Aggressive tax planning and stock price synchronicity: evidence from China

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Abstract

Purpose – The purpose of this paper is to investigate the association between aggressive tax planning and stock price synchronicity.

Design/methodology/approach – Employing the special institutional background of China, this study constructs tax aggressiveness and stock price synchronicity measures for a large sample of Chinese stocks spanning the period 2003–2015. The authors employ OLS regression as the baseline methodology, and a fixed effect model, the Fama–Macbeth method and GMM as sensitivity checks. Matched samples and difference-in-difference analyses are used to control for endogeneity.

Findings – The authors find a significant and positive association between aggressive tax planning and stock price synchronicity. Because material information about risky tax transactions tends to be hidden in various tax accruals accounts, aggressive tax strategies make financial statements less transparent, thereby, increasing information asymmetry and decreasing stock price informativeness. The authors also find that the firms engaging in aggressive tax planning exhibit relatively high corporate opacity. In addition, the authors find that improvements in the tax enforcement regime, ownership status and high-quality auditors all constrain the adverse effects of tax aggressiveness.

Practical implications – This study has important practical implications for China's regulators, who are striving to reduce the tax burden of enterprises. It also helps investors to consider investment decisions more appropriately from a taxation perspective.

Originality/value – First, this paper contributes to the stock price efficiency literature by identifying the effect of a hitherto unexamined factor, namely, firm-level aggressive tax planning, on the efficiency of stock prices. Second, this study provides further empirical evidence to support the agency view of tax aggressiveness, and the informational interpretation of stock price synchronicity. Third, this study helps us better understand the effects of firm-level tax policy on firm-specific information capitalization in an environment where overall country-level investor protection is relatively weak.

Keywords China, Stock price synchronicity, Aggressive tax planning, Corporate opacity

Paper type Research paper

1. Introduction

This paper investigates how aggressive tax planning affects the ability of stock prices to incorporate and reflect information in China. Hanlon and Heitzman (2010) define aggressive tax planning as the reduction of explicit taxes. Traditional theory views taxes as a cost to the firm and shareholders. Thus, transferring wealth from governments to shareholders through aggressive tax planning is viewed as a value-maximizing strategy (Phillips, 2003).

However, aggressive tax planning also generates an information transparency problem. The agency theory argument suggests that tax aggressiveness can facilitate managerial opportunism, such as earnings manipulation and resource diversion (Desai and Dharmapala, 2009). Balakrishnan *et al.* (2018) argue that, although tax planning provides expected tax savings, it can simultaneously increase the complexity of the organization. To the extent that this greater complexity is not adequately communicated to outside parties,

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information transparency concerns arise. We consider synchronous stock price movement stemming from tax aggressiveness as one such information transparency problem.

A substantial body of empirical literature has investigated the determinants of stock price synchronicity, predominantly from an "information transparency" perspective. Roll (1988) finds that a large proportion of stock return variation is unexplained by changes in market-wide factors, or by the announcements of value-relevant public information. As more firm-specific private information is incorporated into stock prices, the latter become less synchronous and more informative. Morck *et al.* (2000) find that stock price synchronicity is pronounced in emerging markets, owing to their relatively strong impediments to informed trading. The literature on price synchronicity, thus, finds that greater transparency and more complete revelation of firm-specific information reduces stock price synchronicity (e.g. Li *et al.*, 2004; Fernandes and Ferreira, 2008; Gul *et al.*, 2010; Kim and Shi, 2012; Hao *et al.*, 2018).

Aggressive tax planning facilitates managerial rent extraction through opaque reporting. Although many tax accruals facilitate earnings management, managers can use valuation allowances (Frank *et al.*, 2009), tax contingency reserves (Gupta *et al.*, 2016), estimates of accrued taxes (Dhaliwal *et al.*, 2004) and the designation of permanently reinvested earnings (Krull, 2004) to achieve earnings targets. Because any material information about risky tax transactions tends to be hidden in these accounts and disclosures, aggressive tax planning makes financial statements less transparent to investors and analysts, increases information asymmetry between insiders and outsiders, and decreases capital pricing efficiency.

We are motivated to study the impact of aggressive tax planning in Chinese firms, because of the uniqueness of its institutional environment. First, prior to 1979, there was no corporate income tax in China. Since the beginning of 1979, and continuing into the 1980s, the Chinese government introduced a number of enterprise taxation reforms, e.g. an income tax rate of 55 percent (35 percent) for large, state-owned enterprises (SOEs) (private firms). In 1994, China enacted the Corporate Income Tax Code, which stipulated that all domestic firms, independent of their ownership type, should pay 33 percent corporate income tax, excepting small firms with taxable income of less than 30,000 RMB, which pay 18 percent income tax. Cai and Liu (2009) argue that, although tax revenue collection has shown impressive growth since the 1994 taxation reform, both the enforcement and the collection of corporate income tax are still considered to be rather weak, engendering tax avoidance on a massive scale. In response to this, the State Administration of Taxation, China's highest tax authority, issued the Administrative Measures for the General Anti-Avoidance Rules, which went into effect on February 1, 2015. Furthermore, the 2008 major tax reform saw a uniform tax rate of 25 percent imposed on both foreign- and domestically funded businesses. This reform provides an external shock for us to test the causal relation between tax aggressiveness and its stock market consequences.

Second, China is the largest emerging economy and, now, the second largest capital market in the world. However, due to the government-dominated institutional environment (Chen *et al.*, 2017), weak corporate governance (Cheung *et al.*, 2008) and relatively poor investor protection (Gul *et al.*, 2010), the empirical findings from western countries cannot be applied easily to the Chinese context. For example, a widely documented institutional feature of China is the dominance of SOEs. On the one hand, the government is likely to charge more taxes to balance the financial budget and make adequate infrastructure investments. On the other hand, the listed SOEs are also likely to save tax and to maximize the wealth of their shareholders. The debate between these two views makes corporate tax planning a paradox for Chinese-listed firms, the incentives and the accompanying consequences for Chinese managers making firm-level tax policy may be different from those prevailing in Western countries. The institutional background in

China allows us to gain more understanding of the interactions between different corporate governance mechanisms.

Third, and in contrast, investors in US firms (e.g.) enjoy significantly better investor protection, because of their much better-developed institutions, which ensure law/regulatory enforcement and adequate compliance via reporting, auditing and disclosure standards. Because of the generally higher level of investor protection available from governance institutions in the USA, these institutions are better able to compensate for aggressive reporting. In other words, China provides an excellent laboratory in which to study the investor protection effect of aggressive tax reporting on stock price informativeness. Finally, Chinese stocks are found to be among the least informative in the world, whereas US stocks are the most informative. Previous research attributes the lack of stock price informativeness in China to poor governance in general, and the lack of investor protection in particular (Morck *et al.*, 2000). However, the specific factors (such as aggressive tax reporting) contributing to weak investor protection in China have not been examined.

By using the market model to estimate the R^2, and four measures of tax aggressiveness, we find that firms that engage in aggressive tax planning exhibit higher stock price synchronicity compared to firms that do not. This finding supports the agency explanation of aggressive tax planning and the information-based explanation of stock price synchronicity. Our results remain robust to alternative measures of stock price synchronicity and alternative estimation methods (i.e. firm fixed effects (FFE) specifications and generalized method of moments (GMM)). We conduct a difference-in-difference analysis in order to establish a causal relation between aggressive tax planning and stock price synchronicity. In 2008, the Chinese government carried out a taxation reform with a favorable impact on some firms, while proving costly for others. We find that firms with an increase (decrease) in tax rate, experience more (less) stock price synchronicity compared to firms with no tax rate change. We further document that the firms engaging in aggressive tax planning exhibit relatively high corporate opacity, as proxied by private corporate news hiding, abnormal discretionary accruals and the probability of informed trading measures. We also find that the positive relation between aggressive tax planning and stock price synchronicity is less pronounced in SOEs than in the non-SOEs. Finally, we find that the improvement of tax enforcement and the high-quality auditing (measured at both the firm- and individual auditor-levels) reduces price synchronicity by constraining aggressive tax strategies.

Our findings contribute to the literature in several ways. First, in recent years, a series of studies have found that the agency problem is also an important determinant or motivation for aggressive tax planning (e.g. Desai and Dharmapala, 2006; Desai *et al.*, 2007). It can be predicted that, in countries or regions with different degrees of capital market development and legal protection levels, the economic consequences of aggressive tax planning might also be different. Therefore, it is particularly necessary to examine the economic consequences of aggressive tax planning under different capital market environments. By taking advantage of the unique Chinese settings (government dominant economics, weak investor protection and taxation reform), this paper contributes to the stock price efficiency literature by identifying the effect of a hitherto unexamined factor, namely firm-level aggressive tax planning, on the efficiency of stock prices. This provides new approaches to understanding disclosure quality from a taxation perspective, and aggregates incremental information on investor protection in emerging markets. Our findings also contribute to the ongoing debate on whether increasing tax aggressiveness provides more or less firm-specific information on the capital market (e.g. Phillips, 2003; Slemrod, 2004; Kim *et al.*, 2011; Armstrong *et al.*, 2012; Balakrishnan *et al.*, 2018; Hoopes *et al.*, 2018).

Second, Kim *et al.* (2011) document that aggressive tax planning provides the pretexts for managers to manipulate earnings, hoard corporate private news and make financial reports complex to outside investors, thus price crash risk increases. We further test this argument by applying a mediation test procedure using three proxies to measure corporate opacity directly. The results indicate a statistically significant partial mediation effect of corporate opacity on stock price synchronicity. In addition, by using the external shock of 2008 taxation reform, we provide evidence on a causal relationship between tax strategies and price synchronicity, which helps us to mitigate the endogeneity problem. Overall, our study provides more direct empirical evidence supporting the agency view of aggressive tax planning and the informational interpretation of stock price synchronicity.

The remainder of the paper is organized as follows. Section 2 provides a literature review and the hypothesis development. Section 3 presents our methodology. Section 4 includes empirical results. Section 5 is robustness tests. Section 6 concludes the paper.

2. Literature and hypothesis

Hanlon and Heitzman (2010) define aggressive tax planning as the reduction of explicit taxes: a continuum of tax planning strategies with legal tax avoidance at one end, and tax noncompliance, evasion, aggressiveness and sheltering at the other. Following Hanlon and Heitzman (2010), we do not distinguish between legal avoidance and illegal evasion, because the legality of a tax avoidance transaction is often determined *ex post* (Cai and Liu, 2009).

They propose two alternative views of aggressive tax planning. Aggressive tax strategies are usually long-term in nature, either permanently avoiding or deferring for several years the payment of taxes. As a result, the cash savings from tax avoidance can be substantial, especially relative to the modest savings that result from deferring payments for only one quarter (Mills *et al.*, 1998). Wilson (2009) estimates an average return of approximately $12 for each $1 in fees paid relating to tax shelters. For the risk-neutral shareholders, aggressive tax strategies, therefore, are value-maximizing activities that transfer wealth from the state to shareholders.

The alternative perspective highlights the opportunistic nature of aggressive tax strategies, from the agency theory perspective. Although aggressive tax planning provides expected tax savings, it can simultaneously increase both the opportunity for rent extraction by managers, and organizational complexity. Complex aggressive tax planning can provide management with the tools for concealing rent extraction and other resource-diverting activities (e.g. Desai and Dharmapala, 2006; Payne and Raiborn, 2018).

With respect to the stock market consequences of aggressive tax planning, Hanlon and Slemrod (2009) document a negative market reaction to tax shelter disclosure, suggesting that investors are concerned about the possibility that tax shelters are intertwined with managerial diversion and performance manipulation. Kim and Li (2014) find that stock price synchronicity is higher for offshore firms (whether having headquarters registered or subsidiaries set up), than for non-offshore firms. Furthermore, as offshore firms become more aggressive in their tax avoidance strategies, their stock prices impound increasingly less firm-specific information relative to common information. Kim *et al.* (2011) provide reliable evidence that aggressive tax planning is associated with firm-specific stock price crash risk positively, arguing that managers shield tax avoidance activities through hoarding bad news. When accumulated bad news is disclosed all at once, the stock price crashes. Kubata *et al.* (2013) use the earnings response coefficient (ERC) as a proxy for financial report informativeness and find a negative relationship between ERC and tax aggressiveness.

Our study extends the stream of research that examines the stock market consequences, proxied by stock price synchronicity, of aggressive tax planning. Stock price synchronicity refers to the synchronous movement of firm-specific stock price with the entire market (the so-called high R^2). A low R^2 means that more of the variation in stock i's price is firm-specific and asynchronous with the overall market. Thus, a low R^2 is arguably optimal, in that firm-specific variation is diversifiable.

Cross-country determinant studies have identified that low R^2 is generally found in those countries having an advanced economic development stage (developed vs emerging markets), stronger public investor property rights (Morck *et al.*, 2000), greater capital market openness, more efficient legal systems and less corrupt economies, lower levels of inflation, smaller geographical size, better corporate governance mechanisms (Li *et al.*, 2004; Khandaker and Heaney, 2008) and individualistic cultural values (Nguyen and Truong, 2013). It is also reported that an improvement in a single country's institutional development over time is associated with a reduced R^2 (Hasan *et al.*, 2014).

At firm-level, the characteristics related to a low R^2 include high block ownership (Brockman and Yan, 2009), low level of government holding, greater foreign ownership and high audit quality (Gul *et al.*, 2010), openness to the market for corporate control (Ferreira and Laux, 2007), fewer interlocking directors on the board (Khanna and Thomas, 2009) and cross-listing status (Fernandes and Ferreira, 2008). Hutton *et al.* (2009) find that opacity, as proxied by earnings manipulation, is associated with a higher R^2, indicating less revelation of firm-specific information. Lin *et al.* (2015) report that the high R^2 of Chinese-listed companies is explained by firms' hiding activities, possibly induced by poor quality government. Hiding activities are measured as the difference between a firm's within-industry ranking of total factor productivity and return on assets.

We posit that aggressive tax planning affects the quality of financial reporting, say through the influence of tax planning on the accrual process. Kim *et al.* (2011) argue that the differing treatments of tax planning transactions under tax and financial reporting, combined with the complexity and obfuscation of those transactions, allow managers to hide corporate private news from outside investors under the pretense of minimizing corporate tax obligations. Balakrishnan *et al.* (2018) argue that, although tax planning provides expected tax savings, it can simultaneously increase the complexity of the organization. Organizational complexity can, in turn, hinder efforts by investors to understand the firm's operations. And, to the extent that this greater complexity cannot be adequately communicated to outside parties, such as equity investors, creditors and analysts, transparency problems can arise.

There are many tax planning opportunities requiring the bifurcation of legal structures into separate business activities (e.g. income that qualifies for treaty-based withholding taxes, activities qualifying for a domestic manufacturers' deduction). We argue that these circuitous flows and separation of business activities make it more difficult for outsiders to interpret the source and persistence of the firm's earnings and cash flows and, hence, reduce the transparency of the firm's financial and operating environment, thus, increasing the R^2[1]. Based on the preceding discussion, we develop the following hypothesis:

H1. Ceteris paribus, firms that engages in more aggressive tax planning exhibit higher stock price synchronicity, i.e. higher R^2.

Our story is built on the speculation that aggressive tax planning provides the pretext for managers to manipulate earnings, hoard private corporate information and make the financial report complex to outside investors, thus, increasing information asymmetry and corporate opacity. As less firm-specific information is disclosed, the stock price of the tax avoidance firms moves synchronously with the market. Hutton *et al.* (2009) examine the direct effect of opaque corporate information disclosure on the R^2. Using earnings management as a measure of opacity, they find that opacity is associated with higher R^2, indicating less revelation of firm-specific information. Since complex tax strategies allow managers to conceal rent-extraction activities, we envision a relationship among tax planning, financial reporting opacity and R^2. More formally, we illustrate our hypothesis for the mediation effect of corporate opacity as the following:

H2. The positive association between aggressive tax planning and high stock price synchronicity is mediated by financial reporting opacity.

Unlike governments in many mature markets, the Chinese government still has absolute power over the allocation of massive state resources (e.g. licenses and permits, initial and subsequent public offerings, bank loans, subsidies and government contracts) and effective control of large-scale SOEs, which continue to dominate key sectors of the economy. On one hand, since SOEs possess substantial resources and receive policy subsidies (Li and Myers, 2006), they are required to contribute, through increased tax payments, to the support of government finance and infrastructure investment. This requirement would be expected to weaken their motivation for avoiding tax. Thus, the positive association between aggressive tax planning and stock price synchronicity is likely to be less pronounced for SOEs than for non-SOEs. On the other hand, the SOEs are listed companies and, hence, the conservation of cash through tax avoidance would help maximize shareholders' wealth and strengthen operating performance. Consequently, the incentives for avoiding tax might be equally as appealing for SOEs. Given the aforementioned competing arguments, we develop the following non-directional hypothesis:

H3. The positive association between aggressive tax planning and high stock price synchronicity varies for SOE vs non-SOE firms.

When determining aggressive tax strategies, decision makers trade off the benefits and costs of such strategies. The most obvious benefit of tax aggressiveness is greater tax savings. On the other hand, the most important cost associated with aggressive tax strategies is the possibility of being detected and sanctioned by the tax authorities (Wilson, 2009). Detection of opportunistic tax strategies requires resources, and the detection rate is likely to increase with an increase in available resources for enforcing tax regulations (Allingham and Sandmo, 1972). Prior studies document that there are significant time-series and cross-sectional differences in the tax enforcement levels among different districts (Qian and Roland, 1998; Zeng and Zhang, 2009; Fan and Tian, 2013), a factor that provides the opportunity to study the economic consequences of tax enforcement. From the perspective of corporate governance, previous literature suggests that tax enforcement results in lower tax aggressiveness (Hoopes *et al.*, 2012), deters tax-motivated income shifting (Beuselinck *et al.*, 2015), reduces rent diversion by managers (Desai *et al.*, 2007), improves the quality of financial reporting (Hanlon *et al.*, 2014) and lowers the cost of debt and implied equity capital (Kim and Zhang, 2016). Other studies based on Chinese-listed companies, also verify the existence of the above governance role of tax enforcement (Zeng and Zhang, 2009; Ye and Liu, 2011; Jiang, 2013). For example, Ye and Liu (2011) use Chinese-listed companies as a research sample and find that increasing the tax enforcement level makes it difficult for firms to manage earnings, which leads to a more transparent environment.

To summarize, tax enforcement can play the role of an external governance mechanism that will weaken the functional effect of aggressive tax planning on hiding insiders' rent extraction and hoarding bad news activities. In addition, the information asymmetry and agency costs caused by aggressive tax planning can also be weakened by increasing the tax enforcement level, thus, decreasing stock price synchronicity. We, therefore, hypothesize the following:

H4. An improvement in the tax enforcement regime reduces aggressive tax planning and, thus, stock price synchronicity.

Prior research suggests that high-quality auditing constrains aggressive tax planning (e.g. Kanagaretnam *et al.*, 2016; Richardson *et al.*, 2013). Auditors evaluate the validity of accrued taxes payable as well as tax contingent liabilities on the balance sheet, income tax expenses on the income statement, and the related note disclosures, in order to provide adequate assurance of the appropriateness of these items and disclosures to the investing public (Barrett, 2004). Although many accruals facilitate earnings management, managers can use valuation allowances (Frank and Rego, 2006), tax contingency reserves (Gupta *et al.*, 2016) and estimates of accrued taxes (Dhaliwal *et al.*, 2004) to achieve earnings targets. Because any material information about risky tax transactions tends to be hidden in these accounts and disclosures, auditors also have to assess whether their clients engage in potentially abusive tax transactions. High-quality auditing ensures this happens, because the ongoing interaction between the audit engagement team and tax personnel improve the auditor's understanding of a client's tax decisions, thereby, improving the quality of the tax estimates (Choudhary *et al.*, 2017). We, therefore, hypothesize the following:

H5. High-quality auditing constrains aggressive tax strategies and reduces stock price synchronicity.

3. Methodology

3.1 Measures of stock price synchronicity

To measure our dependent variable, stock price synchronicity, we first estimate the market model as follows:

$$r_{j,t} = \alpha + \beta_{1,j} \times r_{m,t-1} + \beta_{2,j} \times r_{i,t-1} + \beta_{3,j} \times r_{m,t} + \beta_{4,j} \times r_{i,t} + \beta_{5,j} \times r_{m,t+1} + \beta_{6,j} \times r_{i,t+1} + \varepsilon_{j,t}, \quad (1)$$

where $r_{j,t}$ is the return on stock j in week t, $r_{m,t}$ is the value-weighted A-share market return in week t, and $r_{i,t}$ is the value-weighted industry return for industry i in week t. The value-weighted industry return is created using all firms within the same industry, with firm j's weekly return omitted. In Equation (1), we also include the value of industry and market returns from t–2 to t+2 to alleviate concerns over potential non-synchronous trading bias. We require that all the return data be available for at least 180 trading days in each fiscal year. We define stock price synchronicity as the ratio of common return variation to total return variation, which is equivalent to the R^2 of the market model. To circumvent the bounded nature of R^2 within [0, 1], we use a logistic transformation of R^2:

$$SYNCH_j = \log\left[R_j^2 / \left(1 - R_j^2\right)\right]. \quad (2)$$

3.2 Measures of tax aggressiveness

We use four aggressive tax planning measures (Hanlon and Heitzman, 2010). These are the effective tax rate (*ETR*), Long-term effective tax rate (*LETR*), book-tax difference (*BTD*) and *DD_BTD* (Desai and Dharmapala, 2006).

ETR is computed as in the following equation: the difference of total income tax expense minus deferred income tax expense divided by total pre-tax accounting income:

$$ETR = \frac{Total\ income\ tax\ \text{expense}}{Total\ pre\ tax\ accounting\ income} - \frac{Deferred\ income\ tax\ \text{expense}}{Total\ pre\ tax\ accounting\ income}. \quad (3)$$

LRETR is computed as in the following equation: the sum of income tax paid over the previous three years divided by the sum of a firm's pre-tax income less special items:

$$LETR = \frac{\sum_{k=t-3}^{t} Cash\ tax\ paid_{i,k}}{\sum_{k=t-3}^{t} \left(Total\ pre\ tax\ accounting\ income_{i,k} - Special\ items_{i,k}\right)}. \quad (4)$$

BTD is computed as follows:

$$BTD = \frac{Total\ pre\ tax\ accounting\ income - (Total\ tax\ \text{expense} - Deferred\ income\ tax\ \text{expense})/(Tax\ rate)}{Total\ pre\ tax\ accounting\ income}. \quad (5)$$

The Desai and Dharmapala (2006) residual *BTD* equals the residual from the following FFE regression:

$$DD\_BTD_{i,t} = \gamma_1 \times TA_{i,t} + \mu_i + \varepsilon_{i,t}, \tag{6}$$

where *BTD* is the total book-tax difference, and *TA* is total accruals calculated as net income minus operating cash flows divided by lagged total asset.

3.3 Regression model

We construct our empirical model as follows:

$$\begin{aligned} SYNCH_{i,t+1} = {} & \alpha_0 + \alpha_1 \times TAX\_AGGR_{i,t} + \alpha_2 \times SIZE_{i,t} + \alpha_3 \times TURNOVER_{i,t} + \alpha_4 \\ & \times STDROA_{i,t} + \alpha_5 \times VOL_{i,t} + \alpha_6 \times LEV_{i,t} + \alpha_7 \times MB_{i,t} + \alpha_8 \\ & \times ROA_{i,t} + \alpha_9 \times TOP1_{i,t} + \alpha_{10} \times INSHOLD_{i,t} + \alpha_{11} \\ & \times GOVHOLD_{i,t} + \alpha_{12} \times INDNUM_{i,t} + \alpha_{13} \times INDSIZE_{i,t} + \alpha_{14} \\ & \times BIG4_{i,t} + \Sigma INDUSTRY + \Sigma YEAR + \varepsilon_{i,t}, \end{aligned} \tag{7}$$

where $SYNCH_{i,t+1}$ is stock price synchronicity in year t+1 and $TAX\_AGGR_{i,t}$ is the four tax aggressiveness measures explained in Section 3.2 above. We multiply *ETR* and *LETR* by −1 so that tax avoidance increases with an increase in *ETR* and *LETR*[2]. Following previous related research (e.g. Piotroski and Roulstone, 2004; Chan and Hameed, 2006; Ferreira and Laux, 2007; Hutton *et al.*, 2009; Gul *et al.*, 2010; Balakrishnan *et al.*, 2018; Box, 2018), we include a set of control variables: firm size ($SIZE_{i,t}$), the change in average monthly share turnover ($DTURN_{i,t}$), earnings volatility ($STDROA_{i,t}$), annual trading volume turnover ($VOL_{i,t}$), leverage ($LEV_{i,t}$), market-to-book ratio ($MB_{i,t}$), return on asset ($ROA_{i,t}$), the percentage of shares held by the largest shareholder ($TOP1_{i,t}$), institutional ownership ($INSHOLD_{i,t}$)[3], government ownership ($GOVHOLD_{i,t}$), the natural log of the number of firms in the industry to which a firm belongs ($INDNUM_{i,t}$), industry size ($INDSIZE_{i,t}$), and audit quality ($BIG4_{i,t}$). Finally, we controlled for the year ($\Sigma YEAR$) and industry fixed effects ($\Sigma INDUSTRY$).

4. Results

4.1 Sample selection and descriptive statistics

The data are obtained from the China Stock Market and Accounting Database and the WIND database. The initial sample contains 23,584 firm-year observations, excluding financial industry firms and "special treatment" (ST, ST*) stocks, during the period of 2003–2015. We began with 2003, because the data coverage of many of the corporate governance variables pre-2003 was rather small. Following prior studies (e.g. Gupta and Newberry, 1997; Wu *et al.*, 2012), we exclude 2,102 observations with negative pre-tax accounting income; 2,984 observations with negative *ETR* values and/or *ETR* > 1.00; 2,157 observations with less than 180 trading days per year, and 2,656 observations with missing values for the control variables, resulting in a final sample of 13,685 firm-year observations. We summarize the sample selection process in Panel A in Table I.

Panel B reports the time-series distribution of firm-year observations and the corresponding market model adjusted R^2. The adjusted R^2 from the market model estimates range from a high of 62.8 percent in 2008 to a low of 24.9 percent in 2014. No particular time-trend is observed based on the yearly R^2 values. Panel C reports the industry distribution statistics. Firm-year observations come from a wide variety of industries with the manufacturing industry (Industry Code C) commanding the largest industry representation in our sample (61.147 percent of the observations)[4].

Panel A: sample selection procedure

Explanation	Observations
Total number of firms excludes ST, ST* and Financial industry from 2003~2015	23,584
Less: ETRs with negative values or values larger than one	−2,984
Less: Pre-tax negative accounting income	−2,102
Less: firm-year observations with less than 180 trading days per year	−2,157
Less: missing control variables	−2,656
Final sample	13,685

Panel B: annual number of observations and annual average $SYNCH_{t+1}$

Year	Observations	% distribution	Average R^2
2003	675	4.932	0.468
2004	817	5.970	0.468
2005	795	5.809	0.464
2006	834	6.094	0.451
2007	803	5.868	0.416
2008	863	6.306	0.628
2009	1,028	7.512	0.476
2010	1,185	8.659	0.388
2011	1,388	10.142	0.454
2012	1,459	10.661	0.449
2013	1,470	10.742	0.342
2014	1,206	8.813	0.249
2015	1,162	8.491	0.541

Panel C: industry distribution of the sample observations

Code	Industry name	Observations	%	Average R^2
A	Agriculture	212	1.549	0.423
B	Mining	323	2.360	0.513
C	Manufacturing	8,368	61.147	0.428
D	Electricity, gas and water	623	4.552	0.461
E	Building and construction	368	2.689	0.477
F	Transportation and logistics	984	7.190	0.433
G	Information technology	626	4.574	0.479
H	Commerce	62	0.453	0.449
I	Information, software	492	3.595	0.388
K	Service	812	5.934	0.452
L	Culture and media	162	1.184	0.423
M	Conglomerates	36	0.263	0.429
N	Water conservancy, environment and public facilities	121	0.884	0.457
O	Residential services, repairs and other services	47	0.343	0.481
R	Culture, sports and entertainment	76	0.555	0.383
S	Comprehensive	373	2.726	0.490

Notes: This Table reports the sample selection and distribution. Panel A shows the steps in sample selection. Panel B shows the time-series distribution. Panel C shows the industry distribution. The Industry category is based on "guidance on the industry category of listed companies" issued by the China Securities Regulatory Commission (CSRC). Consistent with most-related studies about China, for the manufacturing industry (C), we take the two-digit code of the CSRC industry classification, for other industries, we take the one-digit code

Table I.
Sample selection and distribution

Table II, Panel A presents the descriptive statistics for the sample of multivariate regression analysis. We winsorize all the continuous variables at 1 percent (99 percent) to eliminate the confounding effects of the outliers. For the dependent variable (R^2 and $SYNCH_{t+1}$), the mean and median of R^2 are 0.437 and 0.443, with a standard deviation of 0.165; The mean and median of $SYNCH_{t+1}$ are −0.293 and −0.208, with a standard deviation of 0.787. These statistics are comparable to the reported mean R^2 of 0.453 for China in the sample of Morck *et al.* (2000), and are more than double the reported mean R^2 of 0.193 for the US sample of Piotroski and Roulstone (2004). This suggests that, compared with US firms, stock prices of

Panel A: descriptive statistics

Variables	Mean	SD	P25	Median	P75
R^2_{t+1}	0.437	0.165	0.321	0.443	0.559
$SYNCH_{t+1}$	−0.293	0.787	−0.752	−0.208	0.256
ETR	0.230	0.148	0.140	0.199	0.291
LETR	0.225	0.112	0.150	0.205	0.287
BTD	0.059	0.056	0.021	0.045	0.080
DD_BTD	0.086	0.035	0.067	0.083	0.101
SIZE	21.936	1.217	21.082	21.771	22.623
DTURN	−0.026	0.380	−0.174	0.009	0.176
STDROA	0.022	0.036	0.006	0.012	0.023
VOL	5.119	3.606	2.393	4.165	6.859
LEV	0.470	0.197	0.325	0.477	0.619
MB	3.253	2.694	1.621	2.464	3.935
ROA	0.049	0.040	0.020	0.040	0.067
ACCM	0.179	0.136	0.084	0.143	0.234
HIDE	0.296	0.213	0.120	0.254	0.439
PIN	0.197	0.132	0.074	0.168	0.298
TOP1	0.380	0.158	0.252	0.363	0.500
INSHOLD	0.340	0.251	0.105	0.321	0.543
GOVHOLD	0.149	0.226	0.000	0.000	0.299
MANHOLD	0.036	0.111	0.000	0.000	0.000
INDNUM	5.291	1.138	4.394	5.509	6.163
INDSIZE	27.828	1.368	27.017	27.936	28.837
BIG4	0.067	0.251	0.000	0.000	0.000

Panel B: correlation matrix

	1	2	3	4	5	6	7	8	9	10
1. R^2_{t+1}	–									
2. $SYNCH_{t+1}$	0.21	–								
3. ETR*	0.07	0.06	–							
4. LETR*	0.07	0.05	0.77	–						
5. BTD	0.15	0.05	0.28	0.24	–					
6. DD_BTD	0.05	0.01	0.06	0.07	0.20	–				
7. SIZE	0.11	0.15	0.07	0.07	0.02	−0.01	–			
8. DTURN	−0.08	0.05	0.06	0.07	−0.07	−0.10	0.06	–		
9. STDROA	−0.06	−0.04	−0.07	−0.06	0.24	0.10	−0.14	0.00	–	
10. VOL	−0.04	0.09	0.00	0.03	−0.05	0.01	−0.21	0.34	0.05	–
11. LEV	0.05	0.07	0.20	0.25	−0.28	−0.02	0.38	0.09	0.05	−0.05
12. MB	−0.27	−0.06	−0.07	−0.07	0.29	0.08	−0.26	0.08	0.22	0.27
13. ROA	−0.13	−0.05	−0.29	−0.26	0.89	0.15	−0.03	−0.08	0.18	−0.06
14. TOP1	0.04	0.03	−0.01	0.00	0.09	−0.02	0.22	−0.06	−0.04	−0.15
15. INSHOLD	−0.13	−0.10	−0.05	−0.05	0.21	0.02	0.42	−0.08	−0.06	−0.29
16. GOVHOLD	0.11	0.13	0.03	0.04	0.01	−0.10	0.02	0.06	−0.02	−0.02
17. MANHOLD	−0.13	−0.15	−0.08	−0.12	0.07	0.09	−0.12	−0.15	−0.03	0.14
18. INDNUM	−0.10	−0.10	−0.11	−0.15	0.02	0.08	−0.02	−0.04	0.01	0.06
19. INDSIZE	−0.08	−0.07	−0.06	−0.09	0.03	0.09	0.24	−0.04	0.00	0.06
20. BIG4	0.04	0.04	−0.01	−0.02	0.04	−0.05	0.37	0.01	−0.03	−0.13

	11	12	13	14	15	16	17	18	19	20
1. R^2_{t+1}										
2. $SYNCH_{t+1}$										
3. ETR*										
4. LETR*										
5. BTD										
6. DD_BTD										

Table II.
Descriptive statistics and correlation matrix

(*continued*)

Table II.

7. *SIZE*										
8. *DTURN*										
9. *STDROA*										
10. *VOL*										
11. *LEV*	–									
12. *MB*	*−0.04*	–								
13. *ROA*	*−0.38*	*0.28*	–							
14. *TOP*1	0.01	*−0.07*	*0.08*	–						
15. *INSHOLD*	*0.07*	*0.13*	*0.22*	*0.16*	–					
16. *GOVHOLD*	*0.04*	*−0.10*	−0.02	*0.39*	*−0.31*	–				
17. *MANHOLD*	*−0.24*	*0.05*	*0.09*	*−0.09*	*−0.15*	*−0.21*	–			
18. *INDNUM*	*−0.10*	*0.03*	*0.02*	*−0.09*	*0.07*	*−0.23*	*0.19*	–		
19. *INDSIZE*	0.00	*0.02*	*0.02*	*−0.02*	*0.27*	*−0.29*	*0.19*	*0.79*	–	
20. *BIG*4	*0.04*	*−0.11*	*0.06*	*0.13*	*0.14*	*0.06*	*−0.07*	*−0.04*	*0.03*	–

Notes: This table presents the summary statistics for the variables used in our regression model. The data were obtained from the WIND and CSMAR databases for the period 2003–2015. The final samples consisted of 13,685 observations. We winsorize all the continuous variables at 1 percent (99 percent) to eliminate outlier effects on the regression results. Variable definitions are in Table AI; This panel provides Pearson correlation coefficients for the key variables used in the regression analyses. Italic coefficients are significant at 5 percent or better

Chinese-listed firms tend to co-move, to a greater (less) extent, with market-wide and/or industry-wide information (firm-specific information).

The mean and median of *ETR* are 0.230 and 0.199, with a standard deviation of 0.148; the mean and median of *LETR* are 0.225 and 0.205, with a standard deviation of 0.112 (recall that we multiplied these measures by −1 for regression purposes, but report the untransformed values in the descriptive statistic section); the mean and median of *BTD* are 0.059 and 0.045, with a standard deviation of 0.056; and the mean and median of *DD_BTD* are 0.086 and 0.083, with a standard deviation of 0.035.

Panel B presents the Pearson correlations between our major variables. Three of the four measures of aggressive tax planning (*ETR**, *LETR**, and *BTD*) are correlated significantly and positively with $SYNCH_{t+1}$ (at $p < 0.05$ and better). $SYNCH_{t+1}$ is also correlated positively with firm size ($p < 0.01$), turnover, volatility, leverage and some corporate governance measures.

4.2 Baseline regression

We present our baseline regression results in Table III. We predict a positive association between aggressive tax strategies and stock price synchronicity, which will support *H1*. To alleviate concern about potential cross-sectional and time-series dependence in the data, we report *t*-values on an adjusted basis, using robust standard errors corrected for double (firm and year) clustering (Gow *et al.*, 2010; Petersen, 2009).

Column (1) reveals that the coefficient on *ETR** is positive and marginally significant ($p < 0.10$). The reported coefficient of 0.082 suggests that a one standard deviation increase in *ETR** is associated with a 1.22 percent increase in $SYNCH_{t+1}$ (0.0824×0.148). The coefficients on the other three tax proxies are also positive and statistically significant (coefficients of 0.16, 1.12 and 0.48 for the *LETR**, *BTD* and *DD_BTD* measures, respectively, all significant at $p < 0.01$). We, therefore, find support for *H1*. The coefficients of the control variables are generally consistent with the findings of prior studies. Consistent with Gul *et al.* (2010), we find that the coefficients on *SIZE*, *INDSIZE* are significantly positive. We also find that *MB*, *LEV*, *VOL*, *ROA*, *INSHOLD*, *GOVHOLD*, *MANHOLD* and *BIG*4 are all negatively related to stock price synchronicity.

Table III.
Baseline regression result

DV	Column (1)	Column (2)	Column (3)	Column (4)
		$SYNCH_{t+1}$		
*ETR**	0.0821* (1.94)	–	–	–
*LETR**	–	0.159*** (2.64)	–	–
BTD	–	–	1.120*** (5.50)	–
DD_BTD	–	–	–	0.477*** (2.79)
SIZE	0.144*** (15.35)	0.143*** (15.32)	0.147*** (15.63)	0.143*** (15.26)
DTURN	0.0123 (0.67)	0.0127 (0.69)	0.0103 (0.56)	0.0143 (0.77)
STDROA	0.137 (0.77)	0.125 (0.70)	0.271 (1.47)	0.112 (0.63)
VOL	−0.0507** (−2.01)	−0.0511** (−2.02)	−0.0524** (−2.07)	−0.0501** (−1.99)
LEV	−0.294*** (−6.75)	−0.286*** (−6.55)	−0.287*** (−6.56)	−0.296*** (−6.80)
MB	−0.0254*** (−8.02)	−0.0254*** (−8.06)	−0.0243*** (−7.76)	−0.0256*** (−8.08)
ROA	−0.802*** (−3.88)	−0.811*** (−3.98)	−0.689** (−2.18)	−0.792*** (−3.93)
TOP1	0.0243 (0.52)	0.0254 (0.54)	0.0233 (0.50)	0.0226 (0.48)
INSHOLD	−0.350*** (−9.08)	−0.351*** (−9.12)	−0.349*** (−9.04)	−0.344*** (−8.94)
GOVHOLD	−0.156*** (−4.52)	−0.155*** (−4.50)	−0.147*** (−4.28)	−0.152*** (−4.42)
MANHOLD	−0.509*** (−8.13)	−0.513*** (−8.19)	−0.504*** (−8.07)	−0.511*** (−8.17)
INDNUM	−0.0205 (−0.45)	−0.0217 (−0.48)	−0.0167 (−0.37)	−0.0177 (−0.39)
INDSIZE	0.0436* (1.69)	0.0448* (1.73)	0.0416 (1.61)	0.0412 (1.59)
BIG4	−0.106*** (−3.45)	−0.106*** (−3.46)	−0.112*** (−3.64)	−0.102*** (−3.33)
INDUSRY& YEAR	Yes	Yes	Yes	Yes
INTERCEPT	−4.028*** (−7.02)	−4.116*** (−7.12)	−5.135*** (−8.44)	−3.932*** (−6.87)
Observation	13,685	13,685	13,685	13,685
F-statistics	186.35***	186.56***	186.27***	187.49***
Adj. R^2	0.3924	0.3926	0.3934	0.3926

Notes: This table presents the main result of the relation between corporate aggressive tax strategies and stock price synchronicity. The dependent variable is $SYNCH_{t+1}$. The independent variables are the four proxies of aggressive tax planning: *ETR**, *LETR**, *BTD*, *DD_BTD*, respectively. We use the OLS model to estimate the regression. To alleviate the concern about potential cross-sectional and time-series dependence in the data, we report *t*-values on an adjusted basis, using robust standard errors corrected for double (firm and year) clustering (Gow *et al.*, 2010; Petersen, 2009). Variable definitions are in Table AI. *,**,***Significant at the 10, 5 and 1 percent levels, respectively (two-sides)

4.3 The mediation test: Does aggressive tax planning induce corporate opacity?

The story of this paper is consistent with the following view: aggressive tax planning provides the pretexts for managers to manipulate earnings, hoard corporate private news and make financial reports complex to outside investors, all of which increase information asymmetry and corporate opacity. As a result, less firm-specific information is incorporated into stock prices, thus, price synchronicity is increased. We test this prediction by applying a mediation test procedure and using three proxies to measure corporate opacity, namely, three years' accumulated abnormal accruals (*ACCM*) (Hutton *et al.*, 2009), degree of private corporate news hiding (*HIDE*) (Lin *et al.*, 2015) and, finally, the probability of informed trading (*PIN*) (Easley and O'Hara, 2004).

We follow the mediation test approach of Baron and Kenny (1986) who propose that a mediation effect exists when the following three conditions are fulfilled. Path A: variations in the levels of the independent variable (i.e. *ETR**, *LETR**, *BTD* and *DD_BTD*) account significantly for variations in the proposed mediators (i.e. *ACCM*, *HIDE*, or *PIN*). Path B: variations in the proposed mediators account significantly for variations in the dependent variable ($SYNCH_{t+1}$ in our study). Path C: the significant relationship between aggressive tax strategies (i.e. *ETR**, *LETR**, *BTD* and *DD_BTD*) and $SYNCH_{t+1}$ (the baseline regression) becomes insignificant once Paths A and B are controlled (full mediation); or the significant relation between *TAX_AGGR* and $SYNCH_{t+1}$ in the baseline model is reduced once Paths A and B are controlled (partial mediation).

Executing this test requires three separate regressions in addition to the baseline regression (Equation (7) above):

$$MV_{i,t} = \alpha_0 + \alpha_1 \times TAX\_AGGR_{i,t} + \sum CONTROLS + \sum INDUSTRY + \sum YEAR + \varepsilon_{i,t}, \quad 8(a)$$

$$SYNCH_{i,t+1} = \alpha_0 + \alpha_1 \times MV_{i,t} + \sum CONTROLS + \sum INDUSTRY + \sum YEAR + \varepsilon_{i,t}, \quad 8(b)$$

$$SYNCH_{i,t+1} = \alpha_0 + \alpha_1 \times TAX\_AGGR_{i,t} + \alpha_2 \times MV_{i,t} + \sum CONTROLS + \sum INDUSTRY + \sum YEAR + \varepsilon_{i,t}, \quad 8(c)$$

where *MV* are the proposed mediators, i.e. $|ACCM|$, *HIDE* or *PIN*. A detailed explanation of the estimation procedures for these variables is reported in Table AI. Results are presented in Table IV. Panel A, Model 2, reveals a positive and significant association between the $|ACCM|$ and $SYNCH_{t+1}$, suggesting that opaque financial information increases stock price synchronicity (e.g. coefficient on $|ACCM|$ is 0.2042 ($p < 0.01$)). Importantly, the coefficients on the aggressive tax planning measures remain positive and significant after controlling $|ACCM|$ (coefficients on *ETR**, *LETR**, *BTD*, *DD_BTD* are 0.0834 ($p < 0.05$), 0.159 ($p < 0.01$), 1.2082 ($p < 0.01$) and 0.6162 ($p < 0.01$), respectively). The Sobel *z*-statistics are significant across all the aggressive tax planning measures (significant at $p < 0.05$ and better). Overall, the tabulated results indicate a statistically significant partial mediation effect of *ACCM* on stock price synchronicity.

Panel B, Model 2, reveals a positive and significant association between the *HIDE* and $SYNCH_{t+1}$, suggesting that hoarding bad news increases stock price synchronicity (coefficient on *HIDE* is 0.0318, *t*-statistic 2.09, ($p < 0.05$)). Moreover, the coefficients on the aggressive tax planning measures remain positive and significant after controlling *HIDE* (coefficients on *ETR**, *LETR**, *BTD*, *DD_BTD* are 0.0815 ($p < 0.10$), 0.1414 ($p < 0.05$), 1.1507 ($p < 0.01$), and 0.6817 ($p < 0.01$), respectively). The Sobel *z*-statistics are significant across all the aggressive tax planning measures (significant at $p < 0.01$). The tabulated results indicate a statistically significant partial mediation effect of *HIDE* on stock price synchronicity.

Finally, Panel C provides test results for the mediation effect of *PIN*, which is qualitatively consistent with the other two measures (*ACCM*, *HIDE*) of corporate opacity (coefficient on *ETR**, *LETR**, *BTD*, *DD_BTD* are 0.0801 ($p > 0.10$), 0.1389 ($p < 0.05$), 1.078 ($p < 0.01$), and 0.6542 ($p < 0.01$), respectively). Overall, the results in Table VIII indicate a statistically significant partial mediation effect of corporate opacity on stock price synchronicity.

4.4 SOEs, tax aggressiveness and price synchronicity

To test *H3*, we run Equation (7) for SOEs (if the ultimate controlling owner is the central/local government or a collective). Panel A of Table V reports the univariate test of difference in mean tax aggressiveness measures between the SOEs and the non-SOEs. Across all four proxies, we document that tax aggressiveness is weaker for SOEs than for their non-SOE counterparts (e.g. the mean value of *ETR** is −0.256 (−0.188) for the SOE (non-SOE) groups with the difference being significant at $p < 0.10$).

Table IV.
The mediation effect of corporate opacity on the relationship between aggressive tax planning and synchronicity

	Column (1)	Column (2)	Column (3)	Column (4)	Column (5)	Column (6)	Column (7)	Column (8)
Panel A: |ACCM| as the mediator								
Model (1) (without the mediator)								
DV (1~4): *SYNCH*$_{t+1}$; DV (5~8): |*ACCM*|	*ETR**	*LETR**	*BTD*	*DD_BTD*	|*ACCM*|	|*ACCM*|	|*ACCM*|	|*ACCM*|
TAX_AGGR	0.082* (1.94)	0.159*** (2.64)	1.120*** (5.50)	0.477*** (2.79)	0.0223** (2.36)	0.0210** (2.32)	0.625*** (9.40)	0.637*** (10.13)
OTHER CONTRROLS	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
INDUSRY & YEAR	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observation	13,685	13,685	13,685	13,685	13,685	13,685	13,685	13,685
Adj. R^2	0.3924	0.3926	0.3934	0.3926	0.2498	0.2495	0.2613	0.2704
Model (2) (with the mediator)								
DV (1~5): *SYNCH*$_{t+1}$								
TAX_AGGR	0.0834** (1.97)	0.159*** (2.65)	1.2082*** (5.90)	0.6162*** (3.50)	/	/	/	/
|*ACCM*|	0.2050*** (3.16)	0.2040*** (3.15)	0.2409*** (3.71)	0.2293** (2.48)	0.2042*** (3.15)	/	/	/
OTHER CONTRROLS	Yes	Yes	Yes	Yes	Yes	/	/	/
INDUSRY & YEAR	Yes	Yes	Yes	Yes	Yes	/	/	/
INTERCEPT	13,685	13,685	13,685	13,685	13,685	/	/	/
Adj. R^2	0.3926	0.3928	0.3937	0.3924	0.3924	/	/	/
Sobel *Z*	0.7732**	0.7761***	0.7823***	0.7931**	–	/	/	/
(p-value) of Sobel *Z*	(0.05)	(0.05)	(0.01)	(0.05)		/	/	/
Panel B: HIDE as the mediator								
Model (1) (without the mediator)								
DV (1~4): *SYNCH*$_{t+1}$; DV (5~8): *HIDE*	*ETR**	*LETR**	*BTD*	*DD_BTD*	*HIDE*	*HIDE*	*HIDE*	*HIDE*
TAX_AGGR	0.0775* (1.82)	0.1414** (2.31)	1.1551*** (5.68)	0.6081*** (3.42)	0.113*** (5.66)	0.0829*** (2.65)	0.150 (1.56)	0.201*** (2.73)
OTHER CONTRROLS	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
INDUSRY & YEAR	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observation	13,591	13,591	13,591	13,591	13,591	13,591	13,591	13,591
Adj. R^2	0.3892	0.3894	0.3903	0.3896	0.0433	0.0398	0.0386	0.0392

(continued)

Model (2) (with the mediator)								
DV (1~5): $SYNCH_{t+1}$								
TAX_AGGR	0.0815* (1.91)	0.1414** (2.36)	1.1507*** (5.66)	0.6817*** (3.39)	/	/	/	/
HIDE	0.0356** (2.21)	0.0358** (2.18)	0.0269** (2.01)	0.0292** (2.00)	0.0318** (2.09)	/	/	/
OTHER CONTRROLS	Yes	Yes	Yes	Yes	Yes	/	/	/
INDUSRY & YEAR	Yes	Yes	Yes	Yes	Yes	/	/	/
Observation	13,591	13,591	13,591	13,591	13,591	/	/	/
Adj. R^2	0.3893	0.3894	0.3903	0.3897	0.3891	/	/	/
Sobel *Z*	0.3222***	0.3212***	0.3215***	0.3213***		/	/	/
(*p*-value) of Sobel *Z*	0.01	0.01	0.01	0.01		/	/	/
Panel C: PIN as the mediator								
Model (1) (without the mediator)								
DV (1~4): $SYNCH_{t+1}$; DV (5~8): *PIN*	*ETR**	*LETR**	*BTD*	*DD_BTD*	*PIN**	*PIN**	*PIN**	*PIN**
TAX_AGGR	0.0821* (1.94)	0.159*** (2.64)	1.120*** (5.50)	0.477*** (2.79)	0.0956* (1.68)	0.189** (2.45)	0.927*** (3.19)	0.618*** (2.66)
OTHER CONTRROLS	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
INDUSRY & YEAR	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observation	13,685	13,685	13,685	13,685	13,685	13,685	13,685	13,685
Adj. R^2	0.3924	0.3926	0.3934	0.3926	0.2630	0.2632	0.2633	0.2632
Model (2) (with the mediator)								
DV (1~5): $SYNCH_{t+1}$								
TAX_AGGR	0.0801 (1.61)	0.1389** (2.02)	1.078*** (3.27)	0.6542*** (2.69)	/	/	/	/
*PIN**	0.0476** (2.26)	0.0427*** (2.58)	0.0513** (2.36)	0.04672** (2.24)	0.0518*** (2.79)	/	/	/
OTHER CONTRROLS	Yes	Yes	Yes	Yes	Yes	/	/	/
INDUSRY & YEAR	Yes	Yes	Yes	Yes	Yes	/	/	/
Observation	13,685	13,685	13,685	13,685	13,685	/	/	/
Adj. R^2	0.3954	0.3955	0.3955	0.3956		/	/	/
Sobel *Z*	0.4282***	0.4279**	0.3824	0.3931		/	/	/
(*p*-value) of Sobel *Z*	0.01	0.05	0.12	0.16		/	/	/

Notes: This table presents the mediation effect of corporate opacity on the relationship between aggressive tax planning and stock price synchronicity. The independent variables are the four proxies of aggressive tax planning: *ETR**, *LETR**, *BTD*, *DD_BTD*, respectively. The dependent variables are the three proxies of corporate opacity: |*ACCM*|, *HIDE* and *PIN**. Year and industry fixed effects are included in our models. To alleviate the concern about potential cross-sectional and time-series dependence in the data, we report *t*-values on an adjusted basis, using robust standard errors corrected for double (firm and year) clustering (Gow *et al.*, 2010; Petersen, 2009). Variable definitions are in Table AI. *,**,***Significant at the 10, 5 and 1 percent levels, respectively (two-sides)

Table IV.

Table V.
SOEs vs non-SOEs

Panel A: univariate test of difference in mean tax aggressiveness in SOEs vs non-SOE firms

	ETR*		LETR*		BTD		DD_BTD	
	Column (1) *SOE*	Column (2) *NON-SOE*	Column (3) *SOE*	Column (4) *NON-SOE*	Column (5) *SOE*	Column (6) *NON-SOE*	Column (7) *SOE*	Column (8) *NON-SOE*
Mean	−0.256	−0.188	−0.247	−0.203	0.045	0.063	0.061	0.093
Observation	8,895	4,790	8,895	4,790	8,895	4,790	8,895	4,790
Diff.	0.052*		0.071*		0.006***		0.031**	

Panel B: regression results for SOE and non-SOE firms

	Column (1) *SOE*	Column (2) *NON-SOE*	Column (3) *SOE*	Column (4) *NON-SOE*	Column (5) *SOE*	Column (6) *NON-SOE*	Column (7) *SOE*	Column (8) *NON-SOE*
*ETR**	0.053** (2.03)	0.107* (1.85)	–	–	–	–	–	–
*LETR**	–	–	0.067** (2.35)	0.073*** (2.10)	–	–	–	–
BTD	–	–	–	–	1.007*** (4.37)	1.526** (2.11)	–	–
DD_BTD	–	–	–	–	–	–	0.254** (2.03)	0.365* (1.91)
OTHER CONTRROLS	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
INDUSRY & YEAR	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
INTERCEPT	−6.133*** (−5.13)	−4.156 (−3.27)	−3.973*** (−6.12)	−3.865*** (−5.54)	−4.497*** (−6.31)	−3.525*** (−4.03)	−2.756*** (−3.97)	−1.987*** (−3.11)
Observation	8,895	4,790	8,895	4,790	8,895	4,790	8,895	4,790
F-statistics	98.29***	79.52***	96.34***	82.45***	97.26***	83.23***	99.03***	84.52***
Adj. R^2	0.3459	0.3013	0.3461	0.3023	0.3445	0.3009	0.3451	0.3007
Hausman test	0.057*		0.265		0.006***		0.031**	

Notes: This table presents the association between aggressive tax planning and synchronicity for SOEs vs non-SOEs. The independent variables are the four proxies of aggressive tax planning: *ETR**, *LETR**, *BTD*, *DD_BTD*, respectively. The dependent variable is $SYNCH_{t+1}$. Year and industry fixed effects are included in our models. To alleviate the concern about potential cross-sectional and time-series dependence in the data, we report *t*-values on an adjusted basis, using robust standard errors corrected for double (firm and year) clustering (Gow *et al.*, 2010; Petersen, 2009). Variable definitions are in Table AI. *,**,***Significant at the 10, 5 and 1 percent levels, respectively (two-sides)

Panel B reports the regression results of Equation (8) for SOE and non-SOE groups. Regression results for both sub-groups reveal that aggressive tax planning increases price synchronicity. Importantly, the Hausman test indicates that the coefficients of the four tax proxies in the SOE group are lower those in the non-SOE group (e.g. the coefficients of *ETR** are 0.053 for the SOE group, but 0.107 for the non-SOE group. The difference is significant at $p < 0.10$). The results for the remaining tax aggressiveness measures are generally consistent.

Overall, the results in Table V support the view that the motivation for aggressive tax planning is weaker for SOEs than for non-SOE firms.

4.5 The moderating effects of tax enforcement

Following Mertens (2003), we measure tax enforcement using the following equation to test *H4*:

$$T_{i,t}/GDP_{i,t} = \alpha_0 + \alpha_1 \times IND1_{i,t}/GDP_{i,t} + \alpha_2 \times IND2_{i,t}/GDP_{i,t} + \alpha_3 + TRADE_{i,t}/GDP_{i,t} + \varepsilon_{i,t}, \quad (9)$$

where $T_{i,t}$ is tax revenue of the provincial government at the end of the fiscal year; $GDP_{i,t}$ is the gross domestic product of the provinces at the end of fiscal year; $IND1_{i,t}$ is the first industry output; $IND2_{i,t}$ is the second industry output; $TRADE_{i,t}$ is the total volume of foreign trade. We divide actual $T_{i,t}/GDP_{i,t}$ by the predicted $T_{i,t}/GDP_{i,t}$ derived from estimating Equation (9) and denote this as $FORCE_{i,t}$. The greater the value of $FORCE_{i,t}$, the higher the level of tax enforcement. We then interact our respective tax measures with $FORCE_{i,t}$, and include the interactive variables in our baseline regression model. We expect the interactive coefficients to be negative and significant, to support the notion that better tax enforcement reduces aggressive tax strategies and, therefore, price synchronicity. Regression results are presented in Table VI. Three of the four interactive variables are negative and significant (coefficients −0.0835 ($p < 0.01$), −0.0831 ($p < 0.01$) and −0.563 ($p < 0.01$) for *ETR**, *LETR** and *DD_BTD* tax proxies, respectively). Therefore, we conclude that a high level of tax enforcement attenuates the adverse effects of aggressive tax strategies on stock price informativeness.

4.6 The moderating effects of high-quality auditing

We now provide test results for *H5*, where we hypothesized that high-quality auditing can mitigate aggressive tax strategies and, hence, can increase stock price informativeness by reducing price synchronicity. We use both firm-level as well as individual auditor-level audit quality indicators.

At the firm level, we use audit firm industry specialization as the audit quality indicator. We follow Minutti-Meza (2013), and measure audit firm specialization using market shares. In Equation (10), $MSA\_FIRM_{m,k,t}$ measures the market share for each industry-year, based on client's size (i.e. assets) by industry k. N represents the number of clients that are served by audit firm m in industry k and M is the number of audit firms in industry k. We calculate $MSA\_FIRM_{m,k,t}$ for every audit firm by year and industry. If $MSA\_FIRM_{m,k,t}$ is above the sample median (across year), we take the value of

DV: $SYNCH_{t+1}$	Column (1) *ETR**	Column (2) *LETR**	Column (3) *BTD*	Column (4) *DD_BTD*
TAX_AGGR	0.0373 (0.83)	0.111* (1.78)	0.547 (0.93)	1.023 (1.55)
*TAX_AGGR*FORCE*	−0.0835*** (−3.16)	−0.0831*** (−3.05)	−0.549 (−0.99)	−0.563*** (−2.85)
FORCE	−0.0769 (−1.50)	−0.0792 (−1.51)	−0.473 (−0.89)	−0.0931 (−1.45)
OTHER CONTRROLS	Yes	Yes	Yes	Yes
INDUSRY & YEAR	Yes	Yes	Yes	Yes
INTERCEPT	−3.874*** (−6.73)	−3.959*** (−6.83)	−4.569*** (−5.43)	−4.012*** (−6.99)
Observation	13,685	13,685	13,685	13,685
F-statistics	180.85***	180.77***	179.37***	180.28***
Adj. R^2	0.3931	0.3933	0.3936	0.3927

Notes: This table presents the test of the moderating effect of tax enforcement on the relation between aggressive tax planning and stock price synchronicity. The independent variables are the four proxies of aggressive tax planning: *ETR**, *LETR**, *BTD*, *DD_BTD*, respectively. The dependent variable is *SYNCH* in year t+1. The moderating variable is *FORCE*, which is estimated from the following model: $T_{i,t}/GDP_{i,t} = \alpha_0 + \alpha_1 \times IND1_{i,t}/GDP_{i,t} + \alpha_2 \times IND2_{i,t}/GDP_{i,t} + \alpha_3 \times TRADE_{i,t}/GDP_{i,t} + \varepsilon_{i,t}$, where $T_{i,t}$ is the tax revenue of local government at the end of a fiscal year (province level); $GDP_{i,t}$ is the gross domestic product of local government at the end of a fiscal year (province level); $IND1_{i,t}$ is the first industry output; $IND2_{i,t}$ is the second industry output; $TRADE_{i,t}$ is the total volume of foreign trade. We run a cross-sectional regression and get the predicted $T_{i,t}/GDP_{i,t}$, then we divide real $T_{i,t}/GDP_{i,t}$ by predicted $T_{i,t}/GDP_{i,t}$, to obtain $FORCE_{i,t}$. The greater the $FORCE_{i,t}$, the higher the level of tax enforcement. Year and industry fixed effects are included in our models. To alleviate the concern about potential cross-sectional and time-series dependence in the data, we report t-values on an adjusted basis, using robust standard errors corrected for double (firm and year) clustering (Gow *et al.*, 2010; Petersen, 2009). Variable definitions are in Table AI. *,***Significant at the 10 and 1 percent levels, respectively (two-sides)

Table VI.
Tax enforcement regime, aggressive tax planning and price synchronicity

EXPERT_FIRM as one, and zero otherwise. We use *EXPRT_FIRM* as the proxy of auditor firm industry specialization:

$$MSA\_FIRM_{m,k,t} = \sum_{n=1}^{N} \sqrt{ASSET_{m,k,n,t}} / \sum_{m=1}^{M} \sum_{n=1}^{N} \sqrt{ASSET_{m,k,n,t}}. \quad (10)$$

At the individual auditor level analysis, we use individual auditor industry specialization as a proxy for high-quality auditing. Equation (11) below is used to measure individual-level industry specialization. $MSA\_AUDITOR_{i,k,t}$ measures the market share for each industry-year based on client's size for individual auditor i by industry k in fiscal year t. J represents the number of clients that are served by individual auditor i in industry k and fiscal year t. Usually, each firm has two auditors, so we take the average value of $MSA\_AUDITOR_{i,k,t}$. As in the case of *EXPERT_FIRM*, if the average value of $MSA\_AUDITOR_{i,k,t}$ of the auditors for each firm is above the sample median across year, we value *EXPRT_AUDITOR* as one, and zero otherwise. We use *EXPRT_AUDITOR* as the proxy of individual auditor level industry specialization:

$$MSA\_AUDITOR_{i,k,t} = \sum_{j=1}^{J} \sqrt{ASSET_{i,k,t,j}} / \sum_{i=1}^{I} \sum_{j=1}^{J} \sqrt{ASSET_{i,j,k,t}}. \quad (11)$$

We include various audit quality indicators and interact those with the aggressive tax measures, to infer whether high-quality auditing reduces price synchronicity by mitigating aggressive tax strategies. Table VII reports the regression results. Panel A reveals that the coefficients on the interactive variable (*TAX_AGGR*×*EXPERT_FIRM*) are negative and significant, suggesting that audit firm industry specialization attenuates aggressive tax strategies and, hence, makes stock prices more informative. Panel B shows that individual auditor-level industry specialization also reduces aggressive tax strategies and price synchronicity above and beyond the audit firm specialization effects (e.g. the interactive coefficients are −0.07 ($p < 0.10$); −0.22 ($p < 0.05$); −0.11 ($p < 0.05$) and −0.60 ($p < 0.10$) for the *ETR**, *LETR**, *BTD* and *DD_BTD* measures, respectively). Overall, we conclude that high-quality auditing measured at both the firm and individual auditor level improves stock price informativeness by constraining aggressive tax strategies.

5. Robustness

5.1 Alternative measures of stock price synchronicity

The institutional features of Chinese markets require us to use three different specifications of the market model from which we derive two alternative measures of synchronicity. In China, some firms issue A-shares only, some issue both A+B shares, while some other firms issue A+H shares. Our primary *SYNCH* measure in Equation (1) did not consider this specification. In fact, returns on stocks of A+B (A+H) share firms are likely to co-move with B-share (H-share) market factors, in addition to A-share market factors. To address this issue, we also estimate, for each fiscal year, the market model for firms with only domestic A-shares, using Equation (12a), and estimate two different market models for firms with A+B shares and firms with A+H shares using Equations (12B) and (12C), respectively:

$$r_{j,t} = \alpha + \beta_{1,j} \times r_{m,t-1} + \beta_{2,j} \times r_{i,t-1} + \beta_{3,j} \times r_{m,t} + \beta_{4,j} \times r_{i,t} + \beta_{5,j} \times r_{m,t+1} + \beta_{6,j} \times r_{i,t+1} + \varepsilon_{j,t}, \quad (12a)$$

DV: $SYNCH_{t+1}$	Column (1) *ETR**	Column (2) *LETR**	Column (3) *BTD*	Column (4) *DD_BTD*
Panel A: firm-level analysis				
TAX_AGGR	0.0156 (0.30)	0.0446 (0.61)	0.997*** (4.34)	0.485** (2.06)
TAX_AGGR× *EXPERT_FIRM*	−0.144* (−1.93)	−0.265*** (−2.59)	−0.0802** (−2.37)	−0.0164** (−2.05)
EXPERT_FIRM	−0.149** (−2.52)	−0.244*** (−3.03)	−0.0371** (−2.18)	−0.0387** (−2.25)
OTHER CONTRROLS	Yes	Yes	Yes	Yes
INDUSRY & YEAR	Yes	Yes	Yes	Yes
INTERCEPT	−3.925*** (−6.81)	−3.988*** (−6.87)	−4.955*** (−7.98)	−3.882*** (−6.74)
Observation	13,685	13,685	13,685	13,685
F-statistics	176.85	176.95	177.19	178.95
Adj. R^2	0.3910	0.3914	0.3916	0.3911
Panel B: individual auditor level: (Include EXPRT_FIRM)				
TAX_AGGR	0.0485 (0.87)	0.0589 (0.75)	0.912*** (3.82)	0.138 (0.55)
TAX_AGGR× *EXPERT_AUDITOR*	−0.0696* (−1.92)	−0.215** (−2.00)	−0.113** (−2.48)	−0.603* (−1.87)
EXPERT_AUDITOR	−0.0591** (−2.10)	−0.0518** (−2.41)	−0.0581** (−2.26)	−0.0566** (−2.17)
EXPERT_FIRM	−0.0385*** (−3.05)	−0.0387*** (−3.07)	−0.0391*** (−3.10)	−0.0378*** (−3.00)
OTHER CONTRROLS	Yes	Yes	Yes	Yes
INDUSRY & YEAR	Yes	Yes	Yes	Yes
INTERCEPT	−3.997*** (−6.94)	−4.055*** (−7.01)	−4.908*** (−7.83)	−3.859*** (−6.70)
Observation	12,841	12,841	12,841	12,841
F-statistics	174.33	174.15	175.14	176.47
Adj. R^2	0.3912	0.3916	0.3919	0.3915

Notes: This table presents the test of the moderating effect of high-quality auditing on the relation between aggressive tax planning and stock price synchronicity. The independent variables are the four proxies of aggressive tax planning: *ETR**, *LETR**, *BTD*, *DD_BTD*, respectively. The dependent variable is *SYNCH* in year *t*+1. Year and industry fixed effects are included in our models. To alleviate the concern about potential cross-sectional and time-series dependence in the data, we report *t*-values on an adjusted basis, using robust standard errors corrected for double (firm and year) clustering (Gow *et al.*, 2010; Petersen, 2009). *,**,***Significant at the 10, 5 and 1 percent levels, respectively (two-sides)

Table VII. The moderating effects of high-quality auditing

$$r_{j,t} = \alpha + \beta_{1,j} \times r_{m,t-1} + \beta_{2,j} \times r_{i,t-1} + \beta_{3,j} \times r_{m,t} + \beta_{4,j} \times r_{i,t} + \beta_{5,j} \times r_{m,t+1} + \beta_{6,j} \times r_{i,t+1} + \beta_{7,j} \times r^B_{m,t-1} + \beta_{8,j} \times r^B_{m,t} + \beta_{9,j} \times r^B_{m,t+1} + \varepsilon_{j,t}, \quad (12b)$$

$$r_{j,t} = \alpha + \beta_{1,j} \times r_{m,t-1} + \beta_{2,j} \times r_{i,t-1} + \beta_{3,j} \times r_{m,t} + \beta_{4,j} \times r_{i,t} + \beta_{5,j} \times r_{m,t+1} + \beta_{6,j} \times r_{i,t+1} + \beta_{7,j} \times r^H_{m,t-1} + \beta_{8,j} \times r^H_{m,t} + \beta_{9,j} \times r^H_{m,t+1} + \varepsilon_{j,t}, \quad (12c)$$

where $r^B_{m,t}$ is the value-weighted B-share market return in week *t*, which reflects B-share price movements in both the Shanghai and Shenzhen exchanges. $r^H_{m,t}$ is the value-weighted H-share market return in week *t*, which reflects H-share price movements in both the Shanghai and Shenzhen exchanges. Other variables are as defined earlier. We match the new *SYNCH* ($SYNCH^a$, $SYNCH^b$, $SYNCH^c$) to the firms that issued only A-shares, A+B shares and A+H shares, respectively, the results in Table VIII are consistent with the baseline regression results, in that all the four coefficients are positive and statistically significant.

Table VIII.
Alternative measures of stock price synchronicity

	$SYNCH_{t+1}^{a,b,c}$ Column (1)	Column (2)	Column (3)	Column (4)
*ETR**	0.0760* (1.83)	–	–	–
*LETR**	–	0.155*** (2.63)	–	–
BTD	–	–	1.011*** (4.92)	–
DD_BTD	–	–	–	0.460*** (2.72)
OTHER CONTRROLS	Yes	Yes	Yes	Yes
INDUSRY & YEAR	Yes	Yes	Yes	Yes
INTERCEPT	−3.618*** (−6.44)	−3.708*** (−6.56)	−4.616*** (−7.79)	−3.529*** (−6.31)
Observation	13,685	13,685	13,685	13,685
F-statistics	178.32	178.54	177.84	179.13
Adj. R^2	0.3627	0.3630	0.3636	0.3629

Notes: This table presents the robust result of alternative measures of stock price synchronicity. The dependent variable is $SYNCH_{t+1}^{a,b,c}$. We also estimate, for each fiscal year, the market model for firms with only domestic A-shares using Equation (12a), and estimate two different market models for firms with A+B shares and firms with A+H shares using Equations (12b) and (12c). The independent variables are the four proxies of aggressive tax planning: *ETR**, *LETR**, *BTD*, *DD_BTD*, respectively. Year and industry fixed effects are included in our models. We use the OLS model to estimate the regression. To alleviate the concern about potential cross-sectional and time-series dependence in the data, we report *t*-values on an adjusted basis, using robust standard errors corrected for double (firm and year) clustering (Gow *et al.*, 2010; Petersen, 2009). Variable definitions are in Table AI. *,***Significant at the 10 and 1 percent levels, respectively (two-sides)

5.2 Alternative estimation methods

Table IX presents FFE, Fama and MacBeth (1973) and GMM regression results. Consistent with our baseline results, all the four coefficients on the aggressive tax measures are significantly positive under the FFE specification (Panel A, Table IX). Panel B presents the Fama and MacBeth (1973) regression results that provide standard errors corrected for cross-sectional correlation. The coefficients on all but *ETR** tax proxies are positive and significant (e.g. the coefficients on *LETR**, *BTD* and *DD_BTD* are 0.138 ($p < 0.10$); 0.99 ($p < 0.01$) and 0.26 ($p < 0.05$), respectively). Finally, we re-estimate the parameters of our model using the GMM procedure. We include the lags of the regressors and a constant as instruments, following existing literature (Clarida *et al.*, 1998). The Sargan (Hansen) test indicates that the instrument variables are not weakened or endogenous. For each measure of aggressive tax planning, the *p*-values of the Sargan (Hansen) test of *ETR**, *LETR**, *BTD*, *DD_BTD* are 0.285(0.165), 0.378(0.467), 0.417(0.592), and 0.388(0.135) respectively. The results in Columns (1) to (4) in Panel C of Table IX are qualitatively consistent with our previous results (the coefficient on *ETR** is positive but insignificant, and other measures of aggressive tax planning are positive and significant at 5 percent or better).

5.3 Match sample analysis

Table X reports matched-sample results for the effects of aggressive tax strategies on stock price synchronicity. We employ two different matching methods. First, we match our sample on the basis of firm size, year and industry with no-replacement method. Panel A of Table X presents the size-matched (based on total asset) results. The coefficients on the tax measures are all positive and statistically significant (the coefficients are 0.08, 0.16, 1.01 and 0.56 for *ETR**, *LETR**, *BTD* and *DD_BTD*, respectively, significant at $p < 0.05$ or better).

We follow the propensity score matching technique developed by Rosenbaum and Rubin (1983). Matching on firm characteristics (covariates) is ideal when the number of characteristics over which the treated and control groups differ is limited. Rosenbaum and Rubin (1983) propose matching by a function of covariates: the probability of an individual

Panel A: FEE				
	Column (1)	Column (2)	Column (3)	Column (4)
DV: $SYNCH_{t+1}$	*ETR**	*LETR**	*BTD*	*DD_BTD*
TAX_AGGR	0.0834* (1.85)	0.235*** (3.26)	1.078*** (4.56)	0.441** (2.40)
OTHER CONTRROLS	YES	YES	YES	YES
INDUSRY& YEAR	YES	YES	YES	YES
INSTERCPT	−6.194*** (−9.00)	−6.352*** (−9.20)	−7.413*** (−9.97)	−6.077*** (−8.86)
Observation	13,685	13,685	13,685	13,685
F-statistics	159.10***	159.36***	159.73***	0.3804***
Within R^2	0.3803	0.3807	0.3812	159.19
Panel B: Fama–MacBeth				
	Column (1)	Column (2)	Column (3)	Column (4)
DV: $SYNCH_{t+1}$	*LETR**	*ETR**	*BTD*	*DD_BTD*
TAX_AGGR	0.0883 (1.41)	0.138* (1.92)	0.989** (2.91)	0.256* (2.30)
OTHER CONTROLS	Yes	Yes	Yes	Yes
INTERCEPT	−3.663*** (−3.99)	−3.687*** (−3.98)	−4.656*** (−4.04)	−3.601*** (−3.83)
Observation	13,685	13,685	13,685	13,685
Wald χ^2	83.26***	4,844.68***	1,519.53***	755.44***
Adj. R^2	0.1493	0.1490	0.1493	0.1482
Panel C: GMM				
	Column (1)	Column (2)	Column (3)	Column (4)
DV: $SYNCH_{t+1}$	*ETR**	*LETR**	*BTD*	*DD_BTD*
TAX_AGGR	0.117 (0.11)	0.196* (1.76)	3.594*** (2.61)	0.895** (2.25)
OTHER CONTRROLS	Yes	Yes	Yes	Yes
INDUSRY & YEAR	Yes	Yes	Yes	Yes
INTERCEPT	−1.589 (−0.49)	−2.186 (−0.66)	−6.798* (−1.90)	−1.925 (−0.62)
Observation	10,370	10,370	10,370	10,370
F-statistics	117.59	117.20	125.65	121.80
p-value of Arellano-Bond test AR2	0.359	0.353	0.126	0.283
p-value of Sargan test	0.285	0.378	0.417	0.388
p-value of Hansen test	0.165	0.467	0.592	0.135

Notes: This table presents the robust result of alternative estimation methods. The dependent variable is *SYNCH* in year *t*+1. The independent variables are the four proxies of aggressive tax planning: *ETR**, *LETR**, *BTD*, *DD_BTD*, respectively. Panel A shows the result of firm fixed effects. Panel B shows the result of the Fama–MacBeth regression. Panel C shows the GMM result. As widely used in previous literature, lags of the regressors and a constant are included as instruments (Clarida *et al.*, 1998). *,**,***Significant at the 10, 5 and 1 percent levels, respectively (two-sides)

Table IX. Alternative estimation methods

being selected into the program (treatment group). The following logit regression model was used to estimate firms' propensity to engage in aggressive tax strategies. The dependent variable is a dummy variable coded one for firm-year observations with the respective tax strategies above the sample median, and zero otherwise:

$$\begin{aligned} Pr\left(DUMMY\_TAX\_AGGR_{i,t}\right) = {} & \alpha_0 + \alpha_2 \times SIZE_{i,t} + \alpha_4 \times STDROA_{i,t} + \alpha_5 \\ & \times VOL_{i,t} + \alpha_6 \times LEV_{i,t} + \alpha_7 \times MB_{i,t} + \alpha_8 \\ & \times ROA_{i,t} + \alpha_9 \times TOP1_{i,t} + \alpha_{10} \\ & \times INSHOLD_{i,t} + \alpha_{11} \times GOVHOLD_{i,t} + \alpha_{12} \\ & \times INDNUM_{i,t} + \alpha_{13} \times INDSIZE_{i,t} + \alpha_{14} \\ & \times BIG4_{i,t} + \Sigma INDUSTRY + \Sigma YEAR + \varepsilon_{i,t}. \end{aligned} \quad (13)$$

We select the optimal match based on the nearest neighbor (NN) technique of the propensity score matching procedure. The NN approach, with replacement, picks a single

Panel A: closest asset matching

DV: $SYNCH_{t+1}$	Match by *ETR** *ETR**	Match by *LETR** *LETR**	Match by *BTD* *BTD*	Match by *DD_BTD* *DD_BTD*
TAX_AGGR	0.0796** (1.98)	0.162*** (3.04)	1.009*** (4.42)	0.560*** (3.35)
OTHER CONTRROLS	Yes	Yes	Yes	Yes
INDUSRY & YEAR	Yes	Yes	Yes	Yes
INTERCEPT	−4.149*** (−7.51)	−4.081*** (−7.34)	−5.034*** (−8.38)	−3.997*** (−7.28)
Observation	13,598	13,576	13,628	13,593
F-statistics	191.97***	191.21***	192.30***	192.26***
Adj. R^2	0.3928	0.3926	0.3920	0.3921

Panel B: Covariate matching table

	Match by *ETR**		Match by *LETR**		Match by *BTD*		Match by *DD_BTD*	
Match or not	No	Yes	No	Yes	No	Yes	No	Yes
Difference	*t*-test	*t*-test	*t*-test	*t*-test	*t*-test	*t*-test	*t*-test	*t*-test
SIZE	5.10***	1.44	3.77***	1.34	4.21***	1.54	5.79***	0.43
STDROA	6.03***	1.19	3.41***	0.01	5.01***	1.77*	5.27***	2.04**
VOL	−1.35	−0.38	−3.35***	1.07	1.25***	0.21	1.28	−0.27
LEV	−5.84***	−1.42	−4.62***	−1.09	−4.10***	−1.29	−3.99***	−1.41
M/B	6.45***	−1.32	6.00***	−1.22	5.00***	−1.31	4.29***	−1.16
ROA	4.64***	1.45	5.49***	1.57	3.75***	1.65	4.42***	1.12
*TOP*1	0.34	0.09	0.88	−0.09	0.89	−0.11	0.25	−0.04
INSHOLD	3.18***	−0.47	5.01***	−1.07	3.22***	−0.77	2.04**	−0.15
GOVHOLD	0.51	0.19	0.91	0.42	1.91	0.56	1.78*	0.98
INDNUM	1.88*	1.39	1.39	−1.25	1.54	−1.01	1.39	−0.32
INDSIZE	1.37	1.50	1.37	−1.33	1.37	1.10	1.37	0.13
*BIG*4	1.53	−0.82	3.03***	−1.38	−3.21***	0.88	−5.57***	0.73

Panel C: PSM regression results

DV: $SYNCH_{t+1}$	Match by *ETR** *ETR**	Match by *LETR** *LETR**	Match by *BTD* *BTD*	Match by *DD_BTD* *DD_BTD*
TAX_AGGR	0.0676 (1.47)	0.137** (2.29)	1.246*** (3.37)	0.314* (1.81)
OTHER CONTRROLS	Yes	Yes	Yes	Yes
INDUSRY & YEAR	Yes	Yes	Yes	Yes
INTERCEPT	−4.450*** (−7.11)	−4.248*** (−6.77)	−4.914*** (−4.37)	−4.064*** (−7.04)
Observation	10,708	10,772	13,006	11,826
F-statistics	147.64***	146.05***	39.06***	172.14***
Adj. R^2	0.3925	0.3865	0.3819	0.3985

Notes: This table presents the robust result of matching sample analysis. We create an indicator variable *DUM_TAX_AGGR* if the respective aggressive tax measures are above the sample median across each year and each industry (treatment group), otherwise 0 (the control group). *,**,***Significant at the 10, 5 and 1 percent levels, respectively (two-sides)

Table X.
Matching sample analysis

control firm according to the closest propensity score. We include a set of firm characteristics that may explain the likelihood that a given firm will be engaged in devising aggressive tax strategies (Cen *et al.*, 2016; Chen *et al.*, 2010). Importantly, the inclusion of these controls ensures a proper balance between treated and untreated subjects in the matched sample, which is one of the key criteria for PSM (Austin, 2011). One important aspect of propensity score matching is to examine the distribution of measured baseline covariates between treated and untreated subjects within the propensity score matched sample. If, after conditioning on the propensity score, no systematic differences exist in baseline covariates between treated and untreated subjects, this indicates that the propensity score model has been correctly specified. In Table X Panel B, none of the included covariates is significantly different between high vs low aggressive tax strategy firms. Panel C, Table X presents the regression results following the PSM approach. The coefficient on *ETR** is positive but insignificant.

However, the coefficients on the remaining tax measures are all positive and significant at $p < 0.05$ or better.

5.4 Difference-in-difference analysis

In order to investigate whether there is a causal relationship between aggressive tax strategies and price synchronicity, we conduct a difference-in-difference analysis using the 2008 taxation reform in China. In 2008, the Chinese government carried out a taxation reform, which saw a uniform tax rate of 25 percent being imposed on both foreign and domestically funded businesses. For the tax rate increase (decrease) firms, managers are motivated to make aggressive (conservative) tax planning. This policy shock gives us a chance to design a quasi-experiment by designating the tax rate decrease (increase) firms as treatment groups with the "no tax rates" change group as the control group, and then run the following regression:

$$SYNCH_{i,t+1} = \alpha_0 + \alpha_1 \times TAX\_INC_{i,t} + \alpha_2 \times TAX\_DEC_{i,t} + \alpha_3 \times POST_{i,t} + \alpha_4 \times TAX\_INC_{i,t} \times POST_{i,t} + \alpha_5 \times TAX\_DEC_{i,t} \times POST_{i,t} + \alpha_i \times CONTROLS_{i,t} + \Sigma INDUSTRY + \Sigma YEAR + \varepsilon_{i,t}, \quad (14)$$

where $TAX\_INC_{i,t}$ ($TAX\_DEC_{i,t}$) is a dummy variable. For the tax rate increase (decrease) firms, we take it as 1, otherwise 0; $POST_{i,t}$ is the time dummy, taking the value of 1 if the observation comes from 2008, and 0 otherwise. Control variables are the same as those appearing in our baseline regression model. Our variables of interests are α_4 and α_5. Table XI presents the regression result. The coefficient on the interactive variable $TAX\_DEC \times POST$ is negative and statistically significant (coefficient −0.0115, t-statistic −2.16, $p < 0.05$), while that on $TAX\_INC \times POST$ is positive and significant (coefficient 0.2144, t-statistic 2.03, $p < 0.05$). The reported results in Table VII, therefore, provide some evidence of a causal relationship between tax strategies and price synchronicity.

6. Conclusion

In recent years, a substantial body of literature has investigated the determinants of stock price synchronicity, as well as the economic consequences of aggressive tax planning. But the potential connection between these two factors has not been well examined. Using a large sample of firms listed in China's emerging stock markets, where "investor protection is weak and agency problems are severe" (Allen *et al.*, 2005), we propose and find a positive and

Table XI. An external shock: tax policy change in China

DV	$SYNCH_{t+1}$
POST	−0.00853** (−2.58)
TAX_DEC	−0.0138** (−2.44)
TAX_INC	0.0226** (1.98)
POST × *TAX_DEC*	−0.0115** (−2.16)
POST × *TAX_INC*	0.2144** (2.03)
OTHER CONTROLS	Yes
INDUSTRY	Yes
INTERCEPT	0.00697 (0.21)
Observation	1,285
F-statistics	12.44***
Adj. R^2	0.2803

Notes: This table presents the robustness test: a quasi-experiment. Using the sample from 2007 to 2008, we take the tax rate decrease (increase) firms as the treatment group, and the control group is the firms with constant tax rates. **,***Significant at the 5 and 1 percent levels, respectively (two-sides) significant relation between aggressive tax planning and stock price synchronicity. Our results are robust to potential endogeneity and to other specifications, as well as to the use of different tax aggressiveness measures. In addition, we find that the firms engaging in aggressive tax planning exhibit relatively high corporate opacity. Furthermore, we find that the improvement in tax enforcement regime, the stated ownership and the high-quality auditors constrain the adverse effects of tax aggressiveness. These results, taken together, indicate that aggressive firm tax planning reduces the ability of firm stocks to incorporate and reflect information.

Our results add to an understanding of the economic consequences of aggressive tax planning. Although tax strategies help conserve cash by transferring wealth from the government to shareholders, opportunistic managers can extract rent through aggressive tax strategies, and make financial statements less transparent in order to hide such rent extraction, thus, making stock price less informative of firm fundamentals. Our findings, therefore, reinforce the agency perspective of aggressive tax planning, and lend further empirical support to the information-efficiency interpretation of stock price synchronicity. Furthermore, the result of this paper helps us better understand the effects of firm-level tax policy on firm-specific information capitalization in an environment where investor protection (i.e. law/regulatory enforcement and compliance via reporting, auditing and disclosure standards) is relatively weak. Finally, our study has important practical implications for China's regulators, who are striving to reduce the tax burden of enterprises, and also helps investors to better consider investment decisions from a taxation perspective.

Notes

1. Other examples of how tax planning strategies can increase opacity, include the creation of entities for multi-state tax planning (e.g. captive real estate investment trusts, intangible holding companies); net operating loss monetization; capital loss utilization, and tax-motivated transfer pricing. Desai (2005) and Desai and Dharmapala (2006) use the Enron and Tyco cases to illustrate how complex structured transactions originating from tax planning can be used to manipulate financial reporting outcomes, because of book-tax nonconformity.
2. In the regression model, we replace *ETR*, *LETR* by *ETR** and *LETR**, respectively.
3. *INSHOLD* is the sum of the Fund Hold Proportion; QFII Hold Proportion; Broker Hold Proportion; Insurance Hold Proportion; Security Fund Hold Proportion; Entrust Hold Proportion; Finance Hold Proportion and Bank Hold Proportion.
4. We use the two-digit code of the CSRC industry classification for the manufacturing industry, and for other industries, we use the one-digit code. In the industry distribution table, the result (61.147 percent) is based on the one-digit code. But in the regression, we control for the manufacturing industry fixed effect based on the two-digit code: C1 (8.13 percent), C2 (19.20 percent), C3 (32.22 percent), and C4 (1.60 percent). We also use the thrree-digit code for the manufacturing industry, and alternative industry classification standards (WIND: www.wind.com.cn/; SWS: www.swsindex.com/idx0530.asp). The untabulated results are still robust compared with our previous findings. We thank an anonymous referee for this suggestion.

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Appendix

Variables	Definitions
R^2	The R^2 of the market model in Equation (1)
SYNCH	Logarithmic transformation of R^2 for the market model in Equation (1), computed as log $[R^2/(1-R^2)]$
$SYNCH^{a,b,c}$	Alternative measure of stock price synchronicity. Computed as Equations (12a)–(12c)
ETR	Effective tax rate
LETR	Long-run cash effective tax rate
BTD	Book-tax difference
DD_BTD	The Desai and Dharmapala (2006) residual book-tax difference
SIZE	The logarithm value of total assets
DTURN	The average monthly share turnover over the current fiscal year period minus the average monthly share turnover over the previous fiscal year period, where monthly share turnover is calculated as the monthly trading volume divided by the total number of shares outstanding during the month
STDROA	The volatility of a firm's earnings stream measured by the standard deviation of a firm's ROAs over the preceding three-year period, including the current year
VOL	The trading volume computed as the total number of shares traded in a year, divided by the total number of shares outstanding at the end of fiscal year
LEV	The leverage computed as total liabilities divided by total assets
MB	Market-to-book ratio, computed as the total market value of equity, divided by the total net assets at the end of fiscal year
ROA	The return on asset of the current year, which is defined as earnings before tax divided by total assets
*TOP*1	The share proportion of the largest shareholder
INSHOLD	The percentage of shares held by institutional investors
GOVHOLD	The percentage of shares held by government
MANHOLD	The percentage of managerial shareholdings
INDNUM	The natural log of the number of firms in the industry to which a firm belongs
INDSIZE	Industry size measured as the log of year-end total assets of all sample firms in the industry to which a firm belongs
*BIG*4	An indicator variable for auditor quality. It equals 1 if a firm is audited by one of the joint ventures of international *Big*4 audit firms and domestic audit firms and 0 otherwise
ACCM	Proxy of corporate opacity. The absolute value of three years accumulated discretionary accruals (Dechow *et al.*, 1995)
HIDE	Proxy of corporate opacity. Following Lin *et al.* (2015), we estimate Real Performance-Total factor productivity (TFP) for each firm year and industry to calculate the degree of private corporate news hiding: $\ln(Y)=\alpha+\beta_1\ln(K)+\beta_2\ln(L)+\varepsilon$, where Y is total income, K is gross property plant and equipment, L is salary. We rank TFP and return on assets (*ROA*) in the same industry according to the above model and calculate the absolute value of the difference between the two rankings. The greater the absolute value of the difference, the greater the difference between the true and the predicted values of a firm's performance, which can reflect the level of private news hiding. To mitigate the industry effect, we adjusted this value by the number of firms in the corresponding industry: $HIDE_{i,t}=Abs[(Rank^{TFP}_{i,t,k}-Rank^{ROA}_{i,t,k})/(Number\ of\ firms\ in\ indutry\ n)]$
PIN	The probability of informed trading (PIN) based on the EKO model
SOE	Indicator: if the firm is the stated owned companies, it takes value as one, and zero otherwise
FORCE	The level of tax enforcement (Mertens, 2003)
EXPERT_FIRM	The proxy of auditor firm industry specialization
EXPERT_AUDITOR	The proxy of individual auditor industry specialization

Table AI. Variables definition

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