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The Whack-a-Mole Game: Tobin Taxes and Trading Frenzy

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To dampen trading frenzy in the stock market, the Chinese government tripled the stamp tax for stock trading on May 30, 2007. The greatly increased trading cost triggered a migration of the trading frenzy from the stock market to the warrant market, which was not subject to the stamp tax. This migration exacerbated a price bubble in the warrant market. Our analysis of investor account data uncovers not only large inflows of new investors to the warrant market but also greatly intensified trading by existing warrant investors. This episode exemplifies the so-called "whack-a-mole" game in financial regulations. (*JEL* G10, G28, G40)

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Tobin taxes (transaction taxes) are a policy tool that regulators widely use to dampen speculative trading in financial markets. However, despite the popularity of Tobin taxes in practice, researchers have reached little consensus about their effects. For example, Roll (1989) uses stock market data from

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23 countries and finds a negative, but nonsignificant, correlation between transaction taxes and price volatility. Umlauf (1993) studies two cases of politically motivated stock market transaction tax increases that occurred in Sweden in 1981 and 1986 and finds no evidence of any decline in market volatility. Jones and Seguin (1997) analyze transaction commission reductions for NYSE/AMEX stocks made in 1975 due to deregulation and document reduced market volatility following the lowered transaction commissions. Deng, Liu, and Wei (2018) find that in China's stock market, increases in transaction taxes decrease the volatility of stocks with high retail ownership but increase the volatility of those with high institutional ownership.[1] These mixed findings are in part due to the challenge of finding counterfactuals. To the extent that a change in the Tobin tax is an endogenous event, other factors may contaminate its effect on market volatility, leaving an open issue as to whether a Tobin tax has any significant effect on speculative trading.

This paper provides a case study of a policy action taken by the Chinese government on May 30, 2007, that tripled the stamp tax on stock trading. Faced with a pool of largely inexperienced individual investors in its rapidly growing financial markets, regulators in China have regularly intervened in the stock market using a stamp tax as a policy instrument with the objectives of maintaining market stability and protecting individual investors, as discussed in Brunnermeier, Sockin, and Xiong (2020). In response to the quadrupling of the market index and the increase of the monthly market turnover rate above 100%, the government tripled the rate of the stamp tax from 0.2% to 0.6%. This stamp tax increase had a modest effect in cooling off the market index and share turnover rate in the stock market. Interestingly, this increase in the stamp tax on stock trading coincided with a speculative bubble in China's warrant market, which was not subject to the stamp tax. Extensive literature, for example, Xiong and Yu (2011), Liao et al. (2014), Gong, Pan, and Shi (2017), Li, Subrahmanyam, and Yang (2020), and Pearson, Yang, and Zhang (2020), has documented that a bubble occurred in the Chinese warrant market in 2005–2008, with the warrant prices substantially surpassing reasonable measures of their fundamentals determined by their underlying stock prices and with frenzied trading. By building on the findings of this literature, we study how the stamp tax increase affected this warrant bubble.

By comparing the warrant price, the daily turnover rate, and the daily price volatility in the 20 trading days before and after the event date of May 30, 2007,

[1] These mixed findings may reflect contrary effects of a Tobin tax on heterogeneous investors. On the one hand, a higher Tobin tax tames noise traders and thus market volatility, as emphasized by Tobin (1978), Stiglitz (1989), and Summers and Summers (1989). On the other hand, the increased trading cost also reduces the effectiveness of smart traders in trading against noise traders, as highlighted by Grundfest (1990), Grundfest and Shoven (1991), Edwards (1993), Heaton and Lo (1993), Schwert and Seguin (1993), and Kupiec (1996). By analyzing a model with these offsetting effects, Davila and Parlatore (2017) show that the net effect can be muted. Furthermore, Scheinkman and Xiong (2003) show that a Tobin tax has a second-order effect in reducing price bubbles because speculators can mitigate the effect of a Tobin tax on price levels by reducing trading frequency.

we find substantially increased price levels, turnover rates, and price volatility across both put and call warrants traded at the time. The effects were particularly strong for the five put warrants, which were all deep-out-of-the-money due to the stock market boom and had virtually no fundamental values. Nevertheless, after the increase in the stamp tax on stock trading, the price levels of these worthless put warrants rose, on average, by 2.4 yuan, the daily turnover rate rose by 434% (i.e., by a multiple of more than four), and daily price volatility rose by 32.8% (in absolute levels). These effects suggest that the stamp tax increase might have exacerbated the warrant bubble.

The magnitude of this effect is substantial despite the small number of warrants in the market. During the 20 trading days after the tax increase, the trading volume of the five put warrants increased from 28.3 billion yuan to 1,086 billion, and the volume of nine other call warrants increased from 295.8 billion to 597 billion. The net increase of 1,358 billion in warrant trading was *22.6% of the stock market trading volume* in the pre-event period.

To analyze the mechanisms that drive these dramatic observations, we examine a proprietary data set of account-level trading records of all stocks and warrants listed on the Shenzhen Stock Exchange (one of the two major stock exchanges in China) during our event window. We uncover several important observations. First, we find that the stamp tax increase triggered large inflows of investors who had never previously traded warrants to the warrant market, especially to put warrants, in the subsequent weeks. In particular, investors who were previously more active in the stock market were more likely to start trading warrants and reduce stock trading.

What led to the stronger inflows of new investors to put warrants than to call warrants? A possible argument is that the increase in the stamp tax signaled a government policy to cool down the stock market, which in turn led to strong investor demand for using put warrants to hedge the stock market. While appealing, this argument contradicts the aforementioned studies of the warrant bubble, which show that these put warrants were too deeply out-of-the-money to provide any meaningful hedging for the stock market. Furthermore, this argument cannot explain why the new investors would be willing to buy these put warrants at substantially overvalued prices. On the event day, the underlying stock prices of the put warrants dropped on average by -6.3% at the opening of trading and then by -1.1% during the trading hours. These drops could not justify the simultaneous increases of put warrant prices of 5.9% and 58.1%. Despite the obvious price overreactions, we find that the inflows of new investors to put warrants jumped from the pre-event level of 3,000 per day to more than 44,000 on the event day. The stamp tax increase alone cannot explain the larger inflows of new investors to the put warrants. Instead, the new warrant investors might have been attracted to the put warrants by their large price increases, which were highly salient on the event day, especially given large drops in the prices of other securities, or by the speculativeness of the put warrants.

To highlight that the stamp tax increase is necessary for what we observe on the event day, we construct a placebo test based on a handful of alternative days with similarly large stock market drops as May 30, 2007, but without any change in the stamp tax for stock trading. We find that a large drop in the stock market, by itself, is insufficient to trigger the speculative frenzy that occurred in the warrant market after May 30, 2007. This placebo test confirms the key role played by the stamp tax increase, even though additional forces also accompanied the stamp tax increase to generate the dramatic observations we document.

Finally, our data also uncover an interesting finding that a large fraction of existing warrant investors substantially intensified their trading of both put and call warrants on the event day, with some of them trading more than 100 times in a single day. One cannot attribute such high trading intensities to hedging or portfolio rebalancing. Instead, they possibly reflect speculative motives of these existing warrant investors, intensified by the large inflows of new warrant investors.

Our analysis shows that while it might be difficult to directly measure the effect of a Tobin tax increase on the targeted market due to other potential contaminating effects, the increase can have a powerful, albeit unintended, effect by driving speculative trading to other unregulated markets.[2] Our findings thus provide consistent evidence for the so-called "whack-a-mole" game, a term initially used by Blinder (2008) to describe the awkward situation faced by the Federal Reserve Board in 2008: each time the Federal Reserve intervened to "whack down" problems in one market, new problems cropped up in other unexpected markets. This vivid metaphor has frequently appeared in public discussions of a wide range of financial regulations, such as the Dodd-Frank Act, new payday lending rules, and shadow banking regulations. Motivated by these observations, Blinder (2015) argues that overregulation might be socially optimal. However, systematic evidence of significant market impacts caused by market participants trying to sidestep financial regulations has been previously lacking. Our study provides such evidence and thus prompts policy makers to consider the spillover effects of financial regulations in increasingly complex financial markets.

1. Institutional Background

This section provides the institutional background of China's financial markets. See Carpenter and Whitelaw (2017) and Song and Xiong (2018) for recent reviews of China's financial markets.

[2] Campbell and Froot's (1994) analysis of Swedish and British cases shows that increasing transaction taxes can prompt investors to move trading offshore. Our study confirms not only the presence of trading migration but also compelling price impacts.

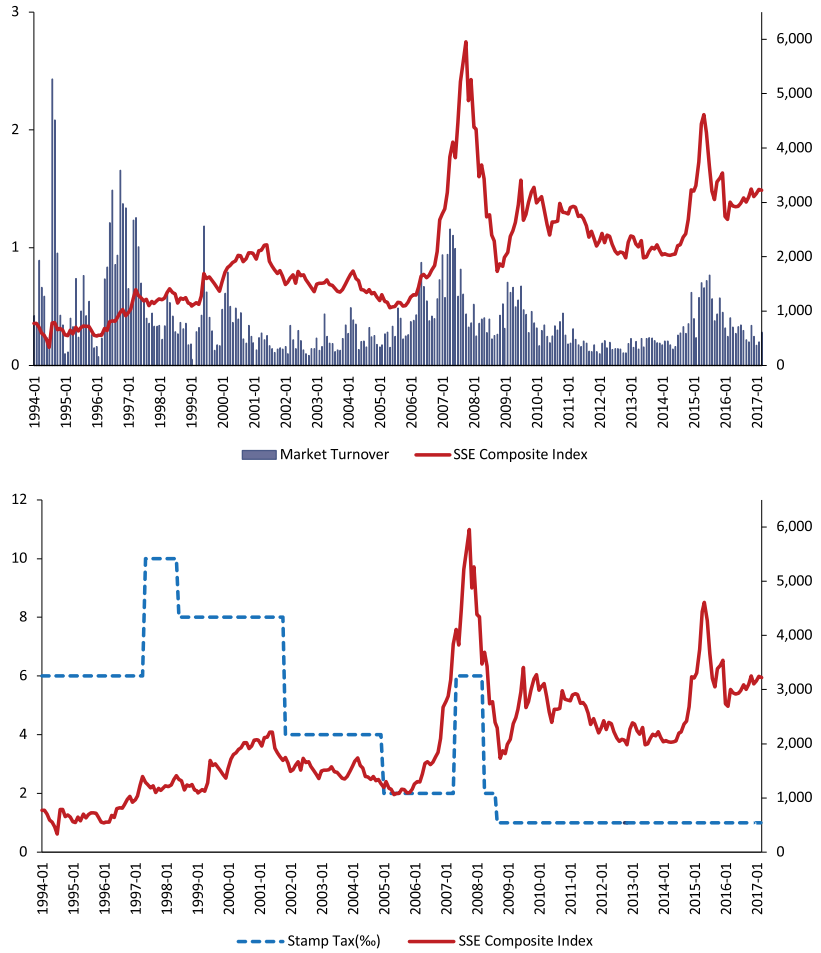

Figure 1
Market turnover, index level, and stamp tax rate over time
The upper panel plots the month-end level of the Shanghai Stock Exchange Composite Index (SSE Composite index, right y-axis) and the monthly turnover rate (left y-axis). The lower panel plots the month-end level of the SSE Composite index (right y-axis) and the stamp tax rate (as 1‰, left y-axis). The sample period is from January 1994 to December 2016.

1.1 Stock market

After the Shanghai and Shenzhen stock exchanges were established in 1990, China's stock market experienced rapid growth; it is now the second-largest equity market in the world. During the market's development, market regulators regularly confronted the problem of a high level of speculation in the stock market driven by a group of generally inexperienced investors.

The upper panel of Figure 1 shows several drastic boom and bust cycles in China's market index (the Shanghai Stock Exchange Composite index). The

most spectacular boom ran from an index level of 1,000 in 2006 to a peak above 6,000 in October 2007; the market then crashed to below 2,000 in 2008. This 2007 boom establishes the market environment for our analysis.[3] This panel also shows that from 1994 to 2016, the monthly turnover rate of the overall stock market rose above 80% per month (or 960% per year) in several periods, including during the market boom of 2007. This dramatic turnover rate reflects the intensive trading frenzies that regularly occur in China's stock market.[4]

The Chinese government has been actively engaged in using various policy tools, including the stamp tax, to manage the frenzied speculation in the stock market. The lower panel of Figure 1 shows that the government changed the stamp tax rate seven times between 1994 and 2016. As discussed by Deng, Liu, and Wei (2018), the government's policy objective is consistent with Tobin's argument (1978): to curb excessive speculation during market booms, the government should raise the stamp tax, and during market busts, the government should stimulate/support the market by reducing the stamp tax.

Our analysis focuses on an increase in the stamp tax during the spectacular boom in 2007. Because the government was worried that the stock market was becoming overly speculative, it tripled the stamp tax from 0.2% to 0.6% on May 30, 2007. Figure 2 depicts this dramatic hike in the stamp tax managed to temporarily slow the rise of the market index; the market index stayed around the level of 4,000 for approximately 1 month before it eventually rose to 6,092 in October 2007. The hike in the stamp tax had a more persistent effect on the share turnover rate, which did not rise above its May 2007 peak in the months following the stamp tax hike.

1.2 Warrant market

As an initial trial of an options market, the Chinese government allowed a set of publicly listed firms to issue 12 put warrants and 37 call warrants on the two stock exchanges in 2005–2008. The government instituted several special features so that the warrant market could maintain the usual advantages of financial derivatives for hedging and speculation purposes. First, unlike stock trading, warrant trading is not subject to the stamp tax. Second, warrants trade on the so-called "T+0" rule, which allows investors to sell warrants on the day of purchase, while stocks trade on the "T+1" rule, which requires investors to hold their stock positions for at least one day before selling. Third, while stocks

[3] This boom was precipitated by the successful share reform completed by the Chinese government in 2005 that made previously nontradable state shares tradable. The restriction had been widely recognized as an obstacle to effective corporate governance, because the investors of tradable shares are holding minority shares in the firms.

[4] See Mei, Scheinkman, and Xiong (2009) for a systematic study of how speculative trading affects stock prices in China's stock market.

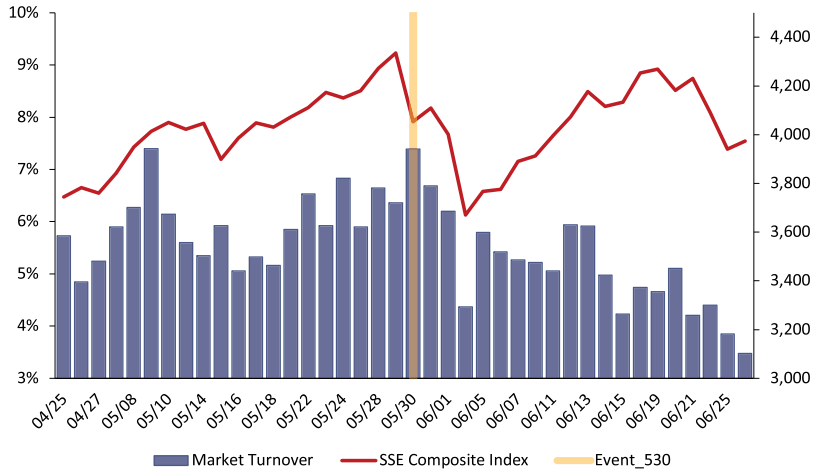

Figure 2
Daily market turnover and index level around May 30, 2007
The figure plots the daily market turnover (left *y*-axis) and the level of the Shanghai Stock Exchange Composite index (SSE Composite index, right *y*-axis) from April 25, 2007, to June 26, 2007.

are subject to daily price limits of 10%, warrants have substantially wider daily price limits.[5]

Despite the intention of the government, these convenient features made the warrant market particularly susceptible to market speculation. As extensively studied by Xiong and Yu (2011), during the stock market boom in 2007, while the put warrants all went deep-out-of-the-money with virtually no fundamental values, each put experienced a spectacular bubble and was traded at highly inflated prices with a frenzied turnover rate of multiple times a day. Furthermore, by analyzing brokerage account data, Liao et al. (2014) and Li, Subrahmanyam, and Yang (2020) provide more granular evidence of some warrant investors' ignorance of warrant mechanics and speculative motives of trading these warrants.

Because of the frenzied speculation in these warrants, the Chinese government discontinued the warrant market after 2008 and has not allowed options on individual stocks to be traded on any exchange since. On May 30, 2007, there were 14 active warrants (five put warrants and nine call warrants), half on the Shenzhen Stock Exchange and the other half on the Shanghai Stock Exchange. Table 1 provides summary information for these warrants, all of which had long maturities of 1 to 2 years and were mostly issued long before the event date.

[5] As with stocks, short sales of these warrants were prohibited. This is a key force that limited arbitrage trading in the warrant market. See Xiong and Yu (2011) for more information on the institutional setting of the warrant market.

Table 1
List of all May 30, 2007, warrants

Warrant code	Warrant name	Type	Exchange	Trading period		Exercise period	
				Begin	End	Begin	End
030002	Wuliang YGC1	Call	SZSE	Apr. 3, 2006	Mar. 26, 2008	Mar. 27, 2008	Apr. 2, 2008
031001	Qiaocheng HQC1	Call	SZSE	Nov. 24, 2006	Nov. 16, 2007	Nov. 19, 2007	Nov. 23, 2007
031002	Gangfan GFC1	Call	SZSE	Dec. 12, 2006	Dec. 4, 2008	Nov. 18, 2008	Dec. 11, 2008
038003	Hualing JTP1	Put	SZSE	Mar. 2, 2006	Feb. 22, 2008	Feb. 27, 2008	Feb. 29, 2008
038004	Wuliang YGP1	Put	SZSE	Apr. 3, 2006	Mar. 26, 2008	Mar. 27, 2008	Apr. 2, 2008
038006	Zhongji ZYP1	Put	SZSE	May 25, 2006	Nov. 16, 2007	Nov. 19, 2007	Nov. 23, 2007
038008	Jiafei JTP1	Put	SZSE	Jun. 30, 2006	Jun. 22, 2007	Jun. 25, 2007	Jun. 29, 2007
580008	Guodian JTB1	Call	SSE	Sep. 5, 2006	Aug. 28, 2007	Aug. 29, 2007	Sept. 4, 2007
580009	Yili CWB1	Call	SSE	Nov. 15, 2006	Nov. 7, 2007	Nov. 8, 2007	Nov. 14, 2007
580010	Magang CWB1	Call	SSE	Nov. 29, 2006	Nov. 14, 2008	Nov. 15, 2007	Nov. 28, 2008
580011	Zhonghua CWB1	Call	SSE	Dec. 18, 2006	Dec. 10, 2007	Dec. 11, 2007	Dec. 17, 2007
580012	Yunhua CWB1	Call	SSE	Mar. 8, 2007	Feb. 20, 2009	Feb. 23, 2009	Mar. 6, 2009
580013	Wugang CWB1	Call	SSE	Apr. 17, 2007	Apr. 9, 2009	Apr. 10, 2009	Apr. 16, 2009
580997	Zhaohang CMP1	Put	SSE	Mar. 2, 2006	Aug. 24, 2007	Aug. 27, 2007	Aug. 31, 2007

This table shows the summary information for the 14 warrants in our sample. The sample includes all warrants traded over the 20 trading days before and after May 30, 2007, that is, from April 25, 2007, to June 26, 2007. For each warrant, the table lists its code, name, type (call or put), exchange (SSE, Shanghai Stock Exchange, or SZSE, Shenzhen Stock Exchange), trading period, and exercise period. Warrants are sorted at the beginning of their trading period.

2. Market Reactions

This section presents an event study of market reactions to the stamp tax increase, including reactions from the stock market, the put warrant market, and the call warrant market. Our analysis focuses on the period of 20 trading days (or 4 weeks) before and after the event date, May 30, 2007, that is, from April 25, 2007, to June 26, 2007.[6]

2.1 Stock market reactions

We first examine how the stock market reacted to the stamp tax increase. We download the daily price and trading data of all A-share stocks (common shares listed on Shanghai and Shenzhen Stock Exchanges) from the database of China Stock Market and Accounting Research (CSMAR) over the period of April 25, 2007, to June 26, 2007. We plot the stock market index and aggregate turnover rate in this period in Figure 2. The figure shows that the stock market dropped sharply and trading visibly cooled after the stamp tax was hiked.

Panel A of Table 2 presents summary statistics of the stock variables separately for the periods before and after the event date. *Return* is daily holding return adjusted for distributions. *Turnover* equals the number of shares traded each day divided by the number of floating shares. *Volume (Bn Yuan)* is the daily trading volume in billion yuan, while *log*(*Volume*) is the log of one plus daily trading volume in yuan. *Volatility*, which is measured on a daily basis,

[6] While the choice of the event window of 20 trading days is somewhat arbitrary, our results are robust to alternative event windows, such as 10 or 5 trading days.

Table 2
Stock price and trading around May 30, 2007

A. Summary statistics

	Mean	SD	P1	P25	P50	P75	P99	Obs.
				Before May 30, 2007				
Return	1.36%	5.93%	−6.49%	−1.38%	0.98%	3.57%	10.00%	25,712
Turnover	7.46%	4.19%	0.61%	4.73%	6.82%	9.44%	20.80%	25,712
Volume (bn yuan)	0.234	0.346	0.011	0.072	0.138	0.261	1.726	25,712
log(Volume)	18.74	1.06	16.2	18.1	18.75	19.38	21.27	25,712
Volatility	5.78%	2.67%	0.00%	3.93%	5.32%	7.22%	13.60%	25,712
				After May 30, 2007				
Return	−0.98%	6.25%	−10.00%	−5.00%	−0.54%	3.02%	10.00%	26,606
Turnover	6.55%	3.91%	0.20%	4.05%	6.05%	8.35%	19.40%	26,606
Volume (bn yuan)	0.208	0.328	0.002	0.057	0.112	0.226	1.635	26,606
log(Volume)	18.53	1.179	14.61	17.87	18.54	19.24	21.22	26,606
Volatility	7.78%	3.60%	0.00%	5.08%	7.42%	10.20%	16.90%	26,606

B. Regression results

	(1)	(2)	(3)	(4)
Dep. variable:	*Return*	*Turnover*	*log(Volume)*	*Volatility*
Post-event	−0.0233	−0.0091	−0.208	0.0200
	(−2.37)	(−3.03)	(−3.18)	(4.13)
Observations	52,318	52,318	52,318	52,318
Adjusted R^2	.035	.012	.009	.090

This table reports summary statistics (panel A) and the results of regression analyses (panel B) of stocks' daily return, turnover, volume, and price volatility before and after the event date of May 30, 2007. *Post-event* equals one for days on or after May 30, 2007, and otherwise zero. *Return* refers to daily return adjusted for dividends and splits. *Volume* is daily trading volume in billion yuan. *log(Volume)* is the log of one plus daily trading volume (in yuan). *Turnover* equals the number of shares traded on each day divided by the number of floating shares. *Volatility* is measured on a daily basis as the difference between the highest and lowest intraday prices scaled by the average. The sample period is from April 25, 2007, to June 26, 2007. Standard errors are clustered by day, and the corresponding *t*-statistics are reported in parentheses.

equals the difference between the highest and lowest intraday prices scaled by the average.[7]

During the 20 trading days before the event, the stocks had an average daily return of 1.36%, reflecting the rising stock market. More importantly, the stocks had an average daily turnover rate of 7.46%, which is equivalent to an annualized turnover rate of 1865% (i.e., 7.46%×250), which is substantially higher than the annualized turnover rate of 900% of internet stocks during the U.S. internet bubble (e.g., Hong and Stein 2007). The stocks also had an average daily volatility of 5.78%, which is equivalent to an annualized volatility of 91.4%. These high levels for the share turnover rate and price volatility reflect the stock market frenzy that motivated the government to hike the stamp tax. During the 20 trading days after the event, the stocks' average daily return dropped to

[7] Alizadeh, Brandt, and Diebold (2002) show that the daily price range provides an effective measure of daily price volatility. Because of the lack of intraday data, the traditional return-based volatility measure is not available on a daily basis. Thus, for the purpose of our analysis, this range-based volatility measure can better capture the immediate effect after the event.

−0.98%, indicating a downturn in the market. The average daily turnover rate also had a modest drop to 6.55%, although the daily price volatility rose to 7.78%. The average daily trading volume across different stocks, measured in yuan, dropped slightly from 0.234 billion to 0.208 billion on average. The aggregate stock market trading volume decreased by 7.81%, from 6.017 trillion yuan in the pre-event window to 5.547 trillion after the event.

We formally examine the changes in these variables using the following regression specification:

$$DepVar_{i,t} = \alpha + \beta_1 Post\text{-}event_t + \varepsilon_{i,t}, \quad (1)$$

for each stock i in the A-share market. *Post-event* is a dummy that equals one for days on and after May 30, 2007, and otherwise zero. The dependent variables include *Return, Turnover, log(Volume)*, and *Volatility*. The event window is 20 trading days before and after May 30, and standard errors are clustered by day.

Panel B of Table 2 reports the regression results. In column 1, the dependent variable is *Return*, and the coefficient of *Post-event* equals −2.33% with a t-statistic of 2.37. The magnitude of the effect of the event on stock returns is economically meaningful, given that the average daily stock return before the event is 1.36% with a standard deviation of 5.93%. In column 2, the dependent variable is *Turnover*, and the coefficient of *Post-event* is −0.91% with a t-statistic of 3.03. This represents a significant drop in stock trading compared with the average daily turnover of 7.46% and the standard deviation of 4.19%. In column 3, *log*(*Volume*) is the dependent variable, and the coefficient of *Post-event* is −0.208 with a t-statistic of 3.18, which indicates a 20.8% decrease in the yuan-amount of trading volume in the stock market.

As we discussed earlier, the literature has extensively examined how a Tobin tax may affect financial market volatility. We also explore this question in our setting by using *Volatility* as the dependent variable in the regression. The result in column 4 shows that after the event, stock volatility increases by 2.0% (with a t-statistic of 4.13). One needs to be cautious in interpreting this correlation as causality because the decision to increase the stamp tax is endogenous and could be correlated with changes in the stocks' fundamental volatility. In other words, in the absence of an appropriate counterfactual, this regression does not rule out the possibility that stock price volatility could have been even higher without the stamp tax increase.[8] In contrast, our analysis of warrant price volatility is less subject to this issue because we can control for the change in the warrants' fundamental volatility through the underlying stock price volatility.

[8] Deng, Liu, and Wei (2018) specifically examine this issue by taking advantage of the dual shares issued by a set of Chinese firms—A-shares issued inside China in the Shanghai and Shenzhen Stock Exchanges and H-shares issued outside China in the Hong Kong Stock Exchange—and using the price volatility of H-shares as a control of fundamental volatility of the corresponding A-shares. In a sample that covers all seven episodes of stamp tax rate changes in China, Deng, Liu, and Wei (2018) find evidence of higher Tobin taxes reducing price volatility.

Table 3
Put warrant price and trading around May 30, 2007

A. Summary statistics

	Mean	SD	P1	P25	P50	P75	P99	Obs.
				Before May 30, 2007				
Price	1.16	0.48	0.37	0.98	1.22	1.27	1.99	98
BlackScholes_value	0.00	0.01	0.00	0.00	0.00	0.01	0.08	98
Adjusted_price	1.16	0.48	0.37	0.98	1.21	1.27	1.97	98
Turnover	67.10%	64.80%	15.70%	33.50%	45.80%	74.50%	385.40%	98
Volume (bn yuan)	0.29	0.13	0.09	0.20	0.25	0.39	0.64	98
log(*Volume*)	19.38	0.46	18.33	19.09	19.33	19.78	20.27	98
Volatility	5.50%	3.16%	1.64%	3.13%	4.54%	7.18%	16.00%	98
				After May 30, 2007				
Price	3.57	1.94	0.11	1.96	3.49	5.13	8.15	96
BlackScholes_value	0.01	0.01	0.00	0.00	0.00	0.00	0.07	96
Adjusted_price	3.56	1.94	0.11	1.92	3.49	5.11	8.15	96
Turnover	559.20%	255.10%	204.90%	403.50%	515.50%	669.70%	1,741.00%	96
Volume (bn yuan)	11.31	10.34	1.21	5.57	8.09	12.22	45.68	96
log(*Volume*)	22.84	0.775	20.91	22.44	22.81	23.23	24.55	96
Volatility	41.80%	24.80%	11.00%	23.60%	33.30%	54.10%	150.50%	96

B. Regression results

	(1)	(2)	(3)	(4)
Dep. variable:	*Adjusted_price*	*Turnover*	*log*(*Volume*)	*Volatility*
Post-event	2.405	4.344	3.303	0.328
	(9.02)	(14.36)	(30.74)	(10.06)
Maturity fixed effect	Yes	Yes	Yes	Yes
Observations	194	194	194	194
Adjusted R^2	.393	.701	.815	.583

This table reports summary statistics (panel A) and results of regression analyses (panel B) of put warrants' price, turnover, volume, and price volatility before and after the event date of May 30, 2007. *Price* is a warrant's daily closing price. *BlackScholes_value* is a warrant's fundamental value based on the Black-Scholes model. *Adjusted_price* refers to a warrant's daily closing price minus its fundamental value based on the Black-Scholes model. *Volume* is daily trading volume in billion yuan. *log*(*Volume*) is the log of one plus daily trading volume (in yuan). *Turnover* equals the number of shares traded on each day divided by the number of outstanding shares. *Volatility* is measured on a daily basis as the difference between the highest and lowest intraday prices scaled by the average. In panel B, *Post-event* equals one for days on or after May 30, 2007 and otherwise zero. All regressions include maturity fixed effects. The sample period is from April 25, 2007, to June 26, 2007. Standard errors are clustered by day, and the corresponding t-statistics are reported in parentheses.

2.2 Put warrant market reactions

We now analyze how the increase in the stamp tax for stock trading affected the warrant market. We obtain daily closing price and trading information for the 14 warrants from WIND. Because of the substantial heterogeneity between put and call warrants, we separately examine their reactions to the event.

Table 3 reports the market reactions of the five put warrants. Panel A reports summary statistics of variables related to put warrants. *Price* is a warrant's daily closing price. *BlackScholes_value* is a warrant's fundamental value calculated from the Black-Scholes model. For each warrant, we use its underlying stock's daily closing price and previous 1-year rolling daily return volatility to compute the warrant's Black-Scholes value. *Adjusted_price* equals *Price* minus *BlackScholes_value* and gives a measure of the price deviation from the warrant fundamental. We acknowledge that the Black-Scholes model may not

be a perfect measure of the fundamental value of a warrant; nevertheless, it is a useful benchmark for our analysis.

Panel A of Table 3 reports summary statistics of these variables separately for 20 trading days before and after the event date. Before the event, the average *BlackScholes_value* is 0.00 yuan, which reflects the market environment: because of the stock market boom, all the put warrants were deep-out-of-the-money. Interestingly, these virtually worthless put warrants had an average *Price* of 1.16 yuan. Xiong and Yu (2011) attribute this highly inflated market price to a price bubble after systematically examining the potential fundamental values of these put warrants beyond the Black-Scholes model. Consistent with this bubble view, these put warrants had an average *daily* turnover rate of 67.1%, which is more than nine times the already enormous stock turnover rate, and an average daily price volatility of 5.5%.

During the 20 trading days after the event, the average price of the put warrants jumped to 3.57 yuan, even though the *BlackScholes_value* remained at 0.01 yuan. The daily turnover rate spiked to an astonishing level of 559.2% (i.e., 5.6 times each day) and the average daily volatility rose to 41.8%. The daily trading volume per put warrant measured in yuan increased from 0.29 billion to 11.3 billion. The greatly increased price level, turnover rate, and price volatility all point to a substantially intensified speculation frenzy in these virtually worthless warrants. In aggregate, the total trading volume of the five put warrants increased from 28.3 billion in the pre-event window to 1,086 billion yuan after the event. The increase is approximately 17.6% of the total trading volume in the stock market before the policy change (i.e., (1,086 – 28.3)/6,017).

For each of the put warrants, Figure 3 plots its daily turnover rate (*Turnover*) and daily closing price (*Price*) along with a horizontal bar indicating the put warrant's strike price (which is also its maximum possible payoff). The turnover rate of each put warrant jumped sharply by several multiples on May 30 and the elevated turnover rate persisted over the subsequent days. While each of the put warrants was already overvalued relative to its fundamental value before May 30, the overvaluation rose substantially in the 1 to 2 weeks after the event. Astonishingly, two of the five put warrants (Hualing JTP1 and Wuliang YGP1) even had their price rise above their strike price (i.e., their maximum possible payoffs), which offers indisputable evidence of a price bubble.

To formally examine the effects of the stamp tax increase on these put warrants, we use the following regression specification:

$$DepVar_{j,t} = \alpha + \beta_1 Post\text{-}event_t + \delta_m + \varepsilon_{j,t}, \tag{2}$$

for each warrant j, where *Post-event* equals one for days on and after May 30, 2007, and otherwise zero. The coefficient of this variable represents the change in the dependent variable after the event date. As noted by Xiong and Yu (2011), the price and turnover of a warrant may change substantially as it approaches its maturity date. Thus, we include maturity fixed effects δ_m. We use several

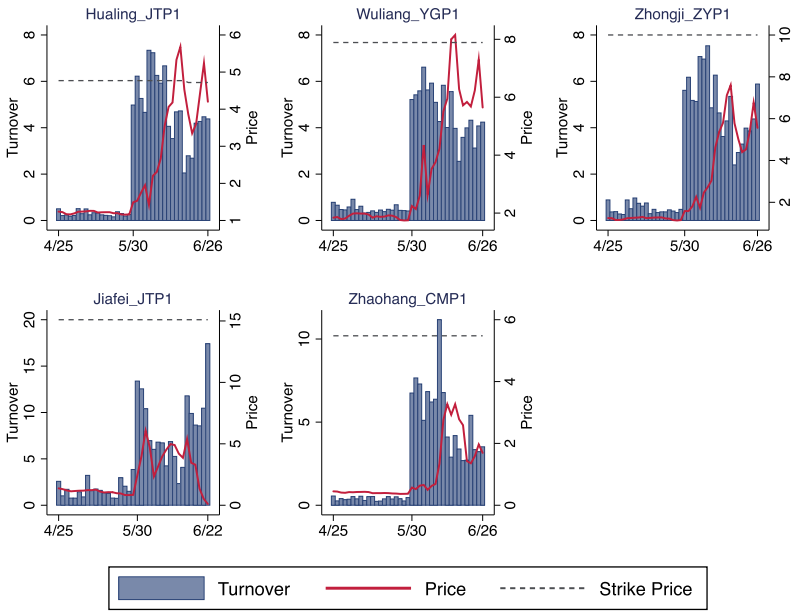

Figure 3
Price and turnover of put warrants around May 30, 2007
The figure plots daily turnover (bar, left *y*-axis), closing price (solid line, right *y*-axis), and strike price (adjusted for exercise ratio, dashed line, right *y*-axis) for each put warrant from April 25, 2007, to June 26, 2007.

dependent variables to measure the speculativeness in the warrant market: *Adjusted_price*, *Turnover*, *log*(*Volume*), and *Volatility*. The event window is 20 trading days before and after May 30, 2007. Standard errors are clustered by day.

Panel B of Table 3 presents the regression results. In column 1, the dependent variable is *Adjusted_price*, that is, nominal price minus the Black-Scholes value. The coefficient of *Post-event* equals 2.40, with a t-statistic of 9.02. The magnitude of this price effect is economically significant relative to the average adjusted price of 1.16 and the standard deviation of 0.48 before the event. In column 2, the dependent variable is *Turnover*, and the coefficient of *Post-event* is 434.4%, with a t-statistic of 14.4. This is an enormous increase in trading intensity relative to the average daily turnover of 67.1% and the standard deviation of 64.8% prior to the event. In column 3, *ln*(*Volume*) is the dependent variable, and the coefficient of *Post-event* is 3.30, with a t-statistic of 30.7. One can interpret the magnitude as a 330% increase in the yuan-amount volume in the put warrant market.

In column 4, *Volatility* is the dependent variable, and the coefficient of *Post-event* is 0.33, with a t-statistic of 10.0, indicating that volatility increased by 32.8% after the stamp tax increase. As these put warrants are deep-out-of-the-money, their fundamental values were all virtually zero. Thus, it is difficult

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to attribute this substantial increase in warrant price volatility to elevated fundamental uncertainty in these put warrants.

It is also difficult to associate the greatly increased price level, turnover rate, and price volatility in these deep-out-of-the-money put warrants to any fundamental-related activities, such as price discovery or hedging, again because these warrants had virtually no fundamentals.[9] Instead, they all point to a greatly intensified speculation frenzy in the put warrant market after the stamp tax increase for stock trading. In this sense, the stamp tax increase might have exacerbated the spectacular price bubble in the put warrants.

2.3 Call warrant market reactions

Table 4 reports reactions of the nine call warrants. Panel A presents the summary statistics. During the 20 trading days before the event, call warrants had an average *BlackScholes_value* of 14.64 yuan and an average *Price* of 14.56 yuan, which is fairly close to the Black-Scholes value. At the time, these call warrants were deep-in-the-money and did not exhibit an obvious price bubble as large as that of the put warrants.[10] Nevertheless, the call warrants also experienced frenzied trading as reflected by an average daily turnover rate of 45.1%, which, while lower than that of the put warrants, is still six times the average turnover rate of stocks.

During the 20 trading days after the event, the average Black-Scholes adjusted price (*Adjusted_price*) increased to 0.53 yuan from −0.08 yuan in the period before the event. Also, the daily turnover rate (*Turnover*) almost doubled to 85.4% from 45.1% before the event, and the daily price volatility increased substantially to 10.3% from 6.47% before the event. The daily trading volume per call warrant measured in yuan increased from 1.75 to 3.41 billion. These increases in the Black-Scholes adjusted price level, turnover rate, and price volatility, while less striking than those experienced by the put warrants, nevertheless reveal greatly intensified speculation in call warrants as well. Figure 4 illustrates the intensified speculation in each of the nine call warrants by plotting their daily Black-Scholes adjusted price and daily turnover rate. In aggregate, the total trading volume of the call warrants increased from 295.8 billion yuan in the pre-event window to 596.7 billion in the post-event window. The increase is approximately 5.0% of the total trading volume in the stock market before the policy change (i.e., (596.7 – 295.8)/6,017).

In panel B of Table 4, we formally examine the changes in these variables by using regression specification (2) for the sample of the nine call warrants. The regressions again confirm that while the effects of the stamp tax increase

[9] Liu, Zhang, and Zhao (2015) study how the speculative activities in the warrants spilled over to the underlying stocks during the Chinese warrants bubble, even after controlling for information-driven trading and hedging motives.

[10] Gong, Pan, and Shi (2017) analyze a call warrant issued by Baogang, which did not trade in our sample period, and show that this call warrant also exhibited a price bubble.

Table 4
Call warrant price and trading around May 30, 2007

A. Summary statistics

	Mean	SD	P1	P25	P50	P75	P99	Obs.
				Before May 30, 2007				
Price	14.56	8.20	4.64	6.29	13.38	23.83	32.00	169
BlackScholes_value	14.64	9.54	3.87	6.64	9.77	25.90	36.13	169
Adjusted_price	−0.08	2.63	−5.34	−1.59	−0.31	0.77	6.54	169
Turnover	45.10%	26.90%	13.70%	25.70%	39.30%	56.90%	162.10%	169
Volume (bn yuan)	1.75	1.51	0.19	0.76	1.33	2.29	6.37	169
log(Volume)	20.98	0.80	19.04	20.45	21.01	21.55	22.57	169
Volatility	6.47%	3.06%	2.32%	4.27%	5.63%	8.11%	15.50%	169
				After May 30, 2007				
Price	16.76	9.82	4.69	7.49	13.71	25.59	36.70	175
BlackScholes_value	16.23	12.09	3.09	7.30	10.81	27.20	40.04	175
Adjusted_price	0.53	3.74	−7.59	−1.61	0.74	2.45	9.77	175
Turnover	85.40%	50.90%	15.40%	48.00%	72.80%	113.30%	226.60%	175
Volume (bn yuan)	3.41	2.69	0.51	1.55	2.64	4.56	13.04	175
log(Volume)	21.68	0.751	20.05	21.16	21.7	22.24	23.29	175
Volatility	10.30%	4.54%	2.62%	6.89%	9.65%	13.40%	23.70%	175

B. Regression results

	(1)	(2)	(3)	(4)
Dep. variable:	*Adjusted_price*	*Turnover*	*log(Volume)*	*Volatility*
Post-event	0.420	0.285	0.634	0.0306
	(1.65)	(4.50)	(7.21)	(3.95)
Maturity fixed effect	Yes	Yes	Yes	Yes
Observations	344	344	344	344
Adjusted R^2	.000	.086	.131	.130

(*Continued*)

have smaller magnitudes for call warrants than for put warrants, all coefficients remain statistically significant and economically meaningful. For example, the adjusted price increased by 0.42 yuan (t-statistic =1.65); the daily turnover rose by 28.5% (t-statistic =4.50); the yuan-amount trading volume rose by 63.4% (t-statistic =7.21); and the daily price volatility rose by 3.1% (t-statistic =3.95).

Figure 4 illustrates a fair amount of heterogeneity in the speculativeness of the nine call warrants (which are visibly more heterogeneous than the put warrants). We further examine whether this heterogeneity is related to each warrant's pre-event speculativeness by running the following regression using the sample of call warrants:

$$DepVar_{j,t} = \alpha + \beta_1 Post\text{-}event_t + \beta_2 Pre\text{-}event\_turnover_j + \beta_3 Post\text{-}event_t * Pre\text{-}event\_turnover_j + \delta_m + \varepsilon_{j,t} t, \quad (3)$$

where *Pre-event_turnover* is a warrant's average turnover rate over the 20 days before the event and demeaned to zero. We use *Pre-event_turnover* to measure a warrant's level of speculativeness prior to the event. If the increase in the stamp tax for stock trading induced investors to trade the more speculative call warrants, the coefficient β_3 would be positive. Panel C of Table 4 reports

Table 4
(Continued)

C. Interaction with warrant turnover

	(1)	(2)	(3)	(4)
Dep. variable:	*Adjusted_price*	*Turnover*	*log*(*Volume*)	*Volatility*
Post-event	0.371	0.281	0.634	0.0306
	(1.49)	(4.39)	(7.18)	(3.91)
Post-event * *Pre-event_turnover*	7.523	1.325	0.876	0.0570
	(9.06)	(5.39)	(2.12)	(2.16)
Maturity fixed effect	Yes	Yes	Yes	Yes
Observations	344	344	344	344
Adjusted R^2	.360	.377	.142	.152

D. Interaction with warrant nominal price

	(1)	(2)	(3)	(4)
Dep. variable:	*Adjusted_price*	*Turnover*	*log*(*Volume*)	*Volatility*
Post-event	0.445	0.289	0.637	0.0307
	(1.84)	(4.53)	(7.26)	(3.93)
Post-event * *Pre-event_price*	−0.117	−0.0253	−0.0208	−0.000980
	(−7.44)	(−5.93)	(−2.61)	(−2.18)
Maturity fixed effect	Yes	Yes	Yes	Yes
Observations	344	344	344	344
Adjusted R^2	.298	.328	.199	.139

This table reports summary statistics (panel A) and the results of regression analyses (panels B–D) of call warrants' price, turnover, volume, and price volatility before and after the event date of May 30, 2007. *Price* is a warrant's daily closing price. *BlackScholes_value* is a warrant's fundamental value based on the Black-Scholes model. *Adjusted_price* refers to a warrant's daily closing price minus its fundamental value based on the Black-Scholes model. *Volume* is daily trading volume in billion yuan. *log*(*Volume*) is the log of one plus daily trading volume (in yuan). *Turnover* equals the number of shares traded on each day divided by the number of outstanding shares. *Volatility* is measured on a daily basis as the difference between the highest and lowest intraday prices scaled by the average. In panels B–D, *Post-event* equals one for days on or after May 30, 2007, and otherwise zero. *Pre-event_turnover* and *Pre-event_price* refer to a warrant's average turnover and closing price in the 20 trading days before the event, respectively, and are demeaned to zero. All regressions include maturity fixed effects. The sample period is from April 25, 2007, to June 26, 2007. Standard errors are clustered by day, and the corresponding t-statistics are reported in parentheses.

the results. The coefficients of all interaction terms are significantly positive, suggesting that after the stamp tax increase, speculative trading tended to migrate to the initially more speculative call warrants. Since *Pre-event_turnover* is demeaned to zero, β_1 estimates the treatment effect for the average turnover warrant and is similar to the results in panel B.

We also use warrants' nominal price as a proxy for speculativeness, as speculative investors tend to prefer low-priced stocks. We replace *Pre-event_turnover* in specification (3) with *Pre-event_turnover*, which is the average closing price over the 20 days before the event and demeaned to zero. Panel D of Table 4 reports the results. The coefficients of all interaction terms are significantly negative, again suggesting that speculative trading migrated to the initially more speculative call warrants.

In sum, after the stamp tax increase for stock trading on May 30, 2007, warrants became more overpriced, more frenziedly traded, and more volatile. These changes were particularly dramatic for the out-of-the-money put

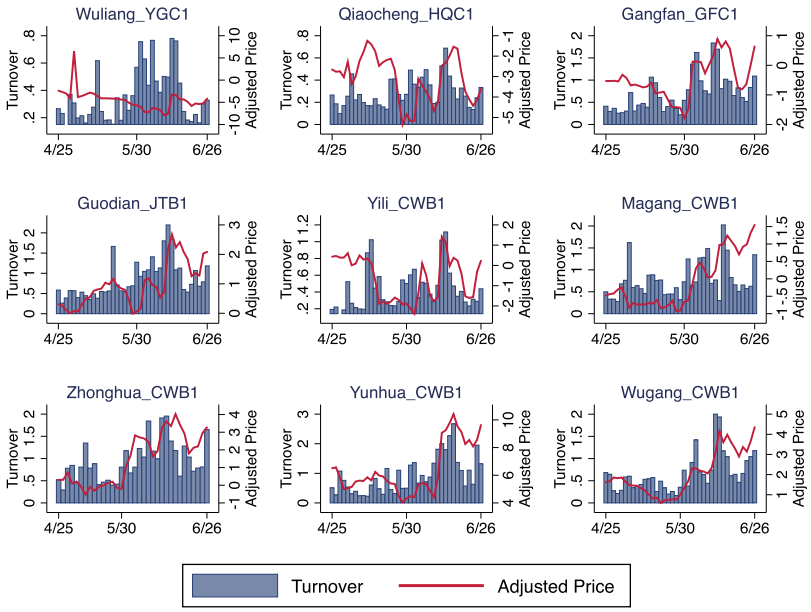

Figure 4
Price and turnover of call warrants around May 30, 2007
The figure plots daily turnover (left *y*-axis) and adjusted price (nominal price minus Black-Scholes value, right *y*-axis) for each call warrant from April 25, 2007, to June 26, 2007.

warrants. In the next section, we examine the economic mechanisms that might have led to these dramatic changes.

3. Economic Mechanisms

What led to the dramatic increases in both trading and pricing of the warrants, especially the put warrants? One argument is that the increase in the stamp tax signaled that the government intended to institute more policies in the future to cool down the stock market. This signal, in turn, might have changed the expectations of the representative investor about the stock market and the warrant market, resulting in strong investor demand for put warrants to hedge the stock market or even to speculate on a market crash. While this argument is appealing, it is too simplistic to reconcile with our findings for the following reasons. First, this argument does not explain the substantially intensified warrant trading after the event, as shown in this paper and in Li, Subrahmanyam, and Yang (2020). Second, it implies that the event would lead to opposite investor demands for put and call warrants, which contradicts our finding that both prices and the trading of call warrants increased in the same direction as put warrants, but with smaller magnitudes. Furthermore, as extensively discussed by Xiong and Yu (2011), these put warrants were deeply

out-of-the-money and, as a result, were largely ineffective as a hedge for the stock market.

In this section, we take advantage of account-level data of warrant trading around this event to provide further evidence against this hedging argument and some evidence supporting an alternative explanation. In our explanation, the increase in the stamp tax served as an initial shock to trigger large inflows of new warrant investors, and the massive entry of new investors further stimulated the speculative motives of existing warrant investors. Together, these forces exacerbate the bubble (which was already present) in the warrant market.

3.1 Substitution of warrant trading for stock trading

We obtain trading data from the Shenzhen Stock Exchange. The data include account-level trading records of all stocks and warrants listed on the exchange during the sample period. In our analysis, we focus on individual investors. We also exclude inactive investors, who did not trade any stock or warrant over the 20 days prior to the event, and new investors, who opened their accounts after April 25, 2007. Our final sample contains 12,888,682 accounts.

Despite the rapid progress in building a pool of institutional investors, individual investors still dominated China's financial markets during our sample period. According to a report issued by the China Securities Regulatory Commission (2008), individual investors contributed to 45.9% of shareholdings and 73.6% of trading volume on the Shenzhen Stock Exchange in 2007. Gong, Pan, and Shi (2017) show that the large inflow of new investors played an important role in driving the warrant bubble. Our trading data also reveal that only a small number of institutions participated in trading the warrants in our sample. As such, we focus on analyzing the trading of individual investors around May 30, 2007.

Table 5 summarizes variables related to the trading of individual investors.[11] Over the 20-day periods before and after May 30, 2007, we count investors' *Number of total trades* in both stocks and warrants, and *Number of trades in stocks, warrants, puts*, and *calls*.[12] If an account did not execute any trade in stocks or warrants during the period, the number would be zero. Before the event on May 30, an account traded 7.52 times on average, which includes 7.29 times for stocks and 0.23 times for warrants, broken down into 0.08 times for put warrants and 0.15 for call warrants. These numbers indicate that warrant trading was not common among investors, and trading of put warrants was particularly rare, as they were deep-out-of-the-money. After the event, investors on average

[11] Our trading data do not contain demographic information or information about investors' total wealth, income, portfolio value, or location.

[12] We count the number of executed orders that an investor placed. Note that this may be different from the number of trades calculated at the aggregate market level. For example, if one investor placed one sell order, which is matched with three buy orders from the other side, the transaction would be counted as one trade for the investor but three trades in the market.

Table 5
Investors' trading of stocks and warrants around May 30, 2007

	Mean	SD	P1	P25	P50	P75	P99	No. of investors
Before May 30, 2007								
Number of total trades	7.52	17.40	1.00	2.00	4.00	8.00	56.00	12,888,682
Number of trades in stocks	7.29	15.97	1.00	2.00	4.00	8.00	54.00	12,888,682
Number of trades in warrants	0.23	6.59	0.00	0.00	0.00	0.00	5.00	12,888,682
Number of trades in puts	0.08	3.03	0.00	0.00	0.00	0.00	2.00	12,888,682
Number of trades in calls	0.15	5.37	0.00	0.00	0.00	0.00	3.00	12,888,682
After May 30, 2007								
Number of total trades	7.59	21.32	0.00	1.00	3.00	8.00	70.00	12,888,682
Number of trades in stocks	6.11	12.97	0.00	1.00	3.00	7.00	50.00	12,888,682
Number of trades in warrants	1.49	16.22	0.00	0.00	0.00	0.00	37.00	12,888,682
Number of trades in puts	1.21	13.12	0.00	0.00	0.00	0.00	31.00	12,888,682
Number of trades in calls	0.28	6.51	0.00	0.00	0.00	0.00	7.00	12,888,682

This table reports summary statistics of investors' number of trades in stocks and warrants before and after the event date of May 30, 2007. Over the 20 trading days before or after the event, each investor's number of total trades, trades of stocks, warrants, puts, and calls are counted.

traded less in stocks (6.11 times) but much more in warrants (1.49 times); the increase was particularly large for put warrants (1.21 times).

We first document the massive entry of first-time investors to the warrant market after May 30, 2007. Before the event, only about 1% of the individual accounts on the Shenzhen Stock Exchange had ever traded put warrants. For each trading day, we count the number of accounts that traded put or call warrants for the first time and plot the time series in Figure 5. The upper panel shows that prior to May 30, the average number of first-time put warrant investors was approximately 3,000 per day. But, on the *first* day after the stamp tax increase, there was a sharp increase to more than 44,000 investors. Furthermore, the arrival each day of new investors remained elevated even 20 days after the event.

The lower panel shows the arrival of first-time investors for call warrants. The pre-event level is similar to that for put warrants, at around 4,500 per day. After the event, there was not an immediate jump on May 30; instead, the daily arrival of first-time investors to call warrants was gradually tripled to 13,000 over the subsequent 20 days. Taken together, after the increase in the stamp tax for stock trading, both put and call warrants experienced large inflows of first-time investors, well spread out across the subsequent several weeks.

Next, we examine whether more-active investors were more likely to start trading warrants after the stamp tax increase. We use the frequency of trades to measure an investor's activeness. More precisely, we sort all individual accounts in the Shenzhen Stock Exchange into 20 *activeness* groups based on their *Number of total trades* in both stocks and warrants during the 20 trading days before May 30. The group that traded more is regarded as more active. We define *Switchers* as stock investors who started trading put or call warrants listed on the exchange. For each investor group based on activeness, Figure 6 separately plots for put and call warrants the fraction of investors who switched over the 20 trading days after May 30. A clear pattern emerges: the fraction of

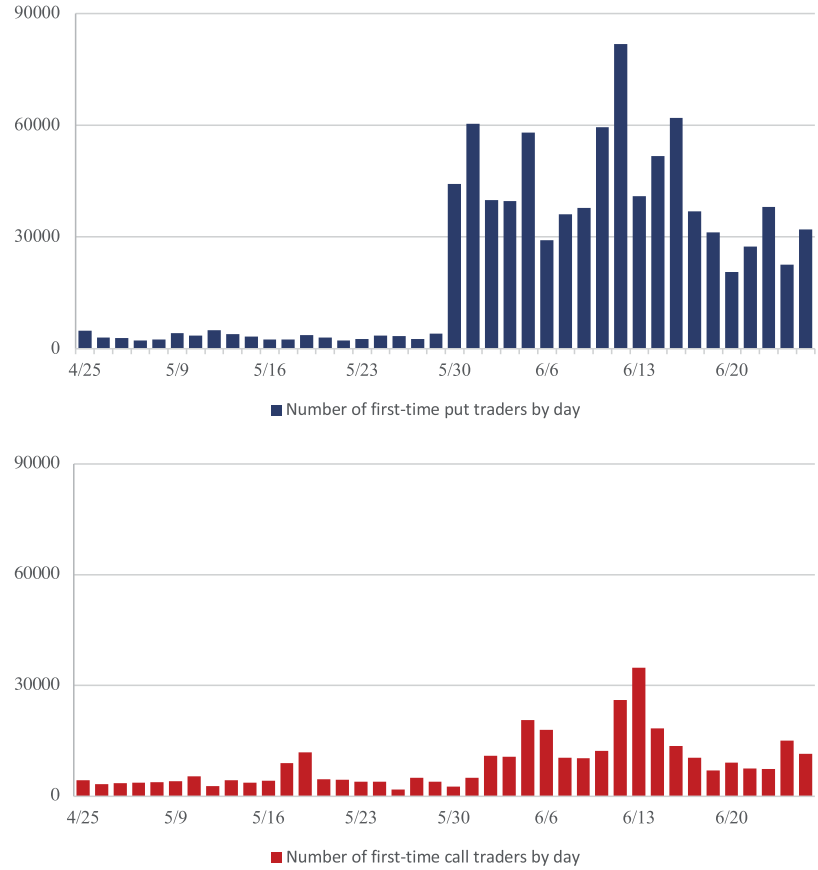

Figure 5
Number of first-time warrant traders by day
The upper (lower) panel plots the daily number of first-time put (call) trader from April 25, 2007, to June 26, 2007. For each day, first-time traders are defined as stock investors who start trading call or put warrants for the first time on that day.

Switchers is monotonically increasing across the 20 groups sorted by investor activeness for both types of warrants. Such pattern is much stronger for put than for call warrants: 2.18% for the least active group to 9.74% for the most active group switched to put warrants, whereas 0.63% for the least active group and 4.63% for the most active group switched to call warrants. This pattern shows that more-active investors had a greater propensity to start trading warrants after the increase in the stamp tax for stock trading.

We now examine the substitution effect between stock trading and warrant trading from another aspect by plotting the change in trading intensity in stocks and warrants by each of the 20 investor groups sorted by activeness over 20 trading days before and after May 30 in Figure 7. The upper panel plots the

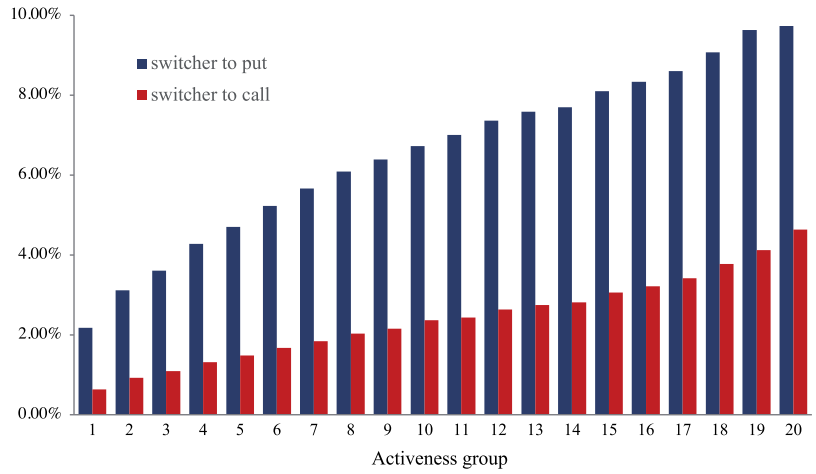

Figure 6
Switchers from stock trading to warrant trading
The event window is from April 25, 2007, to June 26, 2007. *Switcher* is defined as a stock investor who does not trade any warrants during the event window before May 30 but starts to trade warrants after. The figure plots the fraction of the number of *Switchers* after May 30, 2007, to the total number of investors in each activeness group. The 20 activeness groups are sorted by investors' total number of trades before the event.

change in the number of trades in stocks and warrants: *Number of trades in stocks* (dashed line) and *Number of trades in warrants* (solid line). For groups 3 to 20, investors trade more warrants and fewer stocks after the event. Additionally, the substitution effect is most significant for the most active group. In the lower panel, we decompose the change in *Number of trades in warrants* into *Number of trades in calls* and *Number of trades in puts.* The substitution effect exists for both call and put warrants. The magnitude of the substitution effect increases with investor activeness and is roughly 10 times larger for put warrants.

We formally examine this substitution effect by running the following regression:

$$\begin{aligned} \textit{Number of trades}_{k,t} = {} & \alpha + \beta_1 \textit{Post-event}_t + \beta_2 \textit{Activeness}_k \\ & + \beta_3 \textit{Post-event}_t * \textit{Activeness}_k + \varepsilon_{k,t}, \end{aligned} \tag{4}$$

where *Activeness* is the rank of investor k's activeness group, from 1 to 20. The dependent variables are *Number of trades* in *stocks, warrants, calls,* and *puts.* Table 6 presents the regression results. We provide two standard errors. The t-statistics in parentheses are based on robust standard errors, that is, assuming each investor is independent. To be conservative, we also show t-statistics based on standard errors clustered by activeness group in brackets.

In the univariate regression in column 1, β_1 equals 1.25, which indicates that on average investors trade roughly one-and-a-quarter times more in warrants than before the event. In column 2, β_3 is significantly positive. The coefficient

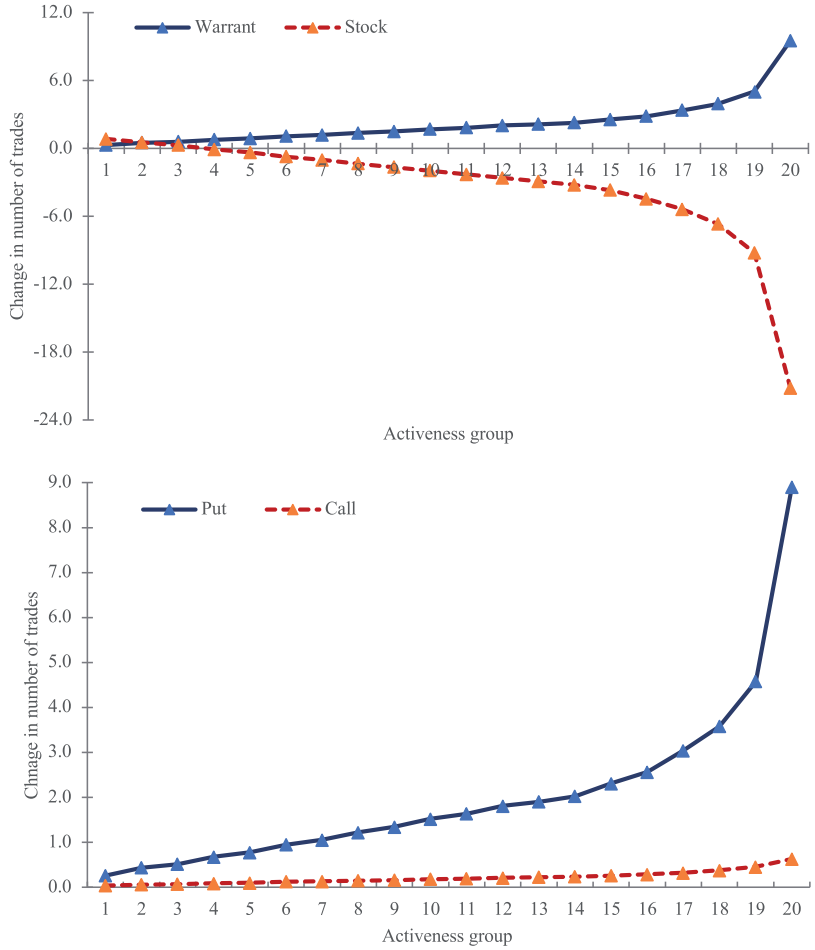

Figure 7
Substitution of stock trading by warrant trading
The upper panel plots the change in the number of trades in warrants (solid line) and in stocks (dashed line) before and after May 30, 2007, by activeness group. The lower panel plots the change in the number of trades in put warrants (solid line) and in call warrants (dashed line). Investors are sorted into 20 activeness groups based on their total number of trades in stocks and warrants before the event.

implies that a one-rank rise in the activeness score increases the frequency of trading warrants by 0.25 times (with t-statistics of 272.6 and 4.88). Columns 3 and 4 use *Number of trades in stocks* as the dependent variable. The result shows that investors trade stocks less frequently, especially for more-active investors. In columns 5–8, we separate investors' warrant trades by put and call and find that the pattern is consistent and statistically significant for both. In terms of economic magnitude, the tendency of migration to puts for active investors is approximately 10 times stronger than to calls.

Table 6
Substitution of trading and investor activeness

	(1)	(2)	(3)	(4)
Dep. variable: Number of trades	Warrant	Warrant	Stock	Stock
Post-event	1.2547	−0.2067	−1.1784	2.0254
	(257.23)	(−28.59)	(−205.63)	(278.22)
	[3.9]	[−0.92]	[−1.66]	[3.54]
Activeness		0.0827		1.6634
		(129.15)		(2581.15)
		[2.21]		[4.25]
*Activeness*Post-event*		0.2467		−0.5409
		(272.62)		(−593.56)
		[4.88]		[−4.16]
Observations	25,777,364	25,777,364	25,777,364	25,777,364
Adjusted R^2	.0026	.0133	.0016	.2745
	(5)	(6)	(7)	(8)
Dep. variable: Number of trades	Call	Call	Put	Put
Post-event	0.1263	0.0052	1.1284	−0.2118
	(53.70)	(1.47)	(300.77)	(−38.08)
	[4.67]	[0.49]	[3.82]	[−0.98]
Activeness		0.0554		0.0273
		(178.83)		(55.43)
		[2.16]		[2.33]
*Activeness*Post-event*		0.0205		0.2263
		(46.70)		(324.98)
		[8.70]		[4.69]
Observations	25,777,364	25,777,364	25,777,364	25,777,364
Adjusted R^2	.0001	.0037	.0035	.0011

This table presents regressions of investors' number of trades in stocks, warrants, calls, and puts on *Post-event* and investor activeness. The dependent variable is the number of trades in warrants (columns 1 and 2), stocks (columns 3 and 4), calls (columns 5 and 6), and puts (columns 7 and 8), over the 20 trading days before or after the May 30, 2007, event. *Post-event* is a dummy variable that equals one if it is after the event. *Activeness* refers to the semidecile score of investors' activeness groups, based on investors' total number of pre-event trades. The t-statistics reported in parentheses are based on standard errors clustered by investor, and t-statistics in brackets are based on standard errors clustered by activeness group.

Taken together, right after the increased stamp tax for stock trading, a large fraction of investors, especially more-active investors, migrated to warrant trading. While this substitution effect is significant for both call and put warrants, the inflows to put warrants were substantially larger and responded to the event immediately.

3.2 Price reactions on the event day

What led to the stronger inflows of new investors to put warrants than to call warrants? One may simply attribute the stronger inflows to the attraction of put warrants as a hedge for a likely stock market downturn. As we discussed earlier, these put warrants were substantially overvalued before the event. This hedging argument cannot explain why so many new investors chose to buy put warrants at highly overvalued prices. Instead, we argue that some other forces were present to make put warrants more attractive to the new warrant investors. In this subsection, we first highlight the price reactions of both put and call

warrants on the event day and then discuss the potential forces that made put warrants more appealing to the new investors.

The increase of the stamp tax for stock trading was announced in the early morning of May 30, 2007, before the opening of stock and warrant trading. Table 7 reports the overnight return (i.e., the return at the opening relative to the close of the previous day), daytime return (i.e., the return during the trading hours of the day), and the total return for each of the call and put warrants that were traded on either the Shenzhen or the Shanghai Stock Exchange on the event day of May 30, along with the overnight return and daytime return of the underlying stock.

As the announcement of the stamp tax increase was negative news to the stock market, stocks dropped by 7.3% on average at the opening of trading, and the underlying stocks of the call and put warrants dropped on average by 7.1% and 6.3%, respectively. Along with these stock price drops, the prices of call warrants dropped by an average of 7.5%, while the prices of five put warrants rose by 5.9%. The movement of warrant prices during the subsequent trading hours became even more interesting. The overall stock market dropped another 1.0%. The underlying stocks of the call warrants decreased by 1.6%, and the call warrants on average dropped by 3.9%, which was even larger than the drop in the underlying stocks. Surprisingly, while the underlying stock prices of the put warrants drifted downward by only 1.1%, these put warrants on average moved up by 58.1%. One of the put warrants, Jiafei, jumped by as much as 171.6%.

Explaining the enormous put warrant price increases by the decreases in the underlying stock prices is difficult to do. To highlight this gap, we use the ratio between the overnight returns of each warrant and its underlying stock to construct its implied delta and then use the implied delta multiplied by the daytime return of the underlying stock to extrapolate the warrant's daytime return. Table 7 reports the implied delta and the extrapolated daytime return for each warrant. The implied delta has the correct sign, in that it is positive for call warrants and negative for put warrants. The value of the implied delta—on average 1.11 for call warrants and -1.25 for put warrants—is excessive. As standard option pricing models imply that the delta of an option should be between -1 and 1, these values indicate that the prices of both put and call warrants already had overreacted at the opening relative to the drops of their underlying stock prices.

Even these excessive delta values implied from the opening prices are insufficient to explain the changes of the warrant prices during the subsequent trading hours. The extrapolated daytime return for the put warrants is only 3.5% on average, which is far from the average realized return of 58.1%. The failure of the extrapolated daytime return to capture the realized daytime return shows that the prices of put warrants overreacted during the trading hours beyond the trend extrapolated from the opening prices by another 54.6%. The extrapolated daytime return of -2.5% for the call warrants also falls short of the realized return of -3.9%, indicating further overreactions by the prices of call warrants,

Table 7
Overnight and daytime return of stocks and warrants on May 30, 2007

Warrant code	Warrant name	Warrant			Underlying stock		Implied delta	Extrapolated daytime return	Realized minus extrapolated
		Overnight	Daytime	Total	Overnight	Daytime			
	Call warrants								
30002	Wuliang YGC1	−5.7%	−1.3%	−6.9%	−6.4%	2.0%	0.89	1.8%	−3.1%
31001	Qiaocheng HQC1	−9.0%	−2.0%	−10.8%	−8.1%	−1.0%	1.11	−1.1%	−1.0%
31002	Gangfan GFC1	–	–	–	–	–	–	–	–
580008	Guodian JTB1	–	–	–	–	–	–	–	–
580009	Yili CWB1	−7.8%	−1.6%	−9.3%	−9.9%	3.2%	0.79	2.5%	−4.2%
580010	Magang CWB1	−8.4%	−4.2%	−12.3%	−4.9%	−5.4%	1.71	−9.2%	5.0%
580011	Zhonghua CWB1	−7.9%	−7.8%	−15.1%	−8.3%	−1.8%	0.94	−1.7%	−6.1%
580012	Yunhua CWB1	−7.4%	−4.4%	−11.5%	−6.0%	−4.0%	1.24	−5.0%	0.5%
580013	Wugang CWB1	−6.4%	−5.9%	−11.9%	−5.8%	−4.5%	1.10	−4.9%	−1.0%
	Average	−7.5%	−3.9%	−11.1%	−7.1%	−1.6%	1.11	−2.5%	−1.4%
	Put warrants								
580997	Zhaohang CMP1	4.8%	46.7%	53.8%	−5.1%	−1.1%	−0.94	1.1%	45.6%
38003	Hualing JTP1	4.8%	22.1%	28.0%	−7.4%	−2.8%	−0.65	1.8%	20.3%
38004	Wuliang YGP1	8.5%	18.3%	28.3%	−6.4%	2.0%	−1.32	−2.7%	21.0%
38006	Zhongji ZYP1	4.5%	31.6%	37.5%	−9.9%	2.7%	−0.46	−1.2%	32.8%
38008	Jiafei JTP1	6.9%	171.6%	190.3%	−2.4%	−6.4%	−2.87	18.4%	153.2%
	Average	5.9%	58.1%	67.6%	−6.3%	−1.1%	−1.25	3.5%	54.6%

	Stock return		
All stocks	Overnight	Daytime	Total
Average	−7.3%	−1.0%	−8.2%
SD	2.6%	3.2%	3.6%

This table presents the return of warrants, warrants' underlying stocks, and all stocks on May 30, 2007. Overnight return is defined as the percentage change of the open price on May 30 to the closing price on May 29. Daytime return equals the percentage change of the closing price on May 30 to the open price. Total return is the sum of overnight and daytime returns. Implied delta is calculated as the ratio of the warrant overnight return to the corresponding underlying stock return. Extrapolated daytime return equals implied delta multiplied by the daytime return of underlying stocks. Realized minus extrapolated refers to the difference between the warrant daytime return and the extrapolated daytime return. Call warrants 31002 and 580008 were suspended for trading on May 30, 2007.

although this gap is much smaller than the put warrants. Given the substantially inflated prices of the put warrants, it is difficult to explain the larger inflows of new investors to put warrants simply by the investors' hedging demand.

Several mechanisms that build on different investor behaviors may help to explain this asymmetry between put and call warrants. One possible argument is through the salience of the large price increases of the put warrants, which were likely to attract investor attention on the event day when other securities were experiencing large price drops. The recent literature provides extensive evidence of positive feedback and trend-chasing by retail investors in China's financial markets. Pearson, Yang, and Zhang (2020) document trend-chasing behavior in warrant investors; Bian et al. (2019) and Liao, Peng, and Zhu (2020) identify similar patterns among stock investors; and Chen et al. (2019) show that retail investors react strongly to attention-grabbing events, such as stock prices hitting daily upper limits. For the four put warrants in our sample, we also confirm in Table A1 of the Internet Appendix that during the 20 post-event trading days, the number of new investors to a put warrant is positively correlated with the warrant's return on the previous day. Thus, the asymmetric price movements of put and call warrants on the event day might have led to stronger inflows of new investors to the put warrants, despite their substantial overvaluations.[13]

In addition to the large price increases on the event day, the put warrants already had been more speculative before the event day; they were overvalued and more intensively traded than the call warrants (Tables 3 and 4). As our analysis in the previous subsection also showed that more-active investors were more likely to migrate to the warrant market, another possible mechanism is that these new warrant investors preferred the more speculative securities, that is, put warrants. Consistent with this mechanism, Table 4 shows that more-speculative call warrants experienced larger increases in prices and trading volume after the event. We find both of these mechanisms plausible, even though the small sample of put warrants prevents us from systematically testing them. Other mechanisms also may be at play. These possible mechanisms serve to guide stronger inflows of new investors, initially triggered by the increase in stamp tax for stock trading, to put warrants than to call warrants.

3.3 A placebo test

One may still be concerned by an alternative argument that the migration of new investors to the warrant market was driven by the large drop in the stock market on May 30, 2007, rather than the tripling of the stamp tax. To rule out this alternative argument, we construct a placebo test that exploits a handful of placebo event days where the stock market experienced similarly large drops

[13] As direct evidence of the ignorance of the warrant fundamentals by some warrant investors, Liao et al. (2014) show that some investors even exercised out-of-the-money put warrants at immediate losses or failed to exercise in-the-money call warrants.

Table 8
Return of stocks and warrants on placebo event days

	Market return	Return of calls	Return of puts	Number of first-time put traders
May 30, 2007				
Mean	−7.02%	−11.1%	67.6%	44,239
SD		2.53%	69.4%	
Observations		7	5	
Placebo dates				
February 27, 2007	−8.96%	−16.7%	5.27%	3,223
June 7, 2006	−6.05%	−10.1%	1.31%	6,581
July 5, 2007	−5.50%	−6.60%	−10.6%	10,089
July 13, 2006	−5.34%	−0.23%	23.3%	5,180
January 31, 2007	−5.19%	−7.68%	−7.17%	1,059
Placebo date summary				
Mean	−6.21%	−8.63%	5.31%	5,226.4
SD		7.04%	19.2%	
Observations		57	62	
Difference = Event – Placebo		−2.48%	62.3%	
t-statistics		(−0.92)	(5.28)	

This table summarizes the returns for the stock market, call warrants, and put warrants, and the number of first-time put traders on May 30, 2007, and on the five placebo event dates. The five placebo event dates are the days with the lowest market returns between December 5, 2005, to October 31, 2007, excluding April 25 to June 26, 2007. Market return is calculated with the value-weighted return of all A-share stocks.

but there was no change in the stamp tax. Since the Chinese stock market is highly volatile, it is not unusual for the market to experience large price fluctuations without any material news, thereby offering us a feasible setting to conduct this placebo test. To identify the placebo event days, we restrict to the period when warrants were traded, that is, December 5, 2005, to June 20, 2008, and we exclude our current event window (i.e., April 25 to June 26, 2007). Furthermore, to make sure that the market environment of the placebo event days is similar to the event day on May 30, 2007, we focus on the period of the stock market boom (i.e., before the market peak on October 31, 2007). We find five trading days during our intended period during which the stock market (measured by the value-weighted return of all A-share stocks) dropped by more than 5%, and we use these days as our placebo event days; Table 8 lists them. For example, on February 27, 2007, the market dropped by 8.96%, which is even more than the 7.02% drop on May 30, 2007. Interestingly, the media did not report any major news around this market drop.

If the alternative argument were true, we should observe similar patterns in price and trading of put warrants on these placebo event days. In particular, we should see a jump in put warrant prices and a large number of new investors entering the put warrant market. However, this is not what we observe.

First, we report the average daily returns of put and call warrants on the placebo event days in Table 8, similar to the analysis in Table 7. Across the five placebo event days, the average daily return of put warrants is modestly positive, only 5.31%, which is in sharp contrast to the increase of 67.6% on May 30, 2007. On two of the five placebo days, put warrant prices even decreased.

Statistically, the average return of put warrants on the placebo days is 62.3% lower than that on May 30, 2007, with a t-statistic of 5.28. This significant difference suggests that a large drop in the stock market does not necessarily lead to excessive price increases of put warrants. In contrast, the magnitude of price decreases of call warrants on these five placebo event days was not significantly different from that on May 30, 2007.

Next, we examine the migration of new investors to the put warrant market on the placebo event days by listing in Table 8 the number of new put warrant investors on each of the placebo event days. We find that, while there is a migration effect, the magnitude is substantially smaller. The average number of new investors in the put warrant market is 5,226.4 across the five placebo event days. By comparison, the average number of new investors over the 20 days prior to May 30, 2007 is approximately 3,000, and on May 30, 2007, the number of new investors reaches 44,239. Even on the day with the largest number of new entries among the placebo event days, July 05, 2007, the number is only 10,089, substantially smaller than on May 30, 2007.

We also repeat the regressions in Tables 3 and 4, which compare the price and volume of put and call warrants over 20 trading days before and after the placebo event days. Recall from Table 3 that put warrants experienced substantially increased price and trading during the 20 trading days after May 30, 2007. In contrast, Table A2 in the Internet Appendix shows no clear patterns before or after the five placebo event days.

In sum, on the five placebo event days, we do not find robust and significant increases in put warrant prices or massive investor migration to the put warrant market. While the statistical power from only five placebo events is limited, this placebo test nonetheless shows that a large drop in the stock market by itself does not necessarily lead to a speculative boom in the put warrant market. The increase in the stamp tax is plausibly necessary to trigger what we observe happened on May 30, 2007, in the warrant market.[14]

3.4 Trading on the event day

While the large inflows of new investors to the warrant market triggered by the stamp tax increase are compelling, they were just part of the picture. Interestingly, existing warrant traders also became more active in response to the inflows of new investors. To illustrate the full picture, we now analyze the trading intensity of different investors in put and call warrants on the event day, in conjunction with their characteristics prior to the event.

Specifically, for each investor who traded any warrants on May 30, we count the *Number of trades* (purchases and sales) in put and call warrants and *Total*

[14] One also may be concerned by another alternative argument: that the sudden sharp increases in put warrant prices alone can generate the effects of migration and intensified trading. Unfortunately, we cannot conduct a similar placebo test to directly examine it, as we cannot identify any day in the prebubble period on which put warrant prices increased by an amount comparable to that on May 30, 2007.

value of trades for the whole day (we exclude any investor who did not trade any call or put warrant on May 30). Then, we rank investors based on the *Number of trades* in each account and classify all accounts into five groups: the top 0.1% active investors, 0.1% to 1%, 1% to 5%, 5% to 50%, and the least active group of the bottom 50%. We also include all new warrant investors in a separate group.[15] For each of these six groups, we also calculate the investors' *Number of trades* and *Total value of trades* per day over the 20-day window before May 30. We conduct this analysis separately for put and call warrants, including the two call warrants and four put warrants traded on the Shenzhen Stock Exchange on the event day.

Panel A of Table 9 reports the results for put warrants. First, note from the first column that about one-third (44,239 of 131,627) of the accounts that traded put warrants on May 30 were new investors. On average, they traded four times on the event day, that is, one time for each warrant. They had net long positions, as their *Total value of purchases* was substantially greater than their *Total value of sales*.

The most active group (top 0.1%) features 131 traders. These traders traded put warrants on average 118.3 times on May 30, nearly thirtyfold the intensity of first-time traders and a sharp increase from their pre-event level of 14.2 times per day. Their trading, measured in yuan, rose from 1.75 million to 34.6 million. The value of their purchases was almost the same as the value of their sales, indicating that they were day traders without a net position. Given that only four put warrants were being traded, each of these active traders traded each put warrant nearly 30 times on this day. It is difficult to attribute such a high trading frequency without a net position to demand for hedging or portfolio balancing. Instead, this intensive trading behavior is more consistent with a speculative trading strategy of timing intraday price patterns, stimulated by the large inflows of first-time warrant investors.

This increase was not limited to the small group of the 131 most active investors; all groups of existing warrant investors dramatically increased their warrant trading on May 30 relative to their respective pre-event levels. The second-most active group of 0.1% to 1% investors, which includes 1,185 investors, traded on average 36.8 times on May 30, a sharp contrast to the 2.0 times before the event. The third-most active group of 1% to 5%, which includes 5,265 investors, traded on average 17.8 times, as opposed to 0.6 times before the event. The largely intensified trading of so many existing warrant investors again reflects their speculative trading motives rather than their hedging or portfolio rebalancing needs.

Panel B of Table 9 reports similar patterns across the investor groups for the two call warrants in our sample. New investors (2,599) of call warrants traded two times on average on the event day, that is, one time for each call

[15] Note that this group of first-time warrant investors overlaps with the aforementioned five groups, as each first-time investor also falls into one of these groups based on his or her number of trades on the event day.

Table 9
Investor trading on and prior to May 30, 2007

A. Put warrants

	First time	Top 0.1%		0.1%–1%		1%–5%		5%–50%		Bottom 50%	
(per day)	On event	Pre-event	On event	Pre-event	On event	Pre-event	On event	Pre-event	On event	Pre-event	On event
Number of trades	4.0	14.2	118.3	2.0	36.8	0.6	17.8	0.2	5.6	0.1	1.5
Number of purchases	2.2	6.4	52.8	1.0	18.4	0.3	9.1	0.1	2.9	0.1	0.8
Number of sales	1.7	7.7	65.5	1.0	18.4	0.3	8.7	0.1	2.7	0.0	0.7
Total value of trades	172.6	1750.7	34572.6	135.0	3887.4	29.0	1065.8	7.4	252.1	3.4	48.8
Total value of purchases	93.5	874.2	17211.8	68.2	1929.0	14.6	531.7	3.9	125.6	1.8	25.3
Total value of sales	79.1	876.5	17360.8	66.8	1958.4	14.4	534.1	3.5	126.5	1.6	23.5
# of investors	44,239	131		1,185		5,265		59,232		65,814	

B. Call warrants

	First time	Top 0.1%		0.1%–1%		1%–5%		5%–50%		Bottom 50%	
(per day)	On event	Pre-event	On event	Pre-event	On event	Pre-event	On event	Pre-event	On event	Pre-event	On event
Number of trades	2.0	105.7	179.4	14.7	34.7	3.9	11.0	0.9	3.1	0.4	1.1
Number of purchases	1.4	48.1	83.6	7.0	18.0	2.0	6.1	0.5	1.7	0.2	0.7
Number of sales	0.6	57.5	95.9	7.7	16.7	1.9	4.9	0.4	1.5	0.2	0.4
Total value of trades	181.0	26805.4	55164.7	3638.7	9057.2	877.4	1964.6	93.0	348.9	37.7	101.3
Total value of purchases	132.0	13402.5	27475.9	1818.6	4623.9	445.8	1022.0	47.7	167.7	20.0	52.1
Total value of sales	49.0	13402.8	27688.9	1820.1	4433.2	431.6	942.6	45.3	181.2	17.7	49.3
# of investors	2,599	27		247		1,100		12,369		13,744	

Investors trading put or call warrants are sorted based on the *Number of trades* in puts or calls on May 30 into five groups, the top 0.1%, 0.1% to 1%, 1% to 5%, 5% to 50%, and the bottom 50%. *Number of trades* equals the daily number of trades in puts or calls. *Number of purchases/sales* equals the number of purchases/sales in puts or calls per day. *Total value of trades/purchases/sales* is the total yuan volume of investors' daily trades/purchases/sales (in thousands) in puts or calls. Columns labeled with "Pre-event" report the mean of the statistics over the 20-day window prior to May 30, 2007. Columns labeled with "On event" report the mean of statistics on May 30, 2007. Column "First time" refers to the group of investors who traded put or call warrants for the first time on May 30. Panel A reports the statistics for put warrants, and panel B reports the statistics for call warrants. The sample includes all investors who trade warrants on the event day.

warrant. This intensity is similar to that of the new put warrant investors. The most-active group (the top 0.1%) had 27 traders who traded 179.4 times on average on May 30, an increase from 105.7 times prior to the event. Investors in the next-most-active group (0.1% to 1%) increased their trading intensity from 14.7 times to 34.7 times.

The contrast between the trading intensity of the new warrant investors and the investors in the most-active groups confirms that the dramatic increase in the trading intensity in the warrant market on the event day was not simply driven by the substitution of warrant trading for stock trading by those new warrant investors. Instead, this discrepancy in trading intensity suggests that the arrival of the new investors to the warrant market greatly stimulated the speculative motives of a significant fraction of existing warrant investors, whose substantially intensified trading helps to explain the increases in the trading volume of both put and call warrants.[16]

4. Conclusion

In this paper, we conduct an event study of China's May 30, 2007, increase of the stamp tax on stock trading. The stamp tax increase precipitated large inflows of new investors to the warrant market, which in turn intensified the speculative motives of existing warrant investors to engage in frenzied trading of highly overvalued put warrants.[17] As these effects induced by a Tobin tax are likely to depend on the specific market conditions at the time, we cannot predict that they would repeat when Tobin taxes are used in other contexts. Nevertheless, we believe that Tobin taxes may well induce unintended consequences in other unrelated markets, even though the consequences of these aftereffects may or may not be in the form of an exacerbated bubble. Taken together, our

[16] The intensified trading by existing warrant traders also helps explain the mechanism that drives the warrant bubble. Xiong and Yu (2011) argue that the bubble in these out-of-the-money put warrants is generated by investors' speculative motives, that is, each investor buys an overvalued warrant, aiming to resell it to a greater fool down the road, who might pay even more, as modeled by Harrison and Kreps (1978) and Scheinkman and Xiong (2003). The emergence of speculative motives requires heterogeneity among warrant investors. Some are ignorant and thus may become the greater fool, whereas others are smart and are thus able to recognize the possibility of reselling to the greater fool. The presence of new warrant investors and the highly active existing investors paints a picture consistent with this argument. Furthermore, Table A3 of the Internet Appendix shows that the warrant with the largest price increase on May 30, 2007, exhibited the most intensive trading. The price of Jiafei JTP1 increased by 171.6%, a value much higher than the other three put warrants. At the same time, the most active 0.1% of Jiafei JTP1 investors increased their trading intensity by 19 times; the increase for the other three put warrants ranges from 7 to 10 times.

[17] During the period when warrants were traded in China, two other changes occurred in the stamp tax rate: both occurred in 2008, during the stock market bust following the market boom in 2007. The Chinese government lowered the rate of the stamp tax on stock trading to 0.2% on April 26, 2008, and further reduced it to 0.1% on September 19, 2008, with the primary intention of stimulating the stock market. One might expect the decrease in the stamp tax to reverse the spillover effects of the initial stamp tax increase on the warrant market. However, these reductions in the stamp tax occurred after the overall market in China, including both stock and warrant markets, suffered large losses, and investors lost their confidence and enthusiasm for security investments. In such market conditions, the stamp tax reductions failed to revive their confidence. Consequently, in unreported analysis, we find only mixed evidence of substitution of trading from the warrant market back to the stock market after these stamp tax reductions.

analysis highlights a key challenge to financial regulators: they need to account for market participants' sidestepping a financial policy by engaging in other unregulated markets and any subsequent spillover effects that may occur as the result of market participants' actions.

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