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Financial market development and firm investment in tax avoidance: Evidence from credit default swap market

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Abstract

Lenders reduce their monitoring efforts after hedging their credit risk exposure through credit default swap (CDS) contracts, which are akin to insurance against borrowers' adverse credit events. In this study, we examine whether, upon observing the reduced lender monitoring following CDS trading, shareholders demand that borrowing firms invest in more aggressive tax planning strategies, which were previously constrained by risk-averse lenders. Using a difference-in-differences design that exploits the variation in timing of the inception of CDS trading, we document that borrowers exhibit greater tax avoidance after the inception of CDS trading. Consistent with shareholders stepping up their demands post-CDS, we find that the increase in tax avoidance is stronger for (i) firms with more powerful and influential shareholders, as measured by dedicated institutional investors, (ii) firms with stronger shareholder defenders, as measured by board independence and board size, and (iii) firms with more strategic default options. We also find that borrowers with higher levels of tax avoidance are less likely to file for bankruptcy in the future. Our findings are robust to a battery of sensitivity checks, including controlling for cost of debt and endogeneity, as well as using alternative measures of tax avoidance.

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1. Introduction

In a world of complete and efficient markets with symmetric information and no market frictions, credit default swaps (CDS), which are essentially insurance contracts against the risk of adverse credit events of the underlying entity, are redundant assets. However, given that markets are not complete, the advent of the CDS market significantly altered the payoff structure of lender banks because these banks can now purchase CDS contracts to protect themselves against adverse credit events such as bankruptcy and restructuring. Having hedged their exposure to credit risk, lending banks reduce their monitoring effort and bargain harder in debt renegotiation.¹ In this study we examine whether, upon observing reduced lender monitoring after the onset of CDS trading, shareholders of the borrowing firm strive to increase their value through more effective tax avoidance. As such, our study contributes to the literature by showing that CDS contracts may alter the strategic behavior of reference firms, thus generating externalities on the real side.

Compared to shareholders who have both upside potential and downside risk with respect to their firm's net assets, lenders face asymmetric payoffs. When the net asset value is higher than the face value of debt at maturity, lenders are not entitled to any additional payoffs over and above the face value of debt. On the other hand, lenders face substantial downside risk if the firm's net asset value falls below the face value of debt. Therefore, lenders have strong incentives to monitor borrowers to ensure that managers do not engage in excessive risk taking (Jensen and Meckling, 1976). One form of risk taking that concerns lenders is excessive tax avoidance (Hasan et al. 2014).² Consistently, prior research shows that lending banks regularly monitor their borrowers' tax returns by using their comparative informational advantage in monitoring borrowers' tax policies (compared to public debtholders) that results from their long-term relationship with borrowing firms (Diamond 1984; Fama 1985; Gorton and Kahn 2000; Berger, Minnis and

¹ There is ample evidence in the literature that bank monitoring improves the quality of the firms financed (Datta, Iskandar-Datta and Patel, 1999; James, 1987; Lummer and McConnell, 1989.)

² The corporate finance literature extensively documents that banks monitor borrowing firms to resolve agency conflicts such as moral hazard (e.g., Diamond 1984 and 1991; Leland and Pyle 1977; Chan 1983; and Fama 1985).

Sutherland 2017). They penalize their borrowers' aggressive tax avoidance by increasing loan spreads (Hasan et al. 2014).

However, the advent of the CDS market significantly altered the payoff structure of lender banks because these banks can now purchase CDS contracts to protect themselves against adverse credit events. This ability to protect against adverse credit events decreased banks' incentives to stringently monitor borrower firms and curb their risk taking behavior (Morrison 2005; Ashcraft and Santos 2009; Subrahmanyam, Tang, and Wang 2014; Martin and Roychowdhury 2015). After hedging their credit risk exposure to the outstanding debt through CDS contracts, lenders become more risk tolerant and, therefore, allow risk-taking behaviors such as aggressive tax avoidance by borrowing firms. Additionally, shareholders have a call option on the underlying firm assets, whose value is increasing in firm asset volatilities. After observing the reduced lender monitoring, shareholders can strive to improve their call-option value by inducing their firm managers to undertake more risky investments, which were previously constrained by risk-averse lenders. That is, they can increase their upside potential through their firms undertaking more aggressive tax strategies, which may be risky but value-increasing investment decisions (Rego and Wilson 2012).³

However, the inception of CDS trading could reduce reference firms' tax avoidance behavior for the following two reasons. First, after effectively hedging their risk exposure to borrowers' credit risk through CDS contracts, creditors could increase the supply of credit (e.g., Saretto and Tookes 2013; Oehmke and Zawadowski 2016). This improved access to capital could, in turn, increase borrowers' financial flexibility to reduce their downside risk and circumvent adverse financial events. Saretto and Tookes (2013) show that the ability of capital suppliers such as banks to hedge credit risk through CDS contracts decreases frictions on the supply side. Reference firms can thus maintain higher leverage ratios and longer debt maturities. Edwards, Schwab and Shevlin (2015) document that the lower external

³ In support of our argument, Hasan et al. (2014) show that firms engaging in greater tax avoidance incur higher interest costs and face more stringent covenant terms in their bank loans.

financing frictions are associated with a decrease in firms' demand for cash tax planning.⁴ In this scenario, borrowers have less incentive to undertake aggressive tax strategies to conserve cash. Second, prior studies document that aggressive tax strategies can engender a range of risks such as regulatory, reputation, information, and agency risks, which potentially exacerbate borrowers' downside risk (Armstrong et al. 2015). Concerned about the downside risk exposure arising from these non-tax risks after CDS trading, reference firms may become more risk averse and shun aggressive tax planning activities. That is, to the extent that borrowers' concern regarding the downside risk exposure related to aggressive tax avoidance is greater than the potential benefits from tax savings, borrowers are less likely to pursue aggressive tax avoidance. In support of this view, Hasan et al. (2014) show that firms engaging in greater tax avoidance incur higher interest costs and face more stringent covenant terms in their bank loans. Given that the credit protection afforded by CDS contracts inhibits lender banks' incentives to closely monitor and dissuade aggressive tax behavior of borrowers and given the conflicting views on the net benefits (costs) of CDS contracts on corporate tax avoidance, an interesting question that arises is whether the presence of CDS contracts is accompanied by an increase in tax avoidance by borrowers.

We attempt to answer this question by examining the association between CDS initiation and tax avoidance for 664 firms with CDS contracts that began trading during the period 2001 to 2013. Following the literature (Ashcraft and Santos 2009; Subrahmanyam et al. 2014; Martin and Roychowdhury 2015), we use non-CDS firms as the control group to implement a difference-in-differences research design by exploiting the staggered introduction of CDS across firms. In additional tests, we adopt a propensity score matching approach and a two-stage regression model to deal with potential endogeneity issues associated with CDS initiation (Ashcraft and Santos 2009; Martin and Roychowdhury 2015) and further strengthen

⁴ Constrained firms will rely on tax planning to finance their operations and investments because tax savings are less likely to imperil the firm's operations relative to other cost-saving methods. Alternative cost-saving methods (e.g., cutting advertising, research and development, capital expenditures) may endanger firms' operating performance and result in a higher likelihood of bankruptcy. Prior research provides evidence that firms likely have opportunities to increase current cash tax savings by exploiting deferral-based tax planning strategies (e.g., Armstrong, Blouin, and Larcker 2012; Graham, Hanlon, Shevlin, and Shroff 2014).

identification. We use effective tax rate, book-tax difference (Manzon and Plesko 2002), probability of having a tax shelter (Wilson 2009), and residual book-tax difference (Desai and Dharmapala 2006) to empirically triangulate firm tax avoidance behavior. As conjectured, we find a significant post-CDS initiation increase in tax avoidance for treatment firms when compared to matched control firms with no CDS contracts. Although we use propensity score matching and a difference-in-differences research specification to address endogeneity problems, in additional tests, we also demonstrate that our findings are robust to an alternative two-stage model specification. This finding indicates that initiation of CDS contracts increases tax avoidance behavior of firms, likely due to lender banks' reduced monitoring after CDS trading inception.

We conduct a number of additional tests to strengthen the validity of our inferences and gain further insights. If our findings are indeed due to lower monitoring efforts by lender banks, then our results should be more pronounced when reputational damage arising from banks' reduced monitoring is especially low. The reason is that lower monitoring can expose lender banks to reputation costs because lending is a repeated game where track record is important. Prior research indicates that banks' proclivity to shirk on monitoring efforts after CDS initiation is particularly high when potential reputation costs arising due to weakened monitoring are low (Ashcraft and Santos 2009; Parlour and Winton 2013; Martin and Roychowdhury 2015). Accordingly, we conduct subsample analyses to investigate whether the observed relation between CDS initiation and tax avoidance is stronger when banks are exposed to lower reputational costs due to borrower default. As conjectured, we find evidence consistent with this prediction.

Having established greater tax avoidance after CDS trading, we strive to sharpen our identification of the effect of shareholder intervention on corporate tax strategies after CDS trading by focusing on settings where shareholder intervention is more likely, i.e., when the borrower has dedicated institutional investors, stronger corporate governance, and ex ante strategic options. We predict and find that firms' shareholders demand more tax avoidance following lower lender monitoring when they are more sophisticated and have more effective mechanisms such as corporate governance to influence management's tax strategies. That

is, demand for risky yet value-enhancing tax avoidance is likely to originate from sophisticated investors who are informed following the onset of CDS contracts about their investee's outstanding loans and sufficiently powerful to influence and alter firm tax strategies. Consistent with prior research illustrating that corporate tax avoidance increases for firms experiencing hedge fund activists' intervention (Cheng, Huang, Li and Stanfield 2012), increases in institutional ownership after the Russell index reconstitution setting (Khan, Srinivasan and Tan 2016; Bird and Karolyi 2016), we hypothesize that dedicated institutional investors demand greater tax avoidance when lenders reduce their monitoring effort following CDS trading. Supporting this hypothesis, the positive relationship between CDS initiation and tax avoidance is stronger for firms with higher dedicated institutional investor ownership. Similarly, we show that the effect of CDS initiation on firm tax avoidance is stronger for firms with stronger corporate governance, as captured by board independence and size (e.g., Minnick and Noga 2010). The board of directors acts as a critical internal monitoring mechanism to protect and promote the interests of shareholders. From an agency theory standpoint, boards serve the internal mechanism for controlling insiders' dysfunctional behavior (such as shirking from tax-planning activities) in the absence of lender monitoring following CDS initiation, which helps to alleviate misalignment between outside shareholders' and insiders' interests (Jensen, 1993). Minnick and Noga (2010) show that stronger corporate governance is associated with better tax-management, which promotes shareholder value.

Also, we find that shareholders are more likely to demand greater tax avoidance for firms with greater ex ante strategic option values in the pre-CDS period. When a firm faces financial distress, its shareholders and debt holders often renegotiate the debt to circumvent a sub-optimal liquidation or bankruptcy and reduce the debt amount (Hart and Moore 1994; Anderson and Sundaresan 1996). However, the introduction of CDS may alter the dynamics of the relationship between shareholders and creditors in the debt renegotiation process. Because they are insured against potential credit events via CDS contracts, "empty creditors" are likely to bargain harder in debt renegotiations (Hu and Black 2008; Bolton and Oehmke 2011). These creditors will deny debt exchange offers from shareholders to gain voting rights that

may accrue during the bankruptcy process (Danis and Gamba 2018). They may even deny debt workouts and enforce bankruptcy on distressed borrowers if the total amount of CDS proceeds exceeds the loan amount. Facing this credible threat from creditors, firm managers may sub-optimally undertake strategic debt default that is favorable to shareholders (Bolton and Oehmke 2011; Kim 2016). Upon observing that their strategic default options shrink and their bankruptcy risk increases in the post-CDS period, shareholders of the borrowing firm will protect their own interest. That is, they will strive to increase their call option value on the underlying firm net assets (Jensen and Meckling 1976), for example, via aggressive tax avoidance.⁵⁶

In summary, the main findings of our study are: (1) firms become more aggressive in tax avoidance after CDS initiation; (2) the increased tax avoidance likely arises from shareholders of the reference firm stepping up their monitoring after observing lender banks' reduced monitoring efforts; and (3) this phenomenon is stronger for firms with greater institutional investor ownership, stronger corporate governance, and ex ante valuable strategic options.

Our findings are largely aligned with the literature reporting that banks reduce monitoring when they can hedge their risk exposure to loans. The reduced lender monitoring is associated with an increase

⁵ Jensen and Meckling (1976) suggest the asset substitution problem; after debt is in place, shareholders will engage in excessively risky investment projects since their payoff is similar to those from a call option on the underlying firm net assets.

⁶ Although data limitations preclude us from directly verifying whether a given lender has indeed purchased the CDS contracts that pertain to its borrowers, we attempt to identify the CDS traders using three approaches that have been employed by prior studies. First, we attempt to identify instances where lenders have purchased CDS contracts by observing the cases where the proportion of lender banks' total risk-weighted assets has increased subsequent to the advent of CDS contracts on a given borrower. After hedging their credit risk exposure through CDS contracts, lending banks can increase their risky capital assets, thus increasing the proportion of total risk-weighted assets (Martin and Roychowdhury 2015). Providing further credence to our inferences, we find that the observed relation between CDS initiation and tax avoidance is more pronounced when the percentage of lender banks' total risk-weighted assets has increased after the onset of CDS trading on a specific borrower. Second, we test whether the post-CDS initiation increase in tax avoidance varies across firms depending on the amount of outstanding loans. Lending banks more vigilantly monitor borrowing firms' tax strategies when the amount of the loan is larger and thus their stake is high. Third, we test whether the post-CDS initiation increase in tax avoidance varies across firms depending on the number of the borrowing firms' relationship banks. Subramanyam et al. (2014) show that the number of reference firm relationship banks increased after CDS trading inception, engendering coordination problems among banks in the event of the reference firms' bankruptcy. The coordination problems can be associated with a reduction in lending banks' stringent monitoring and help firms with CDS contracts undertake more risk-engendering tax strategies.

in the cost of debt financing for risky and informationally opaque firms (Ashcraft and Santos 2009), higher syndicated loan spreads (Amiram et al. 2017), an increase in borrowers' credit risk and bankruptcy likelihood (Subrahmanyam, Tang, and Wang 2014), a decrease in conservative accounting (Martin and Roychowdhury 2015), and an increase in firm technological innovation (Chang et al. 2019) and frequency of management forecasts (Kim et al. 2018). Consistent with these studies, we provide evidence that the reduced lender monitoring after CDS inception leads to greater investment in corporate tax avoidance. Although the preceding studies significantly advance our understanding of the implications of CDS inception, they do not paint a complete picture of the effect of CDS without considering the interaction between shareholders, lenders and firm managers, in general, and shareholders' response concerning firm investment in tax avoidance, in particular. In this regard, our study sheds light on the real effect of CDS with respect to corporate tax planning activities. However, our findings contrast with those of Saretto and Tookes (2013) who report that CDS initiation can reduce financing frictions in the credit market for borrowers, thus allowing these borrowers to maintain high leverage ratios. The reduced financing frictions could in turn mitigate managers' incentive to increase corporate cash reserve through aggressive tax avoidance (Edwards, Schwab and Shevlin 2016).

Our study makes at least two important contributions. First, we contribute to the nascent literature that highlights moral hazard issues in CDS markets, where banks' incentives to strictly monitor their borrowers are severely impaired (Ashcraft and Santos 2009; Parlour and Winton 2013; Martin and Roychowdhury 2015). This is an important finding for regulators and market participants who are interested in the relative costs and benefits of the advent of the CDS market.

Second, we address the important question of how shareholders react to the change in the governance environment after the onset of CDS trading. Our study shows that when lenders reduce their monitoring efforts, shareholders' primary response is not to transfer value from lenders to shareholders (asset substitution), which can jeopardize a firm's survival. Rather, shareholders appear to maximize firm value by increasing their upside potential while protecting downside risk. Specifically, while

Subrahmanyam, Tang, and Wang (2014) report that borrowers with CDS contracts experience a higher likelihood of bankruptcy, shareholders may step up their monitoring and scrutiny, demanding borrowing firms to implement aggressive tax avoidance, secure cash, and weather out adverse credit events. They can thus make the borrower improve financial flexibility and reduce bankruptcy risk. In this regard, our study provides evidence on an important issue regarding the underlying forces of the relationship between the onset of CDS trading and changes in the dynamics of the relationship between the three important stakeholders, the firm manager, the lenders and the shareholders, with respect to corporate tax strategies.

Our study provides valuable insight to stakeholders of the reference firm. If the introduction of CDS contracts signals an increase in aggressive tax avoidance for the reference firm, its stakeholders should reassess the risk factors arising from changes in corporate financing and investment policies. Corporate managers reduce marginal tax rates through investments involving tax deductions or exemptions, and transactions reallocating corporate assets or profits to certain states or countries that are considered tax havens or provide more competitive tax rates. These investment activities often cause firm managers manage to alter the location, timing, and characterization of reported profits. These alterations can engender tax and non-tax risks (Armstrong et al. 2015).⁷ However, the cash tax planning activities can offset the increased credit risk and higher bankruptcy likelihood that firms face after CDS inception. Corporate stakeholders, especially bond investors and firm managers, should therefore consider the introduction of CDS contracts and subsequent changes in corporate tax planning activities in evaluating the net risk of their investment portfolios.

The remainder of this paper is organized as follows: We develop our hypotheses in Section 2, describe the sample and research design in Section 3, present the main results in Section 4, report the results of additional analyses in Section 5, and provide our conclusions in Section 6.

2. Hypothesis Development

⁷ The tax risks can include future tax rate volatility or firm risk. The non-tax risks can include regulatory, reputation, information, and agency risks, which potentially exacerbate firms' downside risk (Armstrong et al. 2015).

2.1 Relation between inception of CDS contracts and tax avoidance

U.S. public corporations display dramatic variation in effective tax rates (Government Accounting Office 2008). This variation is not confined just to one-year tax rates but is also observed in the tax rates measured over long horizons. Dyreng et al. (2008) show that more than 25 % of firms maintain a ten-year cash effective tax rate of below 20 %, and 14 % have a rate exceeding 40 %. Given the economic importance of taxes, Hanlon and Heitzman (2010) call for research on factors that contribute to variation in corporate tax payments. Our study responds to this call by providing evidence that creditors' credible threat after hedging their credit risk exposure via CDS contracts alters reference firms' tax avoidance behavior.

Shareholders perceive tax avoidance practices as potentially value-enhancing but risk-engendering corporate investment activities (Rego and Wilson 2012). However, debtholders likely resist tax avoidance activities. The reason is that lenders are unlikely to benefit much from cash savings achieved by borrowers via aggressive tax strategies. Compared to shareholders, lenders face asymmetric payoffs with respect to a firm's net assets. When the net asset value is higher than the face value of debt at maturity, lenders are not entitled to any additional payoffs over and above the face value of debt. On the other hand, lenders face substantial downside risk if the firm's net asset value falls below the face value of debt. Therefore, lenders have strong incentives to monitor borrowers to ensure that managers do not engage in excessive risk taking (Jensen and Meckling 1976). One form of risk taking that concerns lenders is excessive tax avoidance (Hasan et al. 2014).

Additionally, tax avoidance practices expose the firm to added risks. Debtholders are naturally more risk averse because they are exposed to asymmetric payoff structures with limited upside potential. Added risks associated with tax avoidance may include agency risk (Desai et al. 2007), risk of detection and potential penalties (Mills 1998; Hanlon and Slemrod 2009), risk of stock price crash (Kim et al. 2011), and information risk (Frank et al. 2009; Balakrishnan et al. 2012). Consistent with debt holders' disinclination towards tax avoidance, Hasan et al. (2014) report that firms engaging in greater tax avoidance incur higher interest costs and face more stringent covenant terms in obtaining bank loans.

Prior studies show that lending banks perform an important economic role by monitoring their borrowers' tax returns on a regular basis (Berger, Minnis and Sutherland 2017). As lenders are more risk averse than equity holders, strict lender monitoring should attenuate firms' tax avoidance behavior and reduce the aforementioned risks. However, it is argued that the emergence of the CDS market has significantly diminished banks' monitoring incentives. While the first CDS was traded in 1994, the CDS market has grown rapidly since 2000 and proved resilient in the face of major financial market shocks such as the 2008 financial crisis and the 2012 Greek bailout (Augustin et al. 2014). CDS is a fixed income derivative instrument that allows a protection buyer (CDS buyer) to purchase insurance against a qualifying contingent credit event on an underlying reference entity by paying a premium to the protection seller (CDS seller). A qualifying credit event could include bankruptcy, failure to pay, obligation default or acceleration, and restructuring. In essence, from a lender's standpoint, CDS is akin to an insurance that protects the CDS buyer (lender) against adverse credit outcomes of the borrowing entity.

As CDS contracts allow lender banks to protect against adverse credit events of borrower firms, banks' incentives to closely monitor their borrowers is reduced. Morrison (2005) analytically demonstrates that banks' ability to divest credit risk through CDS contracts weakens their monitoring incentives and induces borrowers to choose second best financing decisions and forgo the first best financing decisions. Ashcraft and Santos (2009) find that the onset of CDS trading has increased the cost of debt financing for firms that are riskier and informationally opaque. This finding is consistent with the notion of syndicate participants demanding higher compensation when extending loans to riskier borrowers due to moral hazard problems that ensue due to lowering of banks' monitoring incentives. Providing further empirical support that banks reduce vigilance in monitoring borrowers whose reductions in credit quality can be hedged via CDS contracts, lender demand for conservative accounting decreases (Martin and Roychowdhury 2015), and shareholders counteract the lenders' reduced monitoring subsequent to the onset of CDS trading by demanding an increase in disclosure on firm-specific information (Kim et al. 2018). Finally, Subrahmanyam, Tang, and Wang (2014) find that firms are more likely to be downgraded or to go bankrupt

after the inception of CDS trading. The reduced monitoring, in turn, could mitigate borrowers' sub-optimally conservative tax strategies, where managers' tax avoidance is constrained by risk-averse lenders (Hasan et al. 2014).

Additionally, CDS-protected creditors are likely to be intransigent in debt renegotiations, denying debt workouts and enforcing bankruptcy on distressed borrowers if the total amount of CDS proceeds exceeds the loan amount. Thus, borrowers face a credible threat from lenders after lenders hedge their credit risk exposure. Shareholders may step up their scrutiny, demanding borrowing firms to engage in aggressive tax avoidance, secure cash, and ride out adverse credit events. They can thus induce the borrower to increase financial flexibility and reduce bankruptcy risk. Consistently, Edwards, Schwab and Shevlin (2015) document that cash tax planning increases for firms that are subject to financial constraint. They argue that constrained firms will rely on tax planning to finance their operations and investments because tax savings are less likely to imperil the firm's operations relative to other cost-saving methods. Alternative cost-saving methods (e.g., cutting advertising, research and development, capital expenditures) may endanger firms' operating performance and result in a higher likelihood of bankruptcy. Prior research provides evidence that firms likely have opportunities to increase current cash tax savings by exploiting deferral-based tax planning strategies (Armstrong, Blouin, and Larcker 2012; Graham, Hanlon, Shevlin, and Shroff 2013).

The preceding discussion indicates that (1) due to their asymmetric payoff structure, lenders are unlikely to tolerate aggressive tax avoidance behavior, and (2) the availability of CDS contracts reduces lenders' incentives to stringently monitor borrowers. Therefore, we hypothesize that because of the weaker lender banks' monitoring incentives following the advent of CDS contracts, there will be a relaxation of the constraints on borrowers to engage in tax aggressive behavior. Overall, it is ultimately an empirical question whether the start of CDS trading is associated with an increase or a decrease in tax avoidance behavior of borrowing firms. Hence, our first hypothesis (stated in alternate form) is:

H1: Borrowers engage in greater tax avoidance following the introduction of CDS contracts.

2.2 Role of reputation costs

Borrower firms may engage in more tax avoidance activities after the onset of CDS trading due to reduction of lender banks' monitoring and increased intransigence in corporate restructuring and debt renegotiation. Prior literature suggests that the initiation of CDS is especially likely to induce such lender behavior when reputation costs associated with reduced monitoring efforts are lower (Parlour and Winton 2013; Martin and Roychowdhury 2015). Whereas CDS contracts can protect lenders from adverse credit events, lower monitoring can expose lender banks to reputation costs because lending is a repeated game where track record is important. For example, prior studies provide theories and supporting empirical evidence that the effect of bank monitoring to resolve moral hazard is more prominent in circumstances where reputation costs are high (Diamond 1984 and 1991; Leland and Pyle 1977; Chan 1983; Fama 1985). Gopalan, Nanda, and Yerramilli (2011) find that lead lenders suffer reputation costs in syndicate lending markets when inadequate screening and monitoring are contributing factors to borrower defaults. Parlour and Winton (2013) argue that these reputation costs are lower when lending to riskier borrowers because it is more difficult to attribute adverse credit events to reduced lender monitoring. Consistent with the notion that reduced monitoring associated with the onset of CDS trading is especially prevalent with respect to riskier borrowers, Ashcraft and Santos (2009) find that post-CDS loan spreads increase for more risky firms when compared to less risky firms. Further, Martin and Roychowdhury (2015) find that the decline in accounting conservatism following the onset of CDS trading is greater for riskier borrowers because lender banks suffer less reputational damage in the event of default by these borrowers. Accordingly, if the decrease in monitoring after the onset of CDS contracts is more pronounced for riskier borrowers that do not expose lenders to high reputation costs, we would expect the increase in tax avoidance following the introduction of CDS contracts to be greater for such borrowers. Hence, our second hypothesis is (in alternate form):

H2: The increase in borrower tax avoidance following the introduction of CDS contracts is greater for borrowers when lender monitoring incentive and strength is weak.

If tax avoidance following the onset of CDS trading is higher (H1), results consistent with hypothesis H2 would suggest that such increases in tax avoidance are indeed due to reduced monitoring efforts by lender banks.

2.3 Corporate tax avoidance after the inception of CDS trading: The role of dedicated institutional investors and corporate governance

In this subsection, we strive to sharpen our identification of the effect of shareholder intervention on corporate tax strategies after CDS trading by focusing on settings where shareholder intervention is more likely—in the presence of dedicated institutional investors and stronger corporate governance. We predict that firms' shareholders demand more tax avoidance following lower lender monitoring when they are more sophisticated and have more effective mechanisms such as corporate governance to influence management's tax strategies. We first examine dedicated institutional investors based on prior research that shows that higher institutional investor ownership leads to greater tax avoidance (Khan, Srinivasan and Tan 2016; Bird and Karolyi 2016). In particular, we categorize institutional investors into two categories: transient institutional investors that take insignificant positions in the firms they hold and have high portfolio turnover, and dedicated institutional investors that take highly concentrated positions in the firms they hold and have low portfolio turnover (Bushee 1998, 2001). The former are likely to be myopic traders that pursue short-term profits due to their short investment horizon and lack of concentration in a given firm. In contrast, the latter takes concentrated positions in the firms they hold and have low portfolio turnover. Both of these attributes indicate that dedicated institutional investors are more likely to be concerned about firm value creation through aggressive tax avoidance, by collecting firm-specific information and trading on the growth potential of a firm. Therefore, we focus on the role of dedicated institutional investors in promoting corporate tax avoidance following CDS trading. Relatedly, we posit that strong corporate governance helps align outside shareholders' interests with those of a risk-averse manager, who has an undiversified equity portfolio, thus encouraging managers to make risky investment in tax planning to increase shareholders' upside potential. In particular, we use board independence and

size as proxies for corporate governance strength because prior research shows that these proxies contribute to reducing agency conflict between managers and outside shareholders (Karamanou and Vafeas 2005). Hence, our third hypothesis (stated in alternate form) is:

H3: The increase in tax avoidance after the onset of CDS trading is greater for firms with higher dedicated institutional ownership and firms with stronger corporate governance.

3. Sample and Variable Construction

3.1 Measuring Tax Avoidance

We use four measures of tax avoidance that are widely employed in the literature. Use of multiple tax avoidance measures allows us to mitigate specific concerns related to each individual measure and to assess the robustness of our inferences. The first tax avoidance measure is effective tax rate (*ETR*), which is a widely used measure of corporate tax reporting. We measure *ETR* as a firm's total income taxes divided by its pre-tax income before special items. It reflects corporate tax reporting activity in terms of current period tax expense. A lower value of *ETR* reflects a higher level of tax avoidance. For ease of exposition, we multiply *ETR* by -1 so that increases (decreases) in *ETR* represent increases (decreases) in corporate tax avoidance.

Our second measure of tax avoidance is book-tax difference (*MPBTD*), i.e., the difference between financial statement income and taxable income as proposed by Manzon and Plesko (2002). Because financial accounting and tax reporting rules differ, the pre-tax income reported in the financial statements differs from that reported in tax filings. While part of this book-tax difference can be attributed to differences in tax accounting rules and to economic factors, the residual that remains unexplained by these structural factors can be attributed to discretionary tax avoidance by managers. Under Manzon and Plesko's (2002) approach, book-tax difference is regressed on change in net sales, gross property, plant, and equipment (PP&E), ratio of net PP&E to gross PP&E, change in goodwill, non-goodwill intangible assets, change in post-retirement benefits, change in unused net operating losses (NOL), lagged book tax difference, foreign pre-tax income, total assets less PP&E and intangibles, as well as dummy variables for

positive pre-tax income and positive NOL carryforwards. The residual from this model (*MPBTD*) captures managerial discretion on the book-tax difference. Higher (lower) values of *MPBTD* indicate higher (lower) levels of tax avoidance.

We use the predicted probability of engaging in tax shelters (*SHELTER*), introduced by Wilson (2009), as our third measure of tax avoidance. Wilson's (2009) model is developed based on a profile of identified tax shelter participants and detects tax shelter participation through variables that are either affected by or associated with having tax shelters. Following Wilson (2009), the probability of having a tax shelter (*SHELTER*) is modeled as follows:

$$\begin{aligned} SHELTER = & -4.86 + 5.20 \times BTD + 4.08 \times |DAP| - 1.41 \times LEV + 0.76 \times AT \\ & + 3.51 \times ROE + 1.72 \times FOREIGN\ INCOME + 2.43 \times R\&D \end{aligned} \quad Eq. (1)$$

In Eq. (1), *DAP* is the discretionary accrual from the performance-adjusted modified cross-sectional Jones model (Kothari et al. 2005), *LEV* is the leverage ratio, defined as long-term debt divided by total assets, *AT* is the log of total assets, *ROE* is income before extraordinary items divided by total assets, *FOREIGN INCOME* is an indicator variable that equals one for firm-years that report foreign income and zero otherwise, and *R&D* is research and development expenses divided by lagged total assets. Higher (lower) values of *SHELTER* imply greater (lower) tax avoidance propensity.

Our fourth measure of tax avoidance is the residual book-tax difference measure (*DD_BT*_{*D*}) proposed by Desai and Dharmapala (2006). *DD_BT*_{*D*} is the residual value from a regression of total book-tax differences on total accruals after controlling for firm fixed effects. Using the residual measure allows us to isolate the component of the book-tax difference that is unrelated to accruals. In other words, *DD_BT*_{*D*} purges, at least partially, the book-tax difference caused by earnings management activities. Higher (lower) values of *DD_BT*_{*D*} indicate higher (lower) levels of tax avoidance.

3.2 Selection of CDS Firms

We gather data from the Markit database, which covers CDS quotes of U.S. firms starting in 2001. Markit verifies its CDS data through a multi-stage scrubbing procedure that includes assessing the legal relationship between a reference entity and a reference obligation as well as corporate actions, CDS succession events, and credit events. Markit covers more than 14,100 reference entities and 8,000 reference obligations in the global market. We retrieve data on firms' lending relationships from the DealScan database provided by the Thomson Reuters Loan Pricing Corporation. We collect financial and stock price data from Compustat North America and CRSP, respectively. Next, we merge the Markit data with the Compustat data using the ticker and also by manually cross-validating the match between these two datasets based on company names. After merging the two data files, we identify 664 U.S. firms that initiated trading on single-name CDS contracts during the sample period from 1987 to 2015.

Table 1 Panel A presents the sample distribution by year. The number of observations monotonically increases over the sample period. Table 1 Panel B summarizes the sample distribution by industry. Our sample covers a range of industries, the most heavily represented being Business Services (10.50%), followed by Petroleum and Natural Gas (6.67%), Electronic Equipment (6.52%), and Pharmaceutical Products (5.84%). In our multivariate regression analysis, we control for year and industry idiosyncratic characteristics by including year and industry fixed effects in all models.

[Insert Table 1 here]

4. Results

4.1 Descriptive statistics

Table 2 reports descriptive statistics of the variables used in our analyses. The mean and median of *ETR* are -0.1889 and -0.2540,⁸ respectively, indicating that *ETR* is positively skewed. The mean and median of *MPBTD* are both slightly negative (-0.0216 and -0.0032). The mean of *SHELTER* is positive (0.0468) and the median is negative (-0.0002), suggesting that the distribution is skewed to the right and some firms

⁸ These values are negative because we multiply *ETR* by -1.

exhibit large, positive shelter values. The mean and median of *DD_BT*D are both positive (0.0117 and 0.0043). We note that the standard deviation is high for each tax avoidance measure, indicating that our sample firms exhibit relatively large cross-firm variation in tax avoidance activities.⁹

The univariate statistics for the control variables are largely consistent with those reported in prior studies (e.g., Frank et al. 2009). The mean of net operating loss (*NOL*) is 0.4029, which suggests that slightly less than half of our sample firms report tax loss carryforwards. The mean and median of *ROA* are -0.0430 and 0.0288, respectively, indicating that the distribution of *ROA* is negatively skewed. The mean (median) of *PPE* is 0.3403 (0.2411) and the mean (median) of *RDEXP* is 0.0446 (0.0000).¹⁰ We provide detailed variable definitions in Appendix A.

[Insert Table 2 here]

The upper (lower) triangle of Table 3 reports Pearson (Spearman) correlation coefficients among our tax avoidance variables and control variables used in the multivariate regressions. This table illustrates that the tax avoidance proxies are positively correlated with *CDS_ENTER*, an indicator variable that equals 1 in periods after the CDS trade initiation, and 0 otherwise. This result provides univariate support for our hypothesis that CDS trading facilitates corporate tax avoidance.

[Insert Table 3 here]

4.2 Tests of H1: Relation between CDS initiation and tax avoidance

Our primary hypothesis, H1, predicts that corporate tax avoidance increases after CDS initiation. We employ the following regression specification to test this hypothesis:

⁹ The untabulated results indicate that our tax avoidance measures are larger for CDS firms than for non-CDS firms, providing preliminary evidence in support of our main hypothesis. We note that these differences are primarily attributed to post-CDS initiation increases in tax avoidance of CDS firms.

¹⁰ As a robustness check, we constrain our analyses to CDS contracts with five-year maturity and a Modified Restructuring clause, as these CDS contracts are the most widely traded CDS contract type. The results are largely consistent with those reported in Table 4.

$$\begin{aligned}
TaxAvoidance_{it} &= \beta_0 + \beta_1 CDS_ENTER_{it} + \beta_2 CDS_FIRM_i + \beta_3 SIZE_{it} + \beta_4 RDEXP_{it} + \beta_5 LEV_{it} \\
&+ \beta_6 BTM_{it} + \beta_7 CASHSIZE_{it} + \beta_8 NOL_{it} + \beta_9 DNOL_{it} + \beta_{10} ROA_{it} + \beta_{11} PPE_{it} \\
&+ \beta_{12} DEP_{it} + \beta_{13} EQINC_{it} + \beta_{14} FI_{it} \\
&+ \varepsilon_{it}
\end{aligned}
\tag{Eq. (2)}$$

In Eq. (2), the dependent variable is one of our four measures of tax avoidance, i.e., *ETR*, *MPBTD*, *SHELTER*, or *DD_BT*. Following Subrahmanyam et al. (2014), we employ a difference-in-differences research design. Specifically, our explanatory variable of interest is *CDS_ENTER*, which equals one for periods after CDS initiation, and zero otherwise. The value of *CDS_ENTER* is zero for the control firms. Following Ashcraft and Santos (2009), Saretto and Tookes (2013), and Subrahmanyam et al. (2014), we include a dummy variable *CDS_FIRM*, which equals one for CDS firms (treatment group), and zero for firms with no CDS. Hence, *CDS_ENTER* ($= POST \times CDS_FIRM$) captures the marginal impact of CDS introduction on corporate tax avoidance behavior. If, as hypothesized in H1, firms engage in increased tax avoidance following the onset of CDS trading, then we would expect β_1 to be positive. Due to the positive correlation between *CDS_FIRM* and *CDS_ENTER*, we follow Subrahmanyam et al. (2014) and report results both with and without controls for *CDS_FIRM* in our main Table 4.

Following prior literature, we include control variables in Eq. (2) to isolate the CDS initiation effect from other firm-level characteristics that may contribute to tax avoidance behavior. To control for the effect of economies of scale and firm complexity on corporate tax strategies, we include firm size (*SIZE*), R&D investment (*RDEXP*), financial leverage (*LEV*), book-to-market ratio (*BTM*), and non-current assets (*PPE*) in Eq. (2) (Mills 1998; Rego 2003; Chen et al. 2011; McGuire et al. 2012). Firms with lower profitability and/or significant net operating loss carryforwards may have less motivation to engage in tax avoidance. We therefore include firm profitability (*ROA*), net operating loss carryforwards (*NOL*), and change of net operating loss carryforwards (*DNOL*) as additional control variables (Rego 2003; Frank et al. 2009; Chen et al. 2011; McGuire et al. 2012; Chyz et al. 2013). We also control for the level of firms' cash holdings (*CASHSIZE*) to account for firms' cash needs that might necessitate certain types of tax avoidance (McGuire et al. 2012).

We report the results in Table 4. The coefficients on *CDS_ENTER* (β_1) are consistently positive across all four tax avoidance measures. β_1 is significant at the one percent level when the dependent variable is *MPBTD* ($\beta_1 = 4.2650$; t-stat = 3.67), *SHELTER* ($\beta_1 = 0.1812$; t-stat = 7.78), and *DD_BTD* ($\beta_1 = 0.0084$; t-stat = 3.12), and at the 10 % level when the dependent variable is *ETR* ($\beta_1 = 0.0135$; t-stat = 1.88). Overall, the results reported in Table 4 provide strong support for the hypothesis that tax avoidance is significantly greater following the onset of CDS trading. Next, we examine whether the observed increase in tax avoidance following CDS initiations is likely due to credible threats from lender banks.

[Insert Table 4 here]

4.3 Creditors' credible threats after CDS trading

Borrower firms may engage in more tax avoidance activities after the onset of CDS trading due to reduction of lender banks' monitoring and increased intransigence in corporate restructuring and debt renegotiation. Prior literature suggests that the initiation of CDS is especially likely to induce such lender behavior when reputation costs associated with reduced monitoring efforts are lower (Parlour and Winton 2013; Martin and Roychowdhury 2015). Parlour and Winton (2013) argue that reputation costs are lower when lending to riskier borrowers because it is more difficult to attribute adverse credit events to reduced lender monitoring.¹¹ If lower monitoring after the inception of CDS contracts is more pronounced for riskier borrowers that do not expose lenders to high reputation costs, then we expect higher tax avoidance following the introduction of CDS contracts for such borrowers.

To test this prediction, we interact the measure of lender reputation cost (*LENDER_REP*) with *CDS_ENTER*. As in Martin and Roychowdhury (2015), we capture lenders' concerns for reputation costs based on the size and credit rating of borrowers. Lenders are less likely to be concerned about reputation

¹¹ Consistent with the notion that reduced monitoring associated with the inception of CDS trading is especially prevalent with respect to riskier borrowers, Ashcraft and Santos (2009) find that post-CDS loan spreads increase for more risky firms compared to less risky firms. Further, Martin and Roychowdhury (2015) find that the decline in accounting conservatism following the onset of CDS trading is greater for riskier firms because lender banks suffer less reputational damage in the event of default by these lenders.

costs due to borrower defaults when borrowers are smaller and riskier, so that it is difficult to attribute unfavorable credit events to lax monitoring efforts. We define *LENDER_REP* as a factor derived from principal component analysis of the two variables: natural logarithm of firm market value of equity and long-term S&P credit rating (Martin and Roychowdhury 2015). A higher value of *LENDER_REP* indicates lower costs of lender reputation.

The results in Table 5 generally support our prediction. We find higher tax avoidance following CDS initiations for firms that do not expose lender banks to severe reputation costs. The coefficient on $CDS_ENTER \times LENDER_REP$ (β_3) is positive and significant at the one percent level for three of the four proxies for tax avoidance, the exception being *ETR*. The insignificant coefficient on *ETR* along with the lower R-Square value indicate that less risky and general types of tax avoidance, as represented by lower levels of effective tax rate, are less likely to affect lender reputation. Consistently, Guenther, Matsunaga, and Williams (2017) show that low tax rates are likely to be more persistent and do not increase future tax rate volatility or firm risk. In contrast, more aggressive and risky tax strategies, as represented by tax shelters and book-to-tax differences, can involve a higher likelihood of incurring tax- as well as non-tax costs and can therefore be more harmful to lender reputation. These results add credence to the argument that the higher post-CDS initiation tax avoidance observed in tests of H1 can be attributed to lower monitoring by lender banks that can protect themselves against adverse credit events due to the availability of CDS contracts.

[Insert Table 5 here]

4.4 Tax planning activities post-CDS trading, conditional on dedicated institutional investors and corporate governance

In this subsection, we test the effect of shareholder intervention on corporate tax strategies after CDS inception. We expect an increase in tax avoidance post-CDS trading when shareholder intervention is stronger because firms' shareholders demand more aggressive tax avoidance due to lower lender monitoring following CDS initiation. Following the literature, we use three proxies for shareholder intervention or

influence: the number of dedicated institutional investors (Bushee 1998, 2001), and board independence and board size (Guest 2009; Cornett, Marcus, and Tehranian 2008; Lobo and Zhao 2013).

With respect to the number of dedicated institutional investors, we extract data on institutional investor ownership from Thomson Reuters Institutional Holdings. The Thomson Reuters holdings database covers investment firms and their security holdings by using their 13F forms reported to the Securities and Exchange Commission (SEC) each quarter. Based on two portfolio characteristics, portfolio turnover and holdings concentration, we categorize institutional investors into transient and dedicated institutional investors (Bushee 1998, 2001; Bushee and Noe 2000). Investors belong to the transient subgroup if they have short investment horizons as captured by high portfolio turnover and highly diversified portfolio holdings. By contrast, dedicated investors have long investment horizons as captured by low portfolio turnover and focused portfolio holdings. With respect to corporate governance strength, we extract data on board independence and size from Institutional Shareholder Services (formerly RiskMetrics) and BoardEx.

We test H3 by adding the interaction term between *CDS_ENTER* and either the measure of dedicated institutional investors (*DEDINST*) or corporate governance, which is captured by board independence (*BDINDEP*) and board size (*BDSIZE*), to the main equation (Eq. (2)). The results in Table 6 are consistent with our hypothesis (H3). Specifically, the coefficient on $CDS_ENTER \times DEDINST$ (β_3) is positive and significant at the five percent level for all the tax avoidance proxies except *DD_BT*, supporting the view that the increased tax avoidance following CDS initiations for firms that have a higher number of dedicated institutional investors.

[Insert Table 6 here]

Table 7 presents the results for corporate governance. We find positive and significant coefficients on $CDS_ENTER \times BDINDEP$ (β_3), except for *DD_BT*, in Panel A and positive and significant coefficients on $CDS_ENTER \times BDSIZE$ (β_3) of *MPBT* and *SHELTER* in Panel B. These findings indicate that the

increase in tax avoidance following CDS initiations is stronger for firms with stronger corporate governance, as captured by board independence and board size.

In sum, the above results add credence to our arguments that the increase in tax avoidance observed in tests of H1 can be ascribed to stronger shareholder intervention, which demands more tax avoidance due to lenders' reduced monitoring after CDS initiation.

[Insert Table 7 here]

5. Additional Analyses

5.1. Identifying lender banks that used CDS contracts

We have documented that the positive relationship between CDS initiation and tax avoidance can be explained by lender banks reducing monitoring efforts as well as increasing their intransigence in debt renegotiation. In this section, we examine whether this result is stronger for banks that are more likely to have purchased CDS contracts. We use banks that are likely to have purchased CDS contracts rather than banks that have purchased CDS contracts because data limitations preclude us from identifying which lenders are buyers of CDS contracts that are mainly traded over the counter.

We use three approaches to identify banks that are more likely to have purchased CDS contracts. First, we follow the approach of Martin and Roychowdhury (2015), who show that after hedging their credit risk exposure through CDS contracts, lending banks can increase their risky capital assets, which will increase the proportion of total risk-weighted assets. Therefore, if the proportion of total risk-weighted assets increases for a bank that lends to a borrower with CDS contracts in the same year that CDS contracts were initiated, that bank is more likely to have purchased CDS protection against the underlying borrower's default risk. Following this approach, we examine whether lender banks' total risk-weighted assets increase in the year of CDS contract initiation and expect the relationship between CDS initiation and tax avoidance to be stronger for those firms whose lender banks are more likely to have purchased the CDS contracts. We identify lenders to CDS and non-CDS firms in our sample using the Dealscan database, and manually collect the risk weights on banks' assets from the Federal Reserve's Y-9C reports. We construct the variable *POS_RISKASSET*,

which equals one if lenders exhibit an increase in the proportion of total risk-weighted assets in the year as CDS initiation, and zero otherwise. We then estimate the following regression model:

$$\begin{aligned}
 TaxAvoidance_{it} &= \beta_0 + \beta_1 CDS_ENTER_{it} + \beta_2 POS_RISKASSET_{it} + \beta_3 CDS_ENTER_{it} \\
 &\times POS_RISKASSET_{it} + \sum \beta_n Control\ Variables_{it} \\
 &+ \varepsilon_{it}
 \end{aligned}
 \tag{Eq. (3)}$$

Table 8 Panel A presents the results of this analysis. The coefficients on the interaction term $CDS_ENTER \times POS_RISKASSET$ are positive and significant for firms whose lenders exhibit an increase in the proportion of total risk-weighted assets. In sum, this analysis reveals that the positive association between CDS initiation and tax avoidance is indeed stronger for the lender banks that are more likely to have purchased the CDS contracts.

Second, we examine whether the post-CDS initiation increase in tax avoidance varies across firms depending on the amount of outstanding loans. We argue that lending banks more vigilantly monitor borrowing firms' tax strategies the larger the amount of the loan. A larger loan amount indicates that the lending bank has more to lose if the borrowing firm experiences an adverse credit event. We measure loan amount for the reference entity ($LNLOANAMT$) as the natural logarithm of the amount of the outstanding loan facility in millions of dollars, and interact this variable with CDS_ENTER . We then estimate the following regression model:

$$\begin{aligned}
 TaxAvoidance_{it} &= \beta_0 + \beta_1 CDS_ENTER_{it} + \beta_2 LNLOANAMT_{it} + \beta_3 CDS_ENTER_{it} \times LNLOANAMT_{it} \\
 &+ \sum \beta_n Control\ Variables_{it} \\
 &+ \varepsilon_{it}
 \end{aligned}
 \tag{Eq. (4)}$$

Table 8 Panel B presents the results of this analysis. The coefficients on the interaction term $CDS_ENTER \times LNLOANAMT$ are positive and significant across our tax avoidance variables (p-value < 0.05), except for ETR . The results in Table 8 Panel B are consistent with lending banks more stringently monitoring borrowers' aggressive and risky tax planning activities (as captured by tax shelters and book-to-tax differences) rather than the general type of tax avoidance (as represented by lower levels of effective tax rate). These results

indicate that the observed effects of CDS trading on corporate tax avoidance increase with the outstanding loan amounts of the reference entity.

Third, we examine whether the post-CDS initiation increase in tax avoidance varies across firms depending on the number of their relationship banks. Subrahmanyam et al. (2014) show that the number of the reference firms' relationship banks increased after CDS trading inception, which engenders coordination problems among banks in the event of the reference firms' bankruptcy. We follow prior studies' methodology and measure the number of banking relationships as the number of unique lead lenders (e.g., Acharya and Johnson 2007). We obtain data on the number of unique lenders from the Loan Pricing Corporation (LPC) DealScan database for each reference entity in a given year, based on all active syndicated loan facilities for which the reference entity is the borrower. We count the number of banking relationships for the reference entity, and then create *MORELENDER* as an indicator variable that equals one if the number of relationship lenders is greater than the sample median in the year of CDS initiation, and zero otherwise. We then estimate the following regression model:

$$\begin{aligned}
 TaxAvoidance_{it} &= \beta_0 + \beta_1 CDS_{ENTER_{it}} + \beta_2 MORELENDER_{it} \\
 &+ \beta_3 CDS_{ENTER_{it}} \times MORELENDER_{it} + \sum \beta_n Control\ Variables_{it} \\
 &+ \varepsilon_{it}
 \end{aligned}
 \quad Eq. (5)$$

Table 8 Panel C presents the results of this analysis. The coefficients on the interaction term *CDS_ENTER* × *MORELENDER* are positive and significant across our tax avoidance variables (p-value < 0.10), except for *ETR*. These results are consistent with the observed effects of CDS trading on corporate tax strategies strengthening with the number of relationship banks. Similar to those in Table 8 Panel B, the results in Panel C support the view that lending banks more diligently scrutinize borrowers' aggressive and risky types of tax planning activities (as captured by tax shelters and book-to-tax differences) rather than the general type of tax avoidance (as represented by lower levels of effective tax rate). Overall, the above findings provide additional support that our main results can indeed be attributed to lower monitoring efforts by lender banks.

[Insert Table 8 here]

5.2. Reduced shareholder strategic options after CDS trading

Prior research shows that due to lenders' increased intransigence in debt renegotiation, managers are less likely to undertake a strategic default favorable to shareholders following the onset of CDS trading (Bolton and Oehmke 2011). When a firm faces financial distress, its shareholders and debt holders often renegotiate the debt to circumvent a sub-optimal liquidation or bankruptcy. In the renegotiation process, creditors often reduce the face value of the debt. Because shareholders may expect such debt reduction via renegotiation, they may choose to default even though the firm is not financially distressed (Hart and Moore 1994; Anderson and Sundaresan 1996). Thus, the onset of CDS trading constrains the opportunity for a firm manager to shift wealth to shareholders from lenders through strategic default. Shareholders can offset this loss in value due to forgone strategic options by increasing the call option value built into their investments via risky tax avoidance. Therefore, we predict that the increase in tax avoidance following CDS trading is stronger for firms with more valuable ex ante strategic default options.

We examine whether, after recognizing the reduced strategic options, shareholders encourage a firm manager to engage in aggressive tax avoidance. Specifically, we empirically test whether the relation between CDS initiation and corporate tax avoidance is more pronounced for firms with more valuable ex ante strategic default options before the onset of CDS trading. Consistent with the literature, we employ the following three proxies for the value of strategic default options: non-fixed assets, market-to-book ratio, and research and development expenditures (Davydenko and Strebulaev 2007). These strategic default option proxies represent lower recovery rates in post-default restructuring processes. Our first proxy for firm strategic default options is *NONFIXEDASSET*, which is one minus net property, plant and equipment divided by total assets. A higher level of non-fixed assets and/or R&D expenditures indicates a lower recovery rate in the post-default restructuring process due to the lower fraction of tangible assets. This suggests more strategic default options favorable to shareholders. We employ a difference-in-differences-in-differences specification (i.e.,

$CDS_ENTER \times NONFIXEDASSET$) using a multivariate regression model with industry and year fixed effects. That is, we estimate the following regression model:

$$\begin{aligned} TaxAvoidance_{it} &= \beta_0 + \beta_1 CDS_ENTER_{it} + \beta_2 NONFIXEDASSET_{it} + \beta_3 CDS_ENTER_{it} \\ &\times NONFIXEDASSET_{it} + \sum \beta_n Control\ Variables_{it} \\ &+ \varepsilon_{it} \end{aligned} \quad Eq. (6)$$

Table 9, Panel A presents the results of this analysis. The coefficients on the interaction term $CDS_ENTER \times NONFIXEDASSET$ are positive and significant with p-value < 0.10 when the dependent variables are *MPBTD*, *SHELTER* and *DDBTD*. This analysis shows that the positive association between CDS initiation and tax avoidance is stronger for firms with more non-fixed assets.

Second, we examine whether the post-CDS initiation increase in tax avoidance varies across firms depending on research and development (R&D) expenditure. Specifically, we estimate the following regression model:

$$\begin{aligned} TaxAvoidance_{it} &= \beta_0 + \beta_1 CDS_ENTER_{it} + \beta_2 RDEXP_{it} + \beta_3 CDS_ENTER_{it} \times RDEXP_{it} \\ &+ \sum \beta_n Control\ Variables_{it} \\ &+ \varepsilon_{it} \end{aligned} \quad Eq. (7)$$

Table 9 Panel B presents the results of this analysis. The coefficients on the interaction term $CDS_ENTER \times RDEXP$ are positive and significant across our tax avoidance variables (p-value < 0.10), except for *MPBTD*. These results support the view that the observed effects of CDS trading on corporate tax strategies strengthen with firms' valuable strategic options.

Third, we examine whether the post-CDS initiation increase in tax avoidance varies across firms contingent upon growth opportunities. Recovery rates are likely to be lower for growth firms (i.e., high market-to-book firms) (Acharya, Bharath, and Srinivasan 2007). We measure firm growth opportunities (*MTB*) using the market-to-book ratio, and interact this variable with CDS_ENTER . We then estimate the following regression model:

$$\begin{aligned}
TaxAvoidance_{it} &= \beta_0 + \beta_1 CDS_ENTER_{it} + \beta_2 MTB_{it} + \beta_3 CDS_ENTER_{it} \times MTB_{it} \\
&+ \sum \beta_n Control\ Variables_{it} \\
&+ \varepsilon_{it}
\end{aligned}
\tag{Eq. (8)}$$

Table 9, Panel C presents the results of this analysis. The coefficients on the interaction term $CDS_ENTER \times MTB$ are positive and significant across our tax avoidance variables (p-value < 0.05), except for *ETR*. These results indicate that the observed effects of CDS trading on corporate tax avoidance increase with the value of strategic default options available to its shareholders.

Overall, the above findings provide additional support that our main results arise from forgone strategic default options subsequent to the CDS trading initiation.

[Insert Table 9 here]

5.3 Selection of matched control firms

One concern with our analysis is that the inception of CDS trading may not be an exogenous event. For example, factors such as a firm's credit risk and growth opportunities could affect the demand for and supply of CDS contracts (Ashcraft and Santos 2009). We follow the extant literature and address this potential endogeneity concern in two ways: (1) employ a propensity score matching approach (Ashcraft and Santos 2009; Martin and Roychowdhury 2015) and (2) employ a two-stage regression model.

The propensity score matching approach involves pairing treatment and control firms based on similar observable characteristics (Dehejia and Wahba 2002). We first estimate the following logit regression model to obtain the probability of initiating CDS trading for all firms following the approach proposed by Martin and Roychowdhury (2015) and Ashcraft and Santos (2009).

$$\begin{aligned}
Prob(CDS_{i,t}=1) &= \alpha + \beta_1 INV_GRADE_{i,t-1} + \beta_2 CREDIT_RATE_{i,t-1} + \beta_3 LEV_{i,t-1} \\
&+ \beta_4 PROFIT_MARGIN_{i,t-1} + \beta_5 SIZE_{i,t-1} \\
&+ \beta_6 RETURN_VOLATILITY_{i,t-1} + \beta_7 META_{i,t-1} + \varepsilon_{i,t}
\end{aligned}
\tag{Eq. (9)}$$

The dependent variable is an indicator that equals one if firms have traded CDS during the sample period, and zero otherwise. Firms' credit risk is proxied by *INV_GRADE*, *CREDIT_RATE*, *LEV*, and *PROFIT_MARGIN*. *INV_GRADE* is an indicator variable that equals one if the firm has an S&P credit rating above BB+, and zero otherwise. *RATING* is an indicator variable that equals one if the firm has an S&P credit rating, and zero otherwise.¹² *LEV* is leverage, computed as total debt divided by total assets. *PROFIT_MARGIN* is net income divided by sales. We also include firm size (*SIZE*), return volatility (*RETURN_VOLATILITY*), and market-to-book ratio (*META*) to account for the effects of the overall information environment and growth opportunities on the demand for and supply of CDS contracts. *SIZE* is the natural logarithm of market value of equity. *RETURN_VOLATILITY* is the standard deviation of monthly stock return within a fiscal year, and *META* is the ratio of market value of equity to total assets. We use all Compustat firms with available information during the period 1987-2015. Specifically, for firms with CDS trading initiated during the sample period, we include observations up to the last fiscal year prior to the initiation date.

[Insert Table 10 here]

Table 10, Panel A reports the estimation results of Eq. (9). Consistent with prior literature (Martin and Roychowdhury 2015), the logit model performs well in predicting the inception of CDS trading.¹³ Firms that are larger, and have higher credit ratings are more likely to experience initiation of CDS trading. Next, we estimate the propensity score for each firm using the predicted probabilities from the logit model and match each CDS firm to a non-CDS firm by year and Campbell (1996) industry classification using the nearest neighbor matching score. Specifically, we use matching with replacement to choose a matched non-CDS firm per CDS firm whose propensity score distance is closest to that of the CDS firm.¹⁴ Thus, with

¹² Our results remain unchanged when *INV_GRADE* and *RATING* are defined as continuous variables.

¹³ The proportion of concordant pairs is over 90 percent and the proportion of discordant pairs is less than 10 percent.

¹⁴ Compared to matching without replacement, matching with replacement decreases bias and circumvents the potential problem that the results are potentially subject to the order in which the treatment units are matched (Dehejia and Wahba 2002). Dehejia and Wahba (2002, page 154) contend "When the treatment and comparison units are very

this propensity-matched design, we have 18,276 firm-years for the treatment group and 9,497 firm-years for the control group.¹⁵ We conduct a covariate balance analysis on the pre-CDS period differences between the treatment and control groups following Cohen (1988). The analysis shows that the differences between the two groups are small for most of the variables, and medium for *SIZE* and *Shelter*. These results (untabulated) indicate that our propensity matching procedure is largely successful.¹⁶

We re-estimate Eq. (2) using the propensity score matched sample and report the results in Table 10 Panel B. We find that the coefficients on *CDS_ENTER* (β_1) are consistently positive across all four alternative proxies for tax avoidance behavior. This result provides further credence to our main results in Table 4 that corporate tax avoidance increases after the CDS initiation.

5.4. Instrumental variables estimation

In this section we examine whether our main finding is robust to an instrumental variables, two-stage regression specification. In the first stage, we regress the binary variable *CDS_ENTER* on an instrumental variable as well as all variables in the CDS determinant model specified in Eq. (2). Specifically, we include an instrumental variable in the first stage following Kim et al. (2016): *INDTRADVOL* (Industry Peers' Bond Trading Volume). This proxy captures bond investors hedging and speculative demand in the CDS market. *INDTRADVOL* is based on the average annual bond trading volume for a firm's two-digit SIC industry peers.

This instrumental variable predicts the value of *CDS_ENTER* but is unlikely to be related to the residuals in the second-stage regression. To validate our choice of instrumental variables, we follow Larcker

different, finding a satisfactory match by matching without replacement can be very problematic. In particular, if there are only a handful of comparison units comparable to the treated units, then once these comparison units have been matched, the remaining treated units will have to be matched to comparison units that are very different. In such settings, matching with replacement is the natural choice.”

¹⁵ The reduced sample size for the non-CDS firms is caused by (1) performing propensity matching with replacement such that one control firm is potentially matched to multiple treatment firms, (2) missing values in the control variables, and (3) cessation of Compustat coverage due to various reasons, including bankruptcy and merger and acquisition by other firms.

¹⁶ Cohen (1988) suggests that Effect Size Indices of 0.2, 0.5, and 0.8 represent small, medium, and large effect sizes, respectively.

and Rusticus (2010) and implement weak instrument identification tests. The adjusted R^2 for the first stage regression is 29.3%. The partial F is 132.96 ($p < 0.0001$) and the under-identification test (χ^2) is 132.77 ($p < 0.0001$), respectively. These results suggest that the instruments pass the weak-instrument tests, and explain a significant amount of the variation in corporate tax avoidance. The weak-instrument test yields a Cragg-Donald Wald F of 132.96 ($p < 0.0001$), compared with the Stock-Yogo critical value.¹⁷ This test shows that the instrumental variables improve the specification over the OLS specification.

Column (1) of Table 11 reports the first stage results and Columns (2) to (5) report the second stage results. *CDS_ENTER* equals one for CDS firms after the inception of CDS trading and zero before the onset of CDS trading. *CDS_ENTER* equals zero for all non-CDS firms. In the second stage we use the predicted value of *CDS_ENTER* from the first stage and regress *TaxAvoidance* on the fitted value of *CDS_ENTER* along with all the control variables specified in Eq. (2). Our interest is in the coefficient on *CDS_ENTER* in Columns (2) to (5). Columns (2) to (5) include an indicator that equals one if the firm had CDS traded during any time in the sample period and zero otherwise. The coefficient on *CDS_ENTER* captures the effect of CDS trading on tax avoidance incremental to the pre-CDS tax avoidance of CDS firms. The coefficient on *CDS_ENTER* is positive and significant across the four tax avoidance measures with p-value ranging from 0.0001 to 0.027, suggesting that tax avoidance of borrower firms increases following the introduction of CDS trading.

[Insert Table 11 here]

6. Conclusions

Prior research provides evidence that the advent of CDS contracts potentially affects managers' reporting policies and investment strategies by reducing lender banks' monitoring (e.g., Morrison 2005; Ashcraft and Santos 2009; Subrahmanyam et al. 2014; Martin and Roychowdhury 2015) and constraining strategic default options valuable to shareholders of the reference firm (Bolton and Oehmke 2011). This

¹⁷ Stock and Yogo (2005) provide a critical value table for a 5% test: Stock-Yogo C.V.: 5% Max IV size 16.38 and 10% Max IV size 10.27.

could mitigate borrowers' sub-optimally conservative tax strategies, such as managers' tax avoidance that is constrained by risk-averse lenders. After transferring the credit risk to the CDS seller, lenders' monitoring incentive is reduced, and borrowers appear to pursue riskier tax strategies. Additionally, facing a credible threat from lending banks after CDS trading, the reference firms exhibit greater tax avoidance behavior.

Our study contributes to the emerging literature suggesting that the advent of CDS contracts decreases lender incentives to closely monitor borrowers (Ashcraft and Santos 2009; Parlour and Winton 2013; Martin and Roychowdhury 2015). This is likely an unintended consequence of CDS contracts, which are developed to facilitate more efficient risk sharing. We also contribute to the literature that views tax avoidance as a risky and value-increasing investment (Rego and Wilson 2012; Armstrong et al. 2015), as well as to research on the optimal levels of tax avoidance (Kim et al. 2016).

We contribute to the growing body of literature suggesting that CDS contracts have a negative impact on banks' monitoring activities and influence managerial behavior in potentially unintended ways by documenting the bright side of CDS contracts on corporate tax strategies. While firms' tax strategies are sub-optimally conservative under the lender banks' scrutiny, CDS trading allows reference firms to pursue more risk-engendering tax strategies.

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APPENDIX A.

Key variables:

CDS_FIRM = An indicator variable that equals 1 for firms with CDS traded at any time during the sample period, and 0 otherwise.

CDS_ENTER = An indicator variable that equals 1 in periods after the CDS trade initiation, and 0 otherwise. The propensity score matched firms take on the same value of POST as the matched CDS firms.

ETR = Effective tax rate, calculated as (-1) times (the total income taxes divided by a firm's pre-tax income before special items). Its value increases with tax avoidance.

MPBTD = The Manzon and Plesko (2002) book-tax difference, which is calculated as US domestic book income less US domestic taxable income less state tax income less other tax income less equity in earnings scaled by lagged assets. US domestic book income is domestic pre-tax income in year *t*. US domestic taxable income is calculated as the current federal tax expense divided by the statutory tax rate.

SHELTER = Estimated probability that a firm engages in a tax shelter, based on Wilson's (2009) tax sheltering model: $SHELTER = 4.86 + 5.20 \times BTD + 4.08 \times \text{Discretionary Accruals} - 1.41 \times \text{Leverage} + 0.76 \times AT + 3.51 \times ROA + 1.72 \times \text{Foreign Income} + 2.42 \times R\&D$, where BTD is the total book-tax difference; Discretionary accruals is the absolute value of discretionary accruals from the modified cross-sectional Jones model; Leverage is long-term leverage, defined as long-term debt divided by total assets; AT is total assets; ROA is return on assets, measured as operating income divided by lagged total assets; Foreign income is an indicator variable that equals one for firm observations reporting foreign income, and zero otherwise; and R&D is R&D expense divided by lagged total assets.

DD_BT = The Desai–Dharmapala (2006) residual book-tax differences. It is the residual estimated from the following firm fixed effects regression: $BTDi,t = \beta_1 TACCi,t + \mu_i + \epsilon_{i,t}$, where BTDi,t is total book-tax differences and TACC is total accruals derived from the statement of cash flows and scaled by lagged total assets. We winsorize BTDi,t and TA at the 1% and 99% levels for regression purposes (Kim et al. 2011).

Control variables:

SIZE = The natural logarithm of total assets at the beginning of year *t*.

RDEXP = Research and development expense in year *t* divided by total assets at the beginning of year *t*.

LEV = Long-term debt divided by total assets at the end of year *t*.

BTM = Natural log of firm's book value of common equity divided by its market value of common equity, both values are measured at the end of year *t*.

CASHSIZE = Cash and short-term investments at the end of year *t* divided by total assets at the beginning of year *t*.

NOL = Indicator variable equal to 1 if there is a tax loss carryforward during year *t*, and 0 otherwise.

DNOL = Change in tax-loss carryforward from year *t*-1 to year *t* scaled by total assets at the beginning of year *t*.

ROA = Income before extraordinary items divided by average of total assets in year *t*.

PPE = Property, plant, and equipment divided by total assets at the beginning of year *t*.

DEP = Depreciation and amortization expense for year *t* divided by total assets at the beginning of year *t*.

EQINC = Equity income in year *t* divided by total assets at the beginning of year *t*. Missing values of equity income are set to 0.

FI = Pre-tax foreign income for year *t* divided by total assets at the beginning of year *t*. Missing values of pre-tax foreign income are set to 0.

Other variables:

LENDER_REP = Lender reputation factor is derived from the principal component analysis based on the two variables: natural logarithm of firm market value of equity and long-term S&P credit rating at the end of year t , following Martin and Roychowdhury (2015).

DEDINST = The Number of the dedicated institutional investors.

BDINDEP = Number of independent board members divided by the total number of board members.

BDSIZE = Total number of directors on the board

POS_RISKASSET = Indicator variable equal to 1 if lenders have an increase in the proportion of banks' assets risk-weight assets in the same year as CDS initiation, and 0 otherwise.

LNLOANAMT = Natural logarithm of the amount of the outstanding loan facility in millions of dollars at the end of year t .

MORELENDER = Indicator variable equal to 1 if the number of lender relationship is greater than sample median in the same year as CDS initiation, and 0 otherwise.

INDTRADVOL = Industry Peers' Bond Trading Volume, the average annual bond trading volume for a firm's two-digit SIC industry peers.

INV_GRADE = Indicator variable that equals 1 if a firm has a S&P credit rating above BB+, and 0 otherwise.

RATING = Indicator variable that equals 1 if a firm has a S&P credit rating, and 0 otherwise.

SIZE = Natural logarithm of market value.

META = Ratio of market value of equity to book value of total assets.

LEV = Total debt divided by total assets.

PROFIT_MARGIN = Net income divided by sales.

RETURN_VOLATILITY = Standard deviation of monthly stock return within a fiscal year.

Table 1 Sample distribution

Panel A: Sample distribution by year

Fiscal Year	Frequency	Percent
1987	1,194	1.28
1988	1,236	1.32
1989	1,651	1.77
1990	1,859	1.99
1991	2,198	2.35
1992	2,296	2.46
1993	2,382	2.55
1994	2,572	2.75
1995	2,891	3.09
1996	3,144	3.36
1997	3,263	3.49
1998	3,311	3.54
1999	3,568	3.82
2000	3,589	3.84
2001	3,490	3.73
2002	3,778	4.04
2003	4,035	4.32
2004	4,157	4.45
2005	4,094	4.38
2006	4,012	4.29
2007	3,964	4.24
2008	3,865	4.13
2009	3,931	4.21
2010	4,007	4.29
2011	3,968	4.24
2012	3,872	4.14
2013	3,845	4.11
2014	3,762	4.02
2015	3,541	3.79
Total	93,475	100.00

Panel B: Sample distribution by Fama-French 48 industry classification

Industry classification	Frequency	Percent	Industry classification	Frequency	Percent
Agriculture	269	0.29	Machinery	3,530	3.78
Aircraft	468	0.50	Measuring and Control Equip.	2,116	2.26
Apparel	1,366	1.46	Medical Equipment	3,212	3.44
Automobiles and Trucks	1,408	1.51	Non-Metallic.	2,254	2.41
Banking	198	0.21	Others	2,044	2.19
Beer & Liquor	434	0.46	Personal Services	753	0.81
Business Services	9,811	10.5	Petroleum and Natural Gas	6,235	6.67
Business Supplies	1,409	1.51	Pharmaceutical Products	5,463	5.84
Candy & Soda	282	0.30	Precious Metals	2,256	2.41
Chemicals	1,913	2.05	Printing and Publishing	734	0.79
Coal	125	0.13	Real Estate	697	0.75
Communication	2,771	2.96	Recreation	751	0.80
Computers	3,437	3.68	Restaurants, Hotels, Motels	1,552	1.66
Construction	589	0.63	Retail	4,812	5.15
Construction Materials	2,547	2.72	Rubber and Plastic Products	838	0.90
Consumer Goods	1,580	1.69	Shipbuilding, Railroad Equip.	138	0.15
Defense	144	0.15	Shipping Containers	282	0.3
Electrical Equipment	1,682	1.80	Steel Works Etc	1,522	1.63
Electronic Equipment	6,097	6.52	Textiles	447	0.48
Entertainment	1,329	1.42	Trading	1,946	2.08
Fabricated Products	359	0.38	Transportation	2,619	2.80
Food Products	1,870	2.00	Utilities	3,149	3.37
Healthcare	1,559	1.67	Wholesale	3,760	4.02
Insurance	718	0.77			
Total				93,475	100.00

Table 1 Panels A and B report the sample distribution across year and across the Fama and French (1997) industry classifications, respectively. The sample consists of 93,475 firm-year observations for a sample period from 1987 to 2015.

Table 2
Descriptive statistics

Variables	Mean	S.D.	P25	Median	P75
CDS_ENTER	0.5264	0.4993	0.0000	1.0000	1.0000
CDS_FIRM	0.1107	0.3137	0.0000	0.0000	0.0000
ETR	-0.1889	0.4399	-0.3693	-0.2540	-0.0000
MPBTD	-0.0216	0.6356	-0.4871	-0.0032	0.4247
SHELTER	0.0468	0.1970	-0.0022	-0.0002	0.0025
DD_BT	0.0117	0.3296	-0.0288	0.0043	0.0382
SIZE	5.2654	2.4850	3.4565	5.2457	7.0468
RDEXP	0.0446	0.0960	0.0000	0.0000	0.0435
LEV	0.1535	0.1652	0.0000	0.1058	0.2625
BTM	0.7709	0.8193	0.3062	0.5426	0.9110
CASHSIZE	0.2054	0.2822	0.0259	0.0976	0.2733
NOL	0.4029	0.4905	0.0000	0.0000	1.0000
DNOL	0.0362	0.2244	0.0000	0.0000	0.0007
ROA	-0.0430	0.2567	-0.0464	0.0288	0.0704
PPE	0.3403	0.3134	0.0950	0.2411	0.5066
DEP	0.0490	0.0370	0.0256	0.0413	0.0622
EQINC	0.0005	0.0048	0.0000	0.0000	0.0000
FI	0.0076	0.0272	0.0000	0.0000	0.0000

Table 2 reports descriptive statistics for the full sample. The sample consists of 93,475 firm-year observations for a sample period from 1987 to 2015. All variables are defined in Appendix A.

Table 3
Correlation matrix among selected variables

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
(1) CDS_ENTER	1	0.710	0.035	0.063	0.270	0.037	0.339	-0.014	0.179	-0.090	-0.061	0.100
(2) CDS_FIRM	0.710	1	0.106	0.056	0.335	0.028	0.427	-0.027	0.236	-0.124	-0.130	0.144
(3) ETR	0.025	0.060	1	0.092	0.250	-0.019	0.232	-0.186	0.143	0.037	-0.164	0.396
(4) MPBTD	0.071	0.053	-0.001	1	0.236	0.268	0.186	-0.075	0.043	-0.036	-0.034	0.519
(5) SHELTER	0.402	0.372	0.037	-0.006	1	0.218	0.699	0.013	0.187	-0.159	-0.017	0.530
(6) DD_BT D	0.001	-0.003	-0.023	0.094	0.023	1	0.030	0.010	-0.035	-0.046	0.046	0.213
(7) SIZE	0.357	0.434	0.125	0.149	0.406	-0.007	1	0.023	0.279	-0.362	-0.011	0.401
(8) RDEXP	-0.063	-0.081	-0.114	-0.102	-0.018	-0.022	-0.060	1	-0.242	-0.242	0.387	-0.095
(9) LEV	0.157	0.204	0.045	0.006	0.041	-0.020	0.216	-0.216	1	0.020	-0.470	0.021
(10) BTM	-0.082	-0.116	-0.028	-0.069	-0.105	-0.016	-0.397	-0.183	-0.021	1	-0.239	-0.192
(11) CASHSIZE	-0.085	-0.126	-0.087	-0.044	-0.037	0.017	-0.049	0.482	-0.326	-0.159	1	0.015
(12) ROA	0.087	0.122	0.164	0.264	0.129	0.117	0.333	-0.388	0.114	-0.019	-0.138	1

Table 3 presents Pearson correlations (in the upper-triangle) and Spearman correlations (in the lower triangle) among selected variables. Bold text indicates a statistical significance (p-value < 0.05). The sample consists of 93,475 firm-year observations for a sample period from 1987 to 2015. All variables are defined in Appendix A.

Table 4
CDS contract initiation and tax avoidance

DEP. VARIABLE	<i>ETR</i>		<i>MPBTD</i>		<i>SHETER</i>		<i>DD_BT D</i>	
CDS_ENTER	0.0228 (2.4633)**	0.0135 (1.8754)*	2.4164 (2.0923)**	4.2650 (3.6716)***	0.2095 (7.1505)***	0.1812 (7.7821)***	0.0123 (5.5257)***	0.0084 (3.1222)***
CDS_FIRM		0.0108 (2.0904)**		-2.1612 (-1.8701)*		0.0330 (2.5234)**		0.0045 (1.9079)*
SIZE	-0.0189 (-12.2325)***	-0.0193 (-17.2104)***	0.5595 (2.4178)**	0.6310 (2.5795)**	0.0210 (10.5472)***	0.0199 (9.7085)***	-0.0046 (-8.6198)***	-0.0047 (-8.5935)***
RDEXP	0.1858 (3.6526)***	0.1862 (3.3106)***	0.7954 (0.3529)	0.7270 (0.3221)	-0.0381 (-2.4447)**	-0.0371 (-2.4183)**	0.0039 (0.2218)	0.0041 (0.2302)
LEV	0.0641 (3.6566)***	0.0636 (5.1791)***	-5.5950 (-4.0235)***	-5.4984 (-3.9844)***	-0.0332 (-3.0884)***	-0.0347 (-3.0885)***	-0.0174 (-3.6153)***	-0.0176 (-3.6357)***
BTM	-0.0015 (-0.4552)	-0.0016 (-0.5401)	-0.6551 (-3.3351)***	-0.6265 (-3.1793)***	0.0168 (7.3396)***	0.0164 (7.1796)***	-0.0061 (-4.2520)***	-0.0062 (-4.3246)***
CASHSIZE	0.0470 (7.6320)***	0.0472 (6.9400)***	-1.7891 (-2.3814)**	-1.8374 (-2.4763)**	-0.0207 (-3.1928)***	-0.0199 (-3.1306)***	-0.0129 (-2.4492)**	-0.0128 (-2.4298)**
NOL	0.0557 (9.6709)***	0.0557 (10.4343)***	-0.3468 (-1.7344)*	-0.3468 (-1.7593)*	0.0082 (2.0639)**	0.0082 (2.0781)**	-0.0047 (-1.6464)*	-0.0047 (-1.6475)*
DNOL	-0.0236 (-2.9827)***	-0.0236 (-4.7165)***	0.7672 (2.2443)**	0.7689 (2.2496)**	0.0109 (4.5857)***	0.0109 (4.5752)***	0.2999 (19.1288)***	0.2999 (19.1301)***
ROA	-0.1407 (-6.4708)***	-0.1401 (-4.6601)***	12.2160 (10.4413)***	12.0885 (10.6500)***	-0.0416 (-6.1817)***	-0.0397 (-5.6704)***	0.1928 (15.4512)***	0.1931 (15.4559)***
PPE	-0.0098 (-0.6616)	-0.0098 (-1.6183)	0.9763 (1.7782)*	0.9923 (1.8194)*	-0.0165 (-2.7761)***	-0.0167 (-2.7773)***	-0.0011 (-0.2397)	-0.0012 (-0.2466)
DEP	-0.0237 (-0.1638)	-0.0226 (-0.4810)	-6.4343 (-1.4959)	-6.6514 (-1.5620)	-0.0330 (-0.9929)	-0.0297 (-0.8893)	-0.1145 (-3.4856)***	-0.1141 (-3.4829)***
EQINC	-0.3600 (-0.8022)	-0.3631 (-1.7773)*	-122.8315 (-4.1311)***	-122.0606 (-4.1285)***	0.6540 (2.0765)**	0.6422 (2.0365)**	0.2271 (2.3043)**	0.2255 (2.2936)**
FI	-0.3791 (-5.1475)***	-0.3827 (-6.2503)***	-55.5827 (-5.5619)***	-54.8324 (-5.5846)***	3.2192 (11.3568)***	3.2077 (11.2118)***	0.1629 (5.7229)***	0.1613 (5.6346)***
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	91,937	91,937	93,475	93,475	93,475	93,475	93,475	93,475

R-squared	0.0555	0.0555	0.0753	0.0761	0.4452	0.4464	0.3035	0.3036
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Table 4 reports regression results of Eq. (2), which tests the effect of the initiation of CDS trading on tax avoidance (H1). All variables are defined in Appendix A. t-statistics in parentheses are based on robust standard errors clustered by industry and year (Petersen 2009). ***, **, and * represent significance at the 1%, 5%, and 10% level, respectively.

Table 5
CDS contract initiation and tax avoidance, conditioning on lender reputation

DEP. VARIABLE	<i>ETR</i>	<i>MPBD</i>	<i>SHETER</i>	<i>DD_BT</i>
CDS_ENTER	-0.0038 (-0.1343)	-7.7523 (-1.9978)**	-0.2580 (-5.8691)***	0.0011 (0.2943)
LENDER_REP	-0.0231 (-1.4909)	1.9905 (1.2901)	0.0309 (0.9589)	0.0005 (0.2666)
CDS_ENTER×LENDER_REP	0.0057 (0.4889)	6.2018 (2.6723)***	0.2020 (6.6937)***	0.0041 (2.6671)***
CDS_FIRM	-0.0017 (-0.1757)	-3.1723 (-3.2396)***	-0.0125 (-1.1175)	-0.0018 (-0.9426)
SIZE	-0.0077 (-1.1922)	1.1403 (1.9083)*	0.0593 (4.6607)***	-0.0012 (-1.8755)*
RDEXP	0.6763 (3.4262)***	15.4064 (1.2087)	-0.0011 (-0.0079)	-0.1225 (-4.1771)***
LEV	0.1550 (3.6005)***	3.7311 (1.5447)	0.1080 (3.2068)***	0.0180 (3.4925)***
BTM	-0.0051 (-0.4235)	0.2520 (0.3766)	0.0550 (4.2587)***	0.0040 (3.2325)***
CASHSIZE	-0.0189 (-0.4275)	-2.8092 (-1.3280)	-0.0544 (-2.3269)**	-0.0023 (-0.2729)
NOL	0.0171 (2.0479)**	0.2788 (0.4031)	0.0214 (1.9648)**	-0.0001 (-0.0570)
DNOL	0.0080 (0.1655)	0.7337 (0.2234)	-0.0239 (-1.5904)	0.5052 (18.4782)***
ROA	-0.3944 (-3.6591)***	124.6616 (11.6039)***	-0.3079 (-5.2683)***	0.3916 (16.3940)***
PPE	-0.0042 (-0.1890)	-0.3890 (-0.3334)	-0.0338 (-1.5013)	-0.0040 (-1.0417)
DEP	-0.0544 (-0.1771)	-16.4584 (-1.9211)*	-0.0531 (-0.2732)	-0.0385 (-1.0960)
EQINC	0.5911 (0.9040)	-429.5951 (-6.1677)***	0.1253 (0.2280)	0.2099 (3.7403)***
FI	-0.0407 (-0.3112)	-228.3049 (-9.0087)***	6.8484 (19.9612)***	0.0422 (1.6050)
Year FE	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes
Observations	21,005	21,459	21,459	21,459
R-squared	0.0366	0.2089	0.6598	0.4531

Table 5 reports regression results of tests of whether the post-CDS initiation increase in tax avoidance is greater for firms that expose lender banks to lower reputation costs. Lender reputation is derived from a principal component analysis of the following two variables: natural logarithm of firm market value of equity and long-term S&P credit rating. Credit rating is measured as an ordinal variable ranging between 1 (AAA) and 19 (CCC-) for firms with S&P long term debt rating. We assign a value of 20 to firms in default on their debt, and 21 to firms with no debt rating. All other variables are defined in Appendix A. t-statistics in

parentheses are based on robust standard errors clustered by industry and year (Petersen 2009). ***, **, and * represent significance at the 1%, 5%, and 10% level, respectively.

Table 6
CDS contract initiation and tax avoidance, conditioning on dedicated institutional investors

VARIABLES	<i>ETR</i>	<i>MPBTD</i>	<i>SHELTER</i>	<i>DD_BT</i>
CDS_ENTER	0.0057 (0.4898)	1.5397 (1.3980)	0.0970 (3.1427)***	0.0087 (2.4651)**
DEDINST	0.0009 (1.3702)	-0.1195 (-1.5850)	0.0010 (1.1086)	0.0000 (0.2776)
CDS_ENTER×DEDINST	0.0016 (2.3741)**	0.5295 (2.7448)***	0.0305 (3.0863)***	0.0002 (0.3455)
CDS_FIRM	0.0141 (2.0147)**	-1.5181 (-1.9969)**	0.0228 (1.9068)*	0.0012 (0.5229)
SIZE	-0.0174 (-9.5104)***	0.9906 (3.0426)***	0.0235 (8.5639)***	-0.0033 (-5.4405)***
RDEXP	0.2006 (3.5415)***	3.6657 (1.4843)	-0.0452 (-1.9180)*	-0.0049 (-0.2332)
LEV	0.0827 (4.3444)***	-5.2728 (-3.4404)***	-0.0361 (-3.2008)***	-0.0087 (-1.2916)
BTM	0.0018 (0.4190)	-0.5052 (-1.6446)	0.0202 (6.5713)***	-0.0047 (-2.4345)**
CASHSIZE	0.0586 (7.2928)***	-2.6050 (-2.3824)**	-0.0279 (-3.4303)***	-0.0080 (-1.2760)
NOL	0.0522 (9.9419)***	-0.1053 (-0.4482)	0.0088 (1.8740)*	-0.0054 (-1.8873)*
DNOL	-0.0388 (-2.3338)**	0.9433 (1.8566)*	0.0051 (1.8463)*	0.3245 (14.5422)***
ROA	-0.2016 (-6.2436)***	17.1754 (10.5154)***	-0.0574 (-4.9984)***	0.2176 (13.9865)***
PPE	-0.0083 (-0.4207)	0.9121 (1.2126)	-0.0210 (-2.1555)**	-0.0003 (-0.0773)
DEP	0.0513 (0.2919)	-3.4579 (-0.5677)	-0.0112 (-0.2308)	-0.0604 (-2.1624)**
EQINC	-0.0186 (-0.0494)	-179.6083 (-4.1112)***	0.8532 (2.0140)**	0.2219 (1.9999)**
FI	-0.3304 (-4.0281)***	-66.7609 (-6.0582)***	3.2297 (10.8609)***	0.1215 (3.5528)***
Year FE	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes
Observations	61,770	62,809	62,809	62,809
R-squared	0.0510	0.0912	0.4855	0.3074

Table 6 reports regression results of tests of whether the post-CDS initiation increase in tax avoidance is greater for firms that have the more number of the dedicated institutional investors (DEDINST). All other variables are defined in Appendix A. t-statistics in parentheses are based on robust standard errors clustered by industry and year (Petersen 2009). ***, **, and * represent significance at the 1%, 5%, and 10% level, respectively.

Table 7
CDS contract initiation and tax avoidance, conditioning on corporate governance

Panel A: Board independence ratio				
VARIABLES	<i>ETR</i>	<i>MPBTD</i>	<i>SHELTER</i>	<i>DD_BT</i>
CDS_ENTER	-0.0102 (-0.5805)	-0.1460 (-0.0899)	-0.0936 (-1.2334)	0.0040 (1.3810)
BDINDEP	0.0291 (2.3071)**	2.2331 (4.9700)***	0.0207 (0.8122)	0.0109 (2.0135)**
CDS_ENTER×BDINDEP	0.0441 (1.6684)*	5.5374 (2.5080)**	0.2699 (2.5883)***	0.0030 (0.5683)
CDS_FIRM	-0.0070 (-0.6589)	-1.6370 (-3.3490)***	-0.0194 (-1.3339)	0.0038 (1.2142)
SIZE	-0.0037 (-1.0961)	1.2200 (5.4290)***	0.0995 (8.9428)***	-0.0020 (-1.9392)*
RDEXP	0.4114 (5.7897)***	4.0320 (1.1694)	-0.1139 (-1.7714)*	-0.0181 (-0.9342)
LEV	0.0507 (2.4874)**	-1.1869 (-1.2601)	-0.0497 (-1.7596)*	0.0204 (3.8684)***
BTM	0.0408 (3.7960)***	0.6446 (1.1209)	0.0947 (5.2284)***	0.0084 (2.3410)**
CASHSIZE	0.0288 (1.5837)	-3.6125 (-6.0101)***	-0.0356 (-1.5840)	-0.0064 (-0.8044)
NOL	0.0144 (2.6662)***	0.6360 (2.9366)***	-0.0146 (-1.4067)	-0.0011 (-0.5264)
DNOL	-0.0106 (-0.3113)	-0.9383 (-0.7355)	0.0030 (0.1436)	0.4927 (11.5632)***
ROA	-0.4649 (-7.3922)***	44.1773 (13.5220)***	-0.2293 (-3.9617)***	0.3449 (17.3746)***
PPE	-0.0157 (-1.3629)	-0.7893 (-0.7477)	-0.0529 (-1.5670)	-0.0027 (-0.5481)
DEP	0.0816 (0.9514)	-11.3597 (-1.9223)*	0.1563 (0.6861)	-0.1145 (-2.5528)**
EQINC	0.3290 (0.6279)	-406.6629 (-13.9446)***	1.8899 (2.2112)**	0.2671 (0.9050)
FI	0.2508 (2.5596)**	-87.0364 (-12.0678)***	4.5544 (10.6183)***	0.1038 (3.6712)***
Year FE	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes
Observations	15,265	15,450	15,450	15,450
R-squared	0.1113	0.1783	0.6320	0.4094

Table 7 Continued.

Panel B: Board size

VARIABLES	<i>ETR</i>	<i>MPBTD</i>	<i>SHELTER</i>	<i>DD_BT D</i>
CDS_ENTER	0.0115 (0.5301)	-2.4681 (-1.3416)	-0.2581 (-3.3747)***	0.0062 (0.8321)
BDSIZE	-0.0013 (-0.9633)	-0.1128 (-1.4121)	-0.0012 (-0.5403)	0.0010 (2.0609)**
CDS_ENTER×BDSIZE	0.0013 (0.5545)	0.6474 (3.6655)***	0.0363 (4.2272)***	0.0001 (0.1093)
CDS_FIRM	-0.0050 (-0.5167)	-1.3176 (-1.5279)	-0.0069 (-0.4762)	0.0031 (0.9130)
SIZE	-0.0027 (-0.7828)	1.2206 (3.8481)***	0.0952 (8.6991)***	-0.0026 (-2.2592)**
RDEXP	0.4110 (5.7684)***	4.0026 (0.9700)	-0.1147 (-1.7543)*	-0.0168 (-0.8626)
LEV	0.0538 (2.6218)***	-0.8412 (-0.4433)	-0.0400 (-1.4726)	0.0210 (3.8897)***
BTM	0.0414 (3.8574)***	0.6033 (0.8085)	0.0895 (5.1160)***	0.0082 (2.2623)**
CASHSIZE	0.0267 (1.4414)	-3.7044 (-3.6687)***	-0.0326 (-1.5194)	-0.0048 (-0.5707)
NOL	0.0146 (2.7219)***	0.6922 (1.8101)*	-0.0121 (-1.2377)	-0.0010 (-0.4510)
DNOL	-0.0113 (-0.3342)	-0.9666 (-0.4966)	0.0040 (0.1907)	0.4926 (11.5541)***
ROA	-0.4663 (-7.3853)***	44.3110 (10.3200)***	-0.2148 (-3.8930)***	0.3446 (17.0891)***
PPE	-0.0180 (-1.5878)	-1.0092 (-0.5382)	-0.0585 (-1.7718)*	-0.0032 (-0.6620)
DEP	0.0849 (0.9654)	-11.1649 (-1.2684)	0.1589 (0.7153)	-0.1107 (-2.4720)**
EQINC	0.3123 (0.6168)	-412.8300 (-6.6366)***	1.5058 (1.7001)*	0.2487 (0.8466)
FI	0.2516 (2.5454)**	-87.9648 (-6.7322)***	4.4928 (10.7998)***	0.1037 (3.6282)***
Year FE	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes
Observations	15,265	15,450	15,450	15,450
R-squared	0.1108	0.1785	0.6397	0.4096

Table 7 reports regression results of tests of whether the post-CDS initiation increase in tax avoidance is greater for firms that have the higher percentage of board independence ratio (BDINDEP) in Panel A and for firms that have the large board size (BDSIZE) in Panel B. All other variables are defined in Appendix A. t-statistics in parentheses are based on robust standard errors clustered by industry and year (Petersen 2009). ***, **, and * represent significance at the 1%, 5%, and 10% level, respectively.

Table 8
CDS contract initiation and tax avoidance: effects of bank characteristics

Panel A: CDS contract initiation and tax avoidance, conditioning on risk weight

DEP. VARIABLE	<i>ETR</i>	<i>MPBTD</i>	<i>SHETER</i>	<i>DD_BT</i>
CDS_ENTER	0.0063 (0.7084)	1.1931 (0.9486)	0.3815 (2.3984)**	0.0046 (1.9568)*
POS_RISKASSET	0.0043 (1.1161)	0.1239 (0.2224)	-0.0011 (-0.0543)	0.0004 (0.2705)
CDS_ENTER×POS_RISKASSET	0.0129 (1.0509)	4.0740 (2.5239)**	0.8431 (2.0127)**	0.0052 (2.5518)**
Firm-level controls	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes
Observations	36,142	36,884	36,884	36,884
R-squared	0.0857	0.1357	0.1805	0.4365

Panel B: CDS contract initiation and tax avoidance, conditioning on loan amount for cds firms

DEP. VARIABLE	<i>ETR</i>	<i>MPBTD</i>	<i>SHETER</i>	<i>DD_BT</i>
CDS_ENTER	0.1371 (0.7247)	-42.1438 (-2.0834)**	-2.0046 (-6.6069)***	-0.0497 (-1.9416)*
LNLOANAMT	0.0067 (-2.5092)**	0.0556 (0.5854)	-0.0075 (-2.7554)***	-0.0002 (-0.2255)
CDS_ENTER×LNLOANAMT	-0.0054 (-0.6114)	2.1904 (2.2546)**	0.1014 (6.6748)***	0.0027 (2.2817)**
Firm-level controls	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes
Observations	41,111	41,830	41,830	41,830
R-squared	0.0347	0.1156	0.5385	0.4545

Panel C: CDS contract initiation and tax avoidance, conditioning on the number of lender relationship

DEP. VARIABLE	<i>ETR</i>	<i>MPBTD</i>	<i>SHETER</i>	<i>DD_BT</i>
CDS_ENTER	0.0227 (1.0628)	1.3133 (0.8665)	-0.0190 (-1.0798)	0.0013 (0.6176)
MORELENDER	-0.0036 (0.2384)	-0.9312 (-1.0643)	-0.0043 (-0.2405)	0.0010 (0.6248)
CDS_ENTER×MORELENDER	-0.0034 (-0.2043)	3.1019 (2.1230)**	0.0560 (2.1332)**	0.0029 (1.8675)*
Firm-level controls	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes
Observations	10,089	10,346	10,346	10,346
R-squared	0.0495	0.1956	0.7144	0.3017

Table 8 Panel A reports regression results of tests of whether the post-CDS initiation increase in tax avoidance varies across firms depending on whether their lenders' proportion of total assets with risk weight of 100% decreased or not

following CDS initiations. Panel B reports regression results of tests of whether the post-CDS initiation increase in tax avoidance varies across firms depending on firms' loan amount outstanding. Panel C reports regression results of tests of whether the post-CDS initiation increase in tax avoidance varies across firms depending on the number of relationship banks with the reference entity. All variables are defined in Appendix A. t-statistics in parentheses are based on robust standard errors clustered by industry and year (Petersen 2009). ***, **, and * represent significance at the 1%, 5%, and 10% level, respectively.

Table 9

CDS contract initiation and tax avoidance: effects of shareholders' strategic options

Panel A: CDS Contract Initiation and Tax Avoidance, Conditioning on Non-Fixed Asset

DEP. VARIABLE	ETR	MPBTD	SHETER	DD_BT
CDS_ENTER	-0.0196 (-0.6270)	2.3816 (3.0634)***	0.0166 (0.1892)	-0.0001 (-0.0274)
NONFIXEDASSET	-0.0311 (-1.3324)	1.7302 (1.6448)	-0.0196 (-1.3235)	0.0093 (1.9134)*
CDS_ENTER ×NONFIXEDASSET	0.0471 (1.0628)	1.6896 (1.7259)*	0.2486 (2.1773)**	0.0162 (5.1626)***
Firm-level controls	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes
Observations	85,130	86,614	86,614	86,614
R-squared	0.0805	0.1135	0.4547	0.3358

Panel B: CDS Contract Initiation and Tax Avoidance, Conditioning on Research and Development Expenditure

DEP. VARIABLE	ETR	MPBTD	SHETER	DD_BT
CDS_ENTER	0.0006 (0.0455)	3.4280 (6.2206)***	0.1468 (6.1070)***	0.0090 (1.8865)*
RDEXP	0.1978 (3.9449)***	5.4238 (7.6732)***	-0.0272 (-1.3891)	-0.1021 (-0.4328)
CDS_ENTER×RDEXP	0.4134 (2.4526)**	4.0765 (0.3293)	1.7909 (3.9653)***	0.4721 (1.7323)*
Firm-level controls	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes
Observations	85,130	86,614	86,614	86,614
R-squared	0.0495	0.1137	0.4568	0.3080

Panel C: CDS Contract Initiation and Tax Avoidance, Conditioning on Market-to-Book Ratio

DEP. VARIABLE	ETR	MPBTD	SHETER	DD_BT
CDS_ENTER	0.0162 (0.9086)	1.8119 (2.3110)**	0.0220 (0.5928)	0.0105 (1.3576)
MTB	0.0027 (2.1642)**	0.1607 (5.1267)***	-0.0032 (-2.3375)**	-0.0060 (-2.2458)**
CDS_ENTER×MTB	0.0055 (0.8131)	1.2254 (2.6037)**	0.1138 (6.0131)***	0.0038 (2.1160)**
Firm-level controls	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes
Observations	85,130	86,614	86,614	86,614
R-squared	0.0497	0.1143	0.4599	0.3093

Table 9 Panel A reports regression results of tests of whether the post-CDS initiation increase in tax avoidance varies across firms depending on firms' non-fixed assets. Panel B reports regression results of tests of whether the post-CDS

initiation increase in tax avoidance varies across firms depending on the level of research and development expenditure. Panel C reports regression results of tests of whether the post-CDS initiation increase in tax avoidance varies across firms depending on firms' market-to-book ratio. All variables are defined in Appendix A. t-statistics in parentheses are based on robust standard errors clustered by industry and year (Petersen 2009). ***, **, and * represent significance at the 1%, 5%, and 10% level, respectively.

Table 10 Propensity score matching

Panel A: First stage model: Prediction model for probability of initiating CDS trading

	ESTIMATE
INV_GRADE	0.4708 (<.0001)
CREDIT_RATE	1.3769 (<.0001)
LEV	-0.0002 (0.9014)
PROFIT_MARGIN	0.0002 (0.3793)
SIZE	0.1410 (<.0001)
RETURN_VOLATILITY	0.1483 (0.2557)
META	0.0000 (0.9487)
Year FE	Yes
Industry FE	Yes
Observations	93,935
Chi Square	8073.42 (P-Value <.0001)
Percent concordant	91.5
Percent discordant	7.8

Table 10 Continued.

Panel B: Rerun Eq. (2) using the Propensity Score Matching sample

DEP. VARIABLE	<i>ETR</i>	<i>MPBTD</i>	<i>SHETER</i>	<i>DD_BT</i>
CDS_ENTER	0.0548 (4.92)***	3.5407 (3.55)***	0.1083 (8.48)***	0.0071 (4.48)***
CDS_FIRM	-0.0418 (-4.53)***	-4.0178 (-5.03)***	0.0057 (0.73)	0.0007 (0.50)
SIZE	-0.0083 (-3.07)***	2.3002 (7.10)***	0.0594 (14.34)***	-0.0022 (-4.34)***
RDEXP	0.2886 (3.17)***	16.4183 (2.56)**	-0.0659 (-1.00)	-0.0564 (-2.49)**
LEV	0.1644 (5.90)***	-1.6664 (-0.94)	0.0226 (1.30)	0.0081 (1.27)
BTM	0.0053 (0.55)	0.7613 (1.50)	0.0592 (8.77)***	0.0010 (0.76)
CASHSIZE	0.0269 (1.23)	-4.2224 (-2.41)**	-0.0690 (-3.71)***	0.0030 (0.42)
NOL	0.0424 (6.37)***	0.2059 (0.33)	0.0104 (1.27)	0.0014 (0.97)
DNOL	-0.0080 (-0.24)	-1.6086 (-0.81)	-0.0058 (-0.49)	0.4480 (26.88)***
ROA	-0.3110 (-6.03)***	79.5135 (15.83)***	-0.1995 (-8.51)***	0.3239 (18.51)***
PPE	-0.0220 (-1.16)	0.0730 (0.06)	-0.0140 (-0.95)	0.0011 (0.33)
DEP	-0.0826 (-0.53)	-13.9778 (-1.20)	-0.0263 (-0.21)	-0.1118 (-3.59)***
EQINC	0.1312 (0.23)	-341.5479 (-7.74)***	0.1008 (0.18)	0.2549 (2.75)***
FI	-0.0604 (-0.60)	-164.3146 (-10.36)***	5.6767 (24.18)***	0.0430 (1.94)*
Year FE	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes
Observations	27,773	27,773	27,773	27,773
R-squared	0.04	0.17	0.45	0.45

Table 10 Panel A reports estimation results of a logistic model to predict the onset of CDS trading. The propensity score matching approach involves pairing treatment and control firms based on similar observable characteristics (Dehejia and Wahba 2002). The dependent variable, CDS, equals one if a CDS is traded on a firm, and zero otherwise. The independent variables include INV_GRADE, an indicator variable that equals one if a firm has a S&P credit rating above BB+, and zero otherwise; CREDIT_RATE, an indicator variable that equals one if a firm has a S&P credit rating, and zero otherwise; META, the ratio of market value of equity to book value of total assets; PROFITMARGIN, net income divided by sales; RETVOL, standard deviation of monthly stock return within a fiscal year. Other variables are defined in Appendix A. The sample period spans from 1997 to 2015, and includes firms with and without traded CDS during this period. For firms with traded CDS, only firm-years prior to the onset of CDS trading are included in the sample. Table 10 Panel B reports the regression results where CDS trading increases corporate tax avoidance, based on the propensity-matched treatment and control samples. T-statistics in parentheses are based on robust standard errors clustered by industry and year (Petersen 2009). ***, **, and * represent significance at the 1%, 5%, and 10% level, respectively.

Table 11
Two-stage regression model

VARIABLES	1 st Stage <i>CDS_ENTER</i>	<i>ETR</i>	<i>MPBTD</i>	<i>SHELTER</i>	<i>DD_BTD</i>
CDS_ENTER		0.9773 (5.4653)***	0.5600 (1.7944)*	0.8775 (2.8321)***	0.4915 (1.9128)*
CDS_FIRM		-0.8361 (-5.4253)***	-0.2904 (-1.7909)*	-0.3468 (-2.1545)**	-0.2468 (-1.8471)*
INDTRADVOL	0.0086 (2.7103)***				
SIZE	0.0479 (50.9150)***	-0.0171 (-23.0310)***	0.0067 (17.3686)***	0.0178 (46.7729)***	-0.0045 (-13.5970)***
RDEXP	-0.0517 (-5.1897)***	0.1641 (11.0333)***	0.0098 (1.1700)	-0.0278 (-3.3445)***	0.0011 (0.1710)
LEV	0.1909 (15.4493)***	0.0887 (11.3728)***	-0.0804 (-5.0828)***	-0.0620 (-3.9466)***	-0.0508 (-3.8877)***
BTM	0.0202 (9.8391)***	0.0045 (3.0961)***	-0.0064 (-8.0872)***	0.0136 (17.3739)***	-0.0064 (-10.4134)***
CASHSIZE	-0.0499 (-16.4308)***	0.0621 (13.8828)***	-0.0127 (-3.0408)***	-0.0084 (-2.0248)**	-0.0023 (-0.6889)
NOL	0.0114 (9.7702)***	0.0294 (13.3117)***	-0.0081 (-2.6531)***	0.0016 (0.5229)	-0.0078 (-2.9844)***
DNOL	-0.0055 (-2.4826)**	0.0032 (0.6974)	0.0106 (3.3159)***	0.0135 (4.2461)***	0.3011 (116.9647)***
ROA	-0.0909 (-28.9021)***	-0.1254 (-25.7064)***	0.1189 (40.1040)***	-0.0365 (-12.4186)***	0.1811 (77.9749)***
PPE	-0.0486 (-12.7794)***	0.0121 (2.3640)**	0.0241 (2.6836)***	0.0043 (0.4837)	0.0278 (4.3992)***
DEP	-0.4137 (-14.7145)***	-0.0213 (-0.5946)	-0.0352 (-1.3482)	0.0150 (0.5798)	-0.1387 (-8.6766)***
EQINC	1.4778 (5.1794)***	-0.1488 (-0.6533)	-1.4179 (-8.5409)***	0.1467 (0.8902)	0.0333 (0.2499)
FI	1.0185 (17.0429)***	-0.3565 (-8.7615)***	-0.6789 (-8.3043)***	2.5772 (31.7526)***	0.0321 (0.4678)
Year FE	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes
Observations	93,475	91,937	93,475	93,475	93,475
F	61.60	128.30	64.70	474.80	613.30
Partial F-Statistic		F= 132.96 (p < 0.0001)			
Weak Identification Test		Cragg-Donald Wald F = 132.96			
		Stock-Yogo C.V.: 5% Max IV size 16.38			
		Stock-Yogo C.V.: 10% Max IV size 10.27			
Under-identification test		Chi2 = 132.77 (p < 0.0001)			
Endogeneity test: Chi ²		35.44 (p < 0.0001)	3.62 (p < 0.1)	10.87 (p < 0.001)	5.42 (p < 0.05)

Table 11 reports results on the relation between CDS initiation and tax avoidance using a 2-SLS approach. First stage results are reported in Column (1) while second stage results are reported in Columns (2) to (5). All variables are defined in Appendix A. t-statistics in parentheses are based on robust standard errors clustered by industry and year (Petersen 2009). ***, **, and * represent significance at the 1%, 5%, and 10% level, respectively.