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Customer concentration and corporate tax avoidance☆

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ABSTRACT

Firms with a concentrated corporate customer base need to hold more cash and have a stronger incentive to manage earnings upwards. Since tax planning can increase both cash flow and accounting earnings, firms with a concentrated customer base may be more likely to engage in tax avoidance. We find evidence of a positive association between the level of corporate customer concentration and the extent of tax avoidance. In addition, we find that the positive relation between corporate customer concentration and tax avoidance is more pronounced when a firm has a lower Market Share in its industry, enjoys less revenue diversification, and engages less in real earnings management. In contrast to corporate major customers, governmental major customers provide stable cash flow to suppliers, which is likely to alleviate supplier firms' need for tax avoidance. We find that firms engage in lower levels of tax avoidance when they have a governmental major customer, and that this association is less pronounced under Democratic presidencies. Taken together, our findings indicate that a firm's customer concentration (i.e., corporate and governmental major customers) has a significant effect on the extent to which it avoids taxes.

1. Introduction

The significant variation in the level of tax avoidance among public firms has attracted much academic attention (e.g., Dyreng et al., 2008). Prior studies show that the level of corporate tax avoidance is affected by: (1) financial characteristics (Gupta and Newberry, 1997; Rego, 2003; Graham and Tucker, 2006; Lisowsky, 2010), (2) governance and executive compensation (Phillips, 2003; Desai and Dharmapala, 2006; Rego and Wilson, 2012), (3) ownership structure (Chen et al., 2010; Cheng et al., 2012), and (4) external stakeholders such as labor unions (Chyz et al., 2013), the Internal Revenue Service (IRS) (Hoopes et al., 2012), and independent auditors (McGuire et al., 2012). Surprisingly, there is little evidence on how a firm's customer concentration, an important feature of its business operation, relates to the extent of its tax avoidance. In this study, we examine the differential effect of corporate and governmental customer concentration on tax avoidance.

Customer concentration measures how concentrated a supplier's customer base is, and is one of the most important characteristics of the supplier–customer relationship.[1] The extant literature finds a significant association between customer concentration and (1) supplier financial policy (Titman and Wessels, 1988; Banerjee et al., 2008; Wang, 2012; Cohen and Li, 2013; Itzkowitz, 2013), (2) supplier performance and risk (Ravenscraft, 1983; Kalwani and Narayandas, 1995; Piercy and Lane, 2006; Patatoukas, 2012; Dhaliwal et al., 2013; Dhaliwal et al., 2016; Campello and Gao, 2014), and (3) supplier financial reporting quality (Raman and Shahrur, 2008; Hui et al., 2012). However, few studies have addressed how customer concentration affects the supplier's relationship with another important stakeholder, the government, through tax payment.[2]

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[1] We use the terms firm, supplier, and supplier firm interchangeably in this paper.

[2] A concurrent paper by Cen et al. (2014) also shows that firms with major customers have higher levels of tax avoidance. Our study differs from theirs in at least the following four ways. First, we differentiate between corporate and governmental major customers and find that these two types of major customers have opposite effects on tax avoidance. Second, we contend that firms with major corporate customers have incentives to engage in tax avoidance because of the cash flow risk inherent in their business model; furthermore, we show that the level of tax avoidance is associated with the level of cash flow risk (e.g., when the customer

Firms with concentrated corporate customers have incentives to hold additional cash for at least three reasons. First, reliance on major customers entails higher cash flow risk because the loss of a major customer could lead to a sizable drop in the supplier's cash flow (Hertzel et al., 2008; Dhaliwal et al., 2013; Dhaliwal et al., 2016; Campello and Gao, 2014). Second, Wang (2012) and Itzkowitz (2013) suggest that suppliers with major customers may need to invest in relationship-specific assets as a commitment to their customers. Third, Ravenscraft (1983), Balakrishnan et al. (1996), Gosman and Kohlbeck (2009), and Piercy and Lane (2006) argue that major customers tend to use their bargaining power to obtain favorable terms from their suppliers, resulting in lower profitability and higher earnings and cash volatility for suppliers. For all the above reasons, suppliers with concentrated customers need to hold more cash. Because tax avoidance can reduce cash outflow (Desai and Dharmapala, 2009; Badertscher et al., 2010; Hanlon and Heitzman, 2010), firms with concentrated customers may have incentives to engage in more tax avoidance activities.

Firms can increase cash using various means other than tax avoidance such as share and debt issuance, cutting dividends, and reducing discretionary spending. For example, Wang (2012) and Itzkowitz (2013) suggest that firms with high customer concentration use lower dividend levels and share issuance, respectively, to keep their cash holding high, suggesting that firms with concentrated customers may not rely on tax avoidance to increase cash. We argue that whether firms rely on tax avoidance or other means to increase cash depends on the relative cost of each method and that tax avoidance is a relatively low cost means for firms with concentrated customers to generate cash internally.[3] First, other ways of generating cash may not be available or may lead to adverse consequences for firms relying on major customers. For example, unfavorable macroeconomic conditions and the high cost of capital associated with firms that rely on major customers could make it very costly to raise cash externally (McLean, 2011; Dhaliwal et al., 2016), cutting dividends could signal a firm's poor future prospects and damage its relationships with major customers (Titman, 1984), and engaging in real earnings management (e.g., reducing discretionary spending) could hurt a firm's operations and future cash flow (Roychowdhury, 2006; Cohen et al., 2008), making it more difficult for firms with a concentrated customer base to keep their cash holding high in the future. Second, firms with a higher probability of financial distress tend to use tax avoidance to save cash (Mills and Newberry, 2001; Noga and Schnader, 2013). Firms with heavy customer concentration have a higher probability of experiencing financial distress (Ravenscraft, 1983; Balakrishnan et al., 1996; Gosman et al., 2004; Piercy and Lane, 2006), and thus are more likely to engage in tax avoidance to conserve cash. Third, the low debt ratio associated with firms with high customer concentration (Titman and Wessels, 1988; Shantanu et al., 2008) provides incentives for tax avoidance because these firms have a small debt tax shield.

Firms with high corporate customer concentration may also have incentives to engage in tax avoidance in order to manage their earnings upwards. Establishing a major supplier–customer relationship requires a long-term purchase commitment and relationship-specific investments that will lose value outside the relationship (Titman, 1984). A customer will therefore be hesitant to commit to such a relationship if the supplier is perceived to have poor future prospects. Therefore, suppliers have incentives to manage their earnings upwards to enhance the perception of their business prospects. Consistent with this proposition, Raman and Shahrur (2008) find that corporate customer concentration is positively related to the magnitude of discretionary accruals and the likelihood of reporting a large earnings increase. Furthermore, Dhaliwal et al. (2004) and Cook et al. (2008) show that firms can use tax accruals to manage their earnings upwards, leading to a lower effective tax rate. On the other hand, the close customer–supplier relationship enables major customers to better assess the supplier's business prospects and major customers are also able to use their bargaining power to demand conservative financial reporting from their suppliers. For example, Hui et al. (2012) show that, in response to major customers' demand for timely recognition of bad news, suppliers report more conservative accounting numbers, implying that suppliers with major customers are less likely to use tax avoidance to manage earnings upward. In summary, prior literature provides somewhat conflicting predictions regarding whether firms with greater corporate customer concentration are more likely to avoid taxes.

We also examine the effect of having a governmental major customer on tax avoidance. In contrast to corporate customers, governmental customers are less likely to default or go bankrupt, and also tend to sign long-term contracts with suppliers. Consequently, the presence of a governmental major customer reduces, rather than increases, a firm's cash flow risk, its need to hold additional cash, and its future financial distress risk (Cohen and Li, 2013; Dhaliwal et al., 2016). Similarly, Mills et al. (2013) show that firms that receive the most federal contract dollars pay higher levels of federal taxes. All these reasons suggest a lower need and incentive for tax avoidance. We therefore expect firms with governmental major customers to have lower levels of tax avoidance.

We define a major customer as a customer that accounts for at least 10% of a supplier firm's total sales.[4] We employ the following three measures to capture the degree of a firm's customer concentration: (1) an indicator variable that reflects whether a firm has at least one corporate major customer, (2) the sales-based Herfindahl–Hirschman Index calculated as the sum of the squares of the ratio of a supplier's sales to corporate major customers over its total sales (Patatoukas, 2012), and (3) the percentage of a supplier's total sales to all corporate major customers. We also use three measures of tax avoidance following prior literature: (1) current effective tax rate (*Current ETR*), (2) cash effective tax rate (*Cash ETR*), and (3) Book-tax Difference factor (*BTD Factor*), which is the first principal component extracted from three different Book-tax Difference measures to capture the difference between a firm's accounting income and taxable income (Kim et al., 2011).

Based on a large sample of U.S. firms during 1988–2011, we find that a firm's corporate customer concentration is positively associated with the level of its tax avoidance after controlling for various determinants of firm-level tax avoidance documented in prior literature. That is, a firm with greater corporate customer concentration tends to engage in more tax avoidance activities. The results are robust to all three measures of customer concentration and all three measures of tax avoidance. For example, we find that

switching cost is low and the firm's revenue is not diversified). In contrast, Cen et al. (2014) focus on how supplier firms can obtain tax avoidance knowledge from their principal customers. Third, we find a substitution effect between tax avoidance and real earnings management for firms with corporate major customers. Fourth, we find that the effect of governmental major customers on tax avoidance is affected by the political/presidential cycle.

[3] Wang (2012) and Itzkowitz (2013) do not examine whether tax avoidance is used by firms with concentrated customers to generate cash. Thus, their studies do not exclude the possibility that tax avoidance is an important means for these firms to keep their cash holding high. In Section 5.8, we show that high customer concentration firms can increase their cash holding especially when they also employ tax avoidance, suggesting that tax avoidance helps these firms increase their cash holding.

[4] Following prior literature, we use the 10% cutoff because Statement of Financial Accounting Standards No. 14 (SFAS 14) requires a firm to disclose in its financial statements external customers that individually account for 10% or more of its total sales.

the presence of a corporate major customer is associated with a 1.2 and a 1.7% lower *Current ETR* and *Cash ETR*, respectively.

In contrast to the results for corporate customer concentration, we find a negative relation between the presence of a governmental major customer and tax avoidance. For example, the presence of a governmental major customer is associated with an increase of 1.9% in *Cash ETR*, consistent with the presence of governmental major customers alleviating cash flow risk and thus the incentive for tax avoidance.

To provide more evidence that cash flow risk and tax avoidance incentives stemming from corporate customer concentration are what drive up tax avoidance, we examine the cross-sectional variation in the relation between tax avoidance and corporate customer concentration. Specifically, we identify conditions where firms with a concentrated corporate customer base have stronger or weaker incentives to engage in tax avoidance activities. First, when a supplier's customers have low switching cost, the supplier is more likely to lose a major customer and thus has higher cash flow and financial distress risks. This will provide additional incentives for the supplier to engage in tax planning to shore up cash and mitigate future financial distress. Using a supplier's Market Share in its industry to proxy for its customers' switching cost, we find that a supplier with corporate major customers is more likely to engage in tax avoidance activities when its Market Share is lower (i.e., its customers' switching cost is lower). Second, when a supplier has lower revenue diversification (i.e., fewer business segments), it is less likely to recover from the loss of a major customer and thus could need more tax planning to save cash and prepare for possible financial distress. We find evidence consistent with this prediction. Third, we test whether real earnings management, which can increase cash and reported earnings (e.g., Roychowdhury, 2006; Cohen et al., 2008; Cohen and Zarowin, 2010), can substitute for a firm's need to engage in tax avoidance activities. We find evidence supporting this substitution hypothesis between real earnings management and tax avoidance.

We conduct several tests to alleviate the endogeneity concern that our corporate major customer results are driven by other firm characteristics. First, we conduct a changes analysis to ensure that the differences in tax avoidance are attributable to differences in corporate customer concentration. We find that changes in corporate customer concentration are positively associated with changes in cash effective tax rate. Second, we use propensity scores to match a sample having no corporate major customers with a sample having at least one corporate major customer. We find that firms with at least one corporate major customer avoid taxes to a greater extent than firms with no corporate major customer. Third, we test the effect of an exogenous shock to customer concentration on the level of tax avoidance. Specifically, we find a decrease in the level of tax avoidance after a firm with high customer concentration acquires a similar-sized firm with low customer concentration. This result indicates that the level of tax avoidance is driven by the level of customer concentration and not by some other unidentified firm characteristics. Fourth, we find a significant increase in the cash holding of high customer concentration firms when these firms' tax avoidance is high, which is consistent with tax avoidance being used by these firms to increase cash holding.

Since the political/presidential cycle affects governmental spending and cash flow volatility (Belo et al., 2013), we also explore how the political/presidential cycle affects the relation between having a governmental major customer and tax avoidance. We find that our previously documented negative relation between the presence of a governmental major customer and tax avoidance is less pronounced under Democratic presidencies, during which the governmental cash flow tends to be more volatile (Belo et al., 2013). This suggests that firms with governmental major customers are also likely to engage in tax avoidance when the cash flow from the government is volatile, consistent with our argument that cash flow volatility is one of the underlying causes for firms to engage in tax avoidance.

We also document the robustness of our results with a battery of additional tests. First, the level of customer concentration may be influenced by a firm's business strategy or life cycle. For example, younger firms tend to have a more concentrated customer base. Our univariate analysis indicates that the level of customer concentration is not economically significantly related to a firm's business strategy or life cycle stage. To further mitigate this concern, we include indicators of business strategy and life cycle stage in our baseline regression analysis, and our main results remain robust. Second, our results are robust to two alternative tax avoidance measures: the 5-year cash effective tax rate and the permanent Book-tax Difference. Finally, our results are qualitatively unchanged when we control for CEO compensation incentives, additional determinants of tax avoidance, and cash flow volatility.

Our study makes several contributions. First, we fill the void in our understanding of how a firm's business model (i.e., customer concentration) affects its tax strategy, an area that is relatively unexplored (Higgins et al., 2015). Specifically, we show that firms with a risky business model (i.e., more concentrated corporate customer base) engage more in tax planning. This effect is more pronounced when the risk associated with having a concentrated corporate customer is exacerbated (e.g., firms with a low Market Share or low revenue diversification). In contrast, when a firm's business model centers on governmental major customers and thus is less risky, the firm tends to engage less in tax avoidance. Second, we add to the growing literature on the effect of external stakeholders on corporate tax avoidance (e.g., McGuire et al., 2012; Hoopes et al., 2012; Chyz et al., 2013). Our study is the first to show that different types of major customers (external stakeholders) have differential effects on tax avoidance. Third, we document a substitution effect between tax avoidance and real earnings management for firms with corporate major customers, thus providing new insights into how various forms of cash generation can interact with each other. Finally, we provide preliminary evidence on the association between political/presidential cycles and tax avoidance, showing that governmental policies have significant implications for tax avoidance, especially for firms with governmental major customers.

The remainder of the paper is organized as follows. Section 2 discusses prior research and develops our hypotheses. Section 3 describes the sample selection process and presents descriptive statistics. Section 4 discusses the results of our main analyses, Sections 5 and 6 present the results of additional analyses and robustness tests, respectively, and Section 7 concludes the study.

2. Hypotheses development

2.1. Corporate customer concentration, cash holding, and tax avoidance

Firms with concentrated customers have incentives to preserve their cash for at least three reasons. First, customer concentration is associated with higher cash flow risk. If a firm relies on a few major customers, loss of sales from one customer can lead to a huge drop in its cash flow (Hertzel et al., 2008; Dhaliwal et al., 2013; Itzkowitz, 2013; Dhaliwal et al., 2016). This can occur either because the customer goes bankrupt or switches to another supplier. In the former case, the firm will also likely incur a considerable amount of uncollectible debt, leading to a significant decline in future cash inflow.[5] As a result, a supplier with concentrated

[5] One salient example is General Motor (GM)'s bankruptcy during the recent financial crisis. The GM bankruptcy in 2009 resulted in more than 40 major suppliers,

customers may choose to hold extra cash to hedge against the possible cash flow risk.

Second, Wang (2012) and Itzkowitz (2013) suggest that suppliers with major customers also may hold additional cash as a commitment to their customers that they have the financial ability to keep investing in relationship-specific assets. According to Titman (1984), optimal firm operation requires both suppliers and major customers to undertake some relationship-specific investments. Because these investments will lose considerable value if one party becomes financially distressed, a supplier has an incentive to use additional cash holding to signal that it will remain financially healthy.

Third, Ravenscraft (1983), Balakrishnan et al. (1996), Gosman et al. (2004), and Piercy and Lane (2006) argue that major customers tend to use their bargaining power to force suppliers to lower their selling prices, extend looser credit terms, and deliver more frequently in smaller quantity (thus lowering inventory levels for the major customers). These unfavorable agreements squeeze suppliers' profit margins and shift the liquidity risk to suppliers, resulting in lower profitability for suppliers. Moreover, as Raman and Shahrur (2008) suggest, firms with major customers are more likely to make relationship-specific investments, such as designing or developing specialized equipment or introducing a new inventory system for a particular customer. If the major customer goes out of business, these relationship-specific investments will lose value immediately. These arguments suggest that firms with heavy customer concentration tend to perform worse and have more volatile and lower cash flow.[6]

The above arguments suggest that firms with highly concentrated corporate customer bases have higher cash flow risks and, therefore, would prefer to hold higher levels of cash. Because paying less tax can save a significant amount of cash outflow through both temporary and permanent Book-tax Differences (Desai and Dharmapala, 2009; Badertscher et al., 2010; Hanlon and Heitzman, 2010), firms may seek to generate funds internally via tax avoidance. However, firms can generate cash from sources other than tax avoidance such as equity issuance, debt issuance, cutting dividends, and slashing discretionary expenditures. For example, there is evidence that firms with high customer concentration use lower dividend levels (Wang, 2012) and share issuance (Itzkowitz, 2013) to keep their cash holding high. In particular, Wang (2012) finds that relationship-specific investments by suppliers lead to cash constraints, and thus provide suppliers with incentives to lower their dividend payments. Itzkowitz (2013) finds that suppliers with concentrated customer bases use share issuance as the primary means to accrue cash as opposed to other means such as debt issuance. Wang (2012) and Itzkowitz (2013), thus, suggest that suppliers with concentrated customers may rely on ways other than tax avoidance to increase cash.

We maintain that whether firms use tax avoidance or other means to increase cash depends on the relative cost of each method. We expect that tax avoidance is a relatively low cost means for firms with concentrated corporate customers to generate cash for several reasons. First, although firms may use other means such as share issuance, trimming dividends, and cutting discretionary spending to accrue cash (Wang, 2012; Itzkowitz, 2013), these approaches may not always be available or may have adverse implications for firms with concentrated customers. Specifically, difficult market conditions could make it prohibitively costly to issue shares (McLean, 2011). Firms with higher customer concentration also have higher cost of capital (Dhaliwal et al., 2016), making it very costly to raise cash through external markets. In addition, a firm needs to show favorable business prospects in order to maintain long-term relationships with its major customers (Titman, 1984). Cutting dividends would signal unfavorable business prospects and make it difficult for firms to keep their major customers. Furthermore, real earnings management (e.g., cutting discretionary spending) has adverse consequences for firms' future operations and cash flows (Roychowdhury, 2006; Cohen et al., 2008). Edwards et al. (2016) indicate that firms prefer not to employ techniques (e.g., real earnings management) that can hurt their operations when seeking ways to generate cash.

Second, because tax avoidance can increase a firm's net cash inflow (Desai and Dharmapala, 2009; Baderscher et al., 2010; Hanlon and Heitzman, 2010), firms with greater reliance on corporate major customers may have incentives to engage in more tax avoidance. Our previous arguments suggest that firms with high customer concentration tend to have a higher probability of experiencing financial distress (Ravenscraft, 1983; Balakrishnan et al., 1996; Gosman et al., 2004; Piercy and Lane, 2006). Mills and Newberry (2001) and Noga and Schnader (2013) suggest that firms with a higher probability of financial distress have incentives to increase cash and earnings by increasing Book-tax Differences. Thus, firms with high customer concentration are likely to resort to tax avoidance for saving cash. In addition, Edwards et al. (2016) show that firms resort to tax avoidance to save cash when they face financial constraints caused by macroeconomic conditions. In our study, the financial constraints are caused by the relationship with major customers, not by macroeconomic conditions. This suggests that the findings in Edwards et al. (2016) are unlikely to apply to our study.[7]

Third, Titman and Wessels (1988) and Shantanu et al. (2008) show that firms with high customer concentration maintain low debt ratios to signal to their major customers that they are not likely to become financially distressed. This constraint makes these firms less likely to issue debt to raise cash, and the lack of a sizeable debt tax shield also provides the incentives for tax avoidance.

For all of the above reasons, we expect suppliers with concentrated customers to employ tax avoidance to increase cash despite the availability of alternative mechanisms for increasing cash.

2.2. Corporate customer concentration, earnings management, and tax avoidance

Building a strategic alliance (i.e., a supplier–major customer relationship) requires relationship-specific investments (Titman, 1984). Because the value of these investments will be lower outside the relationship, a customer will be hesitant to commit to such investments if the supplier's future prospects are perceived to be poor. Similarly, a customer will be unwilling to enter into a long-term agreement with a supplier if the supplier's future prospects are uncertain. As a result, to entice their major customers to engage in long-term contracts and/or make firm-specific investments, suppliers have incentives to manage their earnings upward to enhance the perception that their business prospects are favorable. Consistent with this proposition, Raman and Shahrur (2008) find that corporate customer concentration is positively correlated with the magnitude of a supplier's discretionary

who relied on GM as their major customers, filing for bankruptcy protection, and the U.S. Treasury Department had to provide $5 billion to bail out these suppliers.

[6] Consistent with these arguments, Dhaliwal et al. (2013) show that heavy reliance on major customers is associated with a higher likelihood of future financial distress, and auditors are more likely to issue going-concern audit opinions to suppliers with major customers. Dhaliwal et al. (2016) and Campello and Gao (2014) show that suppliers with major customers experience a higher cost of capital.

[7] In untabulated analyses, we find that tax avoidance is not limited to high customer concentration firms that experience external financial constraints as defined in Edwards et al. (2016), indicating that our results are not driven solely by firms with external financial constraints.

accruals and the likelihood of its reporting a large earnings increase.[8] Dhaliwal et al. (2004) and Cook et al. (2008) show that firms can use tax avoidance (e.g., reducing their effective tax rates) to manage earnings upward. Taken together, the above studies suggest that firms with corporate major customers are more likely to engage in tax avoidance.

However, the close customer–supplier relationship enables major customers to assess the supplier's business prospects more accurately, and major customers are also better able to use their bargaining power to demand conservative financial information from their suppliers. For example, Hui et al. (2012) show that, in response to major customers' demand for timely recognition of bad news, suppliers report more conservative accounting numbers. Therefore, it is less likely that suppliers are able to use tax avoidance to manage earnings upward.

To summarize, prior literature provides somewhat contradictory predictions about whether firms with corporate customer concentration use tax avoidance to save cash. On the one hand, suppliers with concentrated customers may employ alternative ways other than tax avoidance to increase cash (Wang, 2012; Itzkowitz, 2013) and major customers may constrain suppliers' tax avoidance activities (Hui et al., 2012). On the other hand, tax avoidance is a relatively low cost means to generate funds (Desai and Dharmapala, 2009; Hanlon and Heitzman, 2010; Edwards et al., 2016). We, therefore, propose the following hypothesis (stated in alternate form):

H1: Corporate customer concentration is positively associated with tax avoidance.

2.3. Governmental customer concentration and tax avoidance

In contrast to corporate customer concentration, concentration of governmental customers represents a reduction in risk to the supplier for the following reasons. First, because they are much more stable than corporate customers, governmental customers are less likely to default and go bankrupt. Second, major governmental customers tend to sign long-term contracts with suppliers. Consistent with governmental customer concentration representing lower risk, Cohen and Li (2013) find that suppliers with governmental major customers hold less cash due to higher stability of operating cash flows. Dhaliwal et al. (2016) find a negative relation between governmental customer concentration and supplier cost of equity capital. Third, Cohen and Li (2013) consider the relationship between suppliers and governmental major customers as a proxy for political connections. The possible public scrutiny or IRS investigations associated with higher levels of tax avoidance or tax sheltering activities may damage these political connections. Similarly, Mills et al. (2013) argue that federal contractors incur political costs (i.e., federal taxes) to protect their revenues. However, their study uses a small sample of government contractor data and focuses only on firms in the highest decile of all firms' federal contract dollars.[9] Fourth, the government, as an external stakeholder, may serve as a monitor and restrain firms from engaging in risky tax avoidance activities. Based on the above arguments, we propose the following hypothesis (stated in alternate form):

H2: Governmental customer concentration is negatively associated with tax avoidance.

[8] Presumably, incentive to manage earnings upward is stronger during the contract years because such contracts can significantly affect the supplier's financial performance. We do not have the data to identify these contract years and thus are not able to test whether the extent of earnings management is more significant during these years.

[9] In contrast, we examine firms with at least one governmental customer that accounts for at least 10% of its total sales. In our study, the governmental customers include federal, state, local and foreign governments. We test whether the stable cash flows from concentrated governmental customers reduce the incentives for tax avoidance, whereas Mills et al. (2013) examine the political costs associated with large federal contracts.

Table 1
Sample distribution.

Fiscal year	Freq.	Percent	Cum.
1988	1686	3.48	3.48
1989	1783	3.68	7.17
1990	1800	3.72	10.89
1991	1789	3.70	14.59
1992	2047	4.23	18.82
1993	2337	4.83	23.65
1994	2625	5.43	29.07
1995	2689	5.56	34.63
1996	2822	5.83	40.46
1997	2747	5.68	46.14
1998	2531	5.23	51.37
1999	2292	4.74	56.11
2000	2078	4.29	60.40
2001	1663	3.44	63.84
2002	1634	3.38	67.22
2003	1722	3.56	70.77
2004	1936	4.00	74.78
2005	2023	4.18	78.96
2006	2030	4.20	83.15
2007	1931	3.99	87.14
2008	1601	3.31	90.45
2009	1425	2.95	93.40
2010	1672	3.46	96.85
2011	1523	3.15	100
Total	48,386	100	

3. Sample selection, main variables, and descriptive statistics

3.1. Sample selection

We obtain customer concentration data from the Compustat Segment Customer database, tax avoidance and financial data from Compustat, stock return data from CRSP, and tax rate data from the OECD tax database (updated in May 2013). Appendix A provides detailed definitions of variables used in our empirical analysis. We retain only those firms that are incorporated in the United States. We exclude observations from the financial services industry (SIC 6000–6999). We also exclude loss firms since loss firms' ETRs are not meaningful. Our final sample consists of 48,386 firm-year observations from 1988 to 2011 that have all the required data available.[10] Table 1 reports the sample distribution by year. The number of observations ranges from 1425 in 2009 to 2822 in 1996.

3.2. Customer concentration measures

Following Dhaliwal et al. (2016), we compute three measures of customer concentration. Statement of Financial Accounting Standards No.14 (SFAS 14) requires a supplier to disclose external *major* customers that individually account for 10% or more of its total sales. Our first measure, *Corp Major Customer*, is an indicator variable that equals one if a supplier has at least one corporate major customer, and zero otherwise. Similarly, *Gov Major Customer* equals one if a supplier has at least one governmental customer (including federal, state, local, and foreign governments) that accounts for at least 10% of its total sales. Consistent with Patatoukas (2012) and Dhaliwal et al. (2016), our second measure is *Major Customer HHI*, the sales-based Herfindahl–Hirschman Index calculated by summing the squares of the ratios of a supplier's sales to major customers over its total sales. Specifically, supplier *i*'s *Major Customer HHI* in year *t* is measured across its *J* major customers as

[10] Our results are similar if we restrict our sample to post 1993, the year SFAS No. 109, accounting for income taxes, was implemented.

follows:

$$Major\ Customer\ HHI_{i,t} = \sum_{j=1}^{J} (Sales_{i,j,t}/Sales_{i,t})^2,$$

where $Sales_{i,j,t}$ ($Sales_{i,t}$) is supplier *i*'s sales to major customer *j* (total sales) in year *t*. Larger values of *Major Customer HHI* indicate a more concentrated customer base. We set *Major Customer HHI* to zero if a firm does not have a major customer. *Corp Major Customer HHI* and *Gov Major Customer HHI* are calculated based on corporate major customers and governmental major customers, respectively.

The third measure of customer concentration is *Major Customer Sales*, which is defined as the sum of supplier *i*'s sales to its *J* major customers divided by total sales. Larger values of *Major Customer Sales* indicate higher customer concentration. We set *Major Customer Sales* to zero if a firm does not have a major customer. Again, *Corp Major Customer Sales* and *Gov Major Customer Sales* are based on corporate major customers and governmental major customers, respectively.

3.3. Tax avoidance measures

Following Hanlon and Heitzman (2010), we take the view that tax avoidance constitutes any corporate activity that aims to reduce a firm's explicit tax liability. We adopt three measures of tax avoidance that have been widely used in prior research. The first two measures are based on effective tax rate (ETR) and include current effective tax rate (*Current ETR*) and cash effective tax rate (*Cash ETR*). Following Cheng et al. (2012), *Current ETR* is computed as:

$$Current\ ETR_{i,t} = \frac{Total\ Tax\ Expense_{i,t} - Deferred\ Tax\ Expense_{i,t}}{Pretax\ Income_{i,t} - Special\ Items_{i,t}}.$$

Current ETR excludes deferred tax expense and thus captures tax savings resulting from both permanent and temporary Book-tax Differences.[11] A lower *Current ETR* indicates that firms are effectively avoiding more current income taxes than firms with a higher *Current ETR*. Consistent with prior literature, we restrict *Current ETR* to fall in the interval [0, 1].

Following prior literature (Dyreng et al., 2008, 2010; Cheng et al., 2012; McGuire et al., 2012, 2014), our second measure of tax avoidance, *Cash ETR*, is defined as follows:

$$Cash\ ETR_{i,t} = \frac{Cash\ Taxes\ Paid_{i,t}}{Pretax\ Income_{i,t} - Special\ Items_{i,t}}.$$

Cash ETR captures all tax strategies that save cash taxes paid in a year, and a lower *Cash ETR* indicates greater tax avoidance. Similar to *Current ETR*, we also restrict *Cash ETR* to fall in the interval [0, 1].

Following Kim et al. (2011), our third measure of tax avoidance, *BTD Factor*, is the first principal component of the three individual Book-tax Difference measures: *Book-tax Difference, ETR Differential*, and *DD_BTD*. Specifically, *Book-tax Difference* is the difference between book income and taxable income scaled by lagged assets; *ETR Differential* equals total Book-tax Difference less temporary Book-tax Difference, scaled by lagged assets (Frank et al., 2009); *DD_BTD* is the residual from a firm fixed-effects regression of total Book-tax Difference on total accruals (Desai and Dharmapala, 2006). *DD_BTD* purges out the effect of earnings management on the Book-tax Difference. A larger *BTD Factor* indicates greater tax avoidance. Appendix A provides more details on these three Book-tax Difference measures.

[11] A related and more commonly used measure is the book or overall *ETR*, which is defined as total tax expense divided by pretax income minus special items (Dyreng et al., 2010; McGuire et al., 2012, 2014). The book *ETR* captures tax savings without including those from deferring cash taxes to a later period. Our results are qualitatively unchanged if we use the book *ETR* as a measure of tax avoidance.

3.4. Descriptive statistics

Table 2, Panel A, reports the descriptive statistics separately for the subsamples with and without a major corporate customer. There are 17,706 (30,680) firm-years with (without) a major corporate customer.[12] In terms of the tax avoidance measures, the subsample with a major corporate customer tends to have lower ETRs and higher BTD. Specifically, the mean (median) of *Current ETR, Cash ETR*, and *BTD Factor* are 0.277 (0.296), 0.240 (0.234), and 0.063 (0.049), respectively, for the subsample with a major corporate customer, and 0.299 (0317), 0.271 (0.273), and 0.056 (0.045), respectively, for the subsample without a major corporate customer. The subsample with a major corporate customer also has smaller *SIZE*, higher *ROA*, lower *LEV*, and higher *NOL*, indicating these firms are smaller, more profitable, less leveraged, but also more likely to have loss carryforwards.[13] Because we have excluded loss firm-years from our sample in order to compute the tax avoidance measures, the higher *ROA* and *NOL* for firms with a major corporate customer suggest that these firms have higher returns in good years but suffer from higher losses during bad years.

Table 2, Panel B, presents Pearson correlations. All three measures of corporate customer concentration (i.e., *Corp Major Customer, Corp Major Customer HHI*, and *Corp Major Customer Sales*) are negatively related to the effective tax rate measures (i.e., *Current ETR* and *Cash ETR*) and positively related to the Book-tax Difference measure (i.e., *BTD Factor*). These correlations indicate that corporate customer concentration is positively associated with the level of tax avoidance. In contrast, all three measures of governmental customer concentration are positively (negatively) related to effective tax rate (Book-tax Difference), indicating that governmental customer concentration is associated with lower levels of tax avoidance.

4. Methodology and main results

4.1. Methodology

We estimate the relation between customer concentration and tax avoidance using the following specification:

$$\begin{aligned} Tax\,avoidance_{i,t} = {} & \alpha + \beta_1\, Customer\,Concentration_{i,t} + \beta_2 Size_{i,t} \\ & + \beta_3 ROA_{i,t} + \beta_4 LEV_{i,t} + \beta_5 NOL_{i,t} \\ & + \beta_6 \Delta NOL_{i,t} + \beta_7 Foreign\,Income_{i,t} + \beta_8 PPE_{i,t} \\ & + \beta_9 Intangible\,Assets_{i,t} + \beta_{10} EquityIncome_{i,t} \\ & + \beta_{11} MB_{i,t} + IND + YEAR + \varepsilon_{i,t} \end{aligned} \quad (1)$$

where *tax avoidance* is *Current ETR, Cash ETR*, or *BTD Factor* in year *t*, *Customer Concentration* is one of the three corporate customer concentration measures (*Corp Major Customer, Corp Major Customer HHI*, or *Corp Major Customer Sales*), or one of the three governmental customer concentration measures (*Gov Major Customer, Gov Major Customer HHI*, or *Gov Major Customer Sales*). All variables are defined in Appendix A.

We include many control variables in Eq. (1) following prior literature. For example, we control for *SIZE*, which is the natural logarithm of a firm's market value of equity. Prior literature shows

[12] For the full sample, the mean value of *Corp Major Customer* (*Gov Major Customer*) is 0.366 (0.071), indicating that 36.6% (7.1%) of our sample observations have at least one corporate (governmental) major customer that accounts for at least 10% of the firm's total sales.

[13] We identify firms with characteristics of risk taking such as firms with high R&D, high capital expenditures, and high leverage. We then examine the variance of customer concentration for firms with and without these high risk-taking characteristics. Generally, we find wide variance in the customer concentration level for both groups of firms. This suggests that customer concentration is not just a reflection of a firm's propensity for risk taking.

Table 2
Descriptive statistics and correlations.

Panel A: descriptive statistics

	Firms with *Corp Major Customer*				Firms without *Corp Major Customer*				Difference	
Variables	*N*	Mean	Median	Std.	*N*	Mean	Median	Std.	Mean	Median
Corp Major Customer	17,706	1.000	1.000	0.000	30,680	0.000	0.000	0.000	–	–
Corp Major Customer HHI	17,706	0.115	0.064	0.140	30,680	0.000	0.000	0.000	–	–
Corp Major Customer Sales	17,706	0.373	0.320	0.229	30,680	0.000	0.000	0.000	–	–
Gov Major Customer	17,706	0.093	0.000	0.290	30,680	0.059	0.000	0.235	14.02***	14.00***
Gov Major Customer HHI	17,706	0.022	0.000	0.103	30,680	0.015	0.000	0.088	7.59***	13.54***
Gov Major Customer Sales	17,706	0.041	0.000	0.147	30,680	0.030	0.000	0.136	8.28***	13.40***
Current ETR	17,706	0.277	0.296	0.160	30,680	0.299	0.317	0.148	−15.20***	−14.89***
Cash ETR	17,706	0.240	0.234	0.174	30,680	0.271	0.273	0.164	−19.38***	−21.43***
BTD Factor	11,063	0.063	0.049	0.111	19,002	0.056	0.045	0.090	6.61***	4.70***
SIZE	17,706	5.368	5.293	1.957	30,680	6.034	6.035	2.047	−35.05***	−34.53***
ROA	17,569	0.153	0.118	0.129	30,576	0.132	0.104	0.106	19.91***	15.61***
LEV	17,563	0.182	0.109	0.223	30,561	0.216	0.173	0.221	−16.45***	−23.10***
NOL	17,706	0.283	0.000	0.451	30,680	0.238	0.000	0.426	10.99***	10.98***
ΔNOL	17,569	−0.005	0.000	0.059	30,576	−0.002	0.000	0.044	−6.79***	−6.57***
Foreign Income	17,569	0.013	0.000	0.027	30,576	0.013	0.000	0.026	0.96	−2.97***
PPE	17,562	0.333	0.243	0.288	30,504	0.364	0.287	0.282	−11.58***	−15.49***
Intangible Asset	17,569	0.126	0.027	0.198	30,576	0.141	0.043	0.208	−7.86***	−10.41***
Equity Income	17,569	0.001	0.000	0.004	30,576	0.001	0.000	0.004	−4.10***	−5.96***
MB	17,635	2.915	2.128	2.800	30,562	2.888	2.081	2.774	1.04	0.41

Panel B: Pearson correlations

		A	B	C	D	E	F	G	H	I
Corp Major Customer	A	1								
Corp Major Customer HHI	B	0.549***	1							
Corp Major Customer Sales	C	0.792***	0.859***	1						
Gov Major Customer	D	0.064***	0.066***	0.060***	1					
Gov Major Customer HHI	E	0.034***	0.115***	0.080***	0.641***	1				
Gov Major Customer Sales	F	0.038***	0.095***	0.068***	0.817***	0.924***	1			
Current ETR	G	−0.069***	−0.083***	−0.092***	0.011**	0.017***	0.013***	1		
Cash ETR	H	−0.088***	−0.096***	−0.107***	0.013***	0.020***	0.017***	0.623***	1	
BTD Factor	I	0.038***	0.044***	0.051***	−0.042***	−0.028***	−0.035***	−0.323***	−0.258***	1
SIZE	J	−0.157***	−0.137***	−0.155***	−0.084***	−0.067***	−0.066***	−0.001	−0.014***	0.135***
ROA	K	0.090***	0.082***	0.096***	−0.040***	−0.016***	−0.031***	0.143***	0.027***	0.367***
LEV	L	−0.075***	−0.055***	−0.071***	0.004	−0.007	0.000	−0.135***	−0.069***	−0.007
NOL	M	0.050***	0.032***	0.042***	0.017***	0.012***	0.020***	−0.172***	−0.198***	−0.003
ΔNOL	N	−0.031***	−0.041***	−0.038***	−0.003	−0.003	−0.002	0.083***	0.100***	0.468***
Foreign Income	O	0.004	−0.034***	−0.021***	−0.074***	−0.065***	−0.075***	0.001	−0.031***	0.092***
PPE	P	−0.053***	−0.011**	−0.030***	−0.081***	−0.073***	−0.084***	−0.164***	−0.085***	0.203***
Intangible Asset	Q	−0.036***	−0.048***	−0.048***	0.061***	0.060***	0.075***	−0.008*	−0.012***	0.016***
Equity Income	R	−0.019***	−0.019***	−0.020***	−0.001	−0.006	0.000	−0.036***	−0.018***	0.035***
MB	S	0.005	0.004	0.004	−0.049***	−0.034***	−0.044***	0.015***	−0.091***	0.209***

		J	K	L	M	N	O	P	Q	R
SIZE	J	1								
ROA	K	0.079***	1							
LEV	L	0.081***	−0.201***	1						
NOL	M	0.044***	−0.091***	0.012***	1					
ΔNOL	N	0.088***	−0.068***	0.051***	−0.238***	1				
Foreign Income	O	0.330***	0.095***	−0.063***	0.126***	0.038***	1			
PPE	P	0.070***	−0.043***	0.392***	−0.127***	0.043***	−0.117***	1		
Intangible Asset	Q	0.196***	−0.039***	0.257***	0.134***	0.053***	0.075***	−0.216***	1	
Equity Income	R	0.106***	0.010**	0.045***	−0.003	0.000	0.060***	0.036***	−0.004	1
MB	S	0.298***	0.408***	−0.051***	0.025***	−0.009*	0.134***	−0.057***	0.012***	0.010**

This table presents descriptive statistics and Pearson correlations for customer concentration, tax avoidance, and control variables. Panel A reports descriptive statistics of all variables from 2005–2010. Panel B reports the cross-sectional correlation matrix for the major variables used in our empirical tests. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels (two-tailed), respectively. All variables are defined in Appendix A.

that while firm size is an important determinant of tax avoidance, its relation with tax avoidance is unclear (e.g., Mills, 1998; Rego, 2003; Higgins et al., 2015). Thus, we do not make a directional prediction for the coefficient on *SIZE*.

We control for firm profitability by including return on assets (*ROA*), measured as operating income scaled by lagged total assets. More profitable firms may have a higher marginal tax rate (Gupta and Newberry, 1997). On the other hand, more profitable firms may have more resources and can use tax deductions and credits to lower their tax rates (e.g., Manzon and Plesko, 2002; Rego, 2003; Frank et al., 2009; McGuire et al., 2012). We therefore do not provide a directional prediction for the coefficient on *ROA*.

We include firm leverage (*LEV*), measured as long-term debt scaled by lagged total assets. Leverage may provide firms with tax-deductible interest and thus a lower incentive to engage in tax avoidance. On the other hand, highly levered firms may be motivated to use tax avoidance to save cash to pay for the debt (Graham and Tucker, 2006; Badertscher et al., 2013). Accordingly, we do not provide a directional prediction for the coefficient on *LEV*.

We include both *NOL* and ΔNOL in our regression. *NOL* is an indicator variable that equals one if the firm has a positive loss carryforward at the beginning of the year. ΔNOL is the annual change in *NOL*. The presence of *NOL* allows a firm to use the loss carryforward to reduce its tax liability. Relatedly, a decrease in *NOL* indicates that the firm is using the loss carryforward to reduce its tax liability (e.g., Chen et al., 2010; McGuire et al., 2012). Therefore, we expect the coefficients on *NOL* and ΔNOL to be negative and positive, respectively.

We control for a firm's tax-related characteristics such as Foreign Income (*Foreign Income*), property, plant, and equipment (*PPE*), Intangible Assets (*Intangible Assets*), and Equity Income in earnings (*Equity Income*), each of which is scaled by lagged total assets. Firms with Foreign Income can avoid income tax by not repatriating Foreign Income. However, these multinational firms may also face higher tax rates overseas or be taxed by multiple jurisdictions (Markle and Shackelford, 2009). Property, plant, and equipment and Intangible Assets can lead to higher or lower Book-tax Differences depending on the applicable tax and accounting rules on property, plant, and equipment and Intangible Assets. Thus, following Higgins et al. (2015), we provide no directional predictions for the coefficients on *Foreign Income, PPE*, and *Intangible Assets*. Equity Income is included in book income but not in taxable income, thus reducing the tax rate and increasing the Book-tax Difference. Therefore, we expect *Equity Income* to be negatively (positively) associated with effective tax rate (Book-tax Difference).

We include market value of equity divided by book value of equity (*MB*) to control for firm growth. Growth firms typically have more asset purchases and thus have larger depreciation and amortization tax deductions (Chen et al., 2010; Cheng et al., 2012). We therefore predict that *MB* is negatively (positively) associated with effective tax rate (Book-tax Difference).

Finally, we control for tax avoidance differences across industries and years by including industry (Fama-French 48 industries) and year fixed effects.

4.2. Results for corporate customer concentration

We use Eq. (1) to examine the association between corporate customer concentration and tax avoidance. Because we have three measures of tax avoidance (*Current ETR, Cash ETR*, and *BTD Factor*) and three measures of corporate customer concentration (*Corp Major Customer, Corp Major Customer HHI*, and *Corp Major Customer Sales*), we obtain nine sets of regression results. Panel A, Table 3, reports our findings when current effective tax rate, *Current ETR*, is the measure of tax avoidance. Columns (1)–(3) correspond to our three measures of corporate customer concentration. Consistent with H1, all three measures of corporate customer concentration exhibit significantly negative coefficients. For example, in Column (1), the coefficient on *Corp Major Customer* is −0.012 ($p=-5.72$), indicating that having a corporate major customer reduces *Current ETR* by 1.2% (which is equivalent to reducing the current tax liability by 1.2% of the pretax net income).[14] The control variables generally exhibit signs consistent with our predictions. Specifically, we find that *SIZE, ROA*, ΔNOL, *Foreign Income*, and *Intangible Asset* (*LEV, NOL, PPE, Equity Income*, and *MB*) are positively (negatively) associated with *Current ETR*, consistent with Dyreng et al. (2010) and Cheng et al. (2012).

[14] Our economic significance is comparable to that reported in other studies. For example, in Table 3, the coefficient on *Corp Major Customer* is −0.012 for *Current ETR* and −0.017 for *Cash ETR*. Panel A of Table 4 of Chen et al. (2010) report a coefficient on "family firm indicator" of 0.005 for ETR, 0.012 for Cash ETR, −0.025 for MP Book-tax Difference, and −0.043 for DD Book-tax Difference. Dyreng et al. (2010) study the effects of manager characteristics on tax avoidance; in Table 7 (p. 1186), the coefficients on all the variables of interest variables range between −0.01 and 0.02 for GAAP ETR and Cash ETR.

Table 3
Corporate customer concentration and tax avoidance.

Panel A: Current ETR

Variable	(1) *Current ETR*	(2) *Current ETR*	(3) *Current ETR*
Corp Major Customer	−0.012***		
	(−5.72)		
Corp Major Customer HHI		−0.080***	
		(−6.70)	
Corp Major Customer Sales			−0.038***
			(−7.72)
SIZE	0.007***	0.006***	0.006***
	(7.37)	(7.32)	(7.07)
ROA	0.167***	0.168***	0.169***
	(11.80)	(11.70)	(11.88)
LEV	−0.053***	−0.053***	−0.053***
	(−7.62)	(−7.59)	(−7.61)
NOL	−0.041***	−0.041***	−0.041***
	(−13.79)	(−13.91)	(−13.85)
ΔNOL	0.209***	0.207***	0.208***
	(12.05)	(12.21)	(12.12)
Foreign Income	0.000	−0.006	−0.008
	(0.01)	(−0.12)	(−0.16)
PPE	−0.078***	−0.078***	−0.077***
	(−11.24)	(−11.18)	(−11.17)
Intangible Asset	0.019***	0.018**	0.018**
	(2.71)	(2.52)	(2.54)
Equity Income	−0.997***	−1.013***	−1.009***
	(−3.56)	(−3.64)	(−3.63)
MB	−0.003***	−0.003***	−0.003***
	(−6.16)	(−6.13)	(−6.16)
Intercept	0.289***	0.294***	0.293***
	(11.53)	(13.27)	(12.31)
Ind/year fixed effects	Yes	Yes	Yes
Cluster by firm and year	Yes	Yes	Yes
No. of observations	47,507	47,507	47,507
Adjusted R^2	0.143	0.144	0.144
F	112.3	113.2	113.8

Panel B: Cash ETR

Variable	(1) *Cash ETR*	(2) *Cash ETR*	(3) *Cash ETR*
Corp Major Customer	−0.017***		
	(−7.21)		
Corp Major Customer HHI		−0.100***	
		(−8.23)	
Corp Major Customer Sales			−0.048***
			(−8.43)
SIZE	0.006***	0.006***	0.006***
	(5.04)	(5.02)	(4.84)
ROA	0.073***	0.075***	0.076***
	(6.34)	(6.34)	(6.53)
LEV	−0.044***	−0.044***	−0.044***
	(−6.59)	(−6.57)	(−6.58)
NOL	−0.057***	−0.057***	−0.057***
	(−10.77)	(−10.85)	(−10.81)
ΔNOL	0.230***	0.227***	0.229***
	(10.83)	(11.02)	(10.98)
Foreign Income	−0.075	−0.083	−0.085
	(−1.20)	(−1.33)	(−1.37)
PPE	−0.059***	−0.059***	−0.058***
	(−8.65)	(−8.62)	(−8.60)
Intangible Asset	0.016*	0.015*	0.015*
	(1.92)	(1.75)	(1.76)
Equity Income	−0.681**	−0.701**	−0.695**
	(−2.26)	(−2.33)	(−2.31)
MB	−0.007***	−0.007***	−0.007***
	(−11.18)	(−11.28)	(−11.37)
Intercept	0.278***	0.285***	0.283***
	(9.81)	(11.44)	(10.57)
Ind/year fixed effects	Yes	Yes	Yes
Cluster by firm and year	Yes	Yes	Yes
No. of observations	47,507	47,507	47,507
Adjusted R^2	0.118	0.120	0.120
F	92.88	93.56	94.38

(continued on next page.)

Table 3
(continued)

Panel C: BTD Factor			
Variable	(1) *BTD Factor*	(2) *BTD Factor*	(3) *BTD Factor*
Corp Major Customer	0.002		
	(1.08)		
Corp Major Customer HHI		0.028***	
		(4.20)	
Corp Major Customer Sales			0.010***
			(3.29)
SIZE	−0.002***	−0.002***	−0.002***
	(−5.91)	(−5.35)	(−5.43)
ROA	0.357***	0.357***	0.356***
	(22.76)	(22.60)	(22.60)
LEV	−0.012**	−0.012**	−0.012**
	(−2.40)	(−2.42)	(−2.42)
NOL	0.029***	0.029***	0.029***
	(14.07)	(14.13)	(14.10)
ΔNOL	1.001***	1.002***	1.002***
	(43.98)	(44.28)	(44.04)
Foreign Income	0.068	0.072	0.0720
	(1.43)	(1.52)	(1.51)
PPE	0.077***	0.077***	0.077***
	(16.94)	(17.03)	(16.96)
Intangible Asset	0.004	0.004	0.004
	(0.76)	(0.85)	(0.83)
Equity Income	0.509***	0.510***	0.511***
	(3.18)	(3.23)	(3.21)
MB	0.001***	0.001***	0.001***
	(3.59)	(3.59)	(3.58)
Intercept	−0.023***	−0.028***	−0.026***
	(−3.18)	(−3.55)	(−3.43)
Ind/year fixed effects	Yes	Yes	Yes
Cluster by firm and year	Yes	Yes	Yes
No. of observations	29,662	29,662	29,662
Adjusted R^2	0.483	0.484	0.483
F	184.6	185.3	185.0

This table presents the regression results of the impact of corporate customer concentration on the tax avoidance. Regressions include year and industry fixed effects. The *t*-statistics reported in parentheses are based on standard errors that are heteroskedasticity robust and clustered at the firm-year level. To conserve space, we do not report the coefficient estimates for the year and industry dummies. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels (two-tailed), respectively. All variables are defined in Appendix A.

Panel B of Table 3 presents findings using cash effective tax rate, *Cash ETR*, as the measure of tax avoidance. We find results similar to those in Panel A. Specifically, all three measures of corporate customer concentration are negatively and significantly related to *Cash ETR*, consistent with H1 that higher corporate customer concentration is associated with lower cash tax payment. Again, the results suggest that the level of corporate customer concentration has an economically significant effect on the level of tax avoidance. For example, *Corp Major Customer* has a coefficient of −0.017, indicating that on average firms with a corporate major customer reduce cash tax payments by 1.7% of pretax net income relative to firms without a corporate major customer.

Panel C of Table 3 uses Book-tax Differences, *BTD Factor*, as the measure of tax avoidance. As shown, two measures of corporate customer concentration (*Corp Customer HHI* and *Corp Major Customer Sales*) are positively and significantly related to *BTD Factor*, but one measure (*Corp Major Customer*) is insignificantly related to *BTD Factor*.[15] Overall, having a corporate major customer is associated with a larger Book-tax Difference, i.e., greater tax avoidance.

In summary, the results in Table 3 strongly support our hypothesis that corporate customer concentration is positively related to tax avoidance.

4.3. Results for governmental customer concentration

Table 4 reports the results of estimating Eq. (1) using governmental customer concentration measures. We use this model to test H2, i.e., that governmental customer concentration is negatively related to tax avoidance. As in Table 3, we present the results for *Current ETR*, *Cash ETR*, and *BTD Factor* in Panels A, B, and C, respectively. In Panel A, we find that all three measures of governmental customer concentration (*Gov Major Customer, Gov Major Customer HHI*, and *Gov Major Customer Sales*) are positively and significantly related to *Current ETR*. This result implies that higher levels of governmental customer concentration are associated with higher levels of current effective tax rates and thus lower levels of tax avoidance. Similarly, in Panel B, we find that all three measures of governmental customer concentration are positively and significantly related to *Cash ETR*. For example, the coefficient on *Gov Major Customer* is 0.019 ($t=3.52$), indicating that having a governmental major customer is associated with an increase in cash tax payment of 1.9% of pretax net income. Finally, the results in Panel C show that all three measures of governmental customer concentration are negatively and significantly associated with *BTD Factor*, indicating that higher levels of governmental customer concentration are associated with lower levels of Book-tax Differences and thus lower levels of tax avoidance.[16] In summary, the results in Table 4 are consistent with H2 that higher governmental customer concentration is associated with lower tax avoidance.

5. Additional analysis

5.1. Effect of switching costs and revenue diversification

In this section, we conduct additional analyses to explore the cross-sectional variation in the relation between corporate customer concentration and tax avoidance.

Switching costs measure how easily a customer can switch to another supplier. When a supplier's major customers have low switching cost, the supplier has a greater likelihood of losing a major customer. As a result, the supplier faces greater uncertainty in cash flow and increased likelihood of future financial distress and, consequently, has a stronger incentive to engage in tax avoidance in order to boost its cash flow. Following Dhaliwal et al. (2016), we use a supplier's Market Share in its industry to measure the switching cost that its customers face. Specifically, a suppliers' Market Share is the ratio of its sales to the total sales of its Fama-French 48 industry (*Market Share*). A higher *Market Share* indicates a higher switching cost for the supplier's customers.

To examine whether the switching cost affects the association between corporate customer concentration and tax avoidance, we augment Eq. (1) by adding *Market Share* and its interaction with *Corp Major Customer* as two additional explanatory variables. We present the results in Table 5, Panel A. In Columns (1) and (2), where the measures of tax avoidance are *Current ETR* and *Cash ETR*, we find significantly positive coefficients on *Corp Major Customer* × *Market Share*, which suggests that a supplier's effective tax rate is higher (lower) when its Market Share is higher (lower). This result indicates that a supplier's tax avoidance decreases (increases)

[15] When we use each of the three components of *BTD Factor* (*Book-tax Difference, DD_BTD*, and *ETR Differential*) separately in the regression, we find that the coefficient on *DD_BTD* is not significant while the coefficients on the other two measures are significant.

[16] In untabulated results, we also find that this negative association between governmental customer concentration and tax avoidance is driven by firms whose major customers are the U.S. federal government (as opposed to state, local, or foreign governments).

Table 4
Governmental customer concentration and tax avoidance.

Panel A: Current ETR

Variable	(1) *Current ETR*	(2) *Current ETR*	(3) *Current ETR*
Gov Major Customer	0.011**		
	(2.00)		
Gov Major Customer HHI		0.030**	
		(2.26)	
Gov Major Customer Sales			0.021**
			(2.02)
SIZE	0.007***	0.007***	0.007***
	(8.10)	(8.08)	(8.06)
ROA	0.164***	0.163***	0.164***
	(11.71)	(11.63)	(11.70)
LEV	−0.053***	−0.053***	−0.053***
	(−7.60)	(−7.58)	(−7.59)
NOL	−0.041***	−0.041***	−0.041***
	(−14.00)	(−13.98)	(−14.00)
ΔNOL	0.209***	0.209***	0.209***
	(12.14)	(12.14)	(12.13)
Foreign Income	0.012	0.012	0.013
	(0.22)	(0.22)	(0.25)
PPE	−0.079***	−0.079***	−0.079***
	(−11.29)	(−11.29)	(−11.29)
Intangible Asset	0.019***	0.019***	0.019***
	(2.70)	(2.66)	(2.65)
Equity Income	−1.005***	−1.001***	−1.006***
	(−3.56)	(−3.54)	(−3.56)
MB	−0.003***	−0.003***	−0.003***
	(−6.12)	(−6.12)	(−6.09)
Intercept	0.280***	0.281***	0.281***
	(11.18)	(11.20)	(11.19)
Ind/year fixed effects	Yes	Yes	Yes
Cluster by firm and year	Yes	Yes	Yes
No. of observations	47,507	47,507	47,507
Adjusted R^2	0.142	0.142	0.142
F	111.1	111.0	111.0

Panel B: Cash ETR

Variable	(1) *Cash ETR*	(2) *Cash ETR*	(3) *Cash ETR*
Gov Major Customer	0.019***		
	(3.52)		
Gov Major Customer HHI		0.056***	
		(4.23)	
Gov Major Customer Sales			0.039***
			(3.80)
SIZE	0.007***	0.007***	0.007***
	(5.64)	(5.61)	(5.61)
ROA	0.070***	0.069***	0.070***
	(6.10)	(6.01)	(6.09)
LEV	−0.044***	−0.044***	−0.044***
	(−6.59)	(−6.57)	(−6.59)
NOL	−0.057***	−0.057***	−0.057***
	(−10.99)	(−10.97)	(−11.00)
ΔNOL	0.230***	0.230***	0.230***
	(10.89)	(10.91)	(10.90)
Foreign Income	−0.058	−0.056	−0.053
	(−0.91)	(−0.89)	(−0.85)
PPE	−0.060***	−0.060***	−0.060***
	(−8.62)	(−8.66)	(−8.65)
Intangible Asset	0.017*	0.016*	0.016*
	(1.91)	(1.84)	(1.83)
Equity Income	−0.698**	−0.692**	−0.702**
	(−2.29)	(−2.27)	(−2.29)
MB	−0.007***	−0.007***	−0.007***
	(−10.99)	(−10.98)	(−10.92)
Intercept	0.266***	0.267***	0.267***
	(9.29)	(9.32)	(9.29)
Ind/year fixed effects	Yes	Yes	Yes
Cluster by firm and year	Yes	Yes	Yes
No. of observations	47,507	47,507	47,507
Adjusted R^2	0.117	0.117	0.117
F	91.36	91.44	91.44

Panel C: BTD Factor

Variable	(1) *BTD Factor*	(2) *BTD Factor*	(3) *BTD Factor*
Gov Major Customer	−0.005*		
	(−1.73)		
Gov Major Customer HHI		−0.014**	
		(−2.13)	
Gov Major Customer Sales			−0.011**
			(−2.16)
SIZE	−0.002***	−0.002***	−0.002***
	(−6.08)	(−6.06)	(−6.05)
ROA	0.357***	0.358***	0.357***
	(22.62)	(22.60)	(22.64)
LEV	−0.012**	−0.012**	−0.012**
	(−2.38)	(−2.39)	(−2.38)
NOL	0.029***	0.029***	0.029***
	(14.17)	(14.15)	(14.14)
ΔNOL	1.001***	1.001***	1.001***
	(43.96)	(43.98)	(43.98)
Foreign Income	0.065	0.064	0.063
	(1.35)	(1.34)	(1.32)
PPE	0.077***	0.077***	0.077***
	(16.90)	(16.92)	(16.94)
Intangible Asset	0.004	0.004	0.004
	(0.81)	(0.82)	(0.83)
Equity Income	0.517***	0.515***	0.520***
	(3.23)	(3.20)	(3.23)
MB	0.001***	0.001***	0.001***
	(3.56)	(3.56)	(3.55)
Intercept	−0.022***	−0.022***	−0.022***
	(−3.04)	(−3.09)	(−3.05)
Ind/year fixed effects	Yes	Yes	Yes
Cluster by firm and year	Yes	Yes	Yes
No. of observations	29,662	29,662	29,662
Adjusted R^2	0.483	0.483	0.483
F	184.6	184.5	184.6

This table presents the regression results of the impact of governmental customer concentration on the tax avoidance. Regressions include year and industry fixed effects. The *t*-statistics reported in parentheses are based on standard errors that are heteroskedasticity robust and clustered at the firm-year level. To conserve space, we do not report the coefficient estimates for the year and industry dummies. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels (two-tailed), respectively. All variables are defined in Appendix A.

when its customers' switching costs are higher (lower). The coefficient on *Corp Major Customer* × *Market Share*, however, is insignificant when the measure of tax avoidance is *BTD Factor* in Column (3).

We next examine the effect of revenue diversification on the relation between corporate customer concentration and tax avoidance. We use the number of business segments from which a supplier firm draws its customers (*N of Bus Segments*) as a proxy for revenue diversification. When a supplier has diverse sources of revenue, its cash flow and financial health are less likely to be significantly affected by the loss of a major customer. Therefore, firms with greater revenue diversification face less pressure to engage in tax avoidance activities.

To test this prediction, we augment Eq. (1) by adding *N of Bus Segments* and its interaction with *Corp Major Customer* as two additional explanatory variables. The results of this test are reported in Panel B of Table 5. When the measures of tax avoidance are *Current ETR* and *Cash ETR*, the coefficients on *Corp Major Customer* × *N of Bus Segments* are significantly positive in Columns (1) and (2), indicating that the negative association between effective tax rate and corporate customer concentration becomes weaker when a supplier's revenue diversification is higher. These results are consistent with our prediction that firms with greater revenue diversification have fewer concerns about cash flow risk and financial distress, and thus have weaker motivations to engage in tax

Table 5
Corporate customer concentration: switching costs and revenue diversification.

Panel A: switching costs

Variable	(1) *Current ETR*	(2) *Cash ETR*	(3) *BTD Factor*
Corp Major Customer	−0.014***	−0.019***	0.001
	(−6.49)	(−7.57)	(0.88)
Market Share	−0.235***	−0.0730	−0.010
	(−3.40)	(−0.98)	(−0.30)
Corp Major Customer × *Market Share*	0.279***	0.297***	0.031
	(2.71)	(3.02)	(0.63)
SIZE	0.007***	0.006***	−0.002***
	(7.17)	(4.39)	(−4.79)
ROA	0.164***	0.074***	0.357***
	(11.78)	(6.26)	(22.79)
LEV	−0.053***	−0.044***	−0.012**
	(−7.63)	(−6.62)	(−2.40)
NOL	−0.041***	−0.057***	0.029***
	(−13.70)	(−10.79)	(14.11)
ΔNOL	0.208***	0.230***	1.001***
	(11.96)	(10.79)	(44.04)
Foreign Income	0.005	−0.0770	0.068
	(0.10)	(−1.22)	(1.43)
PPE	−0.078***	−0.059***	0.077***
	(−11.30)	(−8.62)	(16.90)
Intangible Asset	0.019***	0.016*	0.004
	(2.60)	(1.88)	(0.76)
Equity Income	−0.971***	−0.676**	0.510***
	(−3.43)	(−2.24)	(3.20)
MB	−0.003***	−0.007***	0.001***
	(−6.27)	(−11.17)	(3.58)
Intercept	0.290***	0.278***	−0.023***
	(11.50)	(9.85)	(−3.17)
Ind/year fixed effects	Yes	Yes	Yes
Cluster by firm and year	Yes	Yes	Yes
No. of observations	47,507	47,507	29,662
Adjusted R^2	0.143	0.118	0.483
F	110.2	90.76	180.1

Panel B: revenue diversification

Variable	(1) *Current ETR*	(2) *Cash ETR*	(3) *BTD Factor*
Corp Major Customer	−0.024***	−0.026***	0.007**
	(−3.52)	(−3.64)	(2.15)
N of Bus Segments	−0.001	0.000	0.000
	(−1.06)	(0.66)	(0.44)
Corp Major Customer × *N of Bus Segments*	0.002*	0.002**	−0.000
	(1.95)	(2.16)	(−0.20)
SIZE	0.005***	0.003**	−0.002***
	(4.04)	(2.00)	(−3.45)
ROA	0.143***	0.078***	0.437***
	(6.21)	(3.66)	(20.73)
LEV	−0.084***	−0.058***	0.007
	(−8.48)	(−5.31)	(0.66)
NOL	−0.032***	−0.036***	0.022***
	(−7.39)	(−6.37)	(5.58)
ΔNOL	0.200***	0.186***	1.055***
	(21.89)	(9.93)	(47.29)
Foreign Income	−0.0800	−0.145	0.185***
	(−0.94)	(−1.33)	(2.65)
PPE	−0.064***	−0.051***	0.073***
	(−3.98)	(−3.06)	(6.80)
Intangible Asset	0.025***	0.0130	0.011*
	(3.00)	(1.28)	(1.72)
Equity Income	−0.788*	−0.985**	0.113
	(−1.82)	(−2.02)	(0.44)
MB	−0.001	−0.004***	0.000
	(−1.48)	(−4.33)	(0.87)
Intercept	0.258***	0.261***	0.004
	(9.19)	(7.58)	(0.34)

Panel B: revenue diversification

Variable	(1) *Current ETR*	(2) *Cash ETR*	(3) *BTD Factor*
Ind/year fixed effects	Yes	Yes	Yes
Cluster by firm and year	Yes	Yes	Yes
No. of observations	12,069	12,069	6986
Adjusted R^2	0.130	0.107	0.609
F	35.26	27.74	99.53

This table presents the regression results of the effect of switching costs and revenue diversification on the relation between corporate customer concentration and tax avoidance relation. Regressions include year and industry fixed effects. The *t*-statistics reported in parentheses are based on standard errors that are heteroskedasticity robust and clustered at the firm-year level. To conserve space, we do not report the coefficient estimates for the year and industry dummies. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels (two-tailed), respectively. All variables are defined in Appendix A.

avoidance activities. However, the coefficient on *Corp Major Customer* × *N of Bus Segments* is insignificant when the measure of tax avoidance is *BTD Factor* in Column (3).

Overall, the results in Table 5 provide some evidence that a supplier's tax avoidance decreases (increases) when its major customers' switching costs are higher (lower) and when the supplier has higher (lower) revenue diversification.

5.2. Effect of real earnings management

Real earnings management may affect a firm's incentive to engage in tax avoidance in at least two ways. First, similar to tax avoidance, real earnings management can help firms shore up their cash holdings (e.g., reducing R&D cash outflow). Second, real earnings management can help with managing earnings upward. Because real earnings management can increase cash holdings and reported earnings, it likely reduces a firm's need to accomplish these same objectives via tax avoidance activities. The above reasoning suggests a substitution effect between real earnings management and tax avoidance. We test this prediction using a measure of real earnings management employed in Roychowdhury (2006), Cohen et al. (2008), and Cohen and Zarowin (2010). Specifically, we measure real earnings management (*Real Earn Mgmt*) as the negative of the sum of abnormal cash flows from operations (*AB_CASH*) and abnormal discretionary expenses (*AB_DISC*). A larger *Real Earn Mgmt* indicates a higher level of real earnings management.

We incorporate *Real Earn Mgmt* and its interaction with *Corporate Major Customer* in Eq. (1), and report the results of estimating this augmented equation in Table 6. We find a significantly positive (negative) coefficient on *Corporate Major Customer* × *Real Earn Mgmt* when the measure of tax avoidance is *Current ETR* (*BTD Factor*), but an insignificant coefficient when the measure of tax avoidance is *Cash ETR*. Overall, the results provide some evidence that firms with corporate major customers that engage in real earnings management are likely to engage in less tax avoidance, and are consistent with a substitution effect between real earnings management and tax avoidance.

5.3. Effect of cash flow volatility on tax avoidance

To provide more evidence that tax avoidance is motivated by saving cash to buffer cash flow risk, we examine the effect of cash volatility on tax avoidance. We use the standard deviation of annual cash flow plus income taxes paid scaled by total assets estimated over the past four years as the proxy for cash volatility (*Cash Volatility*) and use *Cash Volatility* to replace the customer concentration variable in Eq. (1). In untabulated results, we find

Table 6
Corporate customer concentration and real earnings management.

Variable	(1) *Current ETR*	(2) *Cash ETR*	(3) *BTD Factor*
Corp Major Customer	−0.013***	−0.018***	0.004***
	(−6.25)	(−7.54)	(2.63)
Real Earn Mgmt	0.005*	0.008***	−0.028***
	(1.83)	(2.95)	(−12.96)
Corp Major Customer ×	0.010***	0.004	−0.008**
Real Earn Mgmt	(3.01)	(1.18)	(−1.99)
SIZE	0.007***	0.006***	−0.003***
	(7.47)	(5.15)	(−6.99)
ROA	0.166***	0.072***	0.354***
	(11.78)	(6.17)	(24.07)
LEV	−0.056***	−0.047***	−0.005
	(−8.13)	(−7.06)	(−1.10)
NOL	−0.041***	−0.057***	0.029***
	(−13.65)	(−10.83)	(14.59)
ΔNOL	0.207***	0.226***	1.007***
	(11.52)	(10.56)	(44.24)
Foreign Income	0.003	−0.071	0.043
	(0.06)	(−1.12)	(0.88)
PPE	−0.079***	−0.060***	0.078***
	(−11.21)	(−8.59)	(17.52)
Intangible Asset	0.017**	0.014*	0.011**
	(2.41)	(1.68)	(2.56)
Equity Income	−1.010***	−0.673**	0.616***
	(−3.57)	(−2.20)	(3.81)
MB	−0.003***	−0.007***	0.001***
	(−5.84)	(−10.91)	(2.59)
Intercept	0.291***	0.281***	−0.031***
	(11.59)	(9.89)	(−3.99)
Ind/year fixed effects	Yes	Yes	Yes
Cluster by firm and year	Yes	Yes	Yes
No. of observations	47,055	47,055	29,377
Adjusted R^2	0.143	0.119	0.505
F	108.1	90.31	193.8

This table presents the regression results of the effect of real earnings management on the relation between corporate customer concentration and tax avoidance relation. Regressions include year and industry fixed effects. The *t*-statistics reported in parentheses are based on standard errors that are heteroskedasticity robust and clustered at the firm-year level. To conserve space, we do not report the coefficient estimates for the year and industry dummies. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels (two-tailed), respectively. All variables are defined in Appendix A.

that *Cash Volatility* is significantly and positively associated with tax avoidance, suggesting that the degree of tax avoidance is motivated and affected by the level of cash volatility.

5.4. Interaction effect between major corporate customer and major governmental customer

When we include *Corp Major Customer, Gov Major Customer*, and their interaction in Eq. (1), we generally find that *Corp* (*Gov*) *Major Customer* are positively (negatively) related to tax avoidance (untabulated). We also find a significantly positive interaction term when the dependent variable is *Current ETR*, which suggests that having a major governmental customer reduces a firm's incentive for tax avoidance even if the firm has a concentrated corporate customer base.

5.5. Changes analysis

Next, we employ a changes analysis to alleviate the endogeneity concern that our corporate major customer results may be driven by correlated omitted variables. A levels analysis is inherently vulnerable to correlated omitted variables. To lessen this concern, we conduct a multivariate changes analysis by regressing changes in tax avoidance from year $t-1$ to year t (i.e., *ΔCurrent ETR*, *ΔCash ETR*, and *ΔBTD Factor*) on the corresponding changes in corporate customer concentration and other determinants of tax avoidance from year $t-1$ to year t. Table 7 presents the results of this changes analysis. In Panels A, B, and C, we find that the changes in the three measures of corporate customer concentration are negatively (positively) and significantly related to changes in *Cash ETR*. For example, in Column (2) of Panel A, the coefficient on *ΔCorp Major Customer* is −0.008 ($t=-2.70$), which implies that a change from having no corporate major customer to having at least one corporate major customer is associated with a decrease in cash tax payment by 0.8% of pretax net income. Furthermore, in Panel C, we find a significantly negative coefficient on *ΔCurrent ETR*, indicating that change in total major customer sales is associated with the change in *Current ETR*. These results suggest that an increase (a decrease) in corporate customer concentration can lead to a decrease (increase) in cash tax rate, which is consistent with our

Table 7
Changes analysis.

Panel A: corporate major customer

Variable	(1) *ΔCurrent ETR*	(2) *ΔCash ETR*	(3) *ΔBTD Factor*
ΔCorp Major Customer	−0.003	−0.008***	−0.000
	(−1.40)	(−2.70)	(−0.07)
ΔSIZE	0.011***	−0.002	−0.009***
	(7.09)	(−0.95)	(−7.02)
ΔROA	0.058***	−0.128***	0.391***
	(6.50)	(−11.81)	(53.15)
ΔLEV	−0.00700	0.00200	−0.037***
	(−1.27)	(0.34)	(−8.18)
ΔNOL	−0.0150	−0.0270	0.958***
	(−0.91)	(−1.37)	(73.09)
ΔForeign Income	−0.251***	−0.688***	0.248***
	(−4.91)	(−11.06)	(5.73)
ΔPPE	−0.014**	0.025***	0.060***
	(−2.08)	(3.04)	(10.20)
ΔIntangible Asset	0.019***	0.018**	0.031***
	(2.90)	(2.23)	(5.65)
ΔEquity Income	−1.376***	−1.313***	0.573***
	(−5.28)	(−4.13)	(2.63)
ΔMB	−0.001***	−0.002***	0.001***
	(−2.91)	(−5.37)	(3.36)
Intercept	−0.004***	0.001	0.006***
	(−5.24)	(1.02)	(10.24)
No. of observations	40,695	40,695	23,654

Panel B: corporate major customer HHI

Variable	(1) *ΔCurrent ETR*	(2) *ΔCash ETR*	(3) *ΔBTD Factor*
ΔCorp Major Customer HHI	−0.015	−0.030**	0.013
	(−1.36)	(−2.16)	(1.33)
ΔSIZE	0.011***	−0.002	−0.009***
	(7.09)	(−0.94)	(−7.02)
ΔROA	0.058***	−0.128***	0.391***
	(6.51)	(−11.80)	(53.10)
ΔLEV	−0.007	0.003	−0.037***
	(−1.26)	(0.38)	(−8.16)
ΔNOL	−0.015	−0.028	0.958***
	(−0.93)	(−1.40)	(73.09)
ΔForeign Income	−0.251***	−0.688***	0.249***
	(−4.92)	(−11.06)	(5.74)
ΔPPE	−0.014**	0.025***	0.060***
	(−2.09)	(3.00)	(10.21)
ΔIntangible Asset	0.019***	0.018**	0.031***
	(2.88)	(2.21)	(5.68)
ΔEquity Income	−1.377***	−1.313***	0.574***
	(−5.28)	(−4.13)	(2.64)
ΔMB	−0.001***	−0.002***	0.001***
	(−2.90)	(−5.33)	(3.35)
Intercept	−0.004***	0.001	0.006***
	(−5.25)	(1.01)	(10.23)
No. of observations	40,695	40,695	23,654

(continued on next page.)

Table 7
(continued)

Panel C: corporate major customer sales			
Variable	(1) ΔCurrent ETR	(2) ΔCash ETR	(3) ΔBTD Factor
ΔCorp Major Customer Sales	−0.010*	−0.021***	−0.003
	(−1.73)	(−2.89)	(−0.58)
ΔSIZE	0.011***	−0.002	−0.009***
	(7.08)	(−0.96)	(−7.03)
ΔROA	0.058***	−0.127***	0.391***
	(6.54)	(−11.73)	(53.15)
ΔLEV	−0.007	0.002	−0.037***
	(−1.28)	(0.34)	(−8.19)
ΔNOL	−0.015	−0.028	0.958***
	(−0.92)	(−1.40)	(73.10)
ΔForeign Income	−0.252***	−0.689***	0.248***
	(−4.93)	(−11.09)	(5.72)
ΔPPE	−0.014**	0.025***	0.060***
	(−2.08)	(3.03)	(10.21)
ΔIntangible Asset	0.019***	0.017**	0.031***
	(2.87)	(2.19)	(5.65)
ΔEquity Income	−1.377***	−1.314***	0.573***
	(−5.28)	(−4.14)	(2.63)
ΔMB	−0.001***	−0.002***	0.001***
	(−2.90)	(−5.33)	(3.37)
Intercept	−0.004***	0.001	0.006***
	(−5.23)	(1.04)	(10.25)
No. of observations	40,695	40,695	23,654

This table presents the results of regressing the changes in tax avoidance (from year $t-1$ to t) on the changes in corporate customer concentration measures (from year $t-1$ to t). *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels (two-tailed), respectively. All variables are defined in Appendix A.

primary results. They also provide some evidence that the differences in the levels of tax avoidance can be largely attributed to the varying levels of corporate customer concentration.

5.6. Propensity-score-matched sample

To alleviate the endogeneity concern that determinants of having a major customer also simultaneously determine the firm's level of tax avoidance, we use the propensity score matching technique to control for the difference in firm characteristics between firms having no corporate major customers and firms having at least one corporate major customer. Specifically, in the first stage, we regress the indicator variable for corporate major customers, *Corp Major Customer*, on the determinants of having a corporate major customer. We then use the estimated coefficients from the first-stage regression to compute the propensity score for each observation in our sample. The propensity score represents the predicted probability of a firm having at least one corporate major customer. Next, we match, without replacement, firms having at least one corporate major customer with firms having no such customers by the closest propensity score (within a maximum distance of 3%) to generate a matched sample for the second-stage regression.[17]

Table 8, Panel A, presents the results for the first stage regression. The dependent variable is *Corp Major Customer*. Following Dhaliwal et al. (2016), we include firm size (*Size*), financial leverage (*Leverage*), return on assets (*ROA*), growth (*MB*), firm age (*Age*), mergers and acquisitions (*M&A*), and year and industry (Fama-French 48 industry) fixed effects. The results show that firms that are smaller in size, lower in leverage, younger in age, and not involved in *M&A* are more likely to have a corporate major customer.

Table 8
Sample matched by propensity score.

Panel A: first stage of propensity score		
Variable	Dependent variable = Corp Major Customer	
	Coefficient estimate	t-statistic
SIZE	−0.193***	(−11.66)
Leverage	−0.221*	(−1.93)
Return on assets	0.318	(1.40)
MB	−0.010	(−1.24)
Firm age	−0.262***	(−9.32)
M&A	−0.127***	(−3.60)
Intercept	1.306***	(4.14)
Ind/year fixed effects	Yes	
No. of observations	47,707	
Pseudo R^2	0.1513	

Panel B: descriptive statistics for propensity-score matched subsamples			
Variables	Firms with Corp Major Customer (N = 5579) Mean	Firms without Corp Major Customer (N = 5579) Mean	Difference in Means
SIZE	5.744	5.730	0.37
Leverage	0.468	0.459	1.97**
Return on assets	0.074	0.074	0.00
MB	2.937	2.908	0.56
Firm age	2.583	2.552	1.79*
M&A	0.429	0.439	−1.05

Panel C: sample matched by propensity score: second stage			
Variable	(1) Current ETR	(2) Cash ETR	(3) BTD Factor
Corp Major Customer	−0.009***	−0.015***	0.004**
	(−3.44)	(−4.63)	(2.47)
Control variables	Yes	Yes	Yes
Ind/year fixed effects	Yes	Yes	Yes
No. of observations	11,158	11,158	7132
Adjusted R^2	0.134	0.119	0.479

This table presents the regression results of the impact of corporate customer concentration risk on the tax avoidance based on sample matched by propensity score. Regressions include year and industry fixed effects. The *t*-statistics reported in parentheses are based on standard errors that are heteroskedasticity robust and clustered at the firm-year level. To conserve space, we do not report the coefficient estimates for the year, and industry dummies. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels (two-tailed), respectively. All variables are defined in Appendix A.

Panel B of Table 8 presents the difference in the means across the treatment (the sample with at least one corporate major customer) and the propensity-score-matched samples. The means for these determinant variables are similar between these two samples, indicating that these two samples are well matched.[18]

Table 8, Panel C presents the second-stage regression results using the propensity-score-matched sample. Columns (1)–(3) show, respectively, that *Corp Major Customer* is significantly negatively associated with both *Current ETR* and *Cash ETR* and significantly positively associated with *BTD Factor*. For example, in Column (1), the coefficient on *Corp Major Customer* is −0.009 ($t=-3.44$), which indicates that having a corporate major customer is associated with a reduction in current tax expense of 0.9% of pretax net income. These results further reinforce our primary findings.

[17] Our results are based on caliper of 0.03 and are robust to different PSM specifications (e.g., calipers of 0.01, 0.02, 0.04, and 0.05). The area under the ROC curve in the first-stage regression is 0.746.

[18] The difference in means between the two subsamples is small in magnitude but still significant for *Leverage* and *Age*. This is consistent with Lawrence et al. (2011) who also find that the difference in means between the Big 4 and Non-Big 4 subsamples after propensity score matching is significant for some variables.

5.7. Exogenous shock: acquisition of low customer concentration firms by high customer concentration firms

To further mitigate the endogeneity concern, we test the change in corporate customer concentration level after an exogenous shock to customer concentration. Specifically, we use *M&A* data from the SDC database to identify cases where a firm with high customer concentration (i.e., *Corp Major Customer* = 1) acquires a firm with low customer concentration (i.e., *Corp Major Customer* = 0). We set *After_Acquire* equal to 1 if the firm-year is after the acquisition, and 0 otherwise. We regress tax avoidance measures on *After_Acquire* and other determinants of tax avoidance (i.e., replacing *Customer Concentration* with *After_Acquire* in Eq. (1)). In untabulated results, we find that the coefficient on *After_Acquire* is significantly positive when the dependent variable is *Current_ETR* or *Cash_ETR* but is insignificant when the dependent variable is *BTD Factor*, supporting our expectation that the extent of tax avoidance decreases after *M&A* that reduces customer concentration. Overall, the results from this exogenous shock test suggest that the level of tax avoidance is driven by the level of customer concentration.

5.8. Effect of tax avoidance on cash holding

To examine whether tax avoidance is used by high customer concentration firms to increase cash holding, we regress the cash holding on customer concentration level, tax avoidance, and the interaction of these two variables. We use *BTD Factor* to proxy for the level of tax avoidance, and expect that customer concentration, *BTD Factor*, and their interaction are positively related to the cash holding. Following Bates et al. (2009, pp. 1999–2000), we control the determinants of cash holding. As expected, we find in untabulated results that *Corp Major Customer, BTD Factor*, and their interaction are positively related to the level of cash holding. This indicates that high customer concentration firms increase their cash holding especially when they also employ tax avoidance, suggesting that tax avoidance helps these firms in increasing their cash holding.

5.9. Governmental major customer and political/presidential cycle

In this section, we examine how the political/presidential cycle affects the tax avoidance of firms with governmental major customers. Belo et al. (2013) show that the growth of governmental spending is higher and more volatile under Democratic presidencies. On the one hand, the higher governmental spending during Democratic presidencies may bring more cash to firms with governmental major customers and further lessen their need for tax avoidance. On the other hand, the increased governmental spending volatility during Democratic presidencies suggests that firms with governmental major customers may face more uncertainty in cash flow and thus have more incentive to engage in tax avoidance. For example, a federal government shutdown can significantly increase the uncertainty of a government supplier's future cash flow.[19] We therefore empirically test the interaction effect of political/presidential cycle and governmental major customer on tax avoidance.

We use the indicator variable, *Dem Presidency*, which equals one during a Democratic presidency (1988; 1993–2000; 2009–2011), and zero otherwise. In Table 9, the interaction term between *Gov Major Customer* and *Dem Presidency* exhibits significantly negative coefficients under both *Current ETR* and *Cash ETR*, indicating that firms with governmental major customers are more likely to engage in tax avoidance during Democratic presidencies. Meanwhile, *Dem Presidency* has significantly positive (negative) coefficients under these two ETR measures (*BTD Factor*), suggesting that on average Democratic presidencies are associated with lower levels of tax avoidance for all firms.[20] Overall, our results suggest that the political/presidential cycle has significant implications for tax avoidance of firms with governmental major customers.

Table 9
Governmental customer concentration and political/presidential cycles.

Variable	(1) *Current ETR*	(2) *Cash ETR*	(3) *BTD factor*
Gov Major Customer	0.020***	0.027***	−0.006*
	(3.37)	(4.46)	(−1.93)
Dem Presidency	0.006***	0.010***	−0.008***
	(4.07)	(6.30)	(−8.26)
Gov Major Customer × *Dem Presidency*	−0.014**	−0.012*	0.003
	(−2.17)	(−1.85)	(0.80)
SIZE	0.003***	0.003***	−0.001***
	(4.24)	(4.69)	(−3.08)
ROA	0.178***	0.084***	0.353***
	(19.73)	(8.73)	(37.52)
LEV	−0.039***	−0.034***	−0.017***
	(−6.76)	(−5.55)	(−4.49)
NOL	−0.052***	−0.065***	0.034***
	(−19.95)	(−23.81)	(24.16)
ΔNOL	0.181***	0.206***	1.010***
	(9.44)	(11.68)	(67.61)
Foreign Income	−0.0140	−0.0560	0.066*
	(−0.30)	(−1.17)	(1.77)
PPE	−0.066***	−0.050***	0.073***
	(−10.75)	(−7.85)	(17.58)
Intangible Asset	−0.011*	−0.00800	0.013***
	(−1.86)	(−1.23)	(3.26)
Equity Income	−1.129***	−0.796***	0.532***
	(−3.90)	(−2.58)	(3.15)
MB	−0.003***	−0.007***	0.001***
	(−7.28)	(−16.42)	(3.02)
Intercept	0.258***	0.240***	−0.013*
	(10.39)	(8.66)	(−1.80)
Ind fixed effects	Yes	Yes	Yes
Cluster by firm and year	Yes	Yes	Yes
No. of observations	47,507	47,507	29,662
Adjusted R^2	0.111	0.0969	0.473
F	46.03	49.19	159.0

This table presents the regression results of the effect of political/presidential cycles on the relation between governmental customer concentration and tax avoidance relation. Regressions include industry fixed effects. The *t*-statistics reported in parentheses are based on standard errors that are heteroskedasticity robust and clustered at the firm-year level. To conserve space, we do not report the coefficient estimates for the year and industry dummies. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels (two-tailed), respectively. All variables are defined in Appendix A.

6. Robustness tests

6.1. Controlling for business strategy, life cycle, and firm age

Following Higgins et al. (2015), we classify business strategies as Defenders and Prospectors. Following Dickinson (2011), we classify the life cycle stage as Intro, Growth, Mature, and Shakeout. We find in untabulated results that the correlations between customer concentration and business strategy and life cycle stage are

[19] The U.S. federal government has been shut down for 83 days under Democratic presidencies, and 27 days under Republican presidencies (http://www.outsidethebeltway.com/a-brief-history-of-federal-government-shutdowns/).

[20] This finding is consistent with tighter tax enforcement under Democratic presidencies. This finding also provides an alternative explanation for why firms with governmental major customers are more likely to engage in tax avoidance during Democratic presidencies. Specifically, the tighter tax enforcement under Democratic presidencies leads to higher effective tax rate and thus more incentive for these firms to engage in tax avoidance.

statistically significant but not economically significant, with the highest correlation being −0.08. These low correlations suggest that the level of customer concentration is not merely an indicator of business strategy or life cycle. To further mitigate the concern that the results may be driven by business strategy, life cycle, or age, we re-estimate the models after including these three variables, and find that the main results hold.

We also identify the subsample of young firms (firms whose age is less than the median) and the subsample of high growth firms (firms whose sales growth is greater than the median of 12%) and re-estimate the main models for these two subsamples. We find results that are consistent with those for the full sample.

6.2. Using alternative tax avoidance measures

Because annual *Current ETR* and *Cash ETR* are influenced by temporary Book-tax Differences that tend to reverse over time, we also use the 5-year Cash ETR, which covers a longer period and thus is subject to less temporary Book-tax Difference reversal. Furthermore, following Frank et al. (2009), we also use the permanent Book-tax Difference to capture the permanent tax avoidance that does not reverse. We find that the results (untabulated) are robust to using these alternative tax avoidance measures.

6.3. Controlling for CEO compensation incentives

Rego and Wilson (2012) show that corporate tax avoidance is affected by CEO compensation incentives (Vega). To mitigate the concern that the risky tax avoidance is not induced by CEO compensation incentives, we include Vega in our Eq. (1). Specifically, we define Vega as the dollar change in CEO wealth associated with a 0.01 change in the standard deviation of the firm's returns. We find that the results (untabulated) are robust to controlling for Vega.

6.4. Controlling for additional determinants of tax avoidance

We conduct a robustness test by including several determinants of tax avoidance identified in prior literature in our baseline model (Eq. (1)). These determinants include R&D expense, SG&A expense, capital expenditure, cash holding, depreciation expense, discretionary accruals, Big 4 auditor, auditor expertise, and cash flow volatility.[21] We find the results (untabulated) to be robust after incorporating the above additional variables in Eq. (1).

[21] R&D is research and development expense (*XRD*) divided by lagged total assets, and XRD is set to 0 if missing; SG&A expense is Selling, General and Administrative Expenses (*XSGA*) scaled by lagged total assets, and *XSGA* is set to 0 if missing; CAPEX is the ratio of capital expenditures to lagged total assets; Cash holding is Cash divided by lagged total assets; Depreciation is the ratio of depreciation and amortization to lagged total assets; Discretionary accruals is estimated using the Jones (1991) model as modified in Dechow et al. (1995); Big 4 auditor is an indicator variable that equals 1 if the auditor is a Big 4 auditor, 0 otherwise; Auditor expertise is an indicator variable that equals 1 if the auditor is an industry specialist, 0 otherwise. Industry specialists are identified, following Francis et al. (2005), as the largest auditor (measured by Market Share of clients' lagged revenues in a two-digit SIC industry; and cash flow volatility is defined as the standard deviation of annual operating cash flow plus cash taxes paid divided by total assets estimated over the past four years (year t − 4 to year t − 1).

7. Conclusions

This study examines how the customer concentration dimension of a firm's business model relates to its tax strategy. Given that the level of customer concentration affects a firm's operating performance, cash flow risk, and financial policies, we expect it to also affect the extent to which the firm engages in tax avoidance. Specifically, corporate customer concentration leads to demand for more cash holdings, less financial volatility, and higher earnings. Tax avoidance can affect a firm's cash flow, financial distress, and earnings through both temporary and permanent Book-tax Differences. In addition, a firm's business strategy can also reflect a firm's tax strategy, and firms choosing the risky business strategy of relying on major corporate customers are also more likely to choose a risky strategy in tax planning. We therefore conjecture that firms with greater reliance on major corporate customers are more likely to engage in tax avoidance.

Using multiple, comprehensive measures of customer concentration and tax avoidance, we find that firms with a concentrated corporate customer base are more likely to have a higher level of tax avoidance. Consistent with our argument that tax avoidance is driven largely by the cash flow and financial risks associated with customer concentration, we find that the positive association between customer concentration and tax avoidance is more pronounced when a firm's major customers have lower switching costs (measured by the supplier's Market Share) and when the supplier has less diversified revenue (measured by the number of the supplier's business segments). Furthermore, we find that the association is less pronounced when a firm also engages in real earnings management, indicating that cash and earnings generated by real earnings management can reduce the need for tax avoidance.

In contrast, we find that firms engage in lower levels of tax avoidance when they have a governmental major customer. This indicates that firms have weaker incentives to engage in tax avoidance when they have lower cash flow and financial risks. Furthermore, we find that this reduced incentive to engage in tax avoidance is dampened during Democratic presidencies, probably due to the increased government cash flow volatility during these periods. Overall, our findings suggest that the type (i.e., corporate vs. governmental customers) and the extent of a firm's customer concentration (i.e., the level of reliance on major customers) have a significant effect on the extent to which it avoids tax. These findings contribute significantly to the understanding of the relation between a firm's business strategy and its tax strategy.

Appendix A. Variable definition

Variable	Definition
Customer concentration measures	
Corp Major Customer	An indicator variable set to one if a supplier has at least one corporate major customer (i.e., a corporate customer that accounts for at least 10% of the supplier's total sales).
Corp Major Customer HHI	The corporate customer sales-based Herfindahl–Hirschman Index calculated by summing the squares of the ratios of a supplier's sales to corporate major customers over its total sales (Compustat mnemonic: SALE).
Corp Major Customer Sales	The sum of a supplier's sales to all of its corporate major customers divided by its total sales.
Gov Major Customer	An indicator variable set to one if a supplier has at least one governmental major customer (i.e., a governmental customer that accounts for at least 10% of the supplier's total sales).
Gov Major Customer HHI	The governmental customer sales-based Herfindahl–Hirschman Index calculated by summing the squares of the ratios of a supplier's sales to governmental major customers over its total sales (SALE).
Gov Major Customer Sales	The sum of a supplier's sales to all of its governmental major customers divided by its total sales.
Tax avoidance	
Current ETR	Current effective tax rate, which equals total income tax expense (TXT) minus deferred income tax expense (TXDI), divided by pretax net income (PI) minus special items (SPI) in year t. We truncate the values at 0 and 1.
Cash ETR	Cash effective tax rate, which equals cash taxes paid (TXPD) divided by pretax net income (PI) minus special items (SPI) in year t. We truncate the values at 0 and 1.
BTD Factor	The Principal component extracted from three different Book-tax Difference measures: Book-tax Difference, ETR Differential, and DD_BTD.
Book-tax Difference	Book-tax Difference equals book income less taxable income scaled by lagged assets. Taxable income is calculated by summing the current federal tax expense and current foreign tax expense (TXFO) and dividing it by the statutory tax rate (STR) and then subtracting the change in net operating loss carryforwards (TLCF) in year t. Following Kim et al., (2011), if the current federal tax expense is missing, we calculate total current tax expense by subtracting deferred taxes (TXDI), state income taxes (TXS), and other income taxes (TXO) from the total income taxes (TXT) in year t.
ETR Differential	Following Frank et al. (2009), we calculate ETR Differential based on the following equation. $ETR\ Difference_{i,t} = (BI - ((CFTE + CFOR)/STR)) - (DTE/STR)$ Where BI is pre-tax book income (PI) scaled by lagged assets (SPI); CFTE is the current federal tax expense (TXFED) scaled by lagged assets (AT); CFOR is the current foreign tax expense (TXFO) scaled by lagged assets (AT); and DTE is the deferred tax expense (TXDI) scaled by lagged assets (AT).
DD_BTD	We obtain the DD_BTD from the residual of the following firm fixed effects regression: $\text{Book} - \text{tax Difference}_{i,t} = \alpha_1 TA_{i,t} + \mu_i + e_{i,t}$ (Desai and Dharmapala (2006), where Book-tax Difference is the total book tax difference and TA is total accrual measured using cash flow method of Hribar and Collins (2002) scaled by lagged total assets.
Firm-level control variables	
SIZE	The natural logarithm of market value of equity (PRCC_F∗CSHO) at the beginning of the year.
ROA	The return on assets, measured as pretax income (PI), scaled by lagged assets (AT).
LEV	Long-term debt (DLTT), scaled by lagged assets (AT).
NOL	An indicator variable coded as 1 if loss carryforward (TLCF) is positive at the beginning of the year.
ΔNOL	The change in loss carryforward (TLCF), scaled by lagged assets (AT).
Foreign Income	Foreign Income (PIFO), scaled by lagged assets (AT).
PPE	Net property, plant, and equipment (PPENT), scaled by lagged assets (AT).
Intangible Asset	Intangible Assets (INTAN), scaled by lagged assets (AT).
Equity Income	Equity Income in earnings (ESUB), scaled by lagged assets (AT).
MB	The market-to-book ratio at the beginning of the year measured as market value of equity (PRCC_F∗CSHO) divided by book value of equity (CEQ).
Age	Natural log of the number of years that a firm has data in Compustat.
Interaction effects variables	
Market Share	A supplier's Market Share, measured as its total sales (SALE) divided by total sales in the same industry. *Market Share* is a proxy for the switching cost that the supplier's customers face.
N of Bus Segments	A supplier's the total number of business segments. *N of Bus Segments* is a proxy for revenue diversification.
Real Earn Mgmt	Aggregate measure of real earnings management calculated as multiplying abnormal cash flows from operations (AB_CASH) and abnormal discretionary expenses (AB_DISC) by negative one. (Roychowdhury, 2006; Cohen et al., 2008; Cohen and Zarowin, 2010). Higher values of RM1 represent higher levels of real earnings management. Abnormal cash from operations are estimated as the residual from the predicted values from the following industry-year regression: $\frac{CFO_t}{TA_{t-1}} = \lambda_1(\frac{1}{TA_{t-1}}) + \lambda_2(\frac{SALE_t}{TA_{t-1}}) + \lambda_3(\frac{\Delta SALE_t}{TA_{t-1}}) + \varepsilon_t$ where CFO is cash flow from operations; SALE is annual sales revenues and TA is total assets. Abnormal discretionary expenses are estimated as the residual from the predicted values from the following industry-year regression: $\frac{DISC_t}{TA_{t-1}} = \lambda_1(\frac{1}{TA_{t-1}}) + \lambda_2(\frac{SALE_t}{TA_{t-1}}) + \varepsilon_t$ where DISC is discretionary expenses during the year, and is defined as the sum of advertising expenses, R&D expenses and SG&A.
Cash Volatility	Cash flow volatility, measured as the standard deviation of annual cash flows from operations (OANCF) plus cash taxes paid (TXPD) scaled by total assets over the past four fiscal years (year t – 4 to year t – 1).
Dem Presidency	An indicator variable coded as 1 if firm-year is at Democratic presidencies (1988; 1993–2000; 2009–2011), 0 otherwise.

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