance

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May 2014

ABSTRACT

We find that close customer-supplier relationships facilitate tax avoidance by both principal customers and their dependent suppliers. We investigate two mechanisms by which firms in these relationships avoid taxes. First, we find evidence that principal customers engage in a tax strategy involving centralized procurement by tax haven subsidiaries. Second, we find that close customer-supplier relationships promote the diffusion of tax avoidance knowledge from principal customers, who tend to be relatively large and sophisticated, to their dependent suppliers, who tend to be smaller and less sophisticated. Our study provides evidence of the importance of tax avoidance as a source of gains from these relationships.

JEL Classification: H25, H26, L14

Keywords: Tax avoidance, customers, suppliers, stakeholder theory, supply chain

* Corresponding author. We appreciate the helpful comments of Vinayak Deshpande, John Gallemore, Michelle Hanlon, Jim Omartian, Kelly Wentland, Min Zhu, and participants at the UNC Conference on Tax-Efficient Supply Chain Management. We thank Ke Wang for outstanding research assistance.

1. Introduction

A fundamental principle of tax avoidance is that it can rarely be done in isolation (Scholes, Wolfson, Erickson, Hanlon, Maydew, and Shevlin, 2014). Tax avoidance almost invariably affects or is affected by relationships with other parties (Shackelford and Shevlin, 2001; Hanlon and Heitzman, 2010). Researchers have examined the influence of several important relationships on tax avoidance, including relationships with owners (Chen, Chen, Cheng, and Shevlin, 2010), employees (Chyz, Leung, Li, and Rui, 2013), joint-venture partners (Shevlin, 1987), potential acquirers (Erickson, 1998), and other firms via board interlocks (Brown, 2011). Understanding the influence of these relationships is important for explaining why such a large variation in tax avoidance exists across firms (Dyreng, Hanlon, and Maydew, 2008).

In the recent finance and accounting literature, researchers have come to stress the importance of customer-supplier relationships (e.g., Hertz, Li, Officer, and Rodgers, 2008). However, the role of customer-supplier relationships in tax avoidance is for the most part unknown. This gap in the literature is surprising given that most prominent tax advisors, including the Big Four accounting firms (i.e., Ernst & Young, Deloitte Touche Tohmatsu, KPMG and PricewaterhouseCoopers), provide consulting services on tax efficient supply chain management, such as procurement center strategies (Gilson, Wells, Feinberg, and Newman, 2014). The strategies generally result in the shifting of income into low tax jurisdictions, an area of growing interest among researchers (Dyreng and Lindsey, 2009; Dyreng, Lindsey, and Thornock, 2013b). Indeed, tax avoidance via the supply chain has captured the attention of policy-makers, as evidenced by recent Senate hearings involving Caterpillar (U.S. Senate, 2014). According to the Senate report, Caterpillar was able to reduce its U.S. taxes by \$2.4 billion by

tax planning related to its supply chain.¹ The Caterpillar case received extensive coverage in the popular press such as the *Wall Street Journal*, *Financial Times*, and *Reuters*.² However, not every firm is able to engage in tax strategies such as the one used by Caterpillar. We posit that close customer-supplier relationships create opportunities for tax avoidance, particularly supply chain-related tax avoidance, and also facilitate the diffusion of tax avoidance knowledge across firms.³

In the United States, firms are required to disclose the existence of their principal customers, defined as those that account for at least 10% of a firm's total sales. Taking advantage of this disclosure, we classify all Compustat firms into three categories: principal customer firms, dependent supplier firms, and other Compustat firms. Specifically, we define a firm as a principal customer firm if the firm is reported as a principal customer by at least one firm and a firm as a dependent supplier firm if the firm reports at least one principal customer in a specific year. All other firms that are neither principal customers nor dependent suppliers are defined as "other Compustat firms."⁴ In a multiple regression framework, we examine whether firms in significant customer-supplier relationships (i.e., principal customer firms or dependent supplier firms) have a different degree of tax avoidance relative to other Compustat firms.

Besides the advantage of data availability, we focus on the *principal customer-dependent* supplier relationship in our tax avoidance setting for three main reasons. First, the loss of a principal customer usually leads to a significant decline of the dependent supplier's performance

¹ See Section 2.3 for a detailed discussion of Caterpillar's Swiss tax strategy.

² See, for example, Hagerty (2014a, 2014b, 2014c, 2014d), Hagerty and McKinnon (2014), Munshi and Houlder (2014), and Temple-West (2014).

³ Following prior research, we use the term "tax avoidance" to refer to the reduction of a firm's taxes relative to its pre-tax income, with no connotation of anything improper, whereas the term "aggressive tax avoidance" refers to strategies that may fall into the grey area of the law.

⁴ We provide a detailed discussion of these three types of firms in Section 3. On average, 12%, 34%, and 57% of Compustat firms are classified as principal customer firms, dependent supplier firms, and other Compustat firms, respectively. In addition, the overlap of principal customers and dependent suppliers is small: Only 3% of firm-year observations are simultaneously classified as principal customer and dependent supplier firms.

given that the average sales to principal customers represent more than 35% of a dependent supplier's total sales (Hertzel et al. 2008; Cen, Dasgupta, and Sen, 2014). On the other hand, a typical principal customer usually has many dependent suppliers and the input from each individual dependent supplier, on average, accounts for less than 1% of a principal customer's cost of goods sold. Therefore, the loss of one particular supplier may not pose a critical threat to the principal customer. This asymmetry in mutual influence and bargaining position implies that, to avoid potential relationship disruption and termination, dependent suppliers have a strong economic incentive to cater to their big customers' requests.

Second, the repeated interactions with important customers or suppliers requires and cultivates mutual trust and confidentiality in information sharing, which is an essential element for efficient communication and coordination (Li and Zhang, 2008). The efficient communication and coordination between principal customers and dependent suppliers can then facilitate tax planning activities of these firms. Moreover, principal customers can have the confidence that their dependent suppliers will cooperate with them because these suppliers cannot afford the economic consequence of relationship termination. For example, a dependent supplier might be less likely to question a particular transaction with a tax haven affiliate of the principal customer than would another third party firm. In the case of Caterpillar, the dependent suppliers are more likely to cooperate with its change in procurement arrangements that the suppliers have to work with CSARL in the financial transaction (i.e., contracts and invoicing are with CSARL) and with Caterpillar in the product transaction after the implementation of the Swiss tax strategy.⁵ Finally, the close principal-customer relationship can facilitate the transfer of tax planning knowledge from the principal customers, who are relatively large and sophisticated, to the dependent suppliers, who tend to be smaller and less sophisticated.

⁵ CSARL is a subsidiary of Caterpillar located in Switzerland.

Bearing the above observations in mind, we first look at the effect of principal customer status on tax avoidance. We argue that principal customer firms are better able to take advantage of tax planning opportunities involving their supply chains. Our regression analysis shows that principal customer firms have significantly lower cash effective tax rates (CASH ETRs) than other Compustat firms, after controlling for a battery of firm-level characteristics that are potential determinants of effective tax rates, as well as industry and year fixed effects.⁶ Moreover, we find that the number of dependent suppliers for a principal customer firm is negatively and significantly associated with the principal customer firm's CASH ETRs, suggesting that principal customers with more extensive dependent supplier networks can avoid more taxes. Finally, we show that principle customer firms with long-term dependent suppliers have significantly lower CASH ETRs than principle customer firms without long-term dependent suppliers, suggesting that principal customers with more loyal and cooperative dependent suppliers can avoid more taxes.

We next examine a potential mechanism by which principal customers are better able to avoid taxes. Based on the Senate investigation of Caterpillar (U.S. Senate, 2014) and articles in the tax practitioner literature (e.g., Gilson et al., 2014), we examine the use of strategies that shift income to procurement subsidiaries in low-tax jurisdictions. We examine principal customers with tax haven subsidiaries and principal customers that mention the word "procurement" or variations thereof in their 10-K filings. We find that both are associated with lower CASH ETRs for principal customers. The lowest CASH ETRs (i.e., most tax avoidance) are for principal customer firms that have a tax haven subsidiary and that mention procurement in their 10-Ks:

⁶ All the main results are robust to the use of alternative measures of tax avoidance, including GAAP effective tax rates and long-run cash effective tax rates.

The average CASH ETR for this group of principal customers is five percentage points (20% of the mean CASH ETR) lower than other Compustat firms in our sample.

We next look at the dependent supplier firms, which are typically much smaller and less sophisticated than their principal customers. Prior research shows that tax planning ideas spread through business networks, such as board of director interlocks (Brown, 2011; Brown and Drake, 2014). The close ties between dependent suppliers and their principal customers can provide an avenue for the spread of information about tax avoidance activities. For example, principal customers can share their tax planning expertise (e.g., in-house tax experts or recommending external advisors) with their dependent suppliers.

Consistent with dependent suppliers avoiding more taxes, we find that dependent supplier firms have significantly lower CASH ETRs than other Compustat firms, after controlling for other determinants of tax avoidance. Moreover, there is a significantly negative association between a dependent supplier firm's CASH ETRs and the proportion of total sales to its principal customers, suggesting that suppliers with stronger relationships with principal customers can avoid more taxes. In addition, dependent supplier firms with long-term principal customers have significantly lower CASH ETRs than other dependent supplier firms. Consistent with tax information/knowledge transfer, dependent supplier firms' CASH ETRs are positively associated with the CASH ETRs of their principal customers and the association is stronger when the headquarters of the dependent supplier firms are closer in geographical distance to their principal customers' headquarters (Brown, 2011; Brown and Drake, 2014). In addition, we find a significant reduction in supplier firms' CASH ETRs after the relationship establishment with principal customers, relative to a sample of control firms with similar size, similar *ex-ante* CASH ETRs, the same industry, but without principal customers. This effect is particularly strong when

the principal customers have very low *ex-ante* CASH ETRs, which is again consistent with the diffusion of tax avoidance knowledge from principal customers to dependent suppliers (Brown and Drake, 2014).

While our results based on effective tax rates are consistent with principal customer and dependent supplier firms generally avoiding more income taxes, they do not tell us whether these firms employ tax strategies that are near the aggressive end of the tax strategy spectrum. To shed some light on aggressive tax planning, we construct several measures of “tax aggressiveness,” which are supposed to capture the most risky forms of tax avoidance. These measures include the tax shelter prediction score (*SHELTER*) of Wilson (2009), the discretionary book-tax difference (*DTAX*) of Frank et al. (2009), the ending balance of unrecognized tax benefits (*UTB*), and the predicted level of uncertain tax benefits (*Pred_UTB*) of Rego and Wilson (2012). Using these measures of tax aggressiveness, we find strong evidence that principal customer (dependent supplier) firms are more (less) tax aggressive than other Compustat firms. The different findings regarding aggressive tax planning of principal customers and dependent suppliers are likely to be driven by the asymmetric bargaining positions in the customer-supplier relationship.⁷

Our study contributes to the emerging literature on the determinants of corporate tax avoidance (Hanlon and Heitzman, 2010). Recent studies have focused on the manager-shareholder relationship by examining the effects of managerial compensation contracts, ownership structure, and corporate governance on tax avoidance (e.g., Armstrong, Blouin, and Larcker, 2012, 2013; Chen et al., 2010; Desai and Dharmapala, 2006; Phillips 2003; Rego and Wilson, 2012). We advance this literature by examining how customer-supplier relationships affect the extent of tax avoidance. Our research is also related to the findings of Rego (2003), Lisowsky (2010), and Dyreng et al. (2013b) that firms with foreign operations and subsidiaries in

⁷ See Section 6.2 for more detailed discussions on risky tax planning.

tax havens have more opportunities to avoid taxes. Our results suggest that firms with tax haven subsidiaries *and* with extensive dependent-supplier networks (or firms with large corporate customers) engage in more tax avoidance than other firms with subsidiaries in tax havens. Moreover, we find evidence in support of two mechanisms through which principal-customer relationships enhance tax avoidance: by facilitating procurement strategies via tax haven subsidiaries, and by facilitating information transfer between principal customers and dependent suppliers. In this manner, we address calls for research to get inside the “black box” to better understand how tax avoidance takes place (Hanlon and Heitzman, 2010).

Our research also adds to the literature of the stakeholder theory of corporate finance and accounting. One stream of research in this literature examines how information diffusion along the supply chain affects the operating and financial performance of customers and suppliers (e.g., Hertz et al., 2008; Cohen and Frazzini, 2008). Another stream of research investigates how customer-supplier relationships affect various aspects of corporate policy or strategy, such as capital structure (Kale and Shahruh, 2007; Banerjee, Dasgupta, and Kim, 2008), corporate disclosure (Hui, Klasa, and Yeung., 2012; Cen et al., 2014), contract design (Costello, 2013), dividend policy (Wang, 2012), mergers and acquisitions (Fee and Thomas, 2004; Cen et al., 2013), and ownership structure (Fee, Hadlock, and Thomas, 2006). We extend this literature by showing that customer-supplier relationships also have a significant effect on corporate tax planning.

The findings are also relevant for policy-makers, who have expressed concerns about such strategies but lack broad empirical evidence about them. For example, the OECD has recently undertaken a major initiative aimed at what it terms “base erosion” in which multinational firms are able to shift large amounts of their income into tax haven affiliates

(OECD, 2013). Policy-makers in the U.S. are equally concerned, as illustrated by the U.S. Senate hearings scrutinizing individual companies (e.g., U.S. Senate, 2014). By providing rigorous empirical evidence of the influence of customer-supplier relationships on tax avoidance, we contribute to a more complete and in-depth understanding of how tax avoidance takes place and the conditions that give rise to it, both of which are necessary precursors to informed policy-making.

In the next section, we briefly review the related literature and present our hypotheses. Section 3 discusses data and measurement of key variables. Section 4 presents our main empirical analysis. Section 5 conducts several additional tests and robustness checks. Section 6 concludes.

2. Related literature and hypotheses

2.1. Prior research on the determinants of tax avoidance

Corporate tax avoidance represents activities or transactions that reduce a firm's explicit taxes (e.g., Dyreng et al., 2008). Like investment activities, successful tax avoidance can enhance firm performance whereas unsuccessful tax avoidance can decrease firm value, and different types of avoidance activities can have different levels of inherent risks. Hanlon and Heitzman (2010) view tax avoidance as a continuum of tax planning strategies ranging from low risk activities such as municipal bond investments to highly risky or aggressive activities. Early research suggests large returns to investments in tax planning (Mills, Erickson, and Maydew, 1998), although research has struggled to explain why tax avoidance appears to be pervasive in some firms but not others.

A major focus of the research has been to investigate the factors that determine firms' tax avoidance, and what tax avoidance activities firms appear to use. Rego (2003) finds that more

profitable firms have lower ETRs, suggesting that these firms have more incentives and opportunities to engage in tax planning. The author further shows that multinational corporations with more extensive foreign operations have lower worldwide ETRs, consistent with multinational corporations having greater opportunities to avoid tax. Consistent with Rego (2003), Wilson (2009) and Lisowsky (2010) find that firms with foreign operations and subsidiaries in tax havens are more likely to use tax shelters. Dyreng and Lindsey (2009) show that U.S. multinational firms with material operations in tax haven countries have lower worldwide effective tax rates than firms without operations in tax haven countries. Dyreng et al. (2013b) find that firms with subsidiaries in Delaware have more opportunities to avoid tax, supporting the claim that Delaware is a domestic tax haven. De Simone (2013) finds that the adoption of IFRS increases transfer pricing flexibility and leads to more tax-motivated profit shifting. Gallemore and Labro (2013) show that high quality internal information environment facilitates tax avoidance by making tax planning opportunities more visible and tax planning activities better coordinated. Hoopes, Mescall, and Pittman (2012) find that stricter tax enforcement by IRS reduces corporate tax avoidance. More recently, Brown (2011) and Brown and Drake (2014) examine the spread of tax planning ideas through social networks. Specifically, Brown and Drake (2014) find that firms with greater board ties to low-tax firms have lower cash tax rates, consistent with information sharing regarding tax strategies among these firms.⁸

An important subset of tax avoidance research focuses on the shareholder-manager relationship and incentives for tax planning. Phillips (2003) finds that compensating business unit managers on an after-tax basis is related to lower effective tax rates. Desai and Dharmapala (2006) argue that tax avoidance arrangements can facilitate managerial rent extraction or

⁸ Another line of research examines how tax planning motivates important corporate policies, such as cash holdings (Hanlon et al., 2013) and internal ownership structure (Dyreng et al., 2013a; Lewellen and Robinson, 2013). See Hanlon and Heitzman (2010) for a more complete review of the tax avoidance literature.

resource diversion. The authors find that executive equity incentives decrease tax avoidance for firms with weak governance, suggesting that equity incentives reduce tax avoidance activities motivated by managerial diversion. Dyreng, Hanlon, and Maydew (2010) show that individual executives appear to have a large influence on their firm's tax avoidance activities, incremental to firm characteristics, although the authors are unable to explain *ex ante* which individual executives will emphasize tax avoidance. Chen et al. (2010) show a negative association between family ownership and tax avoidance, consistent with the argument that family firms forgo tax benefits to alleviate minority shareholders' concern of resource diversion by family owners. Armstrong et al. (2012) find that the incentive compensation of the tax director is negatively related to GAAP ETR but not CASH ETR. Rego and Wilson (2012) show that CEO equity risk incentives are positively related to aggressive or risky tax planning. We extend the tax avoidance literature from relationships in prior research, such as the shareholder-manager relationship, to the customer-supplier relationship.

2.2. Prior research on the effect of customer-supplier relationships

An emerging literature investigates how customer-supplier relationships affect operating and financial performance of customers and suppliers. Cannon and Homburg (2001) find that better communication and coordination between customers and suppliers is associated with lower customer operating costs. Herztel et al. (2008) find that the bankruptcy filings of principal customers lead to a negative and significant stock price effect on their dependent suppliers. Cohen and Frazzini (2008) shows that the stock returns of principal customers can predict future returns of their dependent suppliers due to investors' limited attention. Patatoukas (2012) finds that firms with a more concentrated customer base have lower operating expense, higher asset turnover, and better accounting performance.

Another strand of this literature focuses on how a firm's relationship with its customers and suppliers affects various aspects of corporate decisions. Kale and Shahrur (2007) and Banerjee et al. (2008) find that firms reduce their leverage as a commitment to induce more relationship-specific investments from their customers and suppliers. Raman and Shahrur (2008) find that relationship-specific investments by suppliers/customers are positively related to earnings management, consistent with the argument that firms in a close customer-supplier relationship have opportunistic incentives to increase their stakeholders' perceived revenues and decrease the perceived risks from the relationship. Wang (2012) finds that firms with more important customer-supplier relationships tend to make lower dividend payments to shareholders. Hui et al. (2012) and Cen et al. (2014) both focus on the role of customer-supplier relationships on corporate disclosure policies. Hui et al. (2012) find that firms with powerful customers or suppliers tend to be more conservative and recognize economic losses more quickly than gains in reporting accounting earnings. Cen et al. (2014) suggest that, under a litigation setting, firms with principal customers have incentives to reveal good news quickly and strategically withhold bad news relative to firms without principal customers. Fee and Thomas (2004) and Cen et al. (2013) investigate how customer-supplier relationships interact with corporate decisions in mergers and acquisitions. Fee and Thomas (2004) find that horizontal mergers generate no significant impact on customer firms' operating and financial performance but lead to a significant decline of suppliers' cash flow margins, which suggests that the gain of horizontal mergers is from improved product efficiency instead of increased monopolistic collusion. Cen et al. (2013) suggest that hostile takeovers, traditionally known as an effective corporate governance mechanism, can be disruptive to firms with important customer-supplier relationships. For the effect of supply-chain relationships on ownership structure, Fee et al.

(2006) find that both contractual incompleteness and financial market frictions are important in the decision of a customer firm to take an equity stake in its suppliers.

2.3. Caterpillar's Tax Strategy

Before turning to our hypothesis, it is useful to explore actual tax strategies that firms in customer-supplier relationships have a unique advantage in structuring. In this subsection, we discuss the case of Caterpillar Inc. (Caterpillar), drawing mainly on the U.S. Senate report of “Caterpillar’s Offshore Tax Strategy.”⁹ Caterpillar, a multinational corporation headquartered in the United States, is the world’s leading manufacturer of construction and mining equipment, diesel and natural gas engines, industrial gas turbines, and diesel-electric locomotives. According to Caterpillar’s documents, while the company typically earns a small profit margin from the initial sales of its machines, its replacement parts business has a high profit margin and generates steady earnings for Caterpillar. The replacement parts, also known as “purchased finished replacement parts (PFRPs),” are produced primarily by third party suppliers. The PFRPs carry the Caterpillar brand and are packaged as Caterpillar products. While Caterpillar does not own most of its suppliers, it exercises oversight of them to maintain product quality and protect its brand. At times, Caterpillar stations its own personnel on site at supplier plants to oversee operations and promote Six Sigma compliance. Currently, approximately half of Caterpillar’s third-party PFRPs suppliers are located in the United States.

Around 1998, Caterpillar began to implement a supply chain tax strategy designed by PricewaterhouseCoopers, building on Caterpillar’s already relatively centralized procurement.¹⁰ As part of the strategy, Caterpillar consolidated several purchasing entities into a single Swiss

⁹ The report is available at: <http://www.hsgac.senate.gov/download/report-caterpillars-offshore-tax-strategy-april-1-2014>.

¹⁰ PricewaterhouseCoopers was paid \$55 million for developing and implementing the supply chain tax strategy for Caterpillar.

subsidiary, known as CSARL. CSARL was to act as the global purchaser of Caterpillar replacement parts. After the implementation of the supply chain tax strategy, Caterpillar's third party suppliers sold Caterpillar brand replacement parts directly to CSARL, which then sold them to Caterpillar or Caterpillar's non-U.S. dealers (Figure 1). For the sales of replacement parts to non-U.S. dealers, the strategy resulted in much of the income being attributed to CSARL, and thus subject to tax in Switzerland at much lower rates than in the United States.¹¹ There are many variations on this strategy in existence, but the general idea is to make the subsidiary in the low-tax jurisdiction be responsible for high-value activities (e.g., procurement expertise) and be the residual claimant within the firm. In most cases, the goods do not physically travel through the tax haven. The key is the high-value aspects of the procurement are centralized into the tax haven subsidiary.

The third party suppliers played an important and subtle role in Caterpillar's supply chain tax strategy: They have to work with CSARL in the financial transaction (i.e., contracts and invoicing are with CSARL) and with Caterpillar in the product transaction (i.e., the product quality and physical inventory delivery are monitored by Caterpillar under a service license agreement between CSARL and Caterpillar).¹² Therefore, the implementation of this strategy required a high level of coordination and trust between Caterpillar and its suppliers.¹³

According to the Senate report, the supply chain tax strategy helps Caterpillar shift 85% or more profits of the replacement parts from the United States to Switzerland, where Caterpillar had negotiated an effective corporate tax rate of 4% to 6%. The Senate report estimated that over

¹¹ Strictly speaking this is a deferral strategy. Since the ultimate parent in Caterpillar's legal structure is a U.S. corporation, presumably at some point the income in the Swiss entity will be repatriated to the U.S. parent and subject to U.S. taxation.

¹² CSARL paid Caterpillar a fee (costs plus 5%) in exchange of Caterpillar's management and sales of replacement parts, including monitoring the third-party suppliers.

¹³ It took Caterpillar five years to fully implement this strategy.

the period 2000 to 2012, the supply chain strategy reduced Caterpillar's U.S. taxes by \$2.4 billion. In the next section, we discuss how close customer-supplier relationships facilitate the implementation of supply chain tax strategies similar to that used by Caterpillar.

2.4. Hypotheses

In this paper, we focus on the bilateral relationship between principal customers and their dependent suppliers (e.g., Banerjee et al., 2008). For the customer side, we argue that principal customer firms can potentially avoid more income taxes because they have more opportunities and lower implementation costs in tax planning involving suppliers. Many tax strategies, such as the one used by Caterpillar, require the involvement of a third party (e.g., dependent suppliers). Principal customers have a natural advantage in implementing such tax planning transactions because of two important characteristics of the supply chain relationship. First, given that sales to principal customers always constitute a significant part of a dependent supplier's total sales (on average 39.6% in our sample), the exit of principal customers has a devastating impact on the dependent supplier's operating and financial performance. As a result, dependent suppliers have a strong economic incentive to cater to their big customers' requests to avoid potential relationship disruption and termination, leading to better coordination in tax planning activities of principal customers involving their suppliers (Gallemore and Labro, 2013).

Second, a significant customer-supplier relationship with repeated transactions cultivates, and in fact requires, a high level of mutual trust between the principal customers and their dependent suppliers. One important reason is that relationship-specific investments often involve the transferring of sensitive information and technology between the two parties (e.g., Li and Zhang, 2008). For example, in training its suppliers to produce parts for a new generation of iPad or iPhone, Apple needs to have trust in its suppliers not to leak the information and technology to

its competitors. In a sense, principal customers' trust in their dependent suppliers is also grounded on their credible threat of exit: Principal customers have the confidence that their dependent suppliers will cooperate because these suppliers cannot afford the economic consequence of relationship termination. In the case of Caterpillar, the dependent suppliers are more likely to cooperate with its change in procurement arrangements (i.e., requiring Caterpillar's suppliers of replacement parts, which were mostly U.S. suppliers, to sell to its Swiss affiliate instead of Caterpillar U.S.). In addition, for a customer firm engaging in tax planning at the aggressive end of the tax avoidance continuum, its dependent suppliers are less likely to challenge or whistle-blow an aggressive strategy.¹⁴

The close relationship between principle customers and dependent suppliers can also benefit the supplier firms, although the supplier firms are unlikely to engage in sophisticated tax planning transactions by themselves. Because of better communication and coordination, firms in a close customer-supplier relationship can organize their bilateral trading activities in optimal tax saving ways. For example, principal customers can help their dependent suppliers to minimize taxes by arranging title transfers in zero or low tax states where the principal customers have warehouses or subsidiaries.¹⁵ Moreover, the dependent suppliers can also learn from their principal customers regarding tax avoidance strategies. Because of their small size and limited resources, dependent suppliers are unlikely to be able to develop their own tax avoidance strategies. Their principle customers can be effective in sharing information and referring them to their network of tax advisors (Brown, 2011; Brown and Drake, 2014). Based on the above

¹⁴ The threat of whistle-blowing is very real (Bowen et al., 2010; Dyck et al., 2010). This is true even for tax strategies that have been vetted by outside tax advisors. The strategy employed by Caterpillar reportedly caught the attention of the U.S. Senate after it was disclosed in a lawsuit involving a former Caterpillar employee (U.S. Senate, 2014). Apart from the costs of attracting the scrutiny of policy-makers and tax authorities, firms appear to be wary of reputational consequences of adverse press coverage, although empirical evidence of lasting reputational effects is mixed (Gallemore et al., 2013).

¹⁵ The "throwback" rule can prevent this type of tax avoidance strategy. However, not all states have the throwback rule.

discussions, we predict that firms in close customer-supplier relationships can avoid more taxes.

***Prediction:** Principal customer firms/dependent supplier firms have lower effective tax rates than other Compustat firms, ceteris paribus.*

Although our discussions above suggest that principal customer firms and dependent supplier firms can avoid more taxes, there are competing arguments. The reputation concern is one of them. For example, prior research argues that the public revelation of tax avoidance can damage a firm's reputation among consumers (e.g., Austin and Wilson, 2013; Hanlon and Slemrod, 2009). This concern over reputation is particularly relevant for the principal customer firms in our sample, such as Caterpillar and Walmart, which have very valuable brands. As a result, there is a possibility that these principle customer firms engage in less tax avoidance activities to avoid potential damage of their reputation.

3. Data and variable measurement

3.1. Sample and data sources

The initial sample includes all firm-year observations in the Compustat Databases over the period 1994 to 2009. We start our sample from 1994 because two regulatory events in 1993 likely affect the consistent measurement of our tax avoidance variables. First, FAS 109, Accounting for Income Taxes, was enacted, which changed the accounting for income taxes. Second, the U.S. statutory corporate income tax rate increased from 34% to 35% in 1994. Following prior research (e.g., Chen et al., 2010; Dyreng, Hanlon, and Maydew, 2014; Hanlon, Maydew, and Saavedra, 2013), we remove firm-year observations with negative pre-tax income or book value, with non-positive sales, or with total assets of less than \$1 million. Firms from the financial services and utilities industries are also excluded. We then drop observations with unavailable information from Compustat in calculating our key tax avoidance variable and other

control variables. These screening criteria yield a final full sample of 42,565 firm–years. Table 1 provides the sample distribution across time and industry. On average, 12%, 34%, and 57% of Compustat firms are classified as principal customer firms, dependent supplier firms, and other Compustat firms, respectively. In addition, the overlap of principal customers and dependent suppliers is small: Only 3% of firm-year observations are simultaneously classified as principal customer and dependent supplier firms.

3.2. Principal customers and dependent suppliers

Information on customer-supplier relationships is based on the Compustat Segments database. This information is publicly available, as SFAS No. 14 (before 1997) and SFAS No. 131 (after 1997) require firms (regardless of the number of segments operated) to disclose the existence and sales to principal customers representing more than 10% of total firm revenues.¹⁶ We define a firm as a dependent supplier firm if it reports at least one principal customer in that year.

However, the database reports only the name of the principal customers without identifiers. In many cases, only the abbreviated versions of the names are reported (e.g., “GM” instead of “General Motors”), and sometimes the same customer is reported in a different form in different years and by different suppliers. Using manual search procedures, we identify and match customers to their Compustat identifier (i.e., GVKEY) whenever possible. Using the matched customer ID data, we define a firm as a principal customer firm if the firm is reported as a principal customer by at least one other firm.

Given our definition of principal customers, it is not surprising that most principal customers are large and mature firms with industry leadership, such as Walmart, AT&T, and

¹⁶ Some firms temporarily stopped reporting principal customers in 1998 and 1999 since it took time for them to adjust their financial reporting after the regulation had changed. However, all our results are robust to dropping observations for these two years from our sample.

Caterpillar. The median market capitalization of principal customers in our sample is \$4.6 billion and their average age in Compustat is 19 years.¹⁷ The dependent supplier firms are usually much smaller and younger than their principal customers. The median market capitalization of dependent suppliers in our sample is \$112.3 million and their median age in Compustat is ten years. As an example, we provide a list of dependent suppliers for Caterpillar in Appendix II. It is worth mentioning that dependent supplier firms are also smaller and younger than firms without important customer-supplier relationships (i.e., “other Compustat firms” in our sample), which have a median market capitalization of \$170.3 million and a median age of 11 years.

In addition to firm size and age, the most important difference between principal customers and dependent suppliers is the strength of their bargaining powers in the customer-supplier relationships. A dependent supplier usually has only one or two principal customers whereas a principal customer, such as Walmart and AT&T, can have more than 50 dependent suppliers.¹⁸ Further, for a dependent supplier, the average percentage purchase from principal customers in its total sales is higher than 35%. On the other hand, for a principal customer, the average percentage of inputs from dependent suppliers is lower than 5% of cost of goods sold. Because of the asymmetry in the mutual importance and the difference in replaceability, it is not surprising that principal customers enjoy a much stronger bargaining position than dependent suppliers. Put differently, dependent suppliers have a much stronger incentive to retain principal customers by catering to the corporate strategies of principal customers than vice versa.

It is useful to point out that it is relatively rare for a principal customer firm to take a

¹⁷ Firm age is measured as the number of years since a firm was initially covered by Compustat.

¹⁸ Note that the data structure is akin to a *separate* “hub-and-spoke” network topology, where each principal customer firm represents a hub and its dependent suppliers represent spokes. There are generally minimal intertwinements between different networks (centered on each customer firm) because a dependent supplier usually has only one or two principal customers and the overlap of principal customers and dependent suppliers is quite small.

partial/full equity stake in its dependent suppliers. Based on the same dataset from 1988 to 2001, Fee et al. (2006) find that significant cross-holding equity stakes are present in only 3.31% of all sample relationships. In explaining this pattern, they argue that the customer-supplier relationships can be effectively governed by explicit and implicit contracts without the involvement of ownership. We argue that this pattern is also consistent with our argument above that the *principal customer—dependent* supplier relationship itself is a strong governing mechanism.

Based on the above observations and bearing our theory in mind, we also design two continuous measures of the principal customer-dependent supplier relationship. Specifically, for dependent suppliers, we measure the strength of the relationship (the importance of principal customers to supplier firms) by the percentage of sales to all principal customers (*Supplier Firm's Sales to Principal Customers*). For principal customers, we measure the strength of the relationship (the extensiveness of dependent supplier network) by the total number of dependent suppliers of the principal customers (*Customer Firm's N of Dependent Suppliers*), which is a direct proxy for the replaceability of one supplier. On average, purchases by the principal customer constitute 39.6% of a dependent supplier's total sales, and a principal customer has 4.5 dependent suppliers.

To capture the importance of coordination and mutual trust between principal customers and dependent suppliers, we also construct two additional measures of long-term relationships. Specifically, the variable *Customer Firm with Long-term Suppliers* is an indicator that takes the value of one if a principal customer firm has at least one long-term dependent supplier. Similarly, the variable *Supplier Firm with Long-term Customers* is an indicator that takes the value of one if a principal customer firm has at least one long-term dependent supplier. We define a supplier

(customer) to be a long-term supplier (customer) if it has been in the customer-supplier relationship with the customer (supplier) firm for at least three years. The coordination and trust between principal customers and dependent suppliers should be enhanced further by long-term relationships. In our sample (firm-year observations), 50.5% of principal customers have at least one long-term dependent supplier and 42.4% of dependent suppliers have at least one long-term principal customer.

3.3. Key tax variable and control variables

Following prior research, we use CASH ETRs (variable name: *CETR*), as our main measure of tax avoidance. It is defined as cash tax paid divided by pre-tax book income less special items. CASH ETR uses cash tax paid in the numerator and thus can capture tax deferral strategies that are not captured in the traditional GAAP effective tax rate (Dyreng et al., 2008). Following prior research (e.g., Dyreng et al., 2008), we winsorize CASH ETR at zero and one. In robustness checks, we use the GAAP effective tax rate, long-run cash effective tax rate, and cash tax paid scaled by cash flows as alternative proxies of tax avoidance.

We identify control variables following prior literature (e.g., Chen et al., 2010; Dyreng et al., 2008; Rego, 2003). The set of control variables include ROA, financial leverage, loss carry forward, change in loss carry forward, foreign assets, new investments, property, plant, and equipment, intangible assets, equity income in earnings, firm size, market-to-book ratio, abnormal accruals, cash holdings, and Delaware indicator. Appendix I provides detailed definitions for all the variables. All variables are measured in the same year when the tax avoidance variable is measured. Following Chen et al. (2010), we measure size and book-to-market at the beginning of the year. We include ROA, loss carry forward, and change in loss carry forward to capture firm profitability, which can affect the incentives and needs to avoid

taxes. We include financial leverage to capture the effect of the tax shield of debt. Higher debt tax shields can reduce marginal tax rates and the incentives for incremental tax planning (Graham, 1996a; Graham, 1996b; Graham, 2000). We include foreign assets as a control because Rego (2003) finds that multinational firms with more extensive foreign operations have more opportunities for tax planning. We use new investments, property, plant, and equipment, intangible assets, and equity income in earnings to control for the effect of a firm's investment activities on book-tax differences because tax and accounting rules are often different for these investments (e.g., Chen et al. 2010). We control for firm size and book-to-market ratio to capture fundamental firm characteristics following most tax avoidance research. Abnormal accruals are included to control the potential effect of earnings management on book-tax differences (e.g., Frank, Lynch, and Rego 2009). We also control for cash holdings to capture the incentives of tax planning. Firms with more cash can have less need to defer cash tax paid. On the other hand, tax aggressive firms may hold more cash as a precautionary measure for future settlements with the IRS (e.g., Hanlon et al. 2013). Finally, we include a Delaware incorporation indicator because prior research argues that Delaware is a domestic tax haven (Dyreng et al., 2013b).

3.4. Descriptive statistics

Table 2 provides the descriptive statistics for our main regression variables. Column (1) of Table 2 reports the means of all variables for the full sample. Columns (2) to (4) report the means for the principal customers, dependent suppliers, and other Compustat firms, respectively. As expected, principal customer firms are generally large firms and dependent supplier firms are generally small firms, relative to other Compustat firms. An interesting pattern from the descriptive data is that dependent suppliers tend to have higher levels of foreign operations and are more likely to be incorporated in Delaware than other Compustat firms. This pattern can

suggest that suppliers with foreign operations and suppliers in Delaware are more likely to be chosen by principal customers, possibly because these types of suppliers can bring more tax planning opportunities to the principal customers, among other considerations. The mean CASH ETR for the principal-customer sample is slightly lower than that for other-firm sample ($CETR = 25.6\%$ versus $CETR = 25.8\%$). On the other hand, the mean CASH ETR of dependent suppliers is discernibly lower than that of other Compustat firms ($CETR = 23.1\%$ versus $CETR = 25.8\%$). While these univariate comparisons can give us some indication of differences across firms, we rely on multiple regression analysis for more rigorous evidence.

4. Main Results

To examine the effect of customer-supplier relationships on corporate tax avoidance, we estimate the following regression model:

$$CETR = \alpha + \beta_1 PC_{i,t} + \beta_2 DS_{i,t} + \Gamma X_{i,t} + Industry\ FE + Year\ FE + \varepsilon_{i,t}, \quad (1)$$

where $CETR$ is our (inverse) measure of tax avoidance; PC is one of the two measures for principal customer firms (*Customer Firm* or *Customer Firm's N of Dependent Suppliers*); DS is one of the two measures for dependent supplier firms (*Supplier Firm* or *Supplier Firm's Sales to Principal Customers*). The vector X represents the set of control variables as discussed in Section 3. In all regressions, we include industry and fiscal year indicators to control for potential time and industry fixed effects.¹⁹ If principal customer (dependent supplier) firms avoid more tax than other Compustat firms, we expect β_1 (β_2) to be significantly negative.

Table 3 presents the regression results. The t -statistics are based on standard errors adjusted for clustering on both firm and year levels. Column (1) of Table 3 presents the results using indicator variables for principal customer firms and dependent supplier firms. Column (1)

¹⁹ The limited within firm variations in our independent variables of interest prevent us from including firm fixed effects in the regression.

shows that principal customer firms have lower CASH ETRs (2.4 percentage points) than other Compustat firms. For an average principal customer firm in our sample, a 2.4% lower cash tax rate translates into about \$31.6 million cash tax savings annually. This statistically and economically significant result suggests that principal customer firms avoid significantly more taxes relative to other Compustat firms. As seen from Column (1), dependent supplier firms also have significantly lower cash effective tax rates than other Compustat firms. Specifically, the average CASH ETR of dependent supplier firms is 1.3 percentage points lower than that of other Compustat firms, which is also economically significant (representing 5.2% of the mean CASH ETR of the full sample).

Turning to control variables, ROA is positively related to CASH ETRs (though statistically insignificant) and loss carry forward is negatively related to CASH ETRs, consistent with Chen et al. (2010). Leverage is negatively related to the CASH ETR measure. Firms with more foreign assets have lower CASH ETRs, albeit insignificantly. Firms with more new investments have higher CASH ETRs. Firms with more PPE, intangible assets, and equity income in earnings generally have lower CASH ETRs. Firm size is positively related to CASH ETRs and market-to-book ratio is negatively related to CASH ETRs. The relation between abnormal accruals and CASH ETRs is negative and significant. Finally, Delaware incorporation is negatively related to CASH ETRs, suggesting that firms incorporated in Delaware generally pay less cash taxes.²⁰

We next investigate whether the characteristics of customer-supplier relationships affect corporate tax avoidance. Column (2) of Table 3 reports the results using continuous measures of customer-supplier relationships. Consistent with the results in Column (1), there is a significantly

²⁰ We also estimate the regression with only a minimal set of controls (i.e., *Firm Size*) and find very similar results (untabulated).

negative association between CASH ETRs and the number of dependent suppliers for a principal customer firm, suggesting that the degree of asymmetric bargaining power against dependent suppliers affects principal customers' degree of tax avoidance. On the dependent supplier side, there is a significantly negative association between CASH ETRs and the proportion of total sales to principal customers, suggesting that suppliers with stronger relationships with principal customers can avoid more taxes.

Column (3) of Table 3 reports the results regarding the duration of customer-supplier relationships. To do this, we add two new variables to Eq. (1), which capture whether the relationships between principal customers and dependent suppliers are of long-term nature. Our results suggest that both long-term relationship variables have negative and significant coefficients, suggesting that principal customer (dependent supplier) firms with long-term dependent suppliers (principal customers) have lower CASH ETRs than principal customer (dependent supplier) firms without long-term customer-supplier relationships. This result suggests that the duration of customer-supplier relationships is positively associated with the efficiency of tax planning, perhaps because of the enhanced coordination and trust cultivated by long-run relationships. Overall, the results in Table 3 suggest that both principal customer firms and dependent supplier firms avoid more income taxes on average than other Compustat firms.

5. Potential mechanisms

5.1. Customer firms

While there are many structured tax planning transactions that firms can use to reduce their effective tax rates, we empirically test a potential mechanism in this section that is likely to be attractive to principal customers – establishing centralized procurement companies that are incorporated in tax haven countries. Principal customer firms are more likely to centralize

procurement because they are better able to leverage economies of scale and take advantage of bulk discounts (APQC, 2014). In addition, by shifting part of their corporate profits to offshore procurement centers incorporated in tax haven countries, companies can substantially reduce their U.S. tax burdens. For example, a U.S.-based manufacturing company could establish a procurement center in a low-tax jurisdiction to purchase raw materials on its behalf. For performing this service, the procurement center charges the manufacturing company a service fee or markup. Because this service fee or markup is subject to a lower level of taxation, such a transfer of profits within the enterprise results in an overall lower effective tax rate. In the case of Caterpillar, 85% of the profits from the sale of replacement parts were attributed to its low-tax procurement affiliate in Switzerland, with 15% of the profits attributed to the U.S. parent Caterpillar (U.S. Senate, 2014). By shifting profits from Caterpillar Inc. to the low-tax procurement company in Switzerland, Caterpillar substantially reduced its effective tax rates. Of course, as mentioned earlier, the successful implementation of this strategy requires a high level of coordination and trust from suppliers, which distinguishes principal customer firms (with dependent suppliers) from other firms (without dependent suppliers).

To empirically identify firms with procurement centers in tax havens, we rely on textual analysis on firms' annual reports to define two variables, *Procurement* and *Tax Haven Subs*. *Procurement* is an indicator that takes the value of one if the annual report (i.e., 10-K) of a firm mentions the words "procure" or "procurement" in a specific year. We use this variable to proxy for the likelihood that a firm has a procurement center in a specific year. According to this proxy, about 40.1% of principal customers, 34.8% of dependent suppliers, and 27.5% of other firms are more likely to have a procurement center.²¹ As a confirmation, in the case of Caterpillar,

²¹ The existence of measurement errors in the variable *Procurement* is somewhat obvious. However, we do not have a better way to identify procurement centers for a firm. One can expect that the noise in the procurement variable

procurement-related words were mentioned in its financial report starting from 1998, which is about the time when Caterpillar started its procurement center tax strategy. *Tax Haven Subs* is an indicator that takes the value of one if a firm has at least one subsidiary in a tax haven country, as defined by Dyreng and Lindsey (2009). Approximately 46.6% of principal customer firms, 27.0% of dependent supplier firms, and 22.6% of other firms have at least one tax haven subsidiary.

Table 4 reports the results when we classify customer firms into different types based on *Procurement* and *Tax Haven Subs*. Column (1) reports the results when we classify customer firms into two types, *PC with Procurement* and *PC with No Procurement*. It shows that both types of customer firms have lower CASH ETRs than other Compustat firms; and *PC with Procurement* has lower CASH ETRs than *PC without Procurement* (the difference is 2.3 percentage points and statistically significant at the five percent level). Column (2) reports the results when we classify customer firms into another two types, *PC with Tax Haven Subs* and *PC with No Tax Haven Subs*. It shows that both types of firms have lower CASH ETRs than other Compustat firms (though the coefficient is only statistically significant for *PC with Tax Haven Subs*). In addition, *PC with Tax Haven Subs* has lower CASH ETRs than *PC without Tax Haven Subs* (the difference is 3.2 percentage points and statistically significant at the one percent level).

Column (3) reports the result when we classify customer firms into four types, *PC with Procurement & Tax Haven Subs* (21.8% of customer firms), *PC with Procurement & No Tax Haven Subs* (15.5% of customer firms), *PC with No Procurement & Tax Haven Subs* (21.6% of customer firms), and *PC with No Procurement & No Tax Haven Subs* (41.1% of customer firms). It shows that *PC with Procurement & Tax Haven Subs* has the lowest cash effective tax rate among the four types of customer firms. Specifically, average CASH ETR of principal customers

work against us finding any significant results. Note also that the regression specification with only the more accurate variable, *Tax Haven Subs* (i.e., Column (2) of Table 4), can provide partial evidence supporting the procurement through tax haven subsidiaries strategy.

with Procurement & Tax Haven Subs is 4.4 percentage points lower than that for firms with no customer-supplier relationships, which translates to a 17.6% reduction of CASH ETR based on its mean level in the full sample. Moreover, the coefficient of *PC with Procurement & Tax Haven Subs* (-0.044) is also significantly lower than the coefficient of *Procurement × Tax Haven Subs* (-0.016), suggesting that principal customer firms are better able to utilize centralized procurement centers in tax havens to avoid tax than other firms. Overall, with some caveats of the measurement error in *Procurement*, the results in Table 4 are consistent with the conjecture that offshore procurement in tax haven countries is one of the potential mechanisms through which customer firms reduce their corporate taxes.

Finally, we repeat our tests in Table 4 by partitioning the sample based on whether a customer firm purchases from manufacturing industries (SIC 4-digit from 2000 to 3999) or not. Because offshore procurement usually involves the procurement of goods rather than services, its effect on customer firms' tax avoidance is limited when suppliers are from non-manufacturing industries. Consistent with this prediction, we find that the results in Table 4 are mainly driven by the subsample of customer firms with suppliers from manufacturing industries (untabulated).

5.2. *Supplier firms*

5.2.1. *Tax avoidance diffusion along the supply chain*

In this section, we empirically test a potential explanation of the lower cash effective tax rates for supplier firms – tax avoidance knowledge diffusion along the supply chain. If dependent suppliers obtain tax avoidance knowledge from their principal customers, the effective tax rates of the customer-supplier pair should be positively correlated. In addition, such a positive correlation should be stronger when the cost of knowledge diffusion is lower. To measure the cost of diffusion, we use the distance between the customer firm and the supplier firm. For this

test, the dataset is at the relationship-year level instead of the firm level. The specification is:

$$\begin{aligned} \text{Supplier's CETR} = & \alpha + \beta_1 \text{Customer's CETR} + \beta_2 (\text{Customer's CETR} \times \text{Distance}) + \beta_3 \text{Distance} \\ & + \Gamma X_{i,t} + \text{Industry FE} + \text{State FE} + \text{Year FE} + \varepsilon_{i,t}, \end{aligned} \quad (2)$$

where *Supplier's CETR* is the CASH ETR for the dependent supplier firm; *Customer's CETR* is the CASH ETR for the corresponding principal customer firm; *Distance* is the geographical distance between the supplier firm and its customer firm based on the Zip codes of the headquarters. The vector *X* represents the set of control variables related to the supplier firm's characteristics. In all regressions, we include industry, state, and fiscal year indicators to control for potential industry, state, and time fixed effects. We include the state fixed effects to ensure that the positive association between the effective tax rates of the customer-supplier pair is not driven by common state tax rates. We expect β_1 to be significantly positive and β_2 to be significantly negative.

Table 5 presents the results. Consistent with the diffusion story, we find a positive association between a supplier's CASH ETR and its principal customer's CASH ETR. In addition, the positive association is stronger when the geographical distance between the customer firm and the supplier firm is shorter.²²

5.2.2. Relationship establishment and tax avoidance of dependent suppliers

The positive association of tax avoidance between dependent supplier firms and their principal customers is consistent with the conjecture that tax avoidance knowledge diffuses along the supply chain. However, the results in Table 5 can suffer from the following concerns. First, it is not clear whether the positive association of tax avoidance between customer firms and supplier firms suggests a uni-directional diffusion of tax avoidance knowledge from customers to

²² As an example, many of Caterpillar's suppliers are located in the United States in close proximity to the Caterpillar manufacturing plants that produce its machines.

suppliers, instead of vice versa. Second, the positive correlation of CASH ETRs between customers and suppliers can also be consistent with the principal customers picking dependent suppliers with similar tax avoidance levels.

We address the above concerns using a difference-in-differences approach around the establishment of customer-supplier relationships.²³ Relationship establishment is defined as the event year t in which a firm reports a principal customer for the first time. Since the diffusion of tax avoidance in the supply chain involves a gradual learning process, we require that the relationship lasts for at least 2 years (i.e., year $t+1$ and year $t+2$) in this test. Accordingly, the pre-establishment period is year $t-2$ (i.e., 2 years before the principal customer is first reported) and the post-establishment period is year $t+2$ (i.e., 2 years after the principal customer is first reported). We combine the observation at year $t-2$ for the pre-establishment period and that at year $t+2$ for the post-establishment period for each relationship establishment into one pair.

Table 6 presents the diff-in-diff tests. The dependent variable in Columns (1)-(3) of Table 6 is CASH ETR, the cash effective tax rate of dependent suppliers; the dependent variable in Columns (4)-(6) of Table 6 is *Adj. CETR*, the adjusted cash effective tax rate of dependent suppliers. The *Adj. CETR* is the difference between *CETR* and the average *CETR* of benchmark firms that are neither principal customers nor dependent suppliers between year $t-2$ and $t+2$. We require that, in year $t-2$, the incumbent supplier and the benchmark firms must belong to the same size and CASH ETR quintiles in the same industry. This adjustment allows us to isolate the changes of CASH ETR from those driven by industry trend. The key independent variable, *After Relationship Establishment*, is a dummy variable that equals zero for the pre-establishment period and one for the post-establishment period. In addition, we also include all time-varying

²³ In spirit, one can do a similar test around relationship terminations. However, relationship terminations usually lead to a devastating effect on suppliers' operating performance (see Cen et al., 2014), which can make tax avoidance less relevant.

control variables in our main specification (i.e., Table 3) in this test.²⁴ We require that all information for the dependent and independent variables be available, resulting in 543 relationship establishments (i.e., 1086 observations with 2 observations for each relationship establishment) in this test. To control for unknown common factors for each relationship establishment, we add the pair fixed effects for each relationship establishment in all specifications reported in Table 6.

The results in Column (1) of Table 6 suggest that, after relationship establishment with principal customers, the CASH ETRs of dependent suppliers decrease by 2.5 percentage points on average. After incorporating the differences between our treatment firms (i.e., incumbent suppliers experiencing relationship establishment in year t) and benchmark firms (i.e., firms of similar size and CASH ETR *ex ante* in the same industry but with no principal customers in the period from $t-2$ to $t+2$), the results in Column (4) confirm that the reduction in CASH ETRs is not driven by common industry trends or common factors that affect firms with similar size or similar tax rates before the relationship establishment.

We further partition our relationship establishment sample into two groups based on the CASH ETRs of principal customers. Specifically, when a customer's CASH ETR is lower than the 25th percentile in the distribution for the industry in a specific year, we define this customer as a low tax firm. According to this definition, 206 relationship establishments (i.e., 412 observations) are classified into the low tax group and others are classified into the normal and high tax group. Our results in Columns (2) and (3) suggest that the reduction in a supplier's CASH ETRs around the relationship establishment is conditional on whether the principal customer has a low tax rate. For example, suppliers establishing relationships with principal

²⁴ In fact, the only control variable we dropped here is Delaware, since the state of incorporation usually does not change after the relationship establishment.

customers in the low tax group have a CASH ETR reduction of 4.5 percentage points, which is statistically significant at the 5% level. On the other hand, supplier firms establishing relationships with principal customers in the normal and high tax group have a reduction in CASH ETR of only one percentage point, which is insignificant statistically. Again, results in Columns (5) and (6) confirm that this result is not driven by industry trends or common characteristic-related factors associated with size or tax rate before the relationship establishment.

Using a similar approach (untabulated), we find that the change in CASH ETRs of principal customers around the relationship establishments is not conditional on the tax rates of incumbent suppliers before the relationship establishment. Taken together, the results in this section suggest that tax planning knowledge is more likely to diffuse from principal customers to dependent suppliers, but not vice versa.

6. Additional tests and robustness checks

6.1. Alternative proxies of tax avoidance

Following prior research, we use several alternative effective tax rates to measure the overall level of tax avoidance. Our first alternative effective tax rate measure is GAAP ETR (denoted by *GETR*), defined as total income tax expense divided by pre-tax book income less special items. GAAP ETR captures tax avoidance activities that result in permanent tax savings. However, GAAP ETR generally does not capture tax avoidance strategies that defer cash taxes because the reduction in current tax expense is offset by an increase in deferred tax expense (Hanlon and Heitzman, 2010; McGill and Outslay, 2004). Our main measure, CASH ETR, does not suffer from these problems. However, Dyreng et al. (2008) point out that the annual CASH ETR measure can suffer from a so-called mismatch problem. That is, the numerator in the CASH ETR formula can include tax paid on earnings in a different period. To alleviate this problem,

Dyreng et al. (2008) develop a long-run CASH ETR measure. Following Dyreng et al. (2008), we define a long-run CASH ETR (denoted by *CETR3* or *CETR5*) as the sum of cash tax paid over three or five years (t to $t+2$ or t to $t+4$) divided by the sum of pre-tax income adjusted for special items over the same accumulation period.

Both GAAP ETR and CASH ETR measures capture non-conforming tax avoidance but not conforming avoidance. Conforming tax avoidance occurs when a firm lowers its taxes by reducing both taxable income and pretax accounting income. It is possible that firms in a close customer-supplier relationship have relatively lower pressure to deliver accounting earnings than other Compustat firms, and thus, these firms can also use conforming tax avoidance strategies. As a result, GAAP ETR or CASH ETR measures can have a limitation in capturing the overall level of tax avoidance of these firms. To address this concern, we use a cash effective tax rate measure (denoted by *CASH_RATIO*) that uses operating cash flows as the denominator. Specifically, the *CASH_RATIO* measure is defined as cash tax paid divided by pre-tax operating cash flows adjusted for extraordinary items and discontinued operations. We winsorize all effective tax rate measures at zero and one.

Table 7 Panel A presents the ETR regression results regarding overall tax avoidance. It shows that principal customer firms have lower GAAP ETRs (0.9 percentage point), long-run CASH ETRs (1.5 or 1.1 percentage points), and *CASH_RATIO*s (2.5 percentage points) than other Compustat firms. The results are both statistically and economically significant, suggesting that principal customer firms have more opportunities (or are more efficient) in overall tax avoidance relative to other Compustat firms. Table 7 also shows that dependent supplier firms have significantly lower effective tax rates than other Compustat firms irrespective which ETR

measures are used.²⁵ In Panel B, we decompose the customer firms into four types and the results are quite consistent with those reported in Table 4.

6.2. Risky tax planning

While the effective tax rate results are consistent with principal customer and dependent supplier firms generally avoiding more income taxes, they do not tell us whether these firms employ tax strategies that are near the aggressive end of the tax strategy spectrum. Although our main arguments suggest that principal customer firms have a natural advantage in implementing tax avoidance strategies, these firms can also have incentives to refrain from highly risky tax avoidance. Both anecdotal and empirical evidence suggests that aggressive tax planning can lead a firm into financial distress. For example, Kim, Li, and Zhang (2011) provide large sample evidence that aggressive tax planning is positively associated with future crash risk. According to prior literature (e.g., Titman and Wessels, 1988), dependent suppliers often have to make investments specific to principal customers because a large proportion of their sales depend on these large customers and the products demanded by these customers are often uniquely designed. As a result, dependent suppliers have a warranted concern over their principal customers' risk-taking activities because they will have difficulty in redeploying their customer-specific assets should the customers fail (e.g., Hertz et al., 2008; Kolay, Lemmon, and Tashjian, 2013). Therefore, to encourage dependent suppliers to make relationship-specific investments, principal customers have incentives to take less tax risk. Similarly, on the supplier side, prior research argues that a firm's incentive to maintain product quality is lower if it faces the prospect of liquidation (Maksimovic and Titman, 1991). Therefore, to ensure the stable supply of high

²⁵ Some of the tax avoidance strategies only affect state income taxes. To examine whether customer-supplier relationships affect state taxes, we separate GAAP ETRs into state ETRs and federal ETRs. Untabulated results show that principal customers have lower federal ETRs but not state ETRs and dependent suppliers have both lower federal ETRs and state ETRs.

quality products, principal customers prefer dependent suppliers to take less risk and the dependent suppliers have incentives to cater to their customers' preference.

There is no consensus in the literature for the definition of aggressive or risky tax planning. Many studies appear to maintain that structured tax planning transactions or complex tax shelters are more risky form of tax avoidance (e.g., Wilson, 2009). Others argue that large positive book-tax differences that cannot be explained by common determinants of corporate tax burdens can reflect aggressive tax planning (e.g., Frank et al., 2009). Finally, Lisowsky (2010) finds that the ending balance of unrecognized tax benefits (UTB) has some power in predicting tax shelter participation.²⁶ Since there is no consensus in the definition and measurement of risky tax planning, we use multiple measures designed by prior research to capture aggressive tax avoidance activities. The first risky tax planning measure is Wilson's (2009) shelter prediction score. The second measure of risky tax planning is the DTAX measure developed by Frank et al. (2009). Finally, we use the ending balance of UTB scaled by total assets to measure aggressive tax planning. However, this measure is only available for a small sample of firms after 2007. To address the small sample problem, we also estimate a predicted level of UTB measure using the model in Rego and Wilson (2012).

Table 8 presents the results using several risky tax planning proxies as the dependent variable. Panel A shows that principal customer firms have a higher tax shelter probability, higher level of *DTAX*, and higher level of reported and predicted UTBs, consistent with the prediction that principal customer firms engage in more risky tax planning. These results are also consistent with anecdotal evidence. For example, Caterpillar's Tax Council reportedly assigned

²⁶ The reported UTB level does not perfectly reflect risky tax planning. If managers believe that high level of UTBs can attract tax authorities to challenge their tax positions, they may have incentives to manipulate the level of UTBs downward (e.g., De Simone et al., 2014). Moreover, the level of UTB can also be affected by managers' earnings management activities (e.g., Dhaliwal et al., 2004). Despite these incentives, Lisowsky et al. (2013) show, using confidential IRS data, that UTBs are a suitable proxy for tax shelter activity.

the highest tax risk rating to several strategies adopted by its Swiss affiliate, CSARL. On the other hand, we find that dependent supplier firms generally engage in *less* risky tax planning, possibly because their principal customers prefer them to take less tax risk. Panel B presents the results when we classify customer firms into the four types and the results are generally the strongest for *PC with Procurement and Tax Haven Subs.*

Overall, the empirical results are consistent with the hypothesis that principal customer firms are more tax aggressive because they have a greater opportunity and a lower cost in implementing structured tax planning strategies. On the other hand, our results imply that dependent supplier firms engage in perhaps less risky tax avoidance activities than other Compustat firms. The different findings regarding risky tax planning of principal customers and dependent suppliers are consistent with the asymmetric bargaining positions in the customer-supplier relationship.

6.3. Delaware suppliers

In recent years, the business press has argued that Delaware is, to some extent, a tax haven. Among other things, Delaware does not tax income generated by intangibles. Some argue that it has a secretive financial system, making it an ideal place to implement aggressive tax avoidance strategies. Dyreng et al. (2013b) find that taxes play an important role in determining whether U.S. firms locate subsidiaries in Delaware. Our descriptive statistics suggest that principal customers are more likely to choose a dependent supplier from Delaware. In this section, we examine whether principal customer firms with Delaware suppliers engage in incremental tax planning relative to other principal customer firms. Toward this end, we count the number of Delaware dependent suppliers for a principal customer firm (*Customer Firm's N*

of *DE Suppliers*) and include it as an additional variable in the regression model.²⁷ In untabulated results, we find that principal customer firms with Delaware suppliers have lower effective tax rates and higher levels of aggressive tax planning than other principal customer firms, suggesting that Delaware dependent suppliers can facilitate aggressive tax planning strategies by principal customer firms.

6.4. Endogeneity

Our main empirical results show that there is a strong association between principal customer or dependent supplier status and corporate tax avoidance. However, our results may be biased if principal customer firms or dependent supplier firms have some other firm-specific characteristics unaccounted for in our empirical model that affect both the degree of tax avoidance and a firm's status in a customer-supplier relationship. In addition, the ability of tax avoidance may contribute to a firm's status as a principal customer or a dependent supplier. To partially address these endogeneity issues, we use an instrumental variable approach to examine the robustness of our main results. We note, however, that it is extremely hard to find valid instruments for our endogenous variables and thus the results in this section (as well as the main results) should be interpreted with caution.

We use three instrumental variables for our two endogenous variables (i.e., *Customer Firm*, *Supplier Firm*). The first and second instrumental variables are the percentage of principal customer firms and dependent supplier firms, respectively, within a firm's industry (Fama-French 48-industry classifications). By construction and in theory, these two variables (i.e., the industry mean of the variable *Customer Firm* and *Supplier Firm*) should have a strong positive relation with our variables of interest, and we have no clear reason to believe that these two

²⁷ Note that the term "*Customer Firm's N of DE Suppliers*" is essentially an interaction term between *Customer Firm* and *Customer Firm's N of DE Suppliers* because other Compustat firms have no dependent suppliers of any type by definition.

variables have any direct impact on firm-level tax avoidance other than through the effect of firm-level status as a principal customer or a dependent supplier. Our third instrumental variable is an indicator variable that takes the value of one for firms in durable goods industries and zero for firms in other industries. We argue that firms in durable goods industries are more likely to develop close customer-supplier relationships because the products are more unique and the levels of relationship-specific investments are higher in these industries (i.e., higher required commitment). Again, in theory, we do not expect any direct relation between durable goods industry membership and firm-level tax avoidance other than through the effect of customer-supplier relationships. Moreover, we control for industry indicators in our regression model, which can make the instruments more safely excluded from the second stage.

We conduct the two-stage least squares (2SLS) regressions using the percentage of principal customers in a firm's industry, the percentage of dependent suppliers in a firm's industry, and an indicator of durable goods industry membership as instruments. Our results are robust to the instrumental variable approach. We also check the validity of our instruments. The large magnitudes of F -statistics (much greater than the rule of thumb critical value of ten) reject the hypothesis that our instruments are jointly weak. Moreover, our over-identification tests show that the hypothesis that the instruments are jointly exogenous cannot be rejected.

To further examine the robustness of our main results, we also use a propensity score matched sample to re-examine our hypothesis and find that all the main results remain very similar. Overall, we conclude that our main results are unlikely to be simply driven by omitted variables or reverse causality.

7. Conclusion

Despite the central importance of customer-supplier relationships to many facets of firm behavior, they have been largely ignored in extant tax literature. Our study fills this void by investigating the effect of customer-supplier relationships on tax avoidance. Consistent with the conjecture that firms in close customer-supplier relationships have more tax planning opportunities and lower tax planning costs, we find that principal customer firms and dependent supplier firms in the Compustat database have lower CASH ETRs than other Compustat firms. The results are statistically and economically significant and are robust after controlling for other determinants of tax avoidance, industry fixed effects, and year fixed effects. In addition, we explore two potential mechanisms through which customer firms and supplier firms reduce their tax rates. We find that customer firms with offshore procurement centers based in tax haven countries have the lowest cash effective tax rates among all customer firms. We also find a positive association between the effective tax rates of customer-supplier firm pairs, especially when the two firms' headquarters are close to each other, supporting tax avoidance diffusion/learning along the supply chain. More importantly, we show that dependent supplier firms' CASH ETRs decline significantly after the establishment of relationship with a principal customer, especially when the principal customer has a low *ex-ante* CASH ETR. Our study extends the recent tax avoidance literature from the shareholder-manager relationship to the customer-supplier relationship. The results also have important implications for tax authorities and policy-makers.

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APPENDIX I
Variable Definitions

Key Tax Variable	
<i>CETR</i>	Cash Effective Tax Rate: TXPD/(PI-SPI).
Key Customer-Supplier Relationship Variables	
<i>Customer Firm</i>	An indicator that takes the value of one if the firm is a principle customer.
<i>Supplier Firm</i>	An indicator that takes the value of one if the firm has at least one corporate principle customer (i.e., the firm is a dependent supplier).
<i>Customer Firm with Long-term Suppliers</i>	An indicator that takes the value of one if the firm is a principle customer with at least one supplier where the relationship has been lasting for at least 3 years.
<i>Supplier Firm with Long-term Customers</i>	An indicator that takes the value of one if the firm has at least one corporate principle customer (i.e., the firm is a dependent supplier) where the relationship has been lasting for at least 3 years.
<i>Customer Firm's N of Dependent Suppliers</i>	The natural logarithm of the number of dependent suppliers that the principle customer has.
<i>Supplier Firm's Sales to Principal Customers</i>	The percentage of sales to all principal customers for suppliers with corporate principal customers.
<i>Procurement</i>	An indicator that takes the value of one if the annual report (i.e., 10-K) of a firm mentions the words "procure" or "procurement" in a specific year.
<i>Tax Haven Subs</i>	An indicator that takes the value of one if a firm has at least one subsidiary in a tax haven country as defined by Dyreng and Lindsay (2009).
<i>PC with Procurement</i>	An indicator that takes the value of one if a customer firm's annual report (i.e., 10-K) mentions the words "procure", "procurement" or "procurement center" in a specific year.
<i>PC with No Procurement</i>	An indicator that takes the value of one if a customer firm's annual report (i.e., 10-K) does not mention the words "procure", "procurement" or "procurement center" in a specific year.
<i>PC with Tax Haven Subs</i>	An indicator that takes the value of one if a customer firm has at least one subsidiary in a tax haven country as defined by Dyreng and Lindsay (2009).
<i>PC with No Tax Haven Subs</i>	An indicator that takes the value of one if a customer firm does not have any subsidiary in a tax haven country as defined by Dyreng and Lindsay (2009).
<i>PC with Procurement & Tax Haven Subs</i>	An indicator that takes the value of one if a customer firm's annual report (i.e., 10-K) mentions the words "procure", "procurement" or "procurement center" in a specific year and it has at least one subsidiary in a tax haven country as defined by Dyreng and Lindsay (2009).
<i>PC with Procurement & No Tax Haven Subs</i>	An indicator that takes the value of one if a customer firm's annual report (i.e., 10-K) mentions the words "procure", "procurement" or "procurement center" in a specific year but it does not have any subsidiary in a tax haven country as defined by Dyreng and Lindsay (2009).
<i>PC with No Procurement & Tax Haven Subs</i>	An indicator that takes the value of one if a customer firm's annual report (i.e., 10-K) does not mention the words "procure", "procurement" or "procurement center" in a specific year but it has at least one subsidiary in a tax haven country as defined by Dyreng and Lindsay (2009).

<i>PC with No Procurement & No Tax Haven Subs</i>	An indicator that takes the value of one if a customer firm's annual report (i.e., 10-K) does not mention the words "procure", "procurement" or "procurement center" in a specific year and it does not have any subsidiary in a tax haven country as defined by Dyreng and Lindsay (2009).
<i>Distance</i>	The distance between the customer firm and the supplier firm based on the Zip codes of the headquarters.
<i>Control Variables</i>	
<i>ROA</i>	Return on assets, calculated as pre-tax income (<i>PI</i>) divided by lagged total assets (<i>AT</i>).
<i>Leverage</i>	Financial leverage at the end of the year, calculated as long-term debt (<i>DLTT</i>) scaled by total assets (<i>AT</i>).
<i>Loss Carryforward</i>	An indicator variable that equals one if net operating loss carryforwards is positive (Compustat: <i>TLCF</i>).
<i>Change in Loss Carryforward</i>	Change in net operating loss carryforwards (Compustat <i>TLCF</i>) scaled by lagged total assets (<i>AT</i>).
<i>Foreign Assets</i>	Foreign assets, estimated following Oler et al. (2007).
<i>New Investments</i>	New investment, calculated as Compustat (<i>XRD+CAPX+AQC-SPPE-DPC</i>), scaled by lagged total assets (<i>AT</i>).
<i>Property, Plant, and Equipment</i>	Net property, plant, and equipment at the end the year, calculated as Compustat <i>PPENT</i> scaled by lagged total assets (<i>AT</i>).
<i>Intangible Assets</i>	Intangible assets at the end of the year, calculated as Compustat <i>INTAN</i> scaled by lagged total assets (<i>AT</i>). If <i>INTAN</i> = 'C', then <i>INTAN</i> = <i>GDWL</i> .
<i>Equity Income in Earnings</i>	Equity income in earnings, calculated as Compustat <i>ESUB</i> scaled by lagged total assets (<i>AT</i>).
<i>Firm Size</i>	Log of market value of equity at the end of the year, calculated as Compustat <i>PRCC_F</i> \times <i>CSHO</i> .
<i>Market-to-Book</i>	Market-to-book ratio at the end of the year, calculated as the market value of equity (Compustat <i>PRCC_F</i> \times <i>CSHO</i>) divided by the book value of equity (Compustat <i>CEQ</i>).
<i>Abnormal Accruals</i>	The absolute value of discretionary accruals, estimated from the performance-adjusted modified cross-sectional Jones model.
<i>Cash Holdings</i>	Cash holdings at the end of the year, calculated as Compustat <i>CHE</i> scaled by lagged total assets (<i>AT</i>).
<i>Delaware</i>	The firm is incorporated in Delaware.
<i>Other Tax Variables</i>	
<i>GETR</i>	GAAP Effective Tax Rate, $\text{TXT}/(\text{PI}-\text{SPI})$.
<i>CETR3</i>	Three-year Cash ETR: $\text{TXPD}/(\text{PI}-\text{SPI})$. Both <i>TXPD</i> and (<i>PI-SPI</i>) are cumulated over three years before calculation.
<i>CETR5</i>	Five-year Cash ETR: $\text{TXPD}/(\text{PI}-\text{SPI})$. Both <i>TXPD</i> and (<i>PI-SPI</i>) are cumulated over five years before calculation.
<i>CASH_RATIO</i>	Cash ratio: $\text{TXPD}/(\text{OANCF}+\text{TXPD}-\text{XIDOC})$.
<i>SHELTER</i>	An indicator variable that takes the value of one for firms in the top quintile of the predicted probability that the firm is engaged in tax sheltering, based on Wilson's

(2009) model:

$$SHELTER = -4.86 + 5.20 \times BTD + 4.08 \times DA - 1.41 \times LEV + 0.76 \times LAT + 3.51 \times ROA + 1.72 \times FI + 2.43 \times R\&D,$$

where *BTD* is the total book–tax difference, scaled by lagged total assets (*AT*); *DA* is the absolute value of discretionary accruals from the performance-adjusted modified cross-sectional Jones model; *LEV* is long-term debt (*DLTT*) divided by total assets (*AT*); *LAT* is the log of total assets (*AT*); *ROA* is pre-tax earnings (*PI*) divided by lagged total assets; *FI* is an indicator variable set equal to one for firm observations reporting foreign income (*PIFO*) and zero otherwise; and *R&D* is R&D expenses (*XRD*) divided by lagged total assets.

DTAX

The discretionary permanent book–tax difference of Frank et al. (2009), which is the residual from the following regression, estimated by year and two-digit SIC code:

$$PERMDIFF_{it} = \alpha_0 + \alpha_1 INTAN_{it} + \alpha_2 UNCON_{it} + \alpha_3 MI_{it} + \alpha_4 CSTE_{it} + \alpha_5 NOL_{it} + \alpha_6 LAGPERM_{it} + e_{it},$$

where *PERMDIFF* = total book–tax difference – temporary book–tax difference = $[(PI - [(TXFED + TXFO) / STR]) - (TXDI / STR)]$, scaled by lagged assets (*AT*); *INTAN* = goodwill and other intangible assets (*INTAN*), scaled by lagged assets; *UNCON* = income (loss) reported under the equity method (*ESUB*), scaled by lagged assets; *MI* = income (loss) attributable to minority interest (*MI*), scaled by lagged assets; *CSTE* = current state tax expense (*TXS*), scaled by lagged assets; *NOL* = change in net operating loss carryforwards (*TLCF*), scaled by lagged assets; *LAGPERM* = *PERMDIFF* in year $t - 1$; and *STR* is the statutory tax rate.

UTB

The ending balance of unrecognized tax benefits, calculated as (TXTUBEND/AT).

Pred_UTB

Predicted level of UTB following the method of Rego and Wilson (2012):

$$\text{Pred_UTB} = -0.004 + 0.011 * PT_ROA + 0.001 * SIZE + 0.010 * FOR_SALE + 0.092 * R\&D - 0.002 * DISC_ACCR - 0.003 * LEV + 0.000 * MTB + 0.014 * SG\&A - 0.018 * SALES_GR,$$

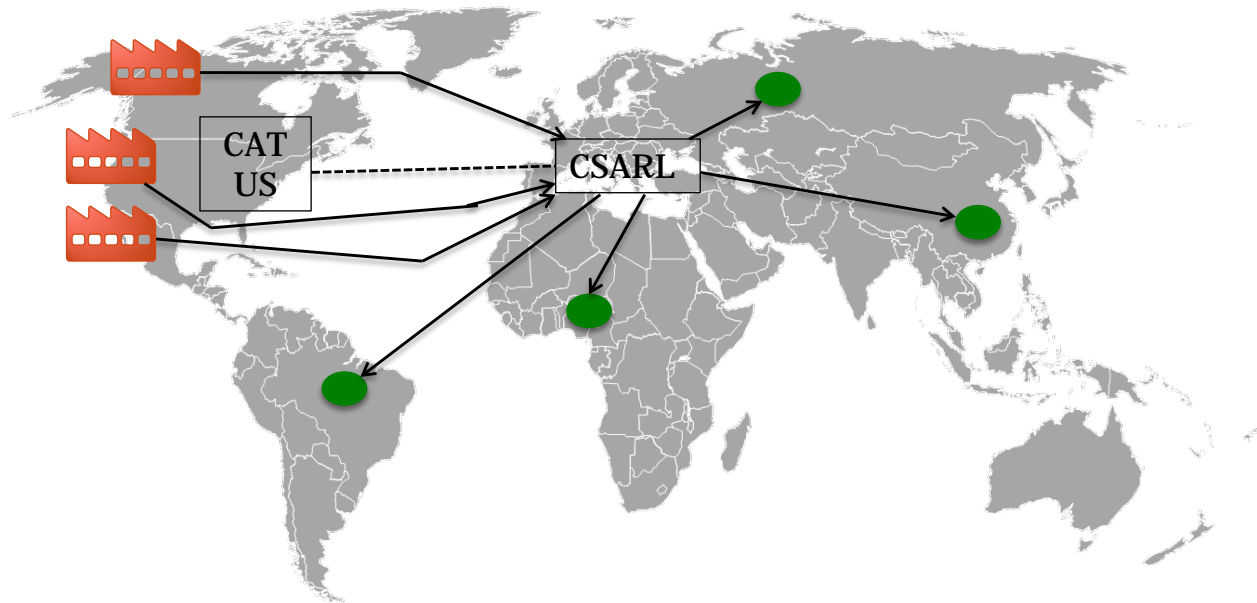
where *PT_ROA* is pre-tax earnings (*PI*) divided by lagged total assets, *SIZE* is the log of total assets (*AT*), *FOR_SALE* is total foreign sales scaled by total sales, *R&D* is R&D expenses (*XRD*) divided by lagged total assets, *DISC_ACCR* is discretionary accruals from the performance-adjusted modified cross-sectional Jones model, *LEV* is long-term debt (*DLTT*) divided by total assets (*AT*), *MTB* is the market-to-book ratio, *SG&A* is SG&A expenses (*XSGA*) scaled by lagged total assets, and *SALES_GR* is net sales growth rate.

APPENDIX II
A List of Dependent Suppliers for Caterpillar

Fiscal Year	Supplier Name	Sales to Caterpillar	Total Sales	Pct Sales to Caterpillar
1994	DONALDSON CO INC	69.107	593.503	11.64%
1994	NEW BASTION DEVELOPMENT INC	10.519	21.946	47.93%
1994	RAYTECH CORP	26.818	167.615	16.00%
1994	TWIN DISC INC	18.355	141.193	13.00%
1994	SCHWITZER INC	41.383	153.271	27.00%
1994	ATCHISON CASTING CORP	12.292	82.519	14.90%
1995	DONALDSON CO INC	88.199	703.959	12.53%
1995	NEW BASTION DEVELOPMENT INC	11.412	22.353	51.05%
1995	RAYTECH CORP	24.85	177.498	14.00%
1995	TWIN DISC INC	19.708	164.232	12.00%
1995	ATCHISON CASTING CORP	18.611	141.579	13.15%
1996	DONALDSON CO INC	88.691	758.646	11.69%
1996	NEW BASTION DEVELOPMENT INC	13.1	23.671	55.34%
1996	RAYTECH CORP	32.652	217.683	15.00%
1996	TWIN DISC INC	17.666	176.657	10.00%
1997	DONALDSON CO INC	91.668	833.348	11.00%
1997	NEW BASTION DEVELOPMENT INC	14.589	25.873	56.39%
1997	RAYTECH CORP	32.827	234.475	14.00%
1997	TWIN DISC INC	20.894	189.942	11.00%
1998	DONALDSON CO INC	103.438	940.351	11.00%
1998	NEW BASTION DEVELOPMENT INC	12.868	22.488	57.22%
1998	RAYTECH CORP	30.716	247.464	12.41%
1998	MORTON INDUSTRIAL GRP INC	119.445	151.196	79.00%
1998	ACTIVE POWER INC	0.156	0.915	17.05%
1999	NEW BASTION DEVELOPMENT INC	15.368	25.194	61.00%
1999	RAYTECH CORP	29.976	251.966	11.90%
1999	ACTIVE POWER INC	0.408	1.047	38.97%
2000	RAYTECH CORP	31.139	239.532	13.00%
2000	ACTIVE POWER INC	4.677	4.872	96.00%
2001	RAYTECH CORP	28.148	201.255	13.99%
2001	A S V INC	8.914	50.081	17.80%
2001	ACTIVE POWER INC	19.629	22.562	87.00%
2002	RAYTECH CORP	23.948	209.866	11.41%
2002	TECHNOLOGY SOLUTIONS CO	14.779	92.368	16.00%
2002	A S V INC	14.023	44.237	31.70%
2002	ACTIVE POWER INC	10.91	13.469	81.00%
2003	TECHNOLOGY SOLUTIONS CO	5.02	45.64	11.00%
2003	A S V INC	52.049	96.387	54.00%
2003	ACTIVE POWER INC	5.334	8.89	60.00%
2004	RAYTECH CORP	26.968	227.313	11.86%
2004	WOODWARD INC	83.562	709.805	11.77%
2004	A S V INC	64.349	160.873	40.00%
2004	ACTIVE POWER INC	8.523	15.783	54.00%
2005	WOODWARD INC	102.018	827.726	12.33%
2005	A S V INC	95.582	245.082	39.00%

2005	ACTIVE POWER INC	7.471	17.788	42.00%
2006	A S V INC	81.225	246.137	33.00%
2006	HAWK CORP	36.049	212.05	17.00%
2006	ACTIVE POWER INC	8.76	25.029	35.00%
2007	HAWK CORP	38.192	228.695	16.70%
2007	ACTIVE POWER INC	10.416	33.601	31.00%
2007	COMMERCIAL VEHICLE GROUP INC	76.646	696.786	11.00%
2008	WOODWARD INC	145.853	1258.204	11.59%
2008	HAWK CORP	51.503	269.648	19.10%
2008	ACTIVE POWER INC	10.144	42.985	23.60%
2008	COMMERCIAL VEHICLE GROUP INC	83.984	763.489	11.00%
2008	ORBCOMM INC	3.28	30.092	10.90%
2009	HAWK CORP	29.826	172.402	17.30%
2009	ACTIVE POWER INC	12.496	40.311	31.00%
2009	ORBCOMM INC	4.466	27.566	16.20%

Figure 1: Caterpillar's Procurement and Sales of Replacement Parts



This figure illustrates the legal title chain for replacement parts in Caterpillar's procurement tax strategy. Caterpillar used its Swiss subsidiary, CSARL, as its global purchaser of manufactured replacement parts (U.S. Senate, 2014). In the figure, the arrows represent the legal title flow of the replacement parts. The red factories represent third-party suppliers of replacement parts. The green circles represent independently-owned Caterpillar dealers, who in turn sell replacement parts to the end customers. According to the Senate report, by 2008 this procurement strategy resulted in 43% of Caterpillar's consolidated profits being shifted to its Swiss subsidiary, CSARL, avoiding about \$2.4 billion in U.S. tax over the period 2000-2012.

Table 1: Sample Distribution

This table provides sample distributions over years (Panel A) and across industries (Panel B). The sample period is from 1994 to 2009.

Panel A: Sample Distribution by Year

Year	All Firms	Principal Customers	Dependent Suppliers	Other Firms
1994	2,595	336	879	1,448
1995	2,691	338	957	1,472
1996	2,847	368	1,081	1,488
1997	2,943	334	1,107	1,596
1998	2,881	300	1,031	1,627
1999	3,002	322	814	1,924
2000	2,843	347	983	1,607
2001	2,363	292	814	1,342
2002	2,507	308	888	1,395
2003	2,644	345	918	1,475
2004	2,852	393	1,008	1,566
2005	2,776	369	980	1,537
2006	2,735	355	1,003	1,485
2007	2,537	338	932	1,371
2008	2,180	282	835	1,160
2009	2,169	262	667	1,303
Total	42,565	5,289	14,897	23,796

Panel B: Sample Distribution by Fama-French 48 Industry Classification

Industry	All Firms	Principal Customers	Dependent Suppliers	Other Firms
Aircraft	314	77	180	83
Agriculture	186	9	73	108
Automobiles and Trucks	852	198	400	302
Beer & Liquor	243	49	50	152
Construction Materials	1,202	52	397	755
Printing and Publishing	452	55	81	316
Shipping Containers	142	12	70	64
Business Services	5,036	257	1,678	3,162
Chemicals	1,040	122	326	603
Electronic Equipment	2,894	475	1,756	940
Apparel	868	58	477	373
Construction	559	20	134	407
Coal	84	0	55	29
Computers	1,666	354	763	677
Pharmaceutical Products	1,418	346	728	514
Electrical Equipment	678	65	239	389
Energy	2,531	374	1,042	1,216
Fabricated Products	216	2	97	119
Food Products	1,106	134	467	560
Entertainment	701	29	125	548
Precious Metals	192	4	40	151
Defense	110	30	70	18
Healthcare	924	85	168	684
Consumer Goods	927	114	373	496
Measuring and Control Equipment	1,167	78	493	612
Machinery	1,944	175	717	1,107
Restaurants, Hotels, Motels	1,007	97	22	889
Medical Equipment	1,442	173	551	752
Non-Metallic and Industrial Metal Mining	313	9	85	220
Miscellaneous	654	56	246	368
Business Supplies	776	88	277	449
Personal Services	510	24	46	440
Retail	2,997	757	122	2,129
Rubber and Plastic Products	546	17	266	270
Shipbuilding, Railroad Equipment	101	8	53	41
Tobacco Products	53	8	26	23
Candy & Soda	133	11	45	79
Steel Works	832	60	301	489
Communication	1,311	220	194	905
Recreation	424	60	253	139
Transportation	1,567	157	606	830
Textiles	248	16	134	101
Wholesale	2,199	354	671	1,287
Total	42,565	5,289	14,897	23,796

Table 2: Summary Statistics

This table provides descriptive statistics for key tax and control variables. The sample period is from 1994 to 2009. All variables are defined in Appendix I

VARIABLE	Mean of Key Variables For			
	All Firms	Principal Customers	Dependent Suppliers	Other Firms
<i>CETR</i>	0.250	0.256	0.231	0.258
<i>ROA</i>	0.122	0.125	0.128	0.118
<i>Leverage</i>	0.157	0.172	0.138	0.165
<i>Loss Carry Forward</i>	0.290	0.329	0.311	0.272
<i>Change in Loss Carry Forward</i>	0.000	0.002	-0.002	0.001
<i>Foreign Assets</i>	0.194	0.282	0.219	0.166
<i>New Investments</i>	0.091	0.090	0.102	0.087
<i>Property, Plant, and Equipment</i>	0.341	0.345	0.321	0.352
<i>Intangible assets</i>	0.148	0.150	0.132	0.158
<i>Equity income in earnings</i>	0.001	0.001	0.001	0.001
<i>Firm Size</i>	5.761	8.322	5.287	5.614
<i>Market-to-Book</i>	2.910	3.758	2.933	2.761
<i>Abnormal Accruals</i>	0.066	0.049	0.074	0.064
<i>Cash Holdings</i>	0.179	0.146	0.221	0.163
<i>Delaware</i>	0.485	0.531	0.530	0.453
<i>Procurement</i>	0.310	0.401	0.348	0.275
<i>Tax Haven Subs</i>	0.262	0.466	0.270	0.226

Table 3: Status in Customer-Supplier Relationships and Its Impact on the Effective Tax Rate

The sample period is from 1994 to 2009. The two-tailed test *t*-statistics in parentheses are based on standard errors clustered by both firm and year. The superscripts ***, **, and * indicate significance at the 0.01, 0.05, and 0.10 levels, respectively. All variables are defined in Appendix I.

VARIABLES	(1) <i>CETR</i>	(2) <i>CETR</i>	(3) <i>CETR</i>
<i>Customer Firm</i>	-0.024*** (-5.58)		-0.011** (-2.39)
<i>Supplier Firm</i>	-0.013*** (-3.40)		-0.008** (-2.00)
<i>Customer Firm's N of Dependent Suppliers</i>		-0.020*** (-6.20)	
<i>Supplier Firm's Sales to Principal Customers</i>		-0.035*** (-4.93)	
<i>Customer Firm with Long-term Suppliers</i>			-0.033*** (-5.27)
<i>Supplier Firm with Long-term Customers</i>			-0.011** (-2.27)
<i>ROA</i>	0.005 (0.21)	0.002 (0.10)	0.004 (0.16)
<i>Leverage</i>	-0.081*** (-6.44)	-0.082*** (-6.51)	-0.081*** (-6.45)
<i>Loss Carry Forward</i>	-0.046*** (-10.40)	-0.046*** (-10.42)	-0.046*** (-10.42)
<i>Change in Loss carry Forward</i>	0.031*** (2.96)	0.030*** (2.88)	0.031*** (2.96)
<i>Foreign Assets</i>	-0.012 (-1.39)	-0.012 (-1.46)	-0.012 (-1.45)
<i>New Investments</i>	0.024** (2.26)	0.025** (2.30)	0.024** (2.27)
<i>Property, Plant, and Equipment</i>	-0.090*** (-8.89)	-0.090*** (-8.90)	-0.091*** (-9.00)
<i>Intangible assets</i>	-0.021 (-1.48)	-0.022 (-1.59)	-0.021 (-1.54)
<i>Equity income in earnings</i>	-0.523 (-1.48)	-0.494 (-1.39)	-0.503 (-1.42)
<i>Firm Size</i>	0.011*** (9.46)	0.012*** (9.85)	0.012*** (9.60)
<i>Market-to-Book</i>	-0.005*** (-6.71)	-0.005*** (-6.77)	-0.005*** (-6.72)
<i>Abnormal Accruals</i>	-0.062*** (-2.98)	-0.058*** (-2.74)	-0.061*** (-2.92)
<i>Cash Holdings</i>	-0.089*** (-9.82)	-0.087*** (-9.57)	-0.089*** (-9.73)
<i>Delaware</i>	-0.009** (-2.42)	-0.008** (-2.33)	-0.009** (-2.40)
<i>Constant</i>	0.236*** (12.54)	0.237*** (12.97)	0.236*** (12.80)
Industry Fixed Effects	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes
Observations	42,565	42,565	42,565
Adjusted R-squared	0.071	0.072	0.072

Table 4: Status in Customer-Supplier Relationships, Offshore Procurement in Tax-Haven Countries and Its Impact on the Effective Tax Rate

The sample period is from 1994 to 2009. The two-tailed test *t*-statistics in parentheses are based on standard errors clustered by both firm and year. The superscripts ***, **, and * indicate significance at the 0.01, 0.05, and 0.10 levels, respectively. All variables are defined in Appendix I.

VARIABLES	(1) <i>CETR</i>	(2) <i>CETR</i>	(3) <i>CETR</i>
<i>PC with Procurement</i>	-0.038*** (-6.94)		
<i>PC with No Procurement</i>	-0.015** (-2.50)		
<i>PC with Tax Haven Subs</i>		-0.042*** (-7.05)	
<i>PC with No Tax Haven Subs</i>		-0.010 (-1.62)	
<i>PC with Procurement & Tax Haven Subs</i>			-0.044*** (-6.42)
<i>PC with Procurement & No Tax Haven Subs</i>			-0.026*** (-3.33)
<i>PC with No Procurement & Tax Haven Subs</i>			-0.039*** (-4.88)
<i>PC with No Procurement & No Tax Haven Subs</i>			-0.003 (-0.43)
<i>Procurement</i>	-0.003 (-0.91)		0.000 (0.11)
<i>Tax Haven Subs</i>		0.006 (1.57)	0.013** (2.55)
<i>Procurement × Tax Haven Subs</i>			-0.016*** (-2.92)
<i>Supplier Firm</i>	-0.013*** (-3.36)	-0.013*** (-3.42)	-0.013*** (-3.39)
<i>ROA</i>	0.004 (0.16)	0.006 (0.22)	0.004 (0.17)
<i>Leverage</i>	-0.080*** (-6.34)	-0.082*** (-6.48)	-0.081*** (-6.43)
<i>Loss Carry Forward</i>	-0.045*** (-10.38)	-0.046*** (-10.61)	-0.045*** (-10.53)
<i>Change in Loss carry Forward</i>	0.031*** (3.00)	0.031*** (2.98)	0.032*** (3.02)
<i>Foreign Assets</i>	-0.012 (-1.44)	-0.012 (-1.47)	-0.013 (-1.50)
<i>New Investments</i>	0.024** (2.30)	0.024** (2.23)	0.024** (2.27)
<i>Property, Plant, and Equipment</i>	-0.091*** (-8.99)	-0.090*** (-8.70)	-0.091*** (-8.78)
<i>Intangible assets</i>	-0.020 (-1.47)	-0.020 (-1.49)	-0.020 (-1.48)
<i>Equity income in earnings</i>	-0.518 (-1.47)	-0.486 (-1.37)	-0.485 (-1.37)
<i>Firm Size</i>	0.011*** (9.48)	0.011*** (8.71)	0.011*** (8.65)
<i>Market-to-Book</i>	-0.005*** (-6.65)	-0.005*** (-6.59)	-0.005*** (-6.53)
<i>Abnormal Accruals</i>	-0.062*** (-2.94)	-0.062*** (-2.98)	-0.061*** (-2.92)
<i>Cash Holdings</i>	-0.089*** (-9.75)	-0.089*** (-9.89)	-0.088*** (-9.78)
<i>Delaware</i>	-0.008** (-2.22)	-0.009** (-2.48)	-0.008** (-2.43)
<i>Constant</i>	0.237*** (12.81)	0.236*** (12.80)	0.237*** (12.99)
Industry Fixed Effects	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes
Observations	42.565	42.565	42.565
Adjusted R-squared	0.072	0.072	0.072

Table 5: Tax Avoidance Diffusion along the Supply Chain

The sample period is from 1994 to 2009. Different from previous specifications, the data is organized at the customer-supplier-year level. The dependent variable is the effective tax rate for dependent supplier firms. Except for the corresponding tax rates of customer firms, all other control variables are related to supplier firms' characteristics. The two-tailed test *t*-statistics in parentheses are based on standard errors clustered by both firm and year. The superscripts ***, **, and * indicate significance at the 0.01, 0.05, and 0.10 levels, respectively. All variables are defined in Appendix I.

VARIABLES	(1) <i>Supplier's CETR</i>	(2) <i>Supplier's CETR</i>
<i>Customer's CETR</i>	0.034** (2.00)	0.073** (2.28)
<i>Customer's CETR × Distance</i>		-0.043** (-2.48)
<i>Distance</i>		0.008 (1.27)
<i>ROA</i>	0.086** (2.46)	0.097*** (2.62)
<i>Leverage</i>	-0.105*** (-3.59)	-0.105*** (-3.51)
<i>Loss Carry Forward</i>	-0.054*** (-8.26)	-0.054*** (-8.41)
<i>Change in Loss carry Forward</i>	0.027 (1.46)	0.028 (1.60)
<i>Foreign Assets</i>	-0.002 (-0.11)	-0.001 (-0.07)
<i>New Investments</i>	0.068*** (3.00)	0.068*** (3.10)
<i>Property, Plant, and Equipment</i>	-0.141*** (-5.58)	-0.142*** (-5.61)
<i>Intangible assets</i>	-0.016 (-0.71)	-0.015 (-0.69)
<i>Equity income in earnings</i>	-1.639** (-2.19)	-1.973** (-2.41)
<i>Firm Size</i>	0.010*** (4.74)	0.010*** (4.59)
<i>Market-to-Book</i>	-0.006*** (-4.18)	-0.006*** (-4.39)
<i>Abnormal Accruals</i>	-0.143*** (-3.11)	-0.130*** (-2.83)
<i>Cash Holdings</i>	-0.111*** (-7.14)	-0.108*** (-6.41)
<i>Delaware</i>	-0.013* (-1.93)	-0.009 (-1.39)
Constant	0.410** (2.20)	0.047 (0.84)
Supplier Industry Fixed Effects	Yes	Yes
Supplier State Fixed Effects	Yes	Yes
Supplier Year Fixed Effects	Yes	Yes
Observations	10,203	8,998
Adjusted R-squared	0.112	0.109

Table 6 Relationship Establishment and Tax Avoidance of Dependent Suppliers

This table reports the impact of relationship establishment on the cash effective tax rate (*CETR*) based on a difference-in-difference approach. The sample period is from 1994 to 2009. Relationship establishment is defined as when a firm reports a principal customer that accounts for at least 10% of its total sales for the first time in year t and the relationship lasts for at least 2 years (i.e., year $t+1$ and year $t+2$). For all tests reported in this table, the pre-establishment period is year $t-2$ (i.e., 2 years before the principal customer is first reported) and the post-establishment period is year $t+2$ (i.e., 2 years after the principal customer is first reported). We combine two observations for the pre-establishment period and the post-establishment period for each relationship establishment into one pair. *After Relationship Establishment* is a dummy variable that equals 0 for pre-establishment period and 1 for post-establishment period. The dependent variable in Columns (1)-(3) is *CETR*, the cash effective tax rate of dependent suppliers; the dependent variable in Columns (4)-(6) is *Adj. CETR*, the adjusted cash effective tax rate of dependent suppliers. The *Adj. CETR* is the difference between *CETR* and the average *CETR* of benchmark firms that are neither principal customers nor dependent suppliers between year $t-2$ and $t+2$. We require that, in year $t-2$, the incumbent supplier and the benchmark firms must belong to the same size and *CETR* quintiles in the same industry. In addition to the tests for the full sample reported in Columns (1) and (4), we also partition all observations into two groups based on the cash effective tax rate of the principal customers. Columns (2) and (5) report the results based on the sample where the principal customer's *CETR* is lower than the 25th percentile (Q1) of *CETR* within its industry; columns (3) and (6) report the results based on the sample where the principal customer's *CETR* is higher than the 25th percentile (Q1) of *CETR* within its industry. In all specifications, we have controlled for pair fixed effects and the two-tailed test t -statistics in parentheses are based on standard errors clustered by both firm and the year of relationship establishment.

VARIABLES	(1)	(2)		(3)	(4)	(5)		(6)
	All	<i>Suppliers' CETR</i>		Customer Tax Rate>Industry Q1	All	<i>Suppliers' Adj. CETR</i>		Customer Tax Rate>Industry Q1
		Customer Tax Rate≤Industry Q1	Customer Tax Rate>Industry Q1			Customer Tax Rate≤Industry Q1	Customer Tax Rate>Industry Q1	
<i>After Relationship Establishment</i>	-0.025***	-0.045**	-0.010	-0.027***	-0.038**	-0.016		
	(-2.81)	(-2.48)	(-1.29)	(-3.18)	(-2.25)	(-1.41)		
<i>ROA</i>	0.113	0.412**	-0.096	-0.211*	0.051	-0.382*		
	(1.19)	(2.11)	(-0.71)	(-1.34)	(0.29)	(-1.74)		
<i>Leverage</i>	-0.131	0.023	-0.254*	-0.088	-0.020	-0.158**		
	(-0.96)	(0.07)	(-1.81)	(-0.85)	(-0.07)	(-2.06)		
<i>Loss Carry Forward</i>	-0.019	0.035	-0.047	0.014	0.034	-0.000		
	(-0.70)	(0.73)	(-1.27)	(0.76)	(0.93)	(-0.01)		
<i>Change in Loss carry Forward</i>	-0.004	-0.104	0.058	-0.069	-0.286	0.036		
	(-0.03)	(-0.29)	(0.75)	(-0.61)	(-1.16)	(0.41)		
<i>Foreign Assets</i>	0.005	-0.163***	0.091**	-0.018	-0.175**	0.062		
	(0.24)	(-2.76)	(2.49)	(-0.65)	(-2.31)	(1.21)		
<i>New Investments</i>	0.074	-0.016	0.176	0.109*	0.060	0.191**		
	(0.83)	(-0.11)	(1.52)	(1.84)	(0.83)	(2.17)		
<i>Property, Plant, and Equipment</i>	0.032	0.058	-0.058	0.128	0.161	0.054		
	(0.21)	(0.45)	(-0.30)	(0.93)	(1.06)	(0.37)		
<i>Intangible assets</i>	-0.053	-0.088	-0.043	-0.094**	-0.129**	-0.090		
	(-0.85)	(-0.84)	(-0.45)	(-2.02)	(-2.10)	(-1.17)		
<i>Equity income in earnings</i>	-4.890**	-6.054**	-2.792*	-2.741	-3.896	-0.242		
	(-2.42)	(-2.17)	(-1.69)	(-1.02)	(-1.15)	(-0.11)		
<i>Firm Size</i>	0.034**	0.050***	0.014	0.019	0.016	0.008		
	(2.09)	(4.04)	(0.51)	(0.93)	(1.28)	(0.26)		
<i>Market-to-Book</i>	-0.014***	-0.017***	-0.010**	-0.009**	-0.011***	-0.005		
	(-3.29)	(-3.74)	(-2.40)	(-2.18)	(-2.57)	(-1.00)		
<i>Abnormal Accruals</i>	0.076	0.403	-0.138	-0.027	0.341	-0.256		
	(0.42)	(1.36)	(-0.95)	(-0.15)	(1.05)	(-1.64)		
<i>Cash Holdings</i>	-0.076*	-0.072	-0.061	0.049	0.092	0.051		
	(-1.81)	(-0.60)	(-1.16)	(1.08)	(1.42)	(0.74)		
<i>Constant</i>	0.100	-0.059	0.276	-0.103	-0.147*	-0.003		
	(0.76)	(-0.83)	(1.35)	(-0.71)	(-1.94)	(-0.01)		
Pair Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes		
Observations	1,086	412	674	1,086	412	674		
Adjusted R-squared	0.319	0.264	0.365	0.098	0.092	0.132		

Table 7: Customer-Supplier Relationships and Various Effective Tax Rates

The sample period is from 1994 to 2009. The two-tailed test *t*-statistics in parentheses are based on standard errors clustered by both firm and year. The superscripts ***, **, and * indicate significance at the 0.01, 0.05, and 0.10 levels, respectively. All variables are defined in Appendix I.

Panel A: Main Effects

VARIABLES	(1) <i>GETR</i>	(2) <i>CETR3</i>	(3) <i>CETR5</i>	(4) <i>Cash Ratio</i>
<i>Customer Firm</i>	-0.009** (-2.55)	-0.015*** (-3.81)	-0.011** (-2.54)	-0.025*** (-7.02)
<i>Supplier Firm</i>	-0.007*** (-2.69)	-0.015*** (-3.89)	-0.014*** (-3.67)	-0.008*** (-2.94)
<i>ROA</i>	0.347*** (18.94)	0.045** (2.18)	0.029 (1.10)	0.493*** (24.53)
<i>Leverage</i>	0.027** (2.16)	-0.062*** (-5.03)	-0.078*** (-6.08)	-0.041*** (-4.48)
<i>Loss Carry Forward</i>	-0.015*** (-3.78)	-0.039*** (-9.49)	-0.030*** (-8.01)	-0.034*** (-9.25)
<i>Change in Loss carry Forward</i>	0.021** (2.06)	0.060*** (3.25)	0.084*** (4.86)	0.036*** (3.38)
<i>Foreign Assets</i>	-0.052*** (-9.77)	-0.019** (-2.17)	-0.019** (-2.03)	-0.012** (-2.16)
<i>New Investments</i>	-0.006 (-0.68)	-0.025** (-2.33)	-0.027** (-2.33)	0.059*** (4.66)
<i>Property, Plant, and Equipment</i>	-0.047*** (-9.55)	-0.088*** (-9.93)	-0.090*** (-9.35)	-0.160*** (-19.57)
<i>Intangible assets</i>	0.009 (0.73)	-0.012 (-0.84)	-0.010 (-0.72)	-0.040*** (-3.35)
<i>Equity income in earnings</i>	-0.966*** (-3.50)	-0.560* (-1.74)	-0.324 (-1.06)	0.342 (1.32)
<i>Firm Size</i>	0.011*** (6.98)	0.006*** (5.13)	0.003** (2.00)	0.009*** (10.96)
<i>Market-to-Book</i>	-0.008*** (-11.23)	-0.005*** (-7.52)	-0.005*** (-7.90)	-0.005*** (-7.62)
<i>Abnormal Accruals</i>	-0.195*** (-9.06)	-0.038** (-2.24)	0.002 (0.09)	0.065*** (3.14)
<i>Cash Holdings</i>	-0.083*** (-11.40)	-0.076*** (-8.08)	-0.074*** (-8.36)	-0.142*** (-17.29)
<i>Delaware</i>	0.009** (2.40)	-0.009** (-2.41)	-0.009** (-2.48)	-0.004 (-1.47)
Constant	0.218*** (13.73)	0.273*** (12.56)	0.292*** (10.36)	0.125*** (6.28)
Industry Fixed Effects	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes
Observations	47,054	36,602	32,499	39,054
Adjusted R-squared	0.093	0.099	0.103	0.192

Panel B: Procurement and Subsidiaries in Tax Haven Countries

VARIABLES	(1) <i>GETR</i>	(3) <i>CETR3</i>	(4) <i>CETR5</i>	(5) <i>Cash Ratio</i>
<i>PC with Procurement & Tax Haven Subs</i>	-0.026*** (-4.25)	-0.034*** (-4.89)	-0.033*** (-4.45)	-0.036*** (-6.43)
<i>PC with Procurement & No Tax Haven Subs</i>	-0.012* (-1.86)	-0.014** (-2.10)	-0.014** (-2.11)	-0.015*** (-2.59)
<i>PC with No Procurement & Tax Haven Subs</i>	-0.024*** (-3.54)	-0.032*** (-5.96)	-0.027*** (-4.84)	-0.036*** (-6.40)
<i>PC with No Procurement & No Tax Haven Subs</i>	0.005 (1.00)	0.007 (1.14)	0.016** (1.99)	-0.015*** (-2.87)
<i>Procurement</i>	0.003 (0.59)	0.003 (0.66)	-0.002 (-0.57)	-0.001 (-0.48)
<i>Tax Haven Subs</i>	0.017*** (4.18)	0.016*** (3.57)	0.009** (2.03)	0.007 (1.61)
<i>Procurement × Tax Haven Subs</i>	-0.025*** (-4.12)	-0.015*** (-2.68)	-0.006 (-1.14)	-0.005 (-1.22)
<i>Supplier Firm</i>	-0.008*** (-3.03)	-0.015*** (-3.96)	-0.014*** (-3.62)	-0.008*** (-2.91)
<i>ROA</i>	0.347*** (19.06)	0.045** (2.16)	0.028 (1.06)	0.492*** (24.51)
<i>Leverage</i>	0.026** (2.02)	-0.064*** (-5.20)	-0.078*** (-6.14)	-0.042*** (-4.55)
<i>Loss Carry Forward</i>	-0.015*** (-3.77)	-0.039*** (-9.66)	-0.030*** (-8.07)	-0.034*** (-9.42)
<i>Change in Loss carry Forward</i>	0.022** (2.07)	0.061*** (3.30)	0.085*** (4.95)	0.036*** (3.40)
<i>Foreign Assets</i>	-0.052*** (-9.82)	-0.021** (-2.34)	-0.020** (-2.19)	-0.013** (-2.29)
<i>New Investments</i>	-0.007 (-0.79)	-0.025** (-2.37)	-0.027** (-2.30)	0.059*** (4.66)
<i>Property, Plant, and Equipment</i>	-0.045*** (-9.36)	-0.088*** (-9.67)	-0.091*** (-9.21)	-0.160*** (-19.22)
<i>Intangible assets</i>	0.009 (0.74)	-0.012 (-0.82)	-0.010 (-0.69)	-0.039*** (-3.37)
<i>Equity income in earnings</i>	-0.940*** (-3.41)	-0.517 (-1.60)	-0.274 (-0.89)	0.370 (1.42)
<i>Firm Size</i>	0.010*** (6.55)	0.005*** (4.48)	0.002* (1.72)	0.009*** (9.62)
<i>Market-to-Book</i>	-0.008*** (-11.07)	-0.005*** (-7.43)	-0.005*** (-7.86)	-0.004*** (-7.51)
<i>Abnormal Accruals</i>	-0.194*** (-9.04)	-0.037** (-2.17)	0.004 (0.16)	0.065*** (3.16)
<i>Cash Holdings</i>	-0.083*** (-11.50)	-0.075*** (-8.07)	-0.073*** (-8.36)	-0.142*** (-17.32)
<i>Delaware</i>	0.008** (2.16)	-0.009*** (-2.60)	-0.008** (-2.35)	-0.003 (-1.41)
Constant	0.217*** (13.71)	0.274*** (13.02)	0.293*** (10.68)	0.126*** (6.45)
Industry Fixed Effects	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes
Observations	47,054	36,602	32,499	39,054
Adjusted R-squared	0.094	0.101	0.105	0.193

Table 8: Customer-Supplier Relationships and Tax Aggressiveness

The sample period is from 1994 to 2009. All regressions also include industry and fiscal year indicators. The two-tailed test *t*-statistics (Z-statistics) in parentheses are based on standard errors clustered by both firm and year. The superscripts ***, **, and * indicate significance at the 0.01, 0.05, and 0.10 levels, respectively. All variables are defined in Appendix I.

Panel A: Main Effects

VARIABLES	(1) <i>SHELTER</i>	(2) <i>DTAX</i>	(3) <i>UTB</i>	(4) <i>Pred_UTB</i>
<i>Customer Firm</i>	0.762*** (9.27)	0.016*** (8.57)	0.001** (2.23)	0.002*** (9.73)
<i>Supplier Firm</i>	-0.147** (-2.30)	-0.000 (-0.34)	-0.000 (-0.06)	-0.001*** (-4.03)
<i>ROA</i>	11.809*** (18.09)	-0.056*** (-3.14)	-0.007** (-2.39)	-0.000 (-0.40)
<i>Leverage</i>	-0.179 (-0.67)	-0.023*** (-4.81)	-0.006*** (-3.01)	-0.008*** (-13.68)
<i>Loss Carry Forward</i>	0.355*** (5.30)	0.012*** (6.57)	0.001 (1.12)	0.001*** (5.08)
<i>Change in Loss carry Forward</i>	16.018*** (20.85)	-0.015 (-1.39)	0.001 (0.35)	0.000 (0.60)
<i>Foreign Assets</i>	1.091*** (9.62)	0.027*** (8.43)	0.006*** (4.72)	0.011*** (33.37)
<i>New Investments</i>	0.480** (2.27)	-0.003 (-0.44)	0.007** (2.55)	0.016*** (19.43)
<i>Property, Plant, and Equipment</i>	1.097*** (8.03)	0.008*** (2.61)	-0.008*** (-4.26)	-0.010*** (-28.58)
<i>Intangible assets</i>	0.221 (1.38)	0.039*** (5.02)	-0.005*** (-2.69)	-0.009*** (-15.52)
<i>Equity income in earnings</i>	20.106*** (3.47)	-0.973*** (-5.91)	0.094 (1.20)	-0.043*** (-4.48)
<i>Firm Size</i>	2.293*** (45.40)	-0.012*** (-18.56)	0.001*** (5.88)	0.000*** (9.99)
<i>Market-to-Book</i>	-0.275*** (-15.22)	0.004*** (8.95)	0.000 (1.50)	0.000*** (9.35)
<i>Abnormal Accruals</i>	18.437*** (41.01)	0.212*** (10.45)	-0.007** (-2.10)	0.001 (0.96)
<i>Cash Holdings</i>	0.956*** (6.10)	0.042*** (9.77)	0.005*** (3.06)	0.004*** (11.13)
<i>Delaware</i>	-0.148** (-2.10)	-0.005*** (-3.32)	0.002*** (4.14)	0.001*** (4.62)
Constant	-19.177*** (-34.89)	0.093*** (8.36)	-0.009*** (-3.44)	0.009*** (11.13)
Industry Fixed Effects	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes
Observations	47,054	47,054	3,488	47,054
Pseudo R2	0.683			
Adjusted R-squared		0.135	0.130	0.526

Panel B: Procurement and Subsidiaries in Tax Haven Countries

VARIABLES	(1) <i>SHELTER</i>	(2) <i>DTAX</i>	(3) <i>UTB</i>	(4) <i>Pred_UTB</i>
<i>PC with Procurement & Tax Haven Subs</i>	0.998*** (5.66)	0.017*** (4.44)	0.003*** (2.72)	0.001*** (2.85)
<i>PC with Procurement & No Tax Haven Subs</i>	0.686*** (4.02)	0.015*** (4.36)	0.002 (1.46)	0.002*** (5.29)
<i>PC with No Procurement & Tax Haven Subs</i>	1.116*** (7.47)	0.014*** (4.98)	0.003 (0.99)	0.002*** (7.42)
<i>PC with No Procurement & No Tax Haven Subs</i>	0.530*** (4.36)	0.016*** (6.24)	-0.001 (-1.07)	0.002*** (8.61)
<i>Procurement</i>	-0.276*** (-4.08)	-0.010*** (-5.56)	-0.001* (-1.75)	0.000** (2.02)
<i>Tax Haven Subs</i>	-0.280*** (-3.02)	-0.005** (-2.24)	0.002*** (3.17)	0.001*** (5.10)
<i>Procurement × Tax Haven Subs</i>	0.432*** (3.14)	0.013*** (4.27)	0.003** (1.99)	-0.000 (-1.51)
<i>Supplier Firm</i>	-0.130** (-1.98)	0.000 (0.20)	-0.000 (-0.28)	-0.001*** (-4.32)
<i>ROA</i>	11.844*** (17.89)	-0.057*** (-3.18)	-0.007** (-2.52)	-0.000 (-0.41)
<i>Leverage</i>	-0.153 (-0.58)	-0.022*** (-4.59)	-0.007*** (-3.55)	-0.008*** (-13.91)
<i>Loss Carry Forward</i>	0.360*** (5.40)	0.012*** (6.58)	0.000 (0.42)	0.001*** (4.77)
<i>Change in Loss carry Forward</i>	16.027*** (20.80)	-0.015 (-1.40)	0.001 (0.19)	0.000 (0.55)
<i>Foreign Assets</i>	1.094*** (9.36)	0.026*** (8.11)	0.004*** (3.65)	0.011*** (32.11)
<i>New Investments</i>	0.499** (2.36)	-0.002 (-0.32)	0.006** (2.43)	0.016*** (19.45)
<i>Property, Plant, and Equipment</i>	1.064*** (7.72)	0.007** (2.27)	-0.007*** (-3.21)	-0.010*** (-27.62)
<i>Intangible assets</i>	0.214 (1.33)	0.039*** (5.03)	-0.005** (-2.43)	-0.009*** (-15.61)
<i>Equity income in earnings</i>	20.318*** (3.51)	-0.979*** (-5.97)	0.087 (1.12)	-0.043*** (-4.38)
<i>Firm Size</i>	2.299*** (44.75)	-0.011*** (-18.35)	0.001*** (4.30)	0.000*** (8.98)
<i>Market-to-Book</i>	-0.275*** (-15.15)	0.004*** (8.97)	0.000* (1.68)	0.000*** (9.52)
<i>Abnormal Accruals</i>	18.399*** (41.04)	0.211*** (10.53)	-0.007** (-2.21)	0.001 (1.05)
<i>Cash Holdings</i>	0.934*** (5.91)	0.041*** (9.79)	0.005*** (3.37)	0.004*** (11.33)
<i>Delaware</i>	-0.103 (-1.46)	-0.004*** (-2.63)	0.002*** (3.63)	0.000*** (3.70)
Constant	-19.110*** (-34.44)	0.094*** (8.43)	-0.009*** (-3.20)	0.009*** (11.22)
Industry Fixed Effects	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes
Observations	47,054	47,054	3,488	47,054
Pseudo R-squared	0.684			
Adjusted R-squared		0.136	0.144	0.527