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Does individual investors' dividend tax influence analyst forecast? Evidence from a quasi-natural experiment in China

Guangqiang Liu [a], Tianbao Liu [b,*]

[a] School of Accounting / Research Center of Accounting Information, Zhongnan University of Economics and Law, Wuhan, China
[b] School of Finance, Anhui University of Finance and Economics, Bengbu, China

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ABSTRACT

Taking the implementation of dividend tax reform (DTR) for individual investors as a quasi-natural experiment, this paper analyzes the effect of individual investors' dividend tax on analyst forecast using difference-in-differences model. The results show a significant decrease in the accuracy of analysts' forecasts after the implementation of DTR, mainly exacerbating the optimistic bias of analysts. Further analysis indicates that this effect is more pronounced for firms with poorer information quality and firms with less private information. Our study provides theoretical support and empirical evidence for regulators concerned with information asymmetry of capital market and investor protection.

1. Introduction

Analysts are responsible for interpreting public information and mining private information in the capital market (Lang and Lundholm, 1996). The earnings forecast issued by analysts is one of the important references for investors to evaluate stock prices (Bali et al., 2022; Yin and Tan, 2017). Since analysts have limited attention and resources (DeHaan et al., 2015; Harford et al., 2019), they may use corporate behavior as one of the sources of information for forecast especially in the absence of sufficient information. For example, Zhang and Wei (2019) find that analysts will adjust their recommendations according to the firm's investment behavior. Firm's dividend is seen as tied to future earnings (Ali and Hegazy, 2022; Ham et al., 2020; Xu and Xu, 2019), and an increase in dividends affects analysts' forecasts, making them more optimistic. However, excessive dividends of the firm may also be an inappropriate investment and financing behavior, adversely affecting the firm's operation, which may cause analysts to worry about the firm's continued operation and underestimate earnings. The literature has documented the relationship between the firms' dividend policy and earnings (Ham et al., 2020), however, the effect of the dividend policy on analyst forecast has not discussed enough. In this study, we try to empirically investigate the dividend on analyst forecast from the perspective of information.

The two individual investors' dividend tax reform (DTR), which are implemented in 2013 and 2015, in China provides a quasi-natural experimental setting. DTR gives individual investors different levels of dividend tax benefits depending on how long they hold firm shares. Specifically, since January 1, 2013, for individual investors who hold firm stocks for more than one year, the tax burden on their dividend income is 5%. If the period is less than one year and more than one month, the tax burden is 10%. If the period

* Corresponding author.
E-mail address: 120210126@aufe.edu.cn (T. Liu).

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Table 1
Descriptive statistics

	Count	Mean	SD	Min	P50	Max
Ferr	100,823	0.4447	1.0930	0.0000	0.1111	8.0000
Opt	100,823	0.3672	1.0806	−0.5385	0.0563	7.7719
Reform1	100,823	0.2873	0.4525	0.0000	0.0000	1.0000
Reform2	100,823	0.3277	0.4694	0.0000	0.0000	1.0000
Divdummy	100,823	0.8701	0.3362	0.0000	1.0000	1.0000
treat	100,823	0.8869	0.3167	0.0000	1.0000	1.0000
Size	100,823	22.6429	1.4128	20.1989	22.4194	26.8954
Lev	100,823	0.4359	0.2009	0.0510	0.4370	0.8474
ROA	100,823	0.0643	0.0482	−0.0500	0.0566	0.2269
Growth	100,823	0.2716	0.4514	−0.3743	0.1842	3.1424
Tobinq	100,823	2.2439	1.3659	0.9341	1.7946	8.2514
SOE	100,823	0.4291	0.4950	0.0000	0.0000	1.0000
Turnover	100,823	0.0234	0.0175	0.0022	0.0183	0.0840
BM	100,823	0.3929	0.2754	0.0649	0.3166	1.4876
Top1	100,823	0.3677	0.1539	0.0889	0.3568	0.7546
Insthold	100,823	0.5317	0.2423	0.0168	0.5813	0.9358
Big4	100,823	0.1106	0.3136	0.0000	0.0000	1.0000
Horizon	100,823	4.8649	0.8976	1.6094	5.1059	5.9558
Follower	100,823	2.5075	0.6652	0.6931	2.5649	3.6109
BrokerSize	100,823	3.7966	0.7519	1.7918	3.8918	5.2311
Payout	100,823	0.2884	0.2461	0.0000	0.2500	1.4000

Notes: See Appendix A for definitions of all variables.

is less than one month, the tax burden is 20%. After 2015, individual investors who hold stock for more than a year will be exempted from the dividend tax of 5%.[1] Since firms take tax rules into account when making dividends decisions (Brown et al., 2007; Hanlon and Hoopes, 2014; Li et al., 2017), DTR may influence analyst forecast by influencing firm dividend decisions.[2]

Using difference-in-differences (DID) method, we find that the reduction of the individual investors' dividend tax reduces the accuracy of analysts' forecasts, mainly exacerbating the optimistic bias of analysts. Robustness tests confirm this finding. We conduct heterogeneity analysis from the perspective of information and find that the effect is pronounced for firms with poorer information quality and firms with less private information.

Our study may contribute to two aspects of the literature. First, we extend research on the economic consequences of the changes in the individual investors' dividend tax from the perspective of analyst forecast. Differ to the previous research on the economic consequences of dividend tax (e.g., Bell and Jenkinson, 2002; Hanlon and Hoopes, 2014; Li et al., 2021), which mainly focus on firm, our results show that the changes in dividend tax may affect the analyst judgment. Similar to Su and Alexiou (2019) finding that corporate managers harm investors' interests by paying dividends, we pay attention to the possible damage of increased dividend payments to capital market information, which is related to investors' interests. Our results suggest that DTR increases analyst forecasting bias, which may exacerbate information asymmetry in capital markets. Second, our study may contribute to the literature on the determinants of analyst forecast. Our results suggest that the dividend tax reduction of individual investors may reduce the accuracy of analysts' forecasts and increase their optimistic bias. Different from Huang et al. (2022), who explore the impact of dividends on analysts' optimism bias from the perspective of analysts' personal interests, we explore the possible impact of dividends on analysts' forecast accuracy based on the quasi-natural experiment of DTR in China, and find that when analysts have less information available, the dividend tax reduction has an even stronger negative impact on the accuracy of analysts' forecasts from the perspective of information.

2. Data and methodology

2.1. Data

In this paper, we examine the individual dividend tax policy in 2013 and 2015. We take three years before and after DTR as samples, so our sample period ranges from 2010 to 2018. We focus on Chinese A-share listed firms tracked by analysts and conduct research at the level of broker-firm-years.[3] After retaining each broker's last forecast for each firm in each year, and deleting financial

[1] http://www.chinatax.gov.cn/chinatax/n810341/n810765/n812188/200506/c1200151/content.html; http://www.chinatax.gov.cn/chinatax/n810341/n810765/n812151/201211/c1082457/content.html. From 2005 until the first DTR, individual investors are taxed at a uniform rate of 10%.

[2] For example, based on DTR, Li et al. (2017) argue that the reduction of investors dividend tax rates may lead to an increase in dividends.

[3] A broker typically has one analyst or analyst team covering a specific firm (Cheng et al. 2016), and it is more feasible to match the visit and forecast data with the broker as the matching object.

Table 2
Individual investors' dividend tax reform and analyst forecast.

Variables	(1) Ferr	(2) Ferr	(3) Ferr	(4) Opt
Reform1	0.1322***	0.1315***	0.1027***	0.1384***
	(0.0335)	(0.0331)	(0.0338)	(0.0352)
Reform2	0.2124***	0.1841***	0.1910***	0.1837***
	(0.0422)	(0.0421)	(0.0417)	(0.0398)
Divdummy	−0.1149***	−0.1027***	−0.0756***	−0.0553**
	(0.0241)	(0.0243)	(0.0239)	(0.0258)
Size		0.1502***	0.1549***	0.2096***
		(0.0164)	(0.0162)	(0.0163)
Lev		0.0758	0.0860	−0.0635
		(0.0580)	(0.0574)	(0.0598)
ROA		−0.1905	0.1655	1.0989***
		(0.1640)	(0.1532)	(0.1441)
Growth		−0.1124***	−0.1060***	−0.1000***
		(0.0106)	(0.0094)	(0.0094)
Tobinq		0.0265***	0.0267***	0.0187***
		(0.0047)	(0.0046)	(0.0047)
SOE		0.0257	0.0062	0.0156
		(0.0452)	(0.0431)	(0.0435)
Turnover		−2.3336***	−2.0847***	−1.9625***
		(0.3988)	(0.3394)	(0.3300)
BM		0.1971***	0.0514	0.0147
		(0.0308)	(0.0322)	(0.0297)
Top1		−0.0035***	−0.0048***	−0.0048***
		(0.0009)	(0.0009)	(0.0009)
Insthold		−0.0039***	−0.0020***	−0.0014***
		(0.0006)	(0.0005)	(0.0005)
Big4		−0.2616***	−0.2225***	−0.2577***
		(0.0235)	(0.0239)	(0.0253)
Horizon			0.2347***	0.2264***
			(0.0048)	(0.0049)
Follower			−0.2916***	−0.2836***
			(0.0135)	(0.0141)
BrokerSize			−0.0026	−0.0037
			(0.0120)	(0.0126)
Constant	0.4363***	−2.6865***	−3.2363***	−4.5505***
	(0.0140)	(0.3708)	(0.3569)	(0.3630)
Year	Yes	Yes	Yes	Yes
Broker	Yes	Yes	Yes	Yes
Firm	Yes	Yes	Yes	Yes
r^2_a	0.218	0.224	0.269	0.253
N_full	100,823	100,823	100,823	100,823

Notes: This table presents the effect of DTR on the analyst forecast. Column (1) presents the regression results by controlling for the fixed effects only. Column (2) presents the results of adding control variables at the firm level. Column (3) presents the results of adding control variables at the firm level and variables associated with analysts. Column (4) presents the effect of DTR on the analyst optimism bias. See Appendix A for the definitions of all the variables. The superscripts ***, **, and * indicate two-tailed statistical significance at the 1%, 5%, and 10% levels, respectively. The value in parentheses is robust Std. Err.

firms and ST firms and deleting observations with missing financial data, our final sample includes 100,823 broker-firm-years, representing 2329 unique firms and 109 unique brokers.[4] To avoid the negative influence of extreme outliers, all of the continuous variables are winsorized at the 1% level. We obtain analyst forecasts and broker visit data from the China Stock Market and Accounting Research (CSMAR) database, and obtain corporate financial data from CSMAR and Wind database.

2.2. Model

We use the following DID model to test the effect of DTR on analyst forecast:

[4] We identify the analyst's forecast of the current period according to the release time of the firm's annual report. If the analyst releases his forecast of the firm after the release of the annual report of the previous year and before the release of the annual report of the current year, it is considered that the forecast belongs to the current period.

Table 3
Dynamic DID.

Variables	(1) Ferr	(2) Ferr
Before2	0.0813	0.0690
	(0.0531)	(0.0491)
Before1	−0.0425	−0.0181
	(0.0576)	(0.0559)
Current	0.1741***	0.1727***
	(0.0489)	(0.0468)
After1	0.0019	−0.0200
	(0.0661)	(0.0627)
After2	0.2327***	0.1932***
	(0.0582)	(0.0584)
After3	0.1787***	0.1428**
	(0.0672)	(0.0629)
After4	0.2046***	0.1910***
	(0.0633)	(0.0607)
After5	0.3423***	0.3553***
	(0.0692)	(0.0648)
Divdummy	−0.1262***	−0.0912**
	(0.0401)	(0.0369)
Constant	0.4351***	−3.2155***
	(0.0135)	(0.3552)
Controls	No	Yes
Year	Yes	Yes
Broker	Yes	Yes
Firm	Yes	Yes
r^2_a	0.218	0.269
N_full	100,823	100,823

Notes: This table presents the regression results of the dynamic DID. We choose 2010 as the base period. *BeforeN* represents the product of the dummy variable and *Divdummy* in the year N before the reform, *Current* represents the product of 2013 and *Divdummy*, and *AfterM* represents the product of the dummy variable and *Divdummy* in the year M after the reform. See Appendix A for the definitions of all the variables. The superscripts ***, **, and * indicate two-tailed statistical significance at the 1%, 5%, and 10% levels, respectively. The value in parentheses is robust Std. Err.

$$Ferr_{i,j,t} = \alpha + \beta_1 Divdummy_{i,t} + \beta_2 Post1_t + \beta_3 Post2_t + \beta_4 Reform1_{i,t} + \beta_5 Reform2_{i,t} + \beta_k \sum_{n=6}^{16} Firm\ Controls_{i,t} + \beta_k \sum_{n=16}^{19} Broker\ Controls_{i,j,t} + \vartheta_{firm} + \theta_{broker} + \delta_t + \varepsilon_{i,j,t} \quad (1)$$

where, $Ferr_{i,j,\,t}$, is the proxy of the accuracy of the analyst's forecast. We employ $Divdummy_{i,t}$ as the proxy variable of the treatment group. $Divdummy_{i,t}$, is a dummy variable that equals 1 if firm i pays cash dividends in the current year and 0 otherwise. $Post1_t$ equals 1 if the year t is from 2013 to 2015, and 0 otherwise, while $Post2_t$ equals 1 if the year is after 2015. To more accurately represent the impact of the two DTR's, we define DTR by comparing the implementation time of reform with the firm's dividend time. We measure the first DTR, $Reform1_{i,t}$, as a dummy variable, which is equal to 1 if the firm pays cash dividends during 2013.01.01 – 2015.09.07, whereas the second DTR, is also a dummy variable, $Reform2_{i,t}$, which is equal to 1 if the firm pays cash dividends on and after 2015.09.08.

Following the literature, we also include a lot of control variables: firm size (*Size*), financial leverage (*Lev*), return on total assets (*ROA*), firm growth ability (*Growth*), investment opportunities (*Tobinq*), state ownership (*SOE*), turnover rate (*Turnover*), book-to-market ratio (*BM*), the largest shareholder' ownership (*TOP1*), institutional ownership (*Inststhare*), the Big Four auditors (*Big4*), the forecast interval (*Horizon*), the number of analysts covering the firm (*Follower*) and the size of the broker (*BrokerSize*).[5] Please refer to Appendix A for detailed variable definitions. We control for year, broker and firm fixed effects, and cluster all standard errors at the broker level.

[5] For the analyst related variables, we take the current period, while we lag firm related variables by one period, because we believe that the current situation of the analyst is more likely to affect the accuracy of his (her) forecast. We classify *Follower* as an analyst related variable, and when this variable is lagged, our results are still robust, but the coefficient of *Follower* is not significant, which does not quite fit the peer effect.

Table 4
Robustness test.

	(1)	(2)	(3)	(4)
	Ferr	Ferr	Ferr	Ferr
Variables	Alternative experimental group	Year and Industry Fixed effect	2010–2014	Firm-Level
Reform1_alter	0.3530***			
	(0.0476)			
Reform2_alter	0.3749***			
	(0.0447)			
Reform1		0.0931***	0.1753***	0.4006***
		(0.0334)	(0.0423)	(0.1169)
Reform2		0.1726***		0.3091***
		(0.0407)		(0.1145)
Divdummy		−0.0752***	0.0033	−0.1840**
		(0.0235)	(0.0288)	(0.0911)
Constant	−3.6039***	−3.3775***	−3.7271***	−4.3314***
	(0.3594)	(0.3759)	(0.8054)	(1.3793)
Controls	Yes	Yes	Yes	Yes
Year	Yes	No	Yes	Yes
*Year*Industry*	No	Yes	No	No
Broker	Yes	Yes	Yes	No
Firm	Yes	Yes	Yes	Yes
r^2_a	0.270	0.280	0.347	0.139
N_full	100,823	100,823	53,591	12,277

Notes: This table presents the results of a series of robustness tests. Column (1) presents the regression results of alternative experimental group, where, *Reform1_alter* is an indicator variable, which is equal to 1 when firm I pays a cash dividend in 2011 or 2012 and the current year is 2013–2015. *Reform2_alter* is an indicator variable, which is equal to 1 when firm I pays a cash dividend in 2011 or 2012 and the current year is after 2015. Column (2) presents the regression results of Year*Industry fixed effect. Column (3) presents the regression result of take 2010–2014 as the sample interval. Column (4) presents the regression result of firm-year level. See Appendix A for the definitions of all the variables. The superscripts ***, **, and * indicate two-tailed statistical significance at the 1%, 5%, and 10% levels, respectively. The value in parentheses is robust Std. Err.

Table 5
Heterogeneity analysis: firm information quality.

	(1)	(2)	(3)	(4)
	Ferr	Ferr	Ferr	Ferr
VARIABLES	Low_REM	High_REM	Low_Opaque	High_Opaque
Reform1	0.0776	0.1670***	0.0364	0.1404**
	(0.0641)	(0.0513)	(0.0661)	(0.0678)
Reform2	0.0519	0.2976***	0.0152	0.2364***
	(0.0538)	(0.0634)	(0.0557)	(0.0738)
Divdummy	0.0667**	−0.2052***	0.0384	−0.1579***
	(0.0333)	(0.0409)	(0.0388)	(0.0533)
Constant	−3.6620***	−4.6809***	−2.5443***	−3.3111***
	(0.5954)	(0.5769)	(0.5811)	(0.5572)
Controls	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes
Broker	Yes	Yes	Yes	Yes
Firm	Yes	Yes	Yes	Yes
r^2_a	0.376	0.393	0.374	0.391
N_full	44,354	44,301	37,669	37,594

Notes: This table presents the impact of firm information quality on the relationship between DTR and the analyst forecast. We divide firms into groups Low_REM and High_REM according to their real earnings management, *REM*, and the grouped regression results are shown in columns (1) and (2). We divide firms into groups Low_ Opaque and High_ Opaque according to their degree of information opacity, Opaque, and the grouped regression results are shown in columns (3) and (4). See Appendix A for the definitions of all the variables. The superscripts ***, **, and * indicate two-tailed statistical significance at the 1%, 5%, and 10% levels, respectively. The value in parentheses is robust Std. Err.

2.3. Descriptive statistics

Table 1 presents our descriptive statistical results. The standard deviation and maximum value of *Ferr* are much larger than its mean and median value, indicating that the accuracy of analysts' predictions varies greatly, and some analysts' forecasts deviate from the real value to a high degree. The mean value of *Divdummy* demonstrates that 87.01% of the observations pay cash dividends between 2010 and 2018. The mean values of *Reform1* and *Reform2* are 0.2873 and 0.3277, demonstrating that 28.73% of the cash dividend behaviors are affected by the rule after the reform in 2013, while 32.77% of the cash dividend behaviors are affected by the second DTR.

Table 6
Heterogeneity analysis: Private information.

	(1) Ferr	(2) Ferr	(3) Ferr	(4) Ferr
VARIABLES	BrokerVisit > 0	BrokerVisit = 0	FirmVisit > 0	FirmVisit = 0
Reform1	0.0636	0.0630	−0.0498	0.3954***
	(0.1853)	(0.0535)	(0.0686)	(0.1274)
Reform2	0.0861	0.1244**	0.0634	0.3162***
	(0.1785)	(0.0483)	(0.0931)	(0.0960)
Divdummy	−0.1165	0.0424	0.0280	−0.0292
	(0.1724)	(0.0346)	(0.0672)	(0.0532)
Constant	−5.4681***	−4.3162***	−5.4391***	−3.4759***
	(1.0290)	(0.4609)	(0.4918)	(1.0446)
Controls	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes
Broker	Yes	Yes	Yes	Yes
Firm	Yes	Yes	Yes	Yes
r^2_a	0.337	0.287	0.320	0.399
N_full	16,633	45,220	45,449	16,404

Notes: This table presents the impact of private information on the relationship between DTR and the analyst forecast. We divided the observations into two groups based on whether the broker visited the firm that year, and the grouped regression results are shown in columns (1) and (2). We divide the observations into two groups based on whether the firm is visited that year, and the grouped regression results are shown in columns (3) and (4). See Appendix A for the definitions of all the variables. The superscripts ***, **, and * indicate two-tailed statistical significance at the 1%, 5%, and 10% levels, respectively. The value in parentheses is robust Std. Err.

3. Empirical results

3.1. Basic results

Table 2 presents our basic results. In column (1), the coefficients of *Reform1* and *Reform2* are significant at the 1% level, indicating that DTR increases analyst bias. Column (2) shows that our results remain robust when we control for a range of firm characteristics. Column (3) presents the estimation of Eq. (1). The coefficients of *Reform1* and *Reform2* are also significantly positive at the 1% level, which suggests that DTR has a negative impact on the accuracy of analyst forecasts. Specifically, the coefficients of *Reform1* and *Reform2* are 0.1027 and 0.1910, implying that first DTR leads to a 23.09% decrease in the accuracy of analyst forecasts relative to the mean (i.e., 0.1027/0.4447) and the second DTR leads to a higher (42.95%) decrease of the accuracy of analyst forecasts relative to the mean (i.e., 0.1910/0.4447). We further explore whether DTR makes analysts' forecasts more optimistic or pessimistic, and thus deviates from the true value, as shown in column (4). The positive coefficients of *Reform1* and *Reform2* suggest that DTR mainly leads to the increase of optimistic bias of analysts and the decrease of their forecast accuracy.

3.2. Dynamic DID

The difference-in-differences method relies on a parallel trend assumption. To be specific, we choose 2010 as the base period, and define a series of dummy variables, where, *BeforeN* is equal to the product of the dummy variable in N years before 2013 and *Divdummy; Current* is equal to the product of the dummy variable in 2013 and *Divdummy; AfterM* is equal to the product of the dummy variable in M years after 2013 and *Divdummy*.

Table 3 presents the results of dynamic DID. The coefficients of *Before1* and *Before2* are insignificant, indicating the parallel trend assumption is satisfied. After the first DTR (*Current*), for firms that pay cash dividends, analysts' forecasts are more out of line. The coefficients of *After2, After3, After4* and *After5* indicate that after the second DTR, for firms that pay cash dividends, analysts' forecasts are further out of line.

3.3. Robustness tests

Table 4 presents the results of a series of robustness tests. Column (1) presents the regression results of alternative experimental group, which is identified based on the firm's 2011 and 2012 dividends. This test may alleviate the concern about the effect of time-varying experimental groups on our results. In column (2), we control the Year*Industry fixed effect rather Year fixed effect. Column (3) present the results of the first DTR on the basic of the subsample of 2010–2014. We also test our conclusions at the firm level, after

controlling for firm-related variables and *Follower*, which are shown in column (4). The results of these tests all support our conclusion of main regression.

3.4. Heterogeneity analysis

We explore the heterogeneous impact of DTR on analyst forecasts from an information perspective. Specifically, we focus on both the quality of information provided by firms and private information. When the quality of information provided by the company is worse, and the firm has less private information, the analyst can rely on less information, and his (her) forecast is more likely to be affected by the dividend behavior under the influence of DTR, resulting in greater bias.

Firstly, we explore the effect of quality of information on the relationship between DTR and analyst forecast, which is presented in Table 5. We employ the real earnings management and information opacity as the proxy variables of quality of information. Following Roychowdhury (2006), we measure real earnings management from sales manipulation, production manipulation and discretionary expense manipulation, and obtain the firm's real earnings management level by summing up the absolute value of operating cash net flow, production cost and discretionary expense manipulation. Based on the median of last year's real earnings management, *REM*, we divide the observations into Low_REM and High_REM groups. In columns (1) and (2), the coefficients of *Reform1* and *Reform2* are significantly positive at the 1% level in the High_REM group, but not significant in the Low _REM group. Those results indicate that the negative impact of DTR on analyst forecasting accuracy is mainly concentrated in firms with low information quality. We calculate a firm's discretionary accruals based on the Modified Jones Model and measure corporate information opacity by summing up the absolute value of discretionary accruals over the past three years. We divide the observations into groups Low_Opaque and High_Opaque based on the information opacity of the company in the previous year, *Opaque*. Columns (3) and (4) present those results, which also suggest that DTR has a stronger impact on the analyst forecast for firms with low information quality.

Second, we explore the relationship among DTR, analyst forecast and private information. Analysts actively collect private information by on-site visits (Cheng et al., 2016; Han et al., 2018). Thus, we identify analysts' access to private information through their on-site visits. We divide the observations into two groups, $Brokervisit > 0$ and $Brokervisit = 0$, based on whether or not the analyst visit the firm in the current year.[6] *Brokervisit* is equal to the number of times the analyst visits the firm for the year. Columns (1) and (2) of Table 6 present the regression results of two subsamples. DTR has no significant effect on analyst forecasts when the analyst has visited the firm. When the analyst has not visited the firm, the coefficient of *Reform1* is 0.0630 but not significant, whereas the coefficient of *Reform2* is 0.1244 and significant at the 5% level. Those results suggest that when there is less private information, DTR is more likely to lead to a reduction in analyst forecasting accuracy. One possible explanation for the insignificant coefficient of *Reform1* is that although the analyst does not visit the firm on the spot, other analysts and investors visit the firm, and listed firms are required to disclose investor relations according to the regulations of Shenzhen Stock Exchange. Analysts may obtain private information by referring to this information or by non-field research, and private information acquisition weakens the negative impact of DTR on analyst forecasting accuracy, especially when the impact of the first DTR is weak.

To test this possibility, we count the number of visits that the firm received in the year, *Firmvisit*. Based on this variable, we divide the observations into $Firmvisit > 0$ and $Firmvisit = 0$ groups. In column (3), the coefficients of *Reform1* and *Reform2* are not significant, whereas in column (4), the coefficients of *Reform1* and *Reform2* are 0.3954 and 0.3162, respectively, and significant at 1% level. These results indicate that DTR is more likely to increase analyst forecasting bias when there is less private information.

4. Conclusion

In this paper, we use the individual investors' DTR in China in 2013 and 2015 to examine the influence of the individual investors' dividend tax on analyst forecast. We find that the reduction of the individual investors' dividend tax reduces the accuracy of analysts' forecasts, mainly exacerbating the optimistic bias of analysts. Heterogeneity tests show that the effect is pronounced for firms with poorer information quality and firms with less private information. Our study provides theoretical support and empirical evidence for regulators concerned with information asymmetry of capital market and investor protection.

CRediT authorship contribution statement

Guangqiang Liu: Conceptualization, Writing – original draft, Writing – review & editing, Methodology, Investigation, Supervision, Validation. **Tianbao Liu:** Software, Writing – review & editing, Writing – original draft.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

[6] Since only Shenzhen Stock Exchange listed firms disclosed their investor relationship data, our sample only included Shenzhen Stock Exchange firms in this analysis. This data comes from the CSMAR database.

Data availability

The data that has been used is confidential.

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Appendix A: Variable definitions

Variable	Definition
Dependent variables	
Ferr	Abs (the analyst's last estimate eps − the company's eps) /EPS
Opt	(the analyst's last estimate eps − the company's eps) /EPS
Independent variables	
Divdummy	An indicator variable, which is equal to 1 if firm i pays cash dividend in year t, and zero otherwise.
Post1	An indicator variable, which is equal to 1 if year t is in 2013–2015, and zero otherwise.
Post2	An indicator variable, which is equal to 1 if year t is in 2016 and subsequent years, and zero otherwise.
Reform1	An indicator variable, which is equal to 1 when firm i pays a cash dividend in 2013.01.01–2015.09.07.
Reform 2	An indicator variable, which is equal to 1 when firm i pays a cash dividend after 2015.09.07.
Control variables	
Size	The natural logarithm of the firm's total assets in year t-1.
Lev	The debt-to-asset ratio of the firm in year t-1.
ROA	Return on assets of the firm in year t-1.
Growth	The sales growth rate of the firm in year t-1.
Tobinq	Tobin Q of the firm in year t-1.
SOE	An indicator variable, which equals one for state-owned firms in year t-1, and zero otherwise.
Turnover	The mean value of daily turnover rate of firm i in year t-1.
BM	The book-to-market ratio of firm i in year t-1.
Top1	Shareholding ratio of the firm's largest shareholder in year t-1.
Insthold	The shareholding ratio of institutional investors in year t-1.
Big4	An indicator variable, which equals one if the firm is audited by the Big Four accounting firms in year t-1.
Horizon	The natural log of the difference between the analyst's report date and the company's annual report date plus one.
Follower	The natural log of the number of analysts covering firm i plus one in year t.
BrokerSize	The natural log of the number of firms covered by broker j in year t.
Other variables	
Reform1_alter	An indicator variable, which is equal to 1 when firm i pays a cash dividend in 2011 or 2012 and the current year is 2013–2015.
Reform2_alter	An indicator variable, which is equal to 1 when firm i pays a cash dividend in 2011 or 2012 and the current year is after 2015.
Payout	The ratio of firm i's dividend per share to eps in year t.
Treat_Turn	An indicator variable, which is equal to 1 if firm i's annual average turnover rate is lower than the median value of all firms in year t, and zero otherwise.
Reform1_Turn	*Treat_Turn* × *Post1*.
Reform2_Turn	*Treat_Turn* × *Post2*.

Appendix B: Pre-testing

An important premise for our hypothesis is that after DTR, the firm increases its dividend, which sends a signal to analysts that the firm is in good condition and makes analysts' earnings forecasts too optimistic. The research of Li et al. (2017) based on the same reform shows that this reform does increase the willingness of firms to share out dividends. We further test this conclusion in our sample. We measure the dividend payout ratio, *Payout*, as the ratio of dividends per share to earnings per share. This variable is put into Eq. (1) as a dependent variable for regression. However, there may be a potential concern about the identification strategy of the experimental group, that is, the relationship between DTR and corporate dividend is caused by the correlation between the dummy variable of dividend and the dividend size itself. Thus, following Li et al. (2017), we employ the turnover rate of the firm in that year as the identification variable of the experimental group. The logic of this identification strategy is that the dividend tax is based on the holding time to distinguish the dividend tax relief that individual investors can get. When individual investors hold the dividend for longer and the annual turnover rate of the firm is lower, DTR has a greater impact. Specifically, we group the firms based on the average daily turnover rate of the previous year. The firms lower than the median of the year are treated as the experimental group, and *Reform1_Turn* is equal to 1 if the firm's turnover rate is below the median. *Reform1_Turn* is multiplied by *Post1* and *Post2* to obtain

Table B1
Pre-test results.

Variables	(1) Payout	(2) Payout
Reform1_Turn	0.0324***	0.0198*
	(0.0119)	(0.0116)
Reform2_Turn	0.0720***	0.0488***
	(0.0137)	(0.0136)
Treat_Turn	−0.0476***	−0.0304***
	(0.0106)	(0.0110)
Size		0.0112
		(0.0091)
Lev		−0.2644***
		(0.0346)
ROA		0.0937
		(0.1038)
Growth		−0.0084*
		(0.0050)
Tobinq		−0.0064*
		(0.0033)
SOE		−0.0221
		(0.0337)
Turnover		−0.0068
		(0.2215)
BM		0.0765***
		(0.0226)
Top1		0.0017***
		(0.0005)
Insthold		−0.0001
		(0.0003)
Big4		0.0049
		(0.0294)
Constant	0.2938***	0.0855
	(0.0032)	(0.1997)
Year	Yes	Yes
Broker	Yes	Yes
Firm	Yes	Yes
r^2_a	0.466	0.477
N_full	100,823	100,823

Notes: This table presents the effect of DTR on the dividend payment. We measure the dividend payout ratio, *Payout*, as the ratio of dividends per share to earnings per share. Columns (1) and (2) present the regression results of the recognition variable of the experimental group with turnover rate. See Appendix A for the definitions of all the variables. The superscripts ***, **, and * indicate two-tailed statistical significance at the 1%, 5%, and 10% levels, respectively. The value in parentheses is robust Std. Err clustered at the firm level.

Reform1_Turn and *Reform2_Turn*. Columns (1) and (2) of Table B1 present this result.[7] The significantly positive coefficients of *Reform1_Turn* and *Reform2_Turn* indicate that DTR has significantly increased the proportion of corporate dividends.

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[7] We mainly control for these variables related to the firm because the analyst variables are unlikely to affect the firm's dividend distribution. Similarly, we cluster standard errors at the firm level, and our results are equally robust when we cluster the standard error at the broker level.

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