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Effect of corporate social responsibility on corporate tax avoidance: evidence from a matching approach

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Abstract The literature provides various theories relating to the relationship between corporate social responsibility (CSR) and tax avoidance. If firms view both CSR activities and tax payments as paths toward contributing to society, CSR and tax avoidance activities exhibit a negative relationship. Conversely, the two activities exhibit a positive relationship if firms engage in CSR for the purpose of risk management. This study examines the effect of CSR on corporate tax avoidance using a matching approach. Three matching algorithms, namely nearest neighbor, radius, and kernel algorithms, are used to match the two groups of firms (CSR and non-CSR firms) in order to correct for sample selection bias. This study adopts Chinese listed firms during 2009–2016 as a research sample. Most empirical results show that CSR firms have higher book-tax differences and lower effective tax rates. This indicates that CSR firms are more aggressive in their tax avoidance. These findings imply that firms engage in CSR activities as a risk management strategy.

Keywords Corporate · Social responsibility · Tax avoidance · Matching methods

1 Introduction

In response to the sustainable development goals announced by the United Nations, the Chinese government proposed ideas for innovative, coordinated, green, open, and shared development for the 13th five-year plan of national economic and social development, laying the foundation for the future development of corporate social responsibility (CSR). The Chinese government also announced the launch of the carbon emission trading system in 2017 and is therefore expected to put more efforts into promoting green development and tackling climate change. Chinese firms facing increasingly strict regulations are required to implement CSR at the earliest. According to the *Research Report on Corporate Social*

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Responsibility of China published by the Corporate Social Responsibility Research Center, Chinese Academy of Social Science (2016), the development of CSR in China has been increasing since 2009.

With the continuous development of CSR, related topics have received attention from the academia. Recent studies have examined the relationship between CSR and tax avoidance, arguing that the relationship varies according to various perspectives. From the perspective of corporate culture theories (Kreps 1990), CSR exerts a negative effect on tax avoidance (Lanis and Richardson 2012).[1] Firms engaging in CSR because of the corporate culture tend to consider not only the interests of shareholders, but also the impact of their business activities on economies, societies, and environments. However, firms failing to pay adequate taxes because of their tax avoidance activity may cause the entire society to pay a high price, resulting in irreparable losses (Weisbach 2002; Williams 2007). In addition, tax avoidance is an opportunistic behavior that violates the invisible contract between firms and the society; it results in high social costs, hinders government's right to collect tax from firms, and sacrifices public interests (Weisbach 2002). Therefore, paying taxes is regarded as a method of contributing to the society and is consistent with the goal of CSR from the perspective of corporate culture theories. In this case, tax payments and CSR are complementary. Lanis and Richardson (2015) target firms in the United States and find that firms with a higher level of CSR performance are less likely to engage in tax avoidance.

By contrast, other studies have argued that if firms treat CSR activities as risk management strategies (Godfrey 2005; Godfrey et al. 2009), they are more likely to engage in tax avoidance (Hoi et al. 2013). Tax avoidance may lead to serious negative outcomes, such as reputation damage, media pressure, penalties imposed by tax administrations, and even boycott from customers (Hanlon and Slemrod 2009; Wilson 2009). Therefore, CSR should be regarded as a risk management strategy that can enhance firms' reputation. Firms with a high reputation can avoid serious political, regulatory, and social sanctions (Godfrey 2005; Minor and Morgan 2011). Minor and Morgan (2011) suggest that CSR provides a function similar to that provided by insurance; it can help firms to reduce the risk of sanctions when facing negative events. Specifically, firms practice CSR activities in order to manage their reputation, thus reducing the expected costs related to tax avoidance (Godfrey 2005). In this case, tax payments and CSR are substitutes for one another. In other words, CSR exerts a positive effect on tax avoidance.

Some studies have also argued that CSR is not related to tax avoidance. Firms are willing to invest resources in CSR activities as long as the CSR activities meet the ultimate goal of shareholder wealth maximization. Previous studies have mostly maintained that CSR is advantageous to corporate performance. For example, Tsoutsoura (2004) contends that CSR can help firms to enhance their brand image and gain a positive reputation, and that it can attract reputed clients, outstanding employees, and quality suppliers; therefore, CSR is beneficial for improving firms' performance. Karagiorgos (2010) finds that despite the CSR costs, firms engaging in CSR can increase stock returns and induce stakeholders to value the firms higher. Gras-Gil et al. (2016) also indicate that firms practicing CSR can effectively use resources while pursuing performance growth. On the other hand, firms may also engage in tax avoidance for the same reason of engaging in CSR—to achieve

[1] According to corporate culture theories, if the corporate culture recognizes that a corporate should not view shareholder wealth maximization as its only goal, but should assume the responsibility of increasing social welfare and making contributions to the society, the corporate is likely to implement CSR (Carroll 1979; Garriga and Mele 2004; Mackey et al. 2007).

shareholder wealth maximization. If tax avoidance and CSR independently contribute to the maximization of firms' value, and managers can participate in the two activities separately, then CSR is unrelated to tax avoidance (Davis et al. 2016).

The literature contains inconsistent evidence regarding the relationship between CSR and tax avoidance; therefore, this study reinvestigates this relationship with a newly developed empirical method. When choosing empirical methods, if firms choose whether to engage in CSR arbitrarily, we can simply compare the average level of tax avoidance of firms that engaged in CSR with those that did not. However, generally, firms do not choose CSR strategies arbitrarily, but do so based on their own specific characteristics, such as firm size or performance. Therefore, comparing the mean value of the two groups may provide a misleading estimate of the effect of CSR engagement on tax avoidance. For example, larger firms are well known and widely monitored. If they do not engage in social responsibility activities, they will be avoided by consumers and thus experience lower profitability. Consequently, the probability of choosing to engage in CSR is higher in large firms (Dierkes and Coppock 1978;Trotman and Bradley 1981; Fombrun and Shanley 1990). This nonarbitrary selection of a firm's CSR strategy based on a firm's characteristics engenders a biased sample with nonprobability sampling, resulting in an endogenous bias that generates biased and inconsistent estimations.

Since Rosenbaum and Rubin's (1983) seminal work, studies have increasingly utilized propensity score matching (PSM) to overcome selection bias. The PSM method pairs treatment and control samples based on several observable characteristics. After the matching process, differences in such characteristics between the two groups of firms can be significantly reduced. Therefore, the difference in tax avoidance between the two groups should be attributed to the difference in their CSR strategy, rather than their characteristics. This study applies three PSM algorithms: nearest neighbor, radius, and kernel matching.

This study uses data from 2009 to 2016 about Chinese listed A-share companies to empirically examine the relationship between CSR and tax avoidance. The remainder of this paper is organized as follows. Literature review Sect. 2 reviews related studies. Section 3 introduces the empirical model. Data and basic statistics are described in Sect. 4. The empirical results are presented in Sect. 5, and the robustness check is reported in Sect. 6. Concluding remarks are put in the last section.

2 Literature review

Kreps (1990) and Fleischer (2007) define corporate culture as the common belief of an organization, which is related to the organization's correct direction of activities and is a crucial factor influencing corporate policy (Cronqvist et al. 2007). Dufays (2005) argues that corporate culture and industry characteristics are critical factors that influence whether a firm engages in CSR. Parker (2014) analyzes four leading British industrialists and finds that corporate leaders' philosophical and religious beliefs and responsibility influence corporations' CSR direction. Gras-Gil et al. (2016) indicate that CSR is related to corporate managers' ethical and moral thinking and has a negative effect on earnings management. These results show that firms engage in CSR because of their corporate culture and their intention of increasing social well-being, which is consistent with the goal of paying taxes. Therefore, CSR reduces firms' tax avoidance tendency.

Researchers have also paid attention to the role of CSR in risk management. According to Godfrey (2005), when a firm encounters a negative event, its CSR reputation is crucial

because it increases the possibility of a positive judgment. Godfrey et al. (2009) empirically verify that engaging in CSR can increase firm reputation, thus creating firm value. Minor and Morgan (2011) suggest that CSR provides a function similar to that provided by insurance, which to a certain extent contributes to the reduction of market, political, routine, and sanction risks. In an empirical study, Graham et al. (2012) suggest that when determining tax avoidance strategies, tax managers are sensitive to the potential negative reputation and the sanction risk. If the positive reputation gained from CSR implementation can reduce the level of the negative reputation and the sanction risk, firms will have an incentive to increase CSR activities to avert the outcomes resulting from tax avoidance. Thus, CSR increases firms' tax avoidance tendency.

However, Davis et al. (2016) claim that CSR and tax avoidance are independent of each other. Conventional economic theories have indicated that firms only invest resources to achieve the goal of stockholder wealth maximization. Dhaliwal et al. (2011) finds that firms engaging in CSR have a relatively low capital cost. Moreover, Lev et al. (2010) find that CSR activities contribute to the growth of earnings. Similarly, tax avoidance enables firms to reserve more resources for future use, consistent with the goal of stockholder wealth maximization. Thus, both CSR and tax avoidance are mechanisms for maximizing firm value and corporate managers engage in these two activities separately. Thus, CSR and tax avoidance are unrelated.

In sum, the relationship between CSR and tax avoidance varies according to the various perspectives of corporate managers. If a firm engages in CSR because of the corporate culture, CSR and tax avoidance exhibit a negative relationship. If the commitment to CSR is because of risk management, CSR and tax avoidance exhibit a positive relationship. If CSR and tax avoidance are regarded as two independent strategies, no relationship exists between them.

3 Econometric framework

3.1 Matching and estimation strategy

This study estimates the difference in tax avoidance between firms who engage in CSR (treatment group) and those who do not (control group). The difference in tax avoidance between these two groups can be represented by the average treatment effect on the treated (*ATT*):

$$ATT = E(t_{1i} - t_{0i}|c_i = 1) = E(t_{1i}|c_i = 1) - E(t_{0i}|c_i = 1) \quad (1)$$

where t_{1i} denotes firm i's potential tax avoidance if it were to engage in CSR, t_{0i} denotes the firm's potential tax avoidance if it did not, and c_i denotes a dummy representing whether firm i engages in CSR.[2]

To obtain the *ATT*, we need to estimate the counterfactual $E(t_{0i}|c_i = 1)$, which is the tax avoidance that firms would have participated in had they not been engaging in CSR.

[2] If we simply compare firms that engaged in CSR with those that did not, this may produce selection bias. The selection bias can be shown as the following equation:

$E(t_{1i}|c_i = 1) - E(t_{0i}|c_i = 0) = E(t_{1i} - t_{0i}|c_i = 1) + E(t_{0i}|c_i = 1) - E(t_{0i}|c_i = 0)$.

The observed difference in tax avoidance between the two groups can be represented by the sum of the *ATT* and selection bias.

According to Rosenbaum and Rubin (1983) and Heckman et al. (1997), given the conditional independence assumption, $E(t_{ji}|X_i, c_i) = E(t_{ji}|X_i)$, for $j = 0, 1$, we can have

$$\begin{aligned} E(t_{1i} - t_{0i}|c_i = 1) &= E\left[E(t_{1i}|X_i, c_i = 1) - E(t_{0i}|X_i, c_i = 1)|c_i = 1\right] \\ &= E\left[E(t_{1i}|X_i, c_i = 1) - E(t_{0i}|X_i, c_i = 0)|c_i = 1\right]. \end{aligned} \tag{2}$$

Specifically, we can obtain the *ATT* by comparing the treated subjects and the matched control subjects who are selected conditional on the observable characteristics X_i.

One difficulty of using the pairing method is finding the appropriate matching sample if there are multiple characteristic variables. The PSM method proposed by Rosenbaum and Rubin (1983) entails adopting the propensity score to capture information on all firms' characteristics to address the excessive dimensioning problems in matching. The propensity score obtained through the probability function represents the probability of engaging in CSR conditional on the characteristic variables X_i:

$$p(X_i) = \text{Prob}(c_i = 1|X_i) = E(c_i|X_i). \tag{3}$$

That is, based on the propensity score $p(X)$, the conditional independent assumption holds. Therefore, we can have

$$ATT_{(X)} = E\left[E(t_{1i}|p(X_i), c_i = 1) - E(t_{0i}|p(X_i), c_i = 0)|c_i = 1\right]. \tag{4}$$

This study employs three matching algorithms, nearest neighbor, radius, and kernel. Applying nearest neighbor matching means that one comparison unit is chosen as a match for a treatment unit that is closest in terms of propensity score.[3] Radius matching involves using all of the comparison units as matches for a treatment unit that lies within a tolerance level.[4] Kernel matching is a nonparametric matching estimator that uses propensity score to calculate the weighted averages of all comparison units and thereby construct the counterfactual outcome.[5]

3.2 Model specification

This section first describes the probit model used to estimate propensity scores. Subsequently, the section introduces the regression model.

3.2.1 Probit model

This study utilizes PSM to conduct regressions on the effect of CSR on tax avoidance. A probit model is used to determine the propensity score. The probit model is as follows:

$$p(X_i) = \text{Prob}(csr_i = 1|X_i) = F(\alpha' X_i) \tag{5}$$

[3] This study applies nearest neighbor matching with replacement, meaning that comparison unit can be used more than once as a match. Matching with replacement helps to reduce bias (Dehejia and Wahba 2002).

[4] This study uses a quarter of a standard deviation of the sample estimated propensity as a tolerance level, which is suggested by Rosenbaum and Rubin (1983).

[5] This study chooses 0.05 as the bandwidth value for the kernel matching. Low bandwidth values yield an unbiased estimate of the true density function.

where X represents the vector for firms' conditions, which controls the effect of each firm's unique characteristics; *csr* represents a dummy variable, coded 1 if the firm engages in CSR, and coded 0 otherwise; and F represents the cumulative density function under normal distribution. Hence, a firm's probability of engaging in CSR, which is its propensity score, can be calculated using the probit model.

The characteristic variable vector is as follows:

$$X_i = \left[1, size_i, lev_i, roa_i, dsale_i, intan_i, absda_i\right]' \tag{6}$$

where firm size (*size*), measured as the natural logarithm of total assets, is used to control for the effect of size (Dierkes and Coppock 1978; Trotman and Bradley 1981; Fombrun and Shanley 1990). Large firms are relatively famous and receive much attention from society. They are more likely to engage in CSR because if they fail to do so, they may face protests or boycott from the public. Firms with a high debt ratio are incapable of implementing CSR. Therefore, leverage (*lev*), measured as the long-term debt divided by total assets, is used as the covariance to control for financial soundness (McKendall et al. 1999; Erekson et al. 2008; Waddock and Graves 1997; Dam and Scholtens 2012). In addition, return on assets (*roa*) is used to measure firm performance. According to the available funds hypothesis, whether a firm engages in CSR depends on the availability of resources; when a firm earns a large profit, it has more resources to engage in CSR (Waddock and Graves 1997; Moore 2001). This study also controls for sales revenue changes (*dsale*) and intangible asset intensity (*intan*) because the potential of future performance improvement will increase firms' willingness to engage in CSR. Kim et al. (2012) suggest that firms with poor earnings quality tend not to engage in CSR. Therefore, this study adopts the absolute value of performance-adjusted abnormal accruals (*absda*) as the control variable.

3.2.2 Multivariate regression model

This study uses the following baseline regression model to test the study hypotheses:

$$\begin{aligned} taxavoid_i =& \beta_0 + \beta_1 csr_i + \beta_2 size_i + \beta_3 lev_i + \beta_4 roa_i + \beta_5 inv_i + \beta_6 ppe_i \\ &+ \beta_7 nol_i + \beta_8 dsale_i + \beta_9 intan_i + \beta_{10} absda_i + \varepsilon_i \end{aligned} \tag{7}$$

where *taxavoid* represents several empirical measures for aggressive tax avoidance. Three adjusted book-tax difference measures are used to capture the tax avoidance degree. These measures are (1) the Frank et al. (2009) discretionary permanent book-tax difference (*dpbtd*); (2) the Desai and Dharmapala (2006) discretionary book-tax difference (*ddbtd*); and (3) the Khurana and Moser (2013) permanent book-tax difference (*pbtd*). In the robustness check, this study also uses the long-run book effective tax rate (*letr*) to capture the consequences of tax avoidance practices.

The equation for the level of corporate tax avoidance includes control variables such as firm size, leverage, firm performance, inventory density, fixed asset intensity (property, plant, and equipment), a dummy variable indicating loss carried forward, future profitability potential, and earnings quality. Firm size (*size*) is expected to influence the level of corporate tax avoidance because a larger firm has a higher incentive and more power to engage in tax avoidance activities (Wilson 2009; Lanis and Richardson 2012). Because a corporation with a high debt ratio is under pressure to engage in aggressive tax avoidance to pay off its matured debt, this study adopts firm leverage (*lev*) (Hoi et al. 2013; Kubick et al. 2015). Moreover, due to tax-deductible interest payments, leverage is associated with

corporate tax avoidance (Gupta and Newberry 1997; Lanis and Richardson 2015). Prior research (e.g. Frank et al. 2009; Wilson 2009; Kubick et al. 2015) finds that the effect of corporate profitability on the tax burden is positive. Therefore, this study adopts return on assets (*roa*) as the control variable. The inventory density variable (*inv*), measured as the inventory scaled by assets, is expected to have an influence on the level of tax avoidance, suggesting that inventory-intensive firms are less able to engage in tax avoidance than are capital-intensive firms (Lanis and Richardson 2012, 2015). The fixed asset intensity variable (*ppe*), measured as fixed assets (property, plant, equipment) scaled by total assets, can influence the level of corporate tax avoidance because the accelerated depreciation charges related to fixed assets cause tax shield effects, thus reducing the tax burden on the firm (Lanis and Richardson 2012; Kubick et al. 2015; Hoi et al. 2013; Gupta and Newberry 1997; Lanis and Richardson 2015). A firm's annual loss can be carried forward to be tax deductible in the following few years. The dummy variable indicating loss carried forward (*nol*) is expected to have an influence on the level of tax avoidance (Kubick et al. 2015; Watson 2011). This study also controls for sales revenue changes (*dsale*) and intangible assets intensity (*intan*), because the growth in future profitability potential increases the future tax burden and consequently increases the incentive for tax avoidance (Hoi et al. 2013; Watson 2011; Kubick et al. 2015). Following Hoi et al. (2013), this study uses the absolute value of performance-adjusted abnormal accruals (*absda*) as a control variable in the regression models to capture the impact of earnings quality on tax avoidance. Finally, this study includes dummy variables to control for year fixed effects.

4 Sample selection and summary statistics

This study obtains research samples from Chinese A-share listed companies; however, financial, insurance, securities, agriculture, forestry, fishing, animal husbandry, education, comprehensive, and nonindustry companies are excluded. The CSR data source is the official report of enterprise CSR activities (CSR Blue Book) released by the CSR research center at the Chinese Academy of Social Sciences. The research center designs overall evaluation systems of an enterprise's CSR activities. The center annually publishes a list of the enterprises with the highest development index of CSR activity.[6] The sample period is from 2009 to 2016. All continuous independent variables are winsorized at the 1st and 99th percentiles. Data of other variables are obtained from the Taiwan Economic Journal. This study presents detailed definitions of all variables in Appendix A.

Table 1 presents descriptive information about the sample firms. The mean and standard deviation for each variable used in the regressions are presented, first for all sample firms and then separately for CSR firms (treatment group) and firms that do not practice CSR (control group). The mean differences between the two groups are tested using a *t* test. As shown in the last column, the differences between the two groups in *dpbtd, ddbtd,* and *pbtd* are all significantly negative, suggesting that CSR firms engage in less tax avoidance behavior if only a t-test is used to compare the mean values of the two groups.

The mean values of the treatment group are significantly greater than those of the control group in terms of *size*, *inv, ppe*, *dsale,* and *intan*, indicating that CSR firms

[6] Such a development index refers to a group of CSR indices such as International Organization for Standardization 26,000, Global Reporting Initiative, Dow Jones Sustainability Index, Wealth Magazine CSR index, and Financial Times Stock Exchange 4 Good Index.

Table 1 Descriptive statistics

	N	Total	*csr* = 1	*csr* = 0	Diff.	t-statistic
pbtd	22,082	2.8032 (0.0249)	1.4232 (0.1058)	2.8348 (0.0253)	− 1.4116***	− 8.4127
dpbtd	19,386	− 0.0607 (0.0229)	− 0.9094 (0.1319)	− 0.0401 (0.0232)	− 0.8694***	− 5.7886
ddbtd	18,204	2.6229 (0.0247)	1.2424 (0.1114)	2.6518 (0.0250)	− 1.4093***	− 8.1080
size	22,082	14.7149 (0.0096)	17.2893 (0.0666)	14.6558 (0.0094)	2.6335***	42.0354
lev	22,082	5.4603 (0.0610)	10.2845 (0.4653)	5.3497 (0.0613)	− 4.9348***	− 12.0105
roa	21,136	7.9070 (0.0437)	5.5051 (0.1909)	7.9641 (0.0445)	− 2.4590***	− 8.4838
inv	22,082	15.8814 (0.0970)	19.0275 (0.7138)	15.8092 (0.0978)	3.2183***	4.9141
ppe	22,072	25.9494 (0.1257)	31.0564 (1.0556)	25.8322 (0.1262)	5.2241***	6.1569
nol	22,083	0.1041 (0.0021)	0.1152 (0.0144)	0.1038 (0.0021)	0.0113	0.8172
dsale	21,118	21.7518 (0.3181)	18.3340 (1.9006)	21.8331 (0.3225)	3.4991**	1.6577
intan	21,596	11.1186 (0.0137)	13.8932 (0.0939)	11.0539 (0.0135)	2.8394***	31.6406
absda	17,197	0.1031 (0.0009)	0.0715 (0.0044)	0.1037 (0.0009)	− 0.0322***	− 5.1865

All continuous independent variables are winsorized at the 1st and 99th percentiles

*, **, ***Indicate statistical significance at the 0.10, 0.05, and 0.01 levels, respectively

Table 2 Correlation matrix

	size	*lev*	*roa*	*inv*	*ppe*	*nol*	*dsale*	*intan*	*absda*
size	1.0000	–	–	–	–	–	–	–	–
lev	0.4745	1.0000	–	–	–	–			–
roa	− 0.3767	− 0.2189	1.0000	–	–	–	–	–	–
inv	0.1165	0.0961	− 0.1161	1.0000	–	–	–	–	–
ppe	0.1584	0.3304	− 0.1198	− 0.3574	1.0000	–	–	–	–
nol	− 0.0064	0.0479	− 0.1527	− 0.0314	0.1023	1.0000	–	–	–
dsale	0.0062	0.0357	0.1792	0.0457	− 0.0960	0.0974	1.0000	–	–
intan	− 0.0356	0.0258	0.0132	− 0.2070	0.1285	0.0257	− 0.0209	1.0000	–
absda	− 0.0665	0.0155	0.1458	0.0151	− 0.1155	0.0847	0.2554	− 0.0410	1.0000

demonstrate greater firm size, inventory, depreciable assets, sales revenue changes, and intangible asset intensity. By contrast, the mean values of the treatment group are significantly lower than those of the control group in terms of *lev*, *roa*, and *absda*, indicating that CSR firms have relatively lower leverage, return on assets, and earnings

Table 3 Probit model used to find propensity scores

Dependent variable: CSR firm	
size	1.2689*** (0.052)
lev	− 0.0429*** (0.006)
roa	− 0.0191 (0.014)
dsale	− 0.0023 (0.002)
intan	− 0.0396*** (0.011)
absda	− 1.5472** (0.766)
_cons	− 23.3200*** (0.893)
N pseudo R^2	17,191 0.296

Robust standard errors are in parentheses

*, **, ***Indicate statistical significance at the 0.10, 0.05, and 0.01 levels, respectively

Table 4 Estimated average treatment effect on the treated: tax avoidance: discretionary permanent book-tax difference *(dpbtd)*

Matching algorithms	Nearest neighbor	Radius	Kernel
Mean difference between CSR and non-CSR firms	0.3987***	0.3959***	0.3909***
[90% Conf. Interval]	[0.0736, 0.7393]	[0.0609, 0.6394]	[0.1390, 0.6858]
[95% Conf. Interval]	[0.0503, 0.8108]	[0.0523, 0.6960]	[0.0939, 0.7844]
[99% Conf. Interval]	[− 0.0908, 0.8830]	[0.0477, 0.7153]	[− 0.0428, 0.8590]

The values in the table represent the effect of engaging in CSR on tax avoidance

The values in the square brackets represent the interval bound values of 90, 95, and 99% bootstrap confidence intervals

*, **, ***Indicate statistical significance at the 0.10, 0.05, and 0.01 levels, respectively

management. Finally, the differences in the mean values for the dummy variable *nol* between the two groups are not significant.

Table 2 presents the correlation matrix of the control variables. As shown, the highest correlation coefficient between *size* and *lev* is 0.4745. The remaining correlation coefficients are around − 0.3767 to 0.3304, all of which are acceptable when it comes to avoiding the problem of multi-collinearity.

5 Empirical results

The probit model is first used to estimate the probability of a firm's decision to engage in CSR, through which the propensity scores are estimated. Then, this study matches each

Table 5 Estimated average treatment effect on the treated: tax avoidance: discretionary book-tax difference *(ddbtd)*

Matching algorithms	Nearest neighbor	Radius	Kernel
Mean difference between CSR and non-CSR firms	0.0801	− 0.0454	− 0.0354
[90% Conf. Interval]	[− 0.1621, 0.4487]	[− 0.2791, 0.1094]	[− 0.2735, 0.1603]
[95% Conf. Interval]	[− 0.2530, 0.4882]	[− 0.2901, 0.2953]	[− 0.2985, 0.2469]
[99% Conf. Interval]	[− 0.3749, 0.5794]	[− 0.4372, 0.3369]	[− 0.4969, 0.2493]

The values in the table represent the effect of engaging in CSR on tax avoidance

The values in the square brackets represent the interval bound values of 90, 95, and 99% bootstrap confidence intervals

*, **, ***Indicate statistical significance at the 0.10, 0.05, and 0.01 levels, respectively

Table 6 Estimated average treatment effect on the treated: tax avoidance: permanent book-tax difference *(pbtd)*

Matching algorithms	Nearest neighbor	Radius	Kernel
Mean difference between CSR and non-CSR firms	0.1051	− 0.0303	− 0.0193
[90% Conf. Interval]	[− 0.1433, 0.4758]	[− 0.2883, 0.1371]	[− 0.2785, 0.2575]
[95% Conf. Interval]	[− 0.2392, 0.5165]	[− 0.3399, 0.3464]	[− 0.3639, 0.3288]
[99% Conf. Interval]	[− 0.3575, 0.6186]	[− 0.3926, 0.3863]	[− 0.4379, 0.3899]

The values in the table represent the effect of engaging in CSR on tax avoidance

The values in the square brackets represent the interval bound values of 90, 95, and 99% bootstrap confidence intervals

*, **, ***Indicate statistical significance at the 0.10, 0.05, and 0.01 levels, respectively

treatment firm to control firms through propensity scores. Table 3 presents the results of the probit model. The coefficient of the characteristic variable *size* is significantly positive, and that of *lev, intan,* and *absda* are significantly negative. The pseudo R^2, which is a measure of the goodness of fit of the probit model, is 0.296.

This study uses three PSM algorithms to adjust for the heterogeneity of the firms. Specifically, the treatment and control firms are paired according to their propensity scores, followed by difference analysis. Table 4 presents the average treatment effects for the CSR firms; *dpbtd* is the proxy variable for tax avoidance. When the nearest-neighbor matching method is used, the point estimate of the difference in tax avoidance is 0.3987, which falls into a 95% bootstrap confidence interval of 0.0503 to 0.8108. That is, this study is 95% confident that a nonzero difference in tax avoidance between CSR and non-CSR firms falls into this interval. The radius and kernel matching algorithms are also employed, and the result indicates that the point estimates for the tax avoidance difference are 0.3959 and 0.3909, both of which are statistically significant. These results show that when the matching methods are used to adjust for the characteristic variables of the two groups of firms to approximate each other, the level of tax avoidance of the CSR firms is higher than that of the non-CSR firms. Firms with similar characteristics tend to engage in a similar level of tax avoidance. However, the empirical

result of this study shows that when the characteristics of the CSR and non-CSR firms are similar, the CSR firms have a higher level of tax avoidance than the non-CSR firms. This implicates that the difference in tax avoidance is caused by firms' CSR engagement decision rather than firms' characteristics.

Table 5 shows the average treatment effects for the CSR firms, but in which *ddbtd* is adopted as the proxy variable for tax avoidance. After using the three matching methods, the results show that CSR has no significant effect on tax avoidance. In Table 6, *pbtd* is used as the proxy variable for tax avoidance. The point estimates for the difference in tax avoidance are still nonsignificant.

Table 7 reports the effectiveness of the matches. The values in this table represent the percentage of decline in the difference in each characteristic variable between CSR and non-CSR firms. When the value is positive (negative), the difference declines (increases). Generally, a reduced difference in the average value of each characteristic variable between two groups indicates the matches are effective. Regardless of using which PSM algorithms, the mean differences of characteristic variables after matching are all reduced, with a balanced effect between 88.7 and 94.6%. This confirms that the differences between characteristic variables are reduced after matching, indicating that the matches are effective in narrowing the difference between treatment and control groups in the characteristic variables.

Next, this study adopts the regression model with matched samples to examine the impact of practicing CSR on corporate tax avoidance. The empirical results obtained with *dpbtd* serving as proxy of tax avoidance are listed in Table 8. Columns (1)–(3) represent the results derived from the nearest neighbor, radius, and kernel matching algorithms, respectively. In Column (1), the estimated coefficient of *csr* is 0.6822, attaining statistical significance at the 1% level; this indicates that the level of tax avoidance is increased significantly in firms engaging in CSR. In Columns (2) and (3), coefficients are still significantly positive, and the values are 0.6501 and 0.2452, respectively. Consequently, the empirical results all show that CSR would be detrimental to tax avoidance. Tables 9 and 10 present the results obtained with *ddbtd* and *pbtd* serving as a proxy of tax avoidance, respectively. Similarly, the empirical results suggest that CSR firms are involved in a higher degree of tax avoidance.

The empirical result obtained using point estimates and that obtained using the ordinary least squares regression are inconsistent. However, most of the empirical results indicate that CSR positively influences firms' level of tax avoidance. By adjusting for the characteristic variables of the two groups of firms to approximate each other using the matching methods, this study finds the CSR firms to show a higher level of tax avoidance than the non-CSR firms, revealing that implementing CSR causes firms to increase their engagement in tax avoidance. This is possibly because firms may have conducted CSR activities as a strategy for managing risks. In other words, implementing CSR can reduce the expected penalties and losses resulting from tax noncompliance, thus causing the firms to engage in tax avoidance. The empirical results of this study are consistent with those of Hoi et al. (2013), Davis et al. (2016), Lv et al. (2015), and Tang and Li (2015). These studies have also revealed that performing CSR activities causes firms to increase their engagement in tax avoidance. The contribution of this study lies in the use of recently developed matching methods to reduce sample selection bias, and ensuring rigorous estimation and identification. Other empirical results of this study indicate that CSR has no significant effect on the level of tax avoidance, supporting that CSR and tax avoidance are unrelated. Both activities are the mechanisms for maximizing firm value; therefore, they are independent strategies.

Table 7 Test of the effectiveness of the propensity score matches

	dpbtd			*ddbtd*			*pbdt*		
Matching algorithms	Nearest neighbor	Radius	Kernel	Nearest neighbor	Radius	Kernel	Nearest neighbor	Radius	Kernel
size	99.2	99.7	99.5	99.2	99.7	99.4	99.2	99.7	99.5
lev	86.7	94.9	94.4	86.7	95.0	92.3	86.7	95.0	94.5
roa	99.1	93.6	91.9	99.1	93.6	97.9	99.1	93.6	91.9
dsale	91.9	95.0	93.7	91.9	95.0	99.9	91.9	73.7	93.8
intan	84.6	82.7	77.1	84.7	83.1	85.1	84.7	83.1	77.4
absda	96.0	87.1	87.9	96.0	87.2	93.1	96.0	87.2	88.0
Average	92.9	92.2	90.8	92.9	92.3	94.6	93.0	88.7	90.9

The values in the table represent the percentage of decline in the mean difference in each characteristic variable between the treatment group and the control group. When the value is positive (negative), the difference declines (increases)

Table 8 Empirical results: OLS model: dependent variable: discretionary permanent book-tax difference *(dpbtd)*

Matching algorithms	Nearest neighbor (1)	Radius (2)	Kernel (3)
csr	0.6822*** (0.104)	0.6501*** (0.109)	0.2452*** (0.067)
size	− 0.1710*** (0.015)	− 0.1436*** (0.023)	− 0.1685*** (0.008)
lev	− 0.0072*** (0.002)	− 0.0074** (0.003)	− 0.0041 (0.004)
roa	0.3467*** (0.003)	0.3201*** (0.005)	0.1573*** (0.009)
inv	− 0.0187*** (0.001)	− 0.0168*** (0.002)	0.0263*** (0.003)
ppe	− 0.0100*** (0.001)	− 0.0094*** (0.001)	0.0046** (0.002)
nol	0.0227 (0.072)	− 0.1556 (0.104)	− 0.6965*** (0.160)
dsale	− 0.0007* (0.000)	0.0004 (0.001)	0.0017 (0.001)
intan	− 0.0155*** (0.003)	− 0.0073 (0.005)	0.0968*** (0.011)
absda	− 1.4836*** (0.146)	− 1.2397*** (0.238)	− 0.1047 (0.423)
_cons	0.4555** (0.232)	0.0526 (0.358)	− 0.0106 (0.010)
N adj. R^2	15,392 0.473	6751 0.417	6765 0.172

Robust standard errors are in parentheses

csr = 1 if a firm engages in CSR activities, otherwise 0. All specifications control for time fixed effects

*, **, ***Indicate statistical significance at the 0.10, 0.05, and 0.01 levels, respectively

6 Robustness check

To verify the empirical results, an alternative tax avoidance proxy is used in the robustness check. Lower values of the effective tax rates suggest greater tax avoidance. Therefore, this study uses a 4-year average book effective tax rate (*letr*) to capture consequences of tax avoidance practices. Table 11 presents the average treatment effects for the CSR firms. When the nearest-neighbor matching method is used, the point estimate of the difference in effective tax rates is significantly negative (− 1.1449). However, the point estimates of the difference in effective tax rates are statistically nonsignificant if the radius or kernel matching method is adopted. The regression results are reported in Table 12. The estimated coefficients are significantly negative when the nearest-neighbor or radius matching method is used. These results indicate that CSR firms have lower effective tax rates, suggesting that they have a higher degree of tax avoidance compared with non-CSR firms.

Table 9 Empirical results: OLS model: dependent variable: discretionary book-tax difference *(ddbtd)*

Matching algorithms	Nearest neighbor	Radius	Kernel
	(1)	(2)	(3)
csr	0.1472*	0.2062**	0.0681***
	(0.084)	(0.092)	(0.026)
size	− 0.1741***	− 0.1475***	0.0475***
	(0.017)	(0.032)	(0.003)
lev	− 0.0092***	− 0.0117***	− 0.0123***
	(0.002)	(0.003)	(0.001)
roa	0.3689***	0.3475***	0.3666***
	(0.007)	(0.012)	(0.004)
inv	− 0.0257***	− 0.0257***	− 0.0405***
	(0.001)	(0.002)	(0.001)
ppe	− 0.0093***	− 0.0082***	− 0.0157***
	(0.001)	(0.001)	(0.001)
nol	0.1758**	0.0661	0.3778***
	(0.070)	(0.097)	(0.059)
dsale	− 0.0010**	0.0003	− 0.0048***
	(0.001)	(0.001)	(0.000)
intan	− 0.0310***	− 0.0246	− 0.0528***
	(0.004)	(0.021)	(0.004)
absda	− 1.4808***	− 1.2844***	− 0.2497
	(0.149)	(0.250)	(0.165)
_cons	3.2175***	2.9962***	0.0015
	(0.264)	(0.403)	(0.002)
N adj. R^2	15,407	6632	13,438
	0.504	0.460	0.667

csr = 1 if a firm engages in CSR activities, otherwise 0

All specifications control for time fixed effects

Robust standard errors are in parentheses

*, **, ***Indicate statistical significance at the 0.10, 0.05, and 0.01 levels, respectively

7 Conclusion

Among the various CSR topics, numerous studies have focused on investigating the effect of CSR on tax avoidance. Studies have argued that firms engaging in CSR due to a corporate culture based on moral perspectives tend to have a low level of tax avoidance. By contrast, firms implementing CSR as a risk management strategy tend to have a high level of tax avoidance. However, if corporate managers regard CSR and tax avoidance as two independent strategies, no relationship exists between them. This study employs matching methods to adjust for the characteristic variables of the CSR and non-CSR firms to approximate each other, thereby evaluating the relationship between CSR and tax avoidance. This study uses the Chinese A-share listed firms as research samples, and those reported in the CSR Blue Book are defined as CSR firms. The research period is from 2009 to 2016.

Nearest neighbor, radius, and kernel matching methods are adopted to control for the characteristics of the two groups of firms, and three measures of the book-tax difference are used as the proxy variables for tax avoidance. The empirical results show that the average treatment effect on the treated is positive or nonsignificant. The regression

Table 10 Empirical results: OLS model: dependent variable: permanent book-tax difference *(pbtd)*

Matching algorithms	Nearest neighbor	Radius	Kernel
	(1)	(2)	(3)
csr	0.1814**	0.1864**	0.2223***
	(0.089)	(0.095)	(0.038)
size	− 0.1658***	− 0.1495***	0.0452***
	(0.017)	(0.025)	(0.005)
lev	− 0.0106***	− 0.0123***	− 0.0066***
	(0.002)	(0.003)	(0.002)
roa	0.3749***	0.3518***	0.3678***
	(0.008)	(0.012)	(0.005)
inv	− 0.0249***	− 0.0255***	− 0.0396***
	(0.001)	(0.002)	(0.001)
ppe	− 0.0105***	− 0.0096***	− 0.0171***
	(0.001)	(0.002)	(0.001)
nol	0.1135	− 0.0350	0.2701***
	(0.076)	(0.102)	(0.091)
dsale	− 0.0008	0.0003	− 0.0056***
	(0.001)	(0.001)	(0.001)
intan	− 0.0298***	− 0.0300***	− 0.0634***
	(0.004)	(0.006)	(0.006)
absda	− 1.5013***	− 1.2564***	0.1857
	(0.156)	(0.250)	(0.241)
_cons	3.1301***	2.9985***	0.0085
	(0.271)	(0.402)	(0.005)
N adj. R^2	15,407	6756	6771
	0.494	0.456	0.634

csr = 1 if a firm engages in CSR activities, otherwise 0

All specifications control for time fixed effects

Robust standard errors are in parentheses

*, **, ***Indicate statistical significance at the 0.10, 0.05, and 0.01 levels, respectively

Table 11 Estimated average treatment effect on the treated: tax avoidance: long-run average effective tax rate (*letr*)

Matching algorithms	Nearest neighbor	Radius	Kernel
Mean difference between CSR and non-CSR firms	− 1.1449*	− 0.6317	− 0.5778
[90% Conf. Interval]	[− 2.4575, − 0.3071]	[− 1.5911, 0.2384]	[− 1.4218, 0.4090]
[95% Conf. Interval]	[− 2.9262, 0.2409]	[− 1.8367, 0.5847]	[− 1.7851, 0.4488]
[99% Conf. Interval]	[− 3.5379, 0.5952]	[− 2.7793, 1.0908]	[− 1.9803, 1.1171]

The values in the table represent the effect of engaging in CSR on tax avoidance

The values in the square brackets represent the interval bound values of 90, 95, and 99% bootstrap confidence intervals

*, **, ***Indicate statistical significance at the 0.10, 0.05, and 0.01 levels, respectively

Table 12 Empirical results: OLS model: dependent variable: long-run average effective tax rate *(letr)*

Matching algorithms	Nearest neighbor (1)	Radius (2)	Kernel (3)
csr	− 1.6488*** (0.501)	− 1.3563** (0.531)	− 0.0848 (0.151)
size	1.1338*** (0.074)	0.9448*** (0.113)	0.8212*** (0.017)
lev	0.0215** (0.010)	0.0097 (0.015)	− 0.0734*** (0.008)
roa	− 0.2568*** (0.016)	− 0.2706*** (0.027)	− 0.3552*** (0.020)
inv	0.1309*** (0.006)	0.1373*** (0.009)	0.2208*** (0.006)
ppe	0.0180*** (0.005)	0.0122* (0.007)	0.0901*** (0.004)
nol	1.7948*** (0.348)	1.7235*** (0.535)	3.2145*** (0.340)
dsale	− 0.0068*** (0.002)	− 0.0070** (0.003)	− 0.0174*** (0.003)
intan	0.1167*** (0.016)	0.1267*** (0.027)	0.1388*** (0.025)
absda	1.2748* (0.704)	2.1428* (1.176)	2.4961*** (0.953)
_cons	− 0.2747 (1.117)	2.3085 (1.753)	0.0283 (0.056)
N adj. R^2	15,407 0.109	6347 0.109	13,438 0.854

Robust standard errors are in parentheses

csr = 1 if a firm engages in CSR activities, otherwise 0

All specifications control for time fixed effects

*, **, ***Indicate statistical significance at the 0.10, 0.05, and 0.01 levels, respectively

analysis results indicate that the effect of CSR activities on tax avoidance is positive. Collectively, although the empirical results of different econometric models are not completely the same, most results suggest that CSR firms exhibit a higher level of tax avoidance than non-CSR firms. The robustness check also shows that the long-term effective tax rate of the CSR firms is lower than that of the non-CSR firms. This means that adopting another dependent variable does not qualitatively change the results.

The study result implies that corporate managers may strategically use CSR as a tool to conceal their tax avoidance behavior, which has a crucial implication for the Chinese government and stakeholders. Related authorities of the Chinese government should enhance the promotion of social responsibility and should implement CSR audits to regulate and supervise the CSR activities of the firms, thereby ensuring the integration of CSR into the corporate culture. In addition, tax audits should be conducted on CSR firms to curb tax avoidance. Stakeholders should identify firms' motivations for implementing CSR and the implicit financial information behind CSR, and make prudent investment decisions accordingly.

Appendix

See Table 13.

Table 13 Variable definitions

Variable	Definition
pbtd(%)	Khurana and Moser (2013) permanent book-tax difference *pbtd* is calculated as follows: $pbtd = \frac{bi - \frac{taxexp}{taxrate} - \frac{taxexpdef}{taxrate}}{ta}$ where *bi* is pre-tax book income; *taxexp* is tax expense; *taxrate* is corporate tax rate; *taxexpdef* is deferred tax expense; and *ta* is total assets
dpbtd	Frank et al. (2009) discretionary permanent book-tax difference *dpbtd* is the ρ_{it} from the following regression: $pbtd_{it} = \eta_0 + \eta_1 bi + \eta_2 taxexp + \eta_3 taxexpdef + \eta_4 taxrate + \eta_5 intang + \eta_6 eqincome + \eta_7 mi + \eta_8 pbtd_{it-1} + \rho_{it};$ where: *intang* = intangible assets; *eqincome* = equity method income in earnings; *mi* = income attributable to minority interest; $pbtd_{it-1}$ = one-year lagged *pbtd*
ddbtd	Desai and Dharmapala (2006) discretionary book-tax difference. *ddbtd* is equal to $\mu_i + \upsilon_{it}$ from the following regression: $BT_{it} = \theta_1 tacc + \mu_i + \upsilon_{it}$ where *BT* is the pretax income less taxable income; *tacc* is Dechow et al. (1995) total accruals measure, scaled by total assets; μ_i is the average value of the residual for firm *i* over the sample period; and υ_{it} is the deviation of the residual in year *t* from firm *i*'s average residual
letr(%)	4-year average effective tax rate. Effective tax rate is defined as book tax expense divided by pre-tax book income. This study truncates *letr* to the range [0, 1]
roa(%)	Net income scaled by total assets
csr	An indicator variable equal to 1 if the firm engages in corporate social responsibility activities, and 0 otherwise
size	Natural logarithm of the firm's total assets
lev(%)	Debt scaled by total assets
ppe(%)	Property, plant, and equipment divided by total assets
inv(%)	Ending inventory scaled by total assets
nol	Indicator variable equal to 1 if a tax loss is carried forward and 0 otherwise
dsale(%)	Changes in sales scaled by lagged sales
absda	Absolute value of discretionary accruals, where discretionary accruals are computed using the modified Jones model including lagged ROA as an additional regressor
intan(%)	Intangible assets scaled by total assets

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