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Abstract

This paper examines the impact of CITIC Securities (CITICS)' insider trading on five state-owned banks' stock returns in China. We first conduct a structural Vector Autoregression model together with Granger causality to investigate the response of banks' returns to that of CITICS. Next an Exponential Generalised AutoRegressive Conditional Heteroskedasticity process is employed to capture the volatilities of stock returns, and therefore investigate the response of five banks to that of CITICS. The dataset for three months after the scandal is obtained and the estimation results show some significant coupling effects do exist within stock returns of financial sector in stock market as well as within their volatilities. The core findings in this study suggest that Chinese stock prices could reflect all relevant information available from past changes in the share price as well as publicly available information. To some extent, China's stock market is semi-strong efficiency, implying the quality of investors' rationality and providing regulators with empirical evidence to policy-making.

Keywords: Financial Scandal; Stock Returns; Coupling Effects.

1. INTRODUCTION

In financial market, asset returns may move together towards same (opposite) direction (Roll, 1984), which is described as co-movement. In particular, stock market exhibits strong co-movement, that is, coupling effects, between returns on small cap stocks, value stocks (Fama and French, 1992; 1995; 1996), closed-end fund (Hardouvelis, Porta and Wizman, 1994; Bodurtha and Kim, 1995; Shleifer and Thaler, 1991). Notwithstanding, the coupling effects have become more significant cross countries since 1990s (Schwert, 2011). For example, global stock markets went down simultaneously as a consequence of US subprime mortgage crisis in 2007, which then caused worldwide panic and financial turmoil. Moreover the co-movement of the stock returns can also be found in the same industry sector, such as the aviation sector in the 1950s and the internet segment in the 1990s (Cheng Qingfeng and Chen Gang, 2010).

Understanding coupling effects is therefore the key to the effectiveness of stock markets. In the theory of the efficient markets hypothesis (EMH)¹, Fama (1970) explains that actual prices of individual securities in an efficient market already reflect the effects of information based both on events occurred and expected in the future. Those participants are rational as well as profit 'maximisers', and each one tries to predict future market values of individual securities. With a strong form EMH, the share prices reflect i) all past information relating to share price movements, ii) all information that is publicly available, and iii) specialist or insider knowledge relevant to the share price. On this ground, stock prices may react to shocks simultaneously. Such co-movement describes the law of stock equity movements, which helps investors understand the trend of stocks and so as to seize profit opportunities. Meanwhile it also reflects the circulation of market information and investors' rationality, which provides regulators with important implication to policy-making.

As the world's second largest economy, China's stock market has been the focus in the study. Since the establishments of 1990s, Chinese stock markets have been hugely expanded with size, trading and effectiveness. According to the report released by the National Council for Social Security Fund (2017), the overall effectiveness of the Chinese stock market has been significantly improved in the past decade, which is also

¹The classic definitions of the EMH were made by Harry Roberts (1967) and Fama (1970).

with an accelerated upward trend². In empirical studies, Li (2010) demonstrates that the value of Chinese stock market's co-movement coefficient is greater than 0.7, and the cumulative contribution rate of each industry is more than 70%, in which the financial industry is ranked the strongest. Zhang (2016) investigates the impact of "the Tianjin Port explosion 2015" on China's listed insurance and other the event-related companies, suggesting that China's stock market is semi-strongly effective.

To extend previous studies, this paper develops a multivariate framework, filling in the gap in the literature, to examine the coupling effects of both stock prices and volatility. Our findings suggest that the co-movement of stock returns delivers important messages to explore the effectiveness of stock market, and provides regulators with useful information to policy-making.

Section 2 introduces the theoretic causes of coupling effects, and section 3 explains the financial scandal of CITICS' insider trading. Then the VAR-EGARCH procedure is outlined in section 4, which is followed by the description of the data and discussion of the estimation results in section 5. Finally section 6 offers some concluding remarks.

2. CAUSES OF COUPLING EFFECTS

From a perspective of behavioural finance, Barberis, Shleifer and Wurgler (2005)³ divided the causes of coupling effects into three categories: i) the coupling effects caused by category view, ii) the coupling effects caused by habitat view, and iii) the coupling effects caused by information diffusion view.

The category view, proposed by Barberis and Shleifer (2003), depicts investors' behavior in stock market. Investors first set stock equities into sub-categories such as small cap stocks, oil stocks or junk stocks, and then form the portfolio among these categories. This classification is generally according to the explicit characteristics of those equities, such as large cap stocks (market capitalisation value), index stocks (indexation), blue chips (market performance) and so on. If these investors are noise traders with familiar sentiment in the market, their trading operations can consequently affect market prices. Since investors share the familiar view towards the same financial decision, the co-movement of stock returns from two category may occur.

There is also another phenomenon in stock market: investors always tend to purchase particular types of stocks. This selective preference arises due to restrictions on their investment behaviours, including the existence of transaction costs, restrictions on international transactions, and the lack of information. When these investors' risk appetite, sentiment, or liquidity requirements change, they will correspondingly change the stocks they originally hold, resulting in the co-movement of the proceeds of these stocks. For example, local preferences, as proposed by Ivkovic and Weisbenner (2005), determine the local linkage of stock prices.

In a perfectly efficient market, the transmission of information and the absorption of information by investors are instant, and thus new information can be fully and immediately reflected in the stock prices. However, the transmission and absorption of information mechanism cannot be complete in the real market. For example, the same information could be responded by some stock prices faster than the others. So that coupling effects can exist between stock equities with the same degree of the absorption of information (Veldkamp, 2004).

3. THE INSIDER TRADING SCANDAL OF CITIC SECURITIES

As one kind of shocks to the stock market volatility, this paper is concerned with the insider trading of (CITICS), and investigates whether this financial scandal could cause the co-movement of the banking sector of the A-share market in China.

² Shi (2000) examined the validity of the stock effectiveness of the Shanghai and Shenzhen stock exchanges through Kalman filters, and suggested a gradually improved effectiveness for both markets due to the policies and regulations reformation. This evidence is supported by many other studies, such as Huang (2001) and Zhang (2016).

³ Henceforth referred to as the BSW model.

CITICS was established in 1995, and is headquartered in Shenzhen, China. Upon approval of Chinese Securities Regulatory Commission (CSRC) on December 13, 2002, CITICS undertook an initial public offering (IPO) of 400 million common A-shares. On 6 January 2003, CITICS (Ticker: 600030) was listed on the Shanghai Stock Exchange (SSE). On 6 October 2011, CITICS (Ticker: 6030) was listed on the Hong Kong Exchange. As a leading (largest and most influential) China-focused international investment bank, CITICS offers services in underwriting, research, brokerage, asset management, wealth management, and investment advisory. Up to 2016, the CITICS recognised total revenue of RMB38 billion and profit attributable to owners of the parent of RMB10.4 billion, and return on equity of 7.36%. CITICS is continuously ranked the first among the domestic securities companies, and hence may have an impact on banking industry.

Form the end of July in 2015, there was a rumor about CITICS insider trading in market. On 25 August, Xinhua⁴ reported that eight senior executives of CITICS were involved with insider trading, and were enquired by the public security authorities to assist in the investigation for engaging in illegal securities transactions. Those senior executives include members of CITICS Executive Committee, managing director (Xu Gang) and senior managers. With the confirmation from CITICS on 30 August, its stock price fell to a maximum of 4.98% next day, followed by resignations of senior executives two weeks later.

As for the credibility and performance of CITICS, Dagong Global Credit Rating⁵, together with other rating agencies, downgraded CITIC Securities in the observation list due to uncertainties caused by the scandal. Consequently CITICS' brokerage business, financial businesses and IPO sponsorship businesses were investigated by the CSRC, and the company was excluded according to "securities companies' classified regulatory requirements".

Apart from its own consequences, the exposure of the CITICS insider trading scandal may affect the performance of banking sector in stock market. If coupling effects can be detected as previous studies suggested, it is vital to find out the degree of the co-movement within stock prices as well as their volatilities.

4. THE MODEL

To describe the coupling effects, accommodating all relevant variables in a Vector Autoregression (VAR) model is a convenient approach applied in the literature⁶, which is written as

$$f(y_t, x_t, c) = e_t \quad (1)$$

where y_t is a vector of endogenous variables, x_t is a vector of exogenous variables, e_t is a vector of serially correlated residuals, and c is the vector of estimated parameters.

However, equation (1) is not capable of capturing heteroskedasticity, that is, one of the important stylised facts of stock returns. If the variance of disturbance term e_t in equation (1) is time varying σ_t^2 then the process is heteroskedastic and heteroskedasticity should be modelled to obtain more efficient estimates.

One of approaches to model heteroskedasticity is Generalised AutoRegressive Conditional Heteroskedasticity (GARCH) by Bollerslev (1986)⁷, allowing the conditional variance to behave as an AutoRegressive Moving Average (ARMA) process:

$$\sigma_t^2 = \omega + \sum_{j=1}^p \beta_j \sigma_{t-j}^2 + \sum_{i=1}^q \alpha_i \varepsilon_{t-i}^2 \quad (2)$$

⁴ Xinhua News Agency is the official press agency of China, which is the biggest and most influential media organization in China, as well as the largest news agency in the world in terms of correspondents worldwide.

⁵ The domestic rating agency

⁶ Among others, Eun and Shim (1989), Connolly and Wang (2003), Durnev, et. al, (2004), Kizys and Pierdzioch (2009), and Ding and Pu (2012).

⁷ Engle (1982) proposed AutoRegressive Conditional Heteroskedasticity (ARCH).

where ω , α_i and β_j are assumed to be positive, and $\sum_{i=1}^q \alpha_i + \sum_{j=1}^p \beta_j < 1$ satisfies the positivity constraint; the disturbance term of ε_t (innovation) follows a Gaussian/student-t or other distribution, and the standard deviation, σ_{ε_t} , is conditional on information set at time $t-1$.

In particular, an exponential(E) GARCH model of Daniel Nelson (1991) relaxes parameter positivity constraints in equation (2), significantly simplifies estimation and inference procedures, and shall be capable of modelling stock returns volatilities. A multivariate EGARCH process to be applied in this paper is written as:

$$\ln h_t = \omega_0 + \alpha(L)g(z_t) + \beta(L) \ln h_t \tag{3}$$

$$g(z_t) = \theta_1 z_t + \theta_2 [|z_t| - E|z_t|] \tag{4}$$

$$h_{i,t} = \rho \sqrt{h_{1t}} \sqrt{h_{2t}} \dots \sqrt{h_{nt}}, \quad -1 \leq \rho \leq 1, \quad i = 1, 2, \dots, n \tag{5}$$

where h_t is the variances $\varepsilon_t = \hat{H}_t^{1/2} z_t$, $\hat{H}_t = \text{diag}(h_i)$, $z_t \sim iid(0, C)$, and C is a $n \times n$ fixed correlation matrix with units on the diagonal. θ_1 captures the leverage effects and $\ln h_t$ responds symmetrically to z_t when $\theta_1 = 0$.

Equation (1) together with equation (3)-(5) provide a flexible solution to depict the co-movement of stock returns while capturing their volatilities, which has been neglected in the literature. To some extent, our approach is a more reliable method to investigate the coupling effects in stock market.

5. EMPIRICAL RESULTS

Equation (1) is estimated⁸ by taking daily closed price of six stock shares (finance sector) from China Stock Market & Accounting Research Database: CITICS, Agricultural Bank of China (ABC), Bank of Communications (BOCOM), Industrial and Commercial Bank of China (ICBC), China Construction Bank (CCB), and Bank of China (BOC) in SSE. Except for CITICS, the others are stated-owned banks with steady performance in stock market, and their daily returns are calculated as:

$$r_{n,t} = \frac{P_{n,t} - P_{n,t-1}}{P_{n,t-1}}$$

where $r_{n,t}$ is denoted as returns, and $P_{n,t}$ is the closing price of the stock n on the trading day of t .

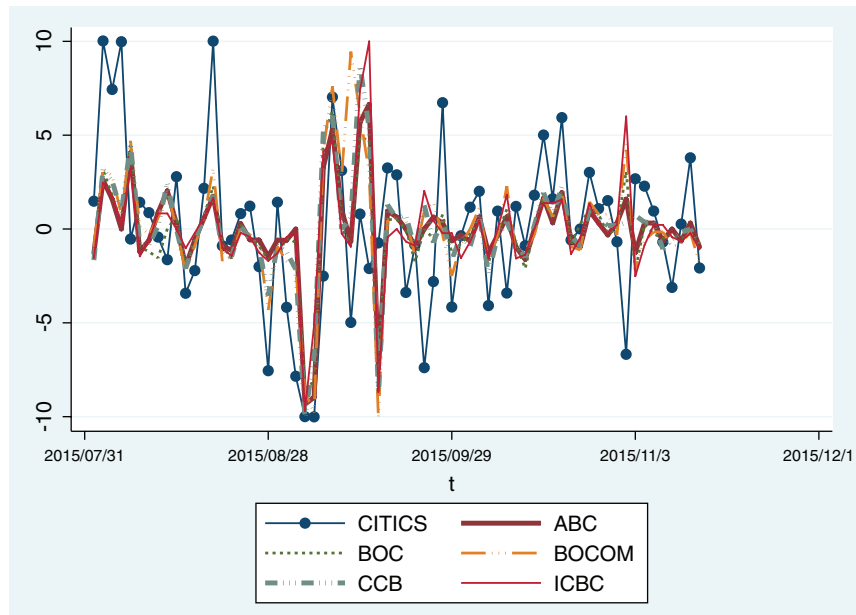
Figure 1 plots the dynamics of six stock returns of finance sector from 31 July 2015 to 11 November 2015, which is three months or so after the CITICS scandal. At first glance, figure 1 shows some apparent co-movements that the other five banks' stock returns increase or decrease together. While it is not clear that how those five banks stock returns react to CITICS sandal.

As presented in table 1, the average conditional standard deviations of CITICS are significantly higher than the other five banks, and stock returns exhibit strong heteroskedasticity for each series. However, normality test rejects that stock returns are normally distributed except for CITICS, indicating the innovations may not be well-modeled by a normal distribution. Also the results of Student's t-test suggest that the innovations are better described as a Student's t-distribution.

To better capture the stability of the series, several unit root tests are applied to detect the short/long memory. The PP (Phillips-Perron, 1988) test is for $I(1)$ against $I(0)$. On the contrary, the KPSS (Kwiatkowski et al., 1992) test is for $I(0)$ against $I(1)$. Unlike the two threshold tests, the HML (Harris et al., 2008) test is for the null hypothesis of short memory against long memory alternatives, that is the test of $I(0)$ against $I(d)$. As reported in table 2, the PP test rejects the null at 1% level for all stock returns, implying the each series does not have a unit root. The KPSS fails to reject that stock returns are stationary at 10% level, and the HML test fails to reject that stock returns are stationary at 1% level. All the unit root tests suggest that each stock return in this paper can be described as following an $I(0)$ process.

⁸ Our estimates are generated by using the package 'Stata v14.1'.

Figure 1. Stock returns of CITICS, BOC, ABC, ICBC, CCB and BOCOM.



Source: China Stock Market & Accounting Research Database

Table 1. Data descriptive statistics.

	Sample					
	CITICS	ABC	BOCOM	ICBC	CCB	BOC
Obs.	67	67	67	67	67	67
Mean	0.088	-0.031	0.071	0.009	-0.004	-0.116
Std. Dev	4.252	2.499	3.153	2.765	2.776	2.433
ARCH_LM(2)	7.689	18.390	9.947	16.475	9.980	17.392
	[0.021]	[0.000]	[0.069]	[0.000]	[0.007]	[0.000]
Normality	0.713	95.558	23.324	71.221	52.028	40.537
	[0.700]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Student's t	6.42E-10	1.53E-09	-1.20E-09	1.21E-09	-3.22E-10	-6.1E-10
	[1.000]	[1.000]	[1.000]	[1.000]	[1.000]	[1.000]

Notes: Obs. denote the number of observations. Std. Dev denote the number of standard deviations. The numbers in brackets are p-value.

Given the results with regard to the stationary properties of the variables, the structural VAR (q) model, including constants, is formulated as:

$$y_t = A_1 y_{t-1} + \dots + A_q y_{t-q} + c_1 + \dots + c_q + e_t \tag{6}$$

where y_t is a k ($k = 6$) vector of endogenous variables of CITICS, BOC, ABC, ICBC, CCB and BOCOM. A_1, \dots, A_q are the matrix of coefficients to be estimated, c_1, \dots, c_q are the constants, and e_t is a vector of innovations. The optimal lag selection is found to be 3 for the VAR model as shown in table 3.

Table 2. Unit root tests.

	PP $H_0:I(1)$ $Z(t_{\hat{\alpha}})$	KPSS $H_0:I(0)$ η_{μ}	HML $H_0:I(0)$ \hat{S}_k
CITICS	-5.896*	0.434***	-0.284*
ABC	-6.995*	0.100***	0.605*
BOCOM	-5.634*	0.122***	0.284*
ICBC	-7.715*	0.102***	0.727*
CCB	-6.412*	0.134***	0.440*
BOC	-7.035*	0.220***	0.592*

Notes: $Z(t_{\hat{\alpha}})$ and η_{μ} are Phillips-Perron adjusted statistic, LM statistic respectively, using Parzen Kernel estimation method with Newey-West Bandwidth and drift. \hat{S}_k is HML statistic with $c=1$ and $L=0.66$. *Significant at 1% level; **Significant at 5% level; ***Significant at 10% level.

Table 3. VAR lag order selection criteria.

lag	LR	FPE	AIC	SC	HQ
0	N/A	52.1985	20.9823	21.1864*	21.0626
1	114.86	26.581	20.3019	21.7307	20.8639
2	114.47	13.9668	19.6279	22.2813	20.6715*
3	83.017	12.7034*	19.453*	23.3311	20.9783
4	62.199*	17.425	19.6086	24.7113	21.6155

Notes: * indicates lag order selected by the criterion; LR: sequential modified LR test statistic (each test at 5% level); FPE: Final prediction error; AIC: Akaike information criterion; SC: Schwarz information criterion; HQ: Hannan-Quinn information criterion.

Table 4. Estimates for VAR of stock returns.

	CITICS	ABC	BOCOM	ICBC	CCB	BOC
CITICS(-1)	0.298 ***	0.196**	0.172	0.174**	0.240*	0.234*
	(0.177)	(0.085)	(0.110)	(0.085)	(0.087)	(0.080)
CITICS(-2)	0.306	0.093	0.010	0.036	0.115	0.112
	(0.185)	(0.078)	(0.106)	(0.079)	(0.081)	(0.074)
CITICS(-3)	0.266***	—	-0.207*	—	—	—
	(0.140)		(0.050)			

Notes: Standard errors are given in parentheses. *Significant at 1% level; **Significant at 5% level; ***Significant at 10% level.

As shown in table 4, the daily returns of CITICS has strong autocorrelation, and a unit of CITICS daily return changes at 1 lag will increase the returns of ABC, ICBC, CCB and BOC significantly, which also has a weak positive correlation with BOCOM. While the correlations disappear, except for that of BOCOM showing an adverse relationship.

Next, we apply the Granger causality test (Granger, 1969) to investigate that if the change of CITICS returns has caused the other banks' returns. As the test results displayed in table 5, we reject the null hypothesis that CITICS does cause significantly the returns of ABC at 5% level, and of BOCOM, CCB and BOC at 1% level. There is also a weak evidence can be found, that CITICS does Granger cause the stock returns of ICBC. Overall, the coupling effects are strong within the stock returns of the finance sector in stock market.

Meanwhile we enter the variables into the system in levels to perform the VAR analysis, and examine the effect of CITICS stock returns on the other five banks' returns using Impulse Response Functions (IRFs). As the results from impulse response bring more information to confirm the VAR estimates, we

Table 5. Granger causality tests.

H ₀	F-Statistic	Prob.
CITICS does not Granger Cause ABC	3.3154**	0.0378
CITICS does not Granger Cause BOCOM	6.7839*	0.0002
CITICS does not Granger Cause ICBC	2.1813	0.1149
CITICS does not Granger Cause CCB	4.7113*	0.0097
CITICS does not Granger Cause BOC	5.3336*	0.0053

Notes: *Significant at 1% level. **Significant at 5% level. ***Significant at 10% level.

Figure 2. Impulse Response Functions for banks to CITICS.

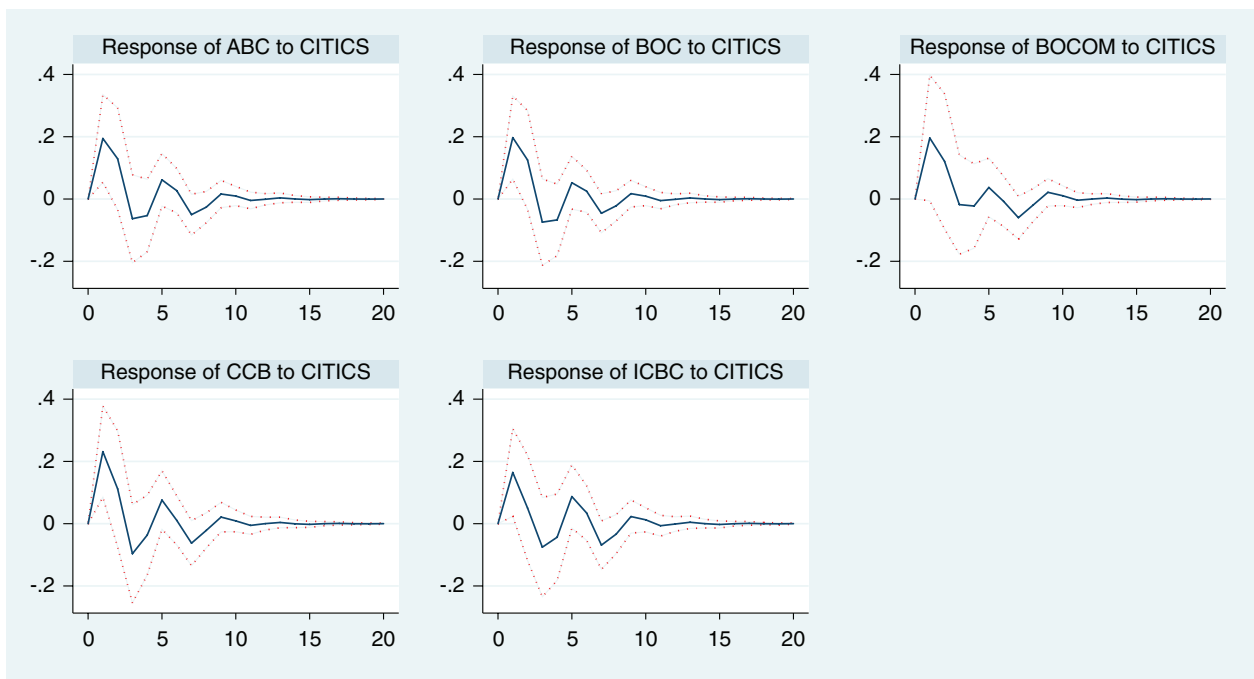
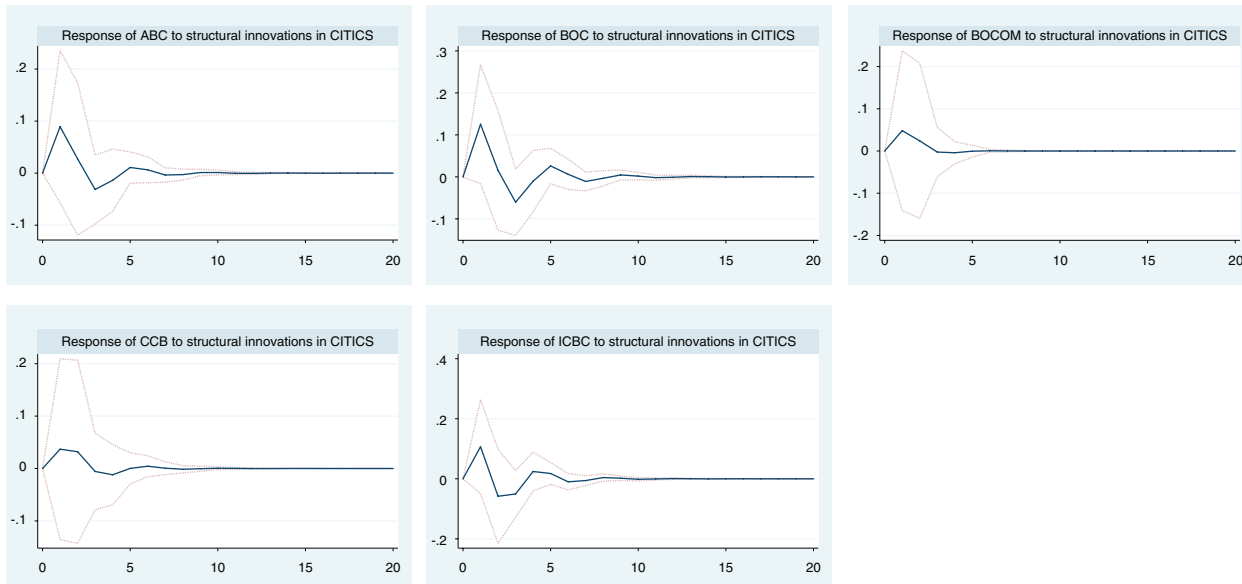


Table 6. Volatility linkages of EGARCH estimates.

	ABC	BOCOM	ICBC	CCB	BOC
β_{CITICS}	1.028	1.857	0.77	0.992	1.217
	(0.723)	(0.917)	(0.528)	(0.501)	(0.692)

Figure 3. Impulse Response Functions for banks to structural innovations in CITICS.



have constructed the IRF of five banks’ returns to a one standard deviation of shock in the stock return of CITICS with ± 2 standard error band for each of impulse response (Sims & Zha, 1999). Figure 2 represents the impulse response from a structural VAR of six stock returns of finance sector in SSE. With regard to the stability properties of the model, the responses appear satisfactory as they are not explosive and there is a decaying response consistently.

As discussed earlier, in order to exactly pinpoint the volatilities of the stock returns from finance sector, we carry out the maximum likelihood-based multivariate EGARCH procedure. In table 6, the results of estimating a vector EGARCH of Equation (3)-(5) are presented, and here we only report how the volatility of CITICS stock returns influence the other five banks: β_{CITICS} . The estimates suggest that CITICS stock returns volatility positively contributes to that of three Chinese state owned banks changes, and weak positive signals are shown for the other two. Like the VAR, coupling effects do exist with stock returns’ volatilities.

Similarly, figure 3 shows the impulse response from five banks to structural innovations in CITICS. As that of figure 2, the responses appear satisfactory as they are not explosive and there is a decaying response consistently, which is in line with the estimates reported in table 6.

6. CONCLUSION

This paper has developed a structural VAR together with Granger causality test, and a multivariate EGARCH approach to model six financial stock returns of SSE in China. Without imposing sign restrictions, our model has thereby cast significant light on coupling effects of five state-owned banks to the CITICS’ insider trading.

Results indicate that returns of five banks do move toward the same direction, that is, a negative shock will cause the returns of financial sector to go down together. These co-movements can be observed not

only within stock returns but also within their volatilities with the same direction. Findings in this study suggest that Chinese stock prices could reflect all relevant information available from past changes in the share price as well as publicly available information for a while, say, three months. Such coupling effects deliver important messages to identify the effectiveness of stock market, and provide regulators with important implication to policy-making.

Further research may extend this framework to investigate a broader range of financial variables such as to interpret bond market, and to consider various shocks as well as their variabilities, in search of an efficient financial market and optimal regulations.

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