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Investor structure and stock market fluctuations: a quantitative analysis

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ABSTRACT
This paper investigates the relationship between the investor structure and stock price by introducing heterogeneous traders into a standard DSGE model. This paper finds that the stock market experiences intense stock price fluctuations due to a high proportion of individual speculators. Our simulations indicate that the optimal proportion of individual speculators in China's stock market is about 43% to maximize social welfare.

KEYWORDS
Investor structure; stock price fluctuation; social welfare; DSGE model

JEL CLASSIFICATION
E32; C68; G10

I. Introduction

The fluctuations of stock markets have always been a prominent topic. The literature shows that the stock market can be an economic indicator and the involvement of informed investors contributes to the stock market' stability (Miao, Shen, and Wang 2019; Yao and Li 2020). However, there is a puzzle in which the Chinese economy has experienced rapid growth while there are frequent occurrences of short boom and long depression in the Chinese stock market (Pan, Xu, and Zhu 2021). The Chinese stock market has a unique structure of investors with a high percentage of individual speculators, which is very different from developed countries (Bouri et al. 2020; Sun, Zheng, and Dong 2015).[1] In a retail investor-dominated emerging market, the stock market may be more unstable (Li and Wang 2010), because the retail investor (or called individual speculator) contains belief and emotional distortions (Boehmer et al. 2021; Kumar and Lee 2006). Therefore, this paper tries to investigate the relationship between the investor structure and stock price by introducing heterogeneous traders into a standard dynamic stochastic general equilibrium (DSGE) model.

This paper is closely related to both macro and behavioural economics literature. Macroeconomics papers usually study stock market fluctuations and the real economy by imposing exogenous bubbles or behavioural beliefs based on exogenous shocks (Farmer and Platonov 2019; Gabaix 2020). Differently, the behavioural literature introduces heterogeneous traders in the stock market, and studies how heterogeneous beliefs affect endogenous stock price bubbles (Barberis et al. 2018; Cutler, Poterba, and Summers 1990; Xiong and Yang 2021). They find that different types of traders play corresponding roles in financial market stability and asset bubbles by herding effect on equity returns (Greenwood and Shleifer 2020; Haruvy, Lahav, and Noussair 2007; Zheng, Li, and Zhu 2015). And even slight belief fluctuations caused by such media reports will generate substantial bubbles (Bordalo et al. 2021; Bouri et al. 2021; Cifuentes, Ferrucci, and Shin 2005; Reinhart and Rogoff 2011; Shahzad et al. 2021; Zhu et al. 2018).

The literature pays little attention to the relationship between the investor structure and the stock market fluctuations in China, and quantitative analysis is rare. This paper, therefore, attempts to contribute the literature from the following two points. First, this paper introduces heterogeneous traders into a DSGE model to study how the investor structure impacts the stock prices, filling the gap between the macro

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[1]The structure of investors can be gauged in various aspects. To concretize our research question, we define the investor structure as the share of individual investors in this paper.

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and the behavioural model. Second, this paper is devoted to the literature by quantifying the economic mechanism.

The rest of the paper proceeds as follows. Section II introduces the model. Section III presents the simulation. Section IV concludes.

II. The key forces of model: heterogeneous traders

There are heterogeneous traders in the stock market: (i) the fraction of fundamental traders is m, and (ii) the fraction of speculators is 1-m. Household provides inelastic 1 unit of labour. Assume the utility of a representative trader is:

$$E_t^i \sum_{t=0}^{\infty} \beta^t \ln C_{it}, i \in \{f, e\} \tag{1}$$

where f and e denote the fundamental trader and the speculator respectively, and C_{it} is the consumption in time t. The budget constraint is given by:

$$C_{it} + D_{it} p_t = w_t + D_{i,t-1}(p_t + d_t), \tag{2}$$

where D_{it} is the fundamental trader's equity holding, p_t is the ex-dividend share price, w_t is the wage rate, and d_t is the firm dividend. A representative trader chooses the optimal $\{C_{it}, D_{it}\}$, and thus we obtain the first order condition:

$$\beta E_t^i \left(\frac{\Lambda_{t+1}^i}{\Lambda_t^i} (p_{t+1} + d_{t+1}) \right) = p_t. \tag{3}$$

where Λ_t^i is the Lagrange multiplier of Eq (2). In particular, following Barberis et al. (2018), the speculator's rule follows:

$$\beta E_t^e \left(\frac{\Lambda_{t+1}^e}{\Lambda_t^e} (p_{t+1} + d_{t+1}) \right) = \beta E_t^e \left(\frac{\Lambda_{t+1}^e}{\Lambda_t^e} X_t \right). \tag{4}$$

where

$X_t = [(1-\theta) \sum_{k=1}^{\infty} \theta^{k-1} (p_{t-k} - p_{t-k-1}) + p_t]/\beta$ is the learning rule for the speculator. The left-hand side of Equation (4) is the speculator's expected discount revenue, the sum of expected discount resale price plus the dividend, which is equal to the adaptive expectation at the right-hand side of Equation (4). See Appendix A for other settings and proofs of the complete model.

III. Simulation

In this section, we calibrate the model and do some simulations to study the mechanism of the model. We report the setting of parameters and procedures of calibration in Appendix B.

Impulse response

In Figure 1, the economy is imposed a positive TFP shock in the first period and a negative TFP shock in the second period. It shows that the stock price of China's stock market begins to decline rapidly since the second period, and the endogenous bubble starts to deflate. As the stock price continues to fall, speculators quickly sell equity, and fundamental traders buy equity meanwhile. The decline in stock price accelerates the process of speculators' selling, and shifts China's stock market from boom to depression. The recession process will last for at least 40 periods (i.e. a long depression). On the contrary, the stock price recovers steadily after the negative shock in the U.S., and the stock market is more stable than that in China with low m, the decline of output of the U.S. is weaker.

On the contrary, we impose a negative TFP shock in the first period and a positive TFP shock in the second period in Figure 2. We find that the negative shock in the 1st period greatly reduces China's stock price (−0.06 of impulse response), and individual speculators' selling behaviour further amplifies the effect of stock price decline. Although there is a positive shock in the 2nd period, it does not make the stock price recover quickly. The stock price does not get rid of depression (i.e. return to 0) until about the 37th period.

Overall, Figures 1 and 2 show that the adaptive expectation rule of speculators can amplify the impact of the negative shock on the stock market and the economy. In particular, when facing a severe recession, individual speculators will overreact to this negativity, thereby accelerating the decline of the stock market. In this behaviour mode, most Chinese individual speculators just want one-time trade, which leads to the inability of the retail investor-dominated Chinese stock

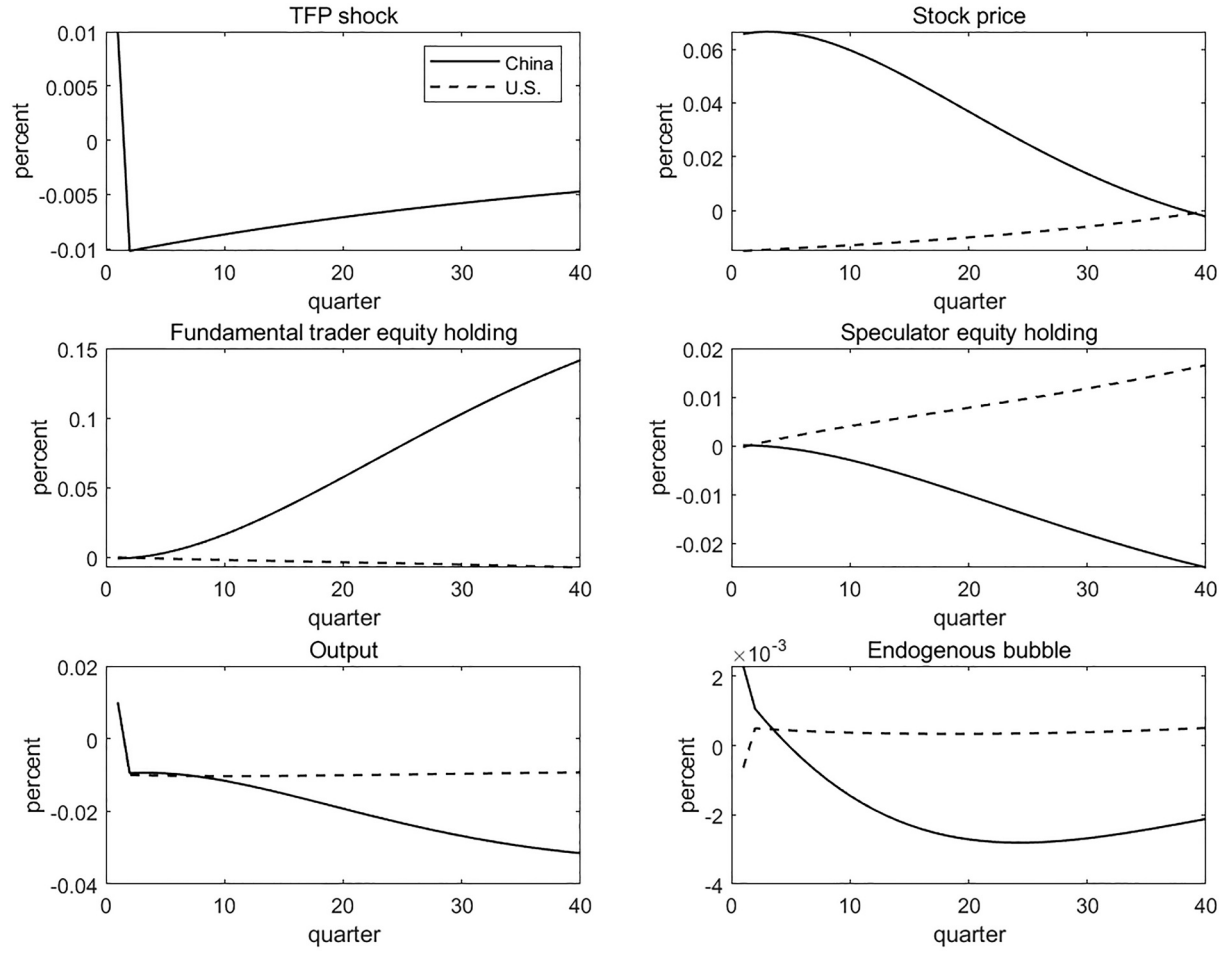

Figure 1. Simulation I.

market. The above analysis is devoted to interpreting the situation in which the Chinese stock market exhibits a short boom and a long depression.

Optimal investor structure

In this section, we study the optimal investor structure in China that can maximize the social welfare measured by the deterministic equivalence of consumption. The results are summarized in Table 1. We find that social welfare is maximized when the proportion of individual investors, m, equals 0.43. The main results we discuss above have significant enlightenment on the development of China's stock market, especially after COVID-19. The literature shows that a slight change in belief will generate substantial fluctuations in the stock market (e.g. Bordalo et al. 2021; Cifuentes, Ferrucci, and Shin 2005; Zhu et al. 2018). COVID-19 has exerted a huge negative impact on investors' expectations, which may cause a long-term downturn in China's stock market.[2] Therefore, macroeconomic regulation of the Chinese stock market after COVID-19 May need to focus on the investor structure, as it determines market expectations, which in turn affects stock price fluctuations and policy effectiveness.

IV. Conclusion

This paper finds that the feature of frequent short booms and long depressions in the Chinese stock market is attributed to a high proportion of

[2]For example, on August 27, 2023, the Chinese government reduced the stamp duty. Before the epidemic, the stock market would rise by over 5% on the second day of reducing stamp duty. However, on August 28, the Shanghai Composite Index only increased by 1.13%, with rapidly large trading volume, indicating that many traders are fleeing the stock market while taking advantage of this favourable policy.

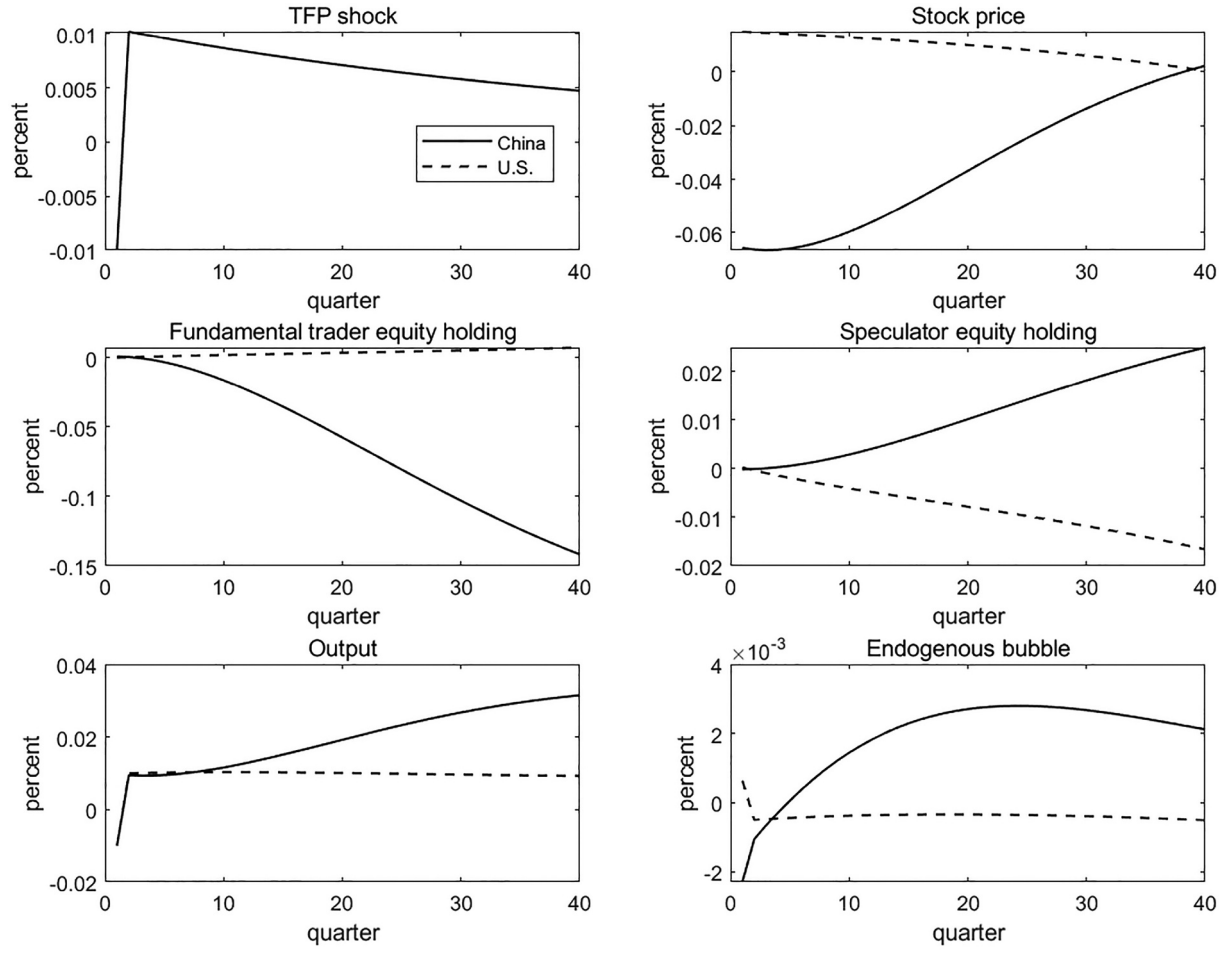

Figure 2. Simulation II.

Table 1. Welfare analysis.

m	Welfare	*m*	Welfare
0.3	0.7098	0.43	0.7935
0.4	0.7860	0.44	0.7934
0.41	0.7897	0.6	0.5458
0.42	0.7922	0.85	0.1285

Note: Following Miao et al. (2015), the model moments are computed using the simulated data for 10,000 periods.

individual speculators and the optimal proportion of individual speculators in China is about 43% to maximize social welfare.

The primary finding is crucial for policy makers to design the financial market, such as the China Securities Regulatory Commission. The individual speculator has an adaptive expectation rather than the rational value-based expectation. Therefore, adjusting the investor structure according to the optimal value of retail investor participation can avoid drastic fluctuations in the stock market when facing shocks. Nevertheless, the adjustments and actions should be slow and cautious since they can also bring market instability.

Disclosure statement

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References

Barberis, N., R. Greenwood, L. Jin, and A. Shleifer. 2018. "Extrapolation and Bubbles." *Journal of Financial Economics* 129 (2): 203–227. https://doi.org/10.1016/j.jfineco.2018.04.007.

Boehmer, K., C. M. Jones, X. Zhang, and X. Zhang. 2021. "Tracking Retail Investor Activity." *The Journal of Finance* 76 (5): 2249–2305. https://doi.org/10.1111/jofi.13033.

Bordalo, P., N. Gennaioli, S. Y. Kwon, and A. Shleifer. 2021. "Diagnostic Bubbles." *Journal of Financial Economics* 141 (3): 1060–1077. https://doi.org/10.1016/j.jfineco.2020.06.019.

Bouri, E., R. Demirer, R. Gupta, and J. Nel. 2021. "COVID-19 Pandemic and Investor Herding in International Stock Markets." *Risk* 9 (9): 168. https://doi.org/10.3390/risks9090168.

Bouri, E., R. Demirer, R. Gupta, and X. Sun. 2020. "The Predictability of Stock Market Volatility in Emerging Economies: Relative Roles of Local, Regional, and Global Business Cycles." *Journal of Forecasting* 39 (6): 957–965. https://doi.org/10.1002/for.2672.

Cifuentes, R., G. Ferrucci, and H. Shin. 2005. "Liquidity risk and contagion." *Journal of the European Economic Association* 3 (2–3): 556–566. https://doi.org/10.1162/jeea.2005.3.2-3.556.

Cutler, D. M., J. M. Poterba, and L. H. Summers. 1990. "Speculative Dynamics and the Role of Feedback Traders." *American Economic Review* 80 (2): 63–68.

Farmer, R. E. A., and K. Platonov. 2019. "Animal spirits in a monetary model." *European Economic Review* 115:60–77. https://doi.org/10.1016/j.euroecorev.2019.02.005.

Gabaix, X. 2020. "A behavioral new Keynesian model." *American Economic Review* 110 (8): 2271–2327. https://doi.org/10.1257/aer.20162005.

Haruvy, E., Y. Lahav, and C. Noussair. 2007. "Traders' Expectations in Asset Markets: Experimental Evidence." *American Economic Review* 97 (5): 1901–1920. https://doi.org/10.1257/aer.97.5.1901.

Kumar, A., and C. Lee. 2006. "Retail Investor Sentiment and Return Comovements." *The Journal of Finance* 61 (5): 2451–2486. https://doi.org/10.1111/j.1540-6261.2006.01063.x.

Li, W., and S. Wang. 2010. "Daily Institutional Trades and Stock Price Volatility in a Retail Investor Dominated Emerging Market." *Journal of Financial Markets* 13 (4): 448–474. https://doi.org/10.1016/j.finmar.2010.07.003.

Miao, J., Z. Shen, and P. Wang. 2019. "Monetary Policy and Rational Asset Price Bubbles: Comment." *American Economic Review* 109 (5): 1969–1990. https://doi.org/10.1257/aer.20180145.

Miao, J., P. Wang, and Z. Xu. 2015. "A Bayesian DSGE Model of Stock Market Bubbles and Business Cycles." *Quantitative Economics* 6 (3): 599–635. https://doi.org/10.3982/QE505.

Pan, N., Q. Xu, and H. Zhu. 2021. "The Impact of Investor Structure on Stock Price Crash Sensitivity: Evidence from China's Stock Market." *Journal of Management Science and Engineering* 6 (3): 312–323. https://doi.org/10.1016/j.jmse.2021.06.003.

Reinhart, C. M., and K. S. Rogoff. 2011. "From Financial Crash to Debt Crisis." *American Economic Review* 101 (5): 1676–1706. https://doi.org/10.1257/aer.101.5.1676.

Shahzad, S., M. Naeem, Z. Peng, and E. Bouri. 2021. "Asymmetric Volatility Spillover Among Chinese Sectors During COVID-19." *International Review of Financial Analysis* 75:101754. https://doi.org/10.1016/j.irfa.2021.101754.

Sun, Y., Z. Zheng, and H. Dong. 2015. "Institutional Investors in Chinese Stock Markets." In *The Chinese Stock Market Volume I*, edited by S. Cheng and Z. Li, 106–186. London: Palgrave Macmillan. https://doi.org/10.1057/9781137391100_3.

Xiong, Y., and L. Yang. 2021. "Disclosure, Competition, and Learning from Asset Prices." *Journal of Economic Theory* 197:105331. https://doi.org/10.1016/j.jet.2021.105331.

Yao, C., and H. Li. 2020. "Time-Varying Lead-Lag Structure Between Investor Sentiment and Stock Market." *The North American Journal of Economics & Finance* 52:101148. https://doi.org/10.1016/j.najef.2020.101148.

Zheng, D., H. Li & X. Zhu. 2015. "Herding Behavior in Institutional Investors: Evidence from China's Stock Market." *Journal of Multinational Financial Management* 32-33:59–76. https://doi.org/10.1016/j.mulfin.2015.09.001.

Zhu, Y., Z. Wu, H. Zhang, and J. Yu. 2018. "Media Sentiment, Institutional Investors and Probability of Stock Price Crash: Evidence from Chinese Stock Markets." *Accounting & Finance* 57 (5): 1635–1670.