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Chinese Stock Market and the U.S. Influence: Analysis of Intraday Returns

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Abstract

Using the data of every minute index of Shanghai and Shenzhen stock markets and daily closing price of S&P 500, this paper investigates the spillover effect of day (t-1) U.S. stock market on time sectionalized Shanghai and Shenzhen stock markets on day t. for the period from September 1, 2008 to February 27, 2009. The empirical results show significant correlation between lagged U.S. stock market and overnight (close-to-open) Chinese stock markets, while the influence of lagged U.S. stock market is limited to the first ten minutes of Chinese market opening. We also find asymmetric response patterns of the Chinese market to the positive and negative U.S. influence. If the day (t-1) U.S. stock market return is positive, making long position on opening price of Chinese stock market yields significant abnormal return; on contrary, if the day (t-1) U.S. stock market return is negative, there is no significant abnormal return from making short position on opening price of Chinese stock market.

Ⅰ. Introduction

Entering the 21st century, the world economy has moved toward a comprehensive regional integration. International stock markets gradually get rid of the split situation. Stock markets are constantly expanding, transnational capital flows are accelerated, and globalization is increasingly clear. All of this provides high quality and efficient service to risk-averse international investors, by increasing investment diversification. Therefore, understanding the relationship between the stock markets provides strong references to government policy and investor decision-making.

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With the reform of non-tradable shares, the Chinese stock market has realized the integration with the international stock markets. Chinese financial industry has entered a full opening time at the end of 2006 as 54 foreign institutions obtained Qualified Foreign Institutional Investors (QF Ⅱ) qualification and 9.045 billion dollars of investment quotas were approved. With the gradually increasing number of QF Ⅱ and investment quota, their role in Chinese stock market have also increased. Meanwhile, the qualified domestic institutional investor (QD Ⅱ) system has entered into a substantive stage of operation, and the Chinese institutional investors have gradually allocated their portfolios in the global capital market. As a result, globalization of Chinese financial markets has been accelerating more. In this context, we are interested inwhether there is linkage phenomenon between the Chinese and U.S. stock markets and whether the Chinese stock market is truly synchronous with the U.S. stock market.

Over the past years, many scholars have committed to investigate an interactive relationship between the international financial markets. Engle (1982) first proposesthe ARCH (Autoregressive Conditional Heteroskedasticity) model and provides a new way of thinking for the resolution ofan alternative to the standard time-series treatments. On the basis of the ARCH model Bollerslev (1986) carriesout a direct linear extension and forms a wider range of GARCH (Generalized Autoregressive Conditional Heteroskedasticity) model. Longin (1995) finds that the linkage between the stock markets rapidly increase in turbulence. Longin and Solnik (2001) find that the correlation between the stock markets are relatively bigger in the bear market. Ji, Cuo, and Yang (2001) studies U.S. stock market movement's impact onthe Korean stock market. Park (2002) investigates the impact of information about the U.S. stock market movement on the intraday returns in the Korean stock market. Zhang (2008) examines the mean and volatility spillover effects using VAR and ARCH-type models, and find that the US dollar exchange rate fluctuation are transferred to the international crude oil market. Park (2008) examines whether the volatility of U.S. market has significant impact on the Chinese stock market volatility. He finds that the comovement of Chinese stock market with U.S. stock market has gradually reinforced, and the information transmission of the U.S. market to the Chinese market be-

comes significant in recent years.

Admati and Pfleiderer (1989) analyze of the pricing process under competitive and monopolistic market surveys and develope a model in which patterns in mean returns of stocks arise endogenously. Jain and Jo (1988) provide evidence on joint characteristics of hourly common stock trading volume and returns on the New York Stock Exchange. There is a strong contemporaneous relation between trading volume and returns and also a relation between trading volume and returns lagged up to four hours. Cheung (1995) examines the behavior of the intra-daily stock return of the Stock Exchange of Hong Kong (SEHK) in Hong Kong during April 1986-December 1990. There is an increasing trend at the very beginning of the day and also a spike in stock return at the end of the trading day. The magnitudes of the standard deviations follow a U-shape curve for each trading session.

This paper uses minute-unit data of the Chinese stock market index and analyzes the influence of U.S. stock return on the Chinese stock market. The biggest difference between this paper and the previous studies on the relationship between the U.S. and Chinese stock markets is index time sectionalization using per-minute data. This paper examines the impact of day (t-1) lagged U.S. stock return on time sectionalized Chinese stock returns on day t.

Ⅱ. Data and Methodology

1. Data Sources

The S&P 500 data are collected from FuGuide data base. The Chinese minute-unit index data are downloaded from Golden Sun Guoxin Online Trading Professional Edition V6.23 including Shanghai Component Index and Shenzhen Component Index. The data period covers from the September 1, 2008 to February 27, 2009, a total of six months of data. This period is the subprime mortgage crisis, U.S. stock market and Chinese stock market experienced great change during this period. As the subprime mortgage crisis intensified, Chinese Shanghai Component Index fell from 6,124 points (October 16, 2007) to lowest point 1,664 (October 28, 2008), reaching 72.83% decline.

The focus of this paper is the examination of the impact of day (t-1) U.S. stock market return on minute-unit sectionalized Chinese stock market return on

<Table 1> Time Sectionalization of Shanghai Index

Symbol	Name	Calculation
CSH1	day return	day t closing price/day t opening price
CSH2	night return	day t opening price/day (t-1) closing price
CSH3	(opening+10 minutes) return	opening+10 minutes/day t opening price
CSH4	(opening+10 minutes-opening+30 minutes) return	opening+30 minutes/opening+10 minutes
CSH5	(opening+30 minutes-opening+60 minutes) return	opening+60 minutes/opening+30 minutes
CSH6	(opening+60 minutes-morning closing price) return	morning closing price/opening+60 minutes
CSH7	afternoon return	afternoon closing price/afternoon opening price
CSH8	morning return	morning closing price/morning opening price

<Table 2> Time Sectionalization Shenzhen Index

Symbol	Name	Calculation
CSZ1	day return	day t closing price/day t opening price
CSZ2	night return	day t opening price/day (t-1) closing price
CSZ3	(opening+10 minutes) return	opening+10 minutes/day t opening price
CSZ4	(opening+10 minutes-opening+30 minutes) return	opening+30 minutes/opening+10 minutes
CSZ5	(opening+30 minutes-opening+60 minutes) return	opening+60 minutes/opening+30 minutes
CSZ6	(opening+60 minutes-morning closing price) return	morning closing price/opening+60 minutes
CSZ7	afternoon return	afternoon closing price/afternoon opening price
CSZ8	morning return	morning closing price/morning opening price

day t. The Chinese stock market refers to Shanghai Component Index and Shenzhen Component Index. The time sectionalized index returns are calculated as <Table 1> and <Table 2> illustrate. There are several issues neededto explain about the returns. First, opening price is determined by call auction. Call auction approach is used to determine the opening price because it prevents the manipulation phenomenon. In the Chinese market every morning from 9:00 to 9:25 is set as call auction time. Thus this paper takes into account call auction, using the starting price at 9:30 as an opening price. Second, Shanghai and Shenzhen stock markets have a noon break for an hour and a half. Morning trading time begins at 9:30 and ends at 11:30, and afternoon trading time begins at 13:00 and ends at 15:00. Thus morning opening price is marked at 9:30 while morning closing price at 11:30 and afternoon opening price is marked at 13:01 while afternoon closing price at 13:00.

2. Descriptive Statistics

The Shanghai Stock market summary statistics are illustrated in <Table 3>. All the time sectionalized rate of returns listed in <Table 3> have been matched to the day (t-1) U.S. stock market data, producing total 87 of successfully matched observations during six months. Most of the time sectionalized rate of returns fit normal distribution showing the skewness are near to 0 and the kurtosis value are near to 3. However, verified by JB statistic analysis, we reject the null hypothesis of normal distribution at 1% significant level for CSH2 (night return) and CSH5 (opening+30 minutes-opening+60 minutes). These returns have fat-tail characteristic.

Shenzhen Stock market summary statistics are illustrated in <Table 4>. There are also 87 observations during half year sample period. Except CSZ2 (night rate of return), CSZ3 (opening+10 minutes return) and CSZ5 ("opening+30 minutes-opening+60 minutes" return), wecannot reject the null hypothesis of normal distribution for the other time sectionalized rate of returns. The kurtosis values approximately equal to 3, and skewness values are negative and approximately equal to 0.

3. Econometrics Model

Before econometrics analysis we need to match the day (t-1) U.S. stock prices with day t Chinese stock prices. If day (t-1) U.S. stock market and t Chinese stock market both open, there is no problem to match. If not, matching becomes a bit complicated between two stock markets. We need to pay special attention if there are two situations. First, if the U.S. stock market is not openon day (t-1), then the day t Chinese stock market transactions data are removed. Second, if the Chinese stock market has no trading on day t, then we merger day (t-1) and day t U.S. stock market returns, and the merged information have impact on (t+1) day Chinese stock market returns.

Considering autocorrelation of rate of returns and conditional heteroscedasticity, we investigate the spillover effect using GARCH (1, 1) models which consist of mean equation and conditional variance equation. Equation set as follows: set null hypothesis of Ho: $\beta = 0$ and Ho: ϕ-0 respectively for Shanghai and Shenzhen stock markets. We test the regression coefficient of β and ϕ, and then judge the impact of U.S. stock market on time sectionalized Chinese stock market returns

<Table 3> Summary Statistics of Time Sectionalized Shanghai Index Returns

	CSH1 (Day)	CSH2 (Night)	CSH3 (Open+10)	CSH4 (Open+30)	CSH5 (Open+60)	CSH6 (Open+120)	CSH7 (Afternoon)	CSH8 (Morning)	R (U.S. day return)
Mean	0.001699	-0.003836	0.000974	0.000083	0.000261	0.000763	0.000147	0.002173	-0.005947
Median	0.001182	-0.001887	0.001914	0.000448	0.000865	0.000536	-0.000689	0.001168	-0.004023
Maximum	0.065611	0.086746	0.0121	0.01596	0.018922	0.025342	0.047276	0.032026	0.102457
Minimum	-0.060455	-0.040171	-0.018099	-0.01647	-0.02466	-0.030034	-0.044209	-0.02988	-0.091272
Std. Dev.	0.024136	0.017498	0.006102	0.006218	0.006788	0.00978	0.01667	0.012992	0.036419
Skewness	-0.10779	1.778336	-0.616562	-0.057996	-0.478426	-0.227768	0.113958	-0.123799	0.239857
Kurtosis	3.334101	11.52287	3.252774	3.217736	4.605919	3.411957	3.506737	2.912762	3.570989
Jarque-Bera	0.573105	309.1733	5.743781	0.220629	12.66771	1.367424	1.119139	0.249817	2.01606
Probability	0.750848	0.000000	0.056592	0.895552	0.001775	0.50474	0.571455	0.882577	0.364937
Observations	87	87	87	87	87	87	87	87	87

<Table 4> Summary Statistics of Time Sectionalized Shenzhen Index Returns

	CSZ1 (Day)	CSZ2 (Night)	CSZ3 (Open+10)	CSZ4 (Open+30)	CSZ5 (Open+60)	CSZ6 (Open+120)	CSZ7 (Afternoon)	CSZ8 (Morning)	R (U.S. day return)
Mean	0.002361	-0.002903	0.001569	0.000553	0.000719	0.000246	-0.000279	0.003088	-0.005947
Median	0.003586	-0.001789	0.00208	0.001165	0.001586	0.000564	-0.000942	0.003592	-0.004023
Maximum	0.064975	0.076983	0.013412	0.01375	0.026344	0.024532	0.040838	0.040674	0.102457
Minimum	-0.065308	-0.033858	-0.018276	-0.014968	-0.030959	-0.027503	-0.051949	-0.038009	-0.091272
Std. Dev.	0.025129	0.015439	0.006181	0.005885	0.007537	0.010076	0.017574	0.01538	0.036419
Skewness	-0.360195	2.01776	-0.774976	-0.382241	-0.527099	-0.163431	-0.078955	-0.300399	0.239857
Kurtosis	3.200867	12.3237	3.851101	3.141895	6.48723	3.101817	3.210711	3.293713	3.570989
Jarque-Bera	2.027493	374.1608	11.33438	2.191559	48.11137	0.424868	0.251337	1.621195	2.01606
Probability	0.362857	0.000000	0.003458	0.334279	0.000000	0.808614	0.881907	0.444592	0.364937
Observations	87	87	87	87	87	87	87	87	87

(Shanghai Stock Market: CSH1, CSH2 …… CSH8; Shenzhen Stock Market: CSZ1, CSZ2 …… CSZ8).

$$R_t^{cshi} = \alpha + \beta R_{t-1}^{USA} + \varepsilon_t + \theta \varepsilon_{t-1}, \quad \varepsilon_t | \Omega_{t-1} \sim N(0, h_t)$$

$$h_t = \gamma_0 + \gamma_1 \varepsilon_{t-1}^2 + \gamma_2 h_{t-1}$$

$$R_t^{cszi} = \pi + \phi R_{t-1}^{USA} + \varepsilon_t + \omega \varepsilon_{t-1}, \quad \varepsilon_t | \Omega_{t-1} \sim N(0, h_t)$$

$$h_t = \delta_0 + \delta_1 \varepsilon_{t-1}^2 + \delta_2 h_{t-1}$$

Ⅲ. Empirical Results

1. Correlation Analysis

To analyze comovement of the stock markets, the frequently used method is correlation analysis between rates of return. <Table 5> shows the correlation of the day (t-1) U.S. stock market returns and time sectionalized Chinese stock market returns on day t. For both Shanghai and Shenzhen Component Index daytime rate of returns have negative correlation with S&P 500 Index. Overnight returns of Shanghai and S&P 500 have positive correlation of 0.7214 at 1% significant level; overnight return of Shenzhen and S&P 500 has positive correlations of 0.7149 at 1% significant level.

Now we see the correlation between day (t-1) U.S. market return and time sectionalized rates of return of two Chinese stock markets divided into 6 parts. For the (opening+10 minutes) yield rate, the correlation between Shanghai and U.S. marketsis -0.2850 at 1% significant level, for Shenzhen the correlation coefficient is -0.3269 at 1% significant level. The

<Table 5> Correlation between Day (t-1) U.S. Stock Market Returns and Time Sectionalized Chinese Market Index Returns on Day t

Time Sectionalization	Shenzhen Market	Shanghai Market
day return	-0.1212	-0.2115*
night return	0.7149**	0.7214**
(opening+10 minutes) return	-0.3269**	-0.2850**
(opening+10 minutes-opening+30 minutes) return	-0.1844	-0.1241
(opening+30 minutes-opening+60 minutes) return	-0.1874	-0.2361*
(opening+60 minutes-morning closing price) return	0.1842	0.1326
afternoon return	-0.1346	-0.2109
morning return	-0.1731	-0.2380*

*and **indicate coefficient is significant at 5%, or 1% significant level, respectively.

<Table 6> Correlation Matrix of Daily Returns between U.S. and Chinese Sock Markets

Correlation	CSH (Shanghai day returns)	CSZ (Shenzhen day returns)	US (S&P 500 day returns)
CSH	1		
CSZ	0.92583**	1	
US	0.16749	0.08776	1

*and **indicate coefficient is significant at 5%, or 1% significant level, respectively.

other time sectionalized rate of returns have negative or positive values at low significant level or not significant.

In addition to time sectionalized rate of returns, we examine the correlation of the daily rate of returns between Chinese stock markets and U.S. stock marketfor the period during September 1, 2008 to February 27, 2009 The results are illustrated in <Table 6>. Chinese mainland component of Shanghai and Shenzhen have highest correlation coefficient value 0.92583. The correlation between U.S. stock market and Shanghai Component Index is higher than Shenzhen Component Index. The reason is that most of the domestic large enterprises are listed in Shanghai stock market; some of these companies are also listed in the United States and Hong Kong at the same time.

2. GARCH Model Analysis

Considering autocorrelation of rate of returns and conditional heteroscedasticity, we test the spillover effect using GARCH (1, 1) models. In the regression model day (t-1) S&P 500 rate of returns are used as dependent variable while day t time sectionalized Shanghai and Shenzhen Component Index rate of returns as independent variables respectively. E-views 3.0 and SAS 9.1 are used to test GARCH (1, 1) model. The results of the econometrics regression analysisare shown in <Table 7> and <Table 8>.

Shanghai Component Index time sectionalized yield rate results are listed in <Table 9>. The coefficient β estimates the response of different time sectionalized rate of returns to lagged U.S. stock market variation. First of all, daytime return (CSH1) estimate value is -0.1348, which is not significant. For overnight return (CSH2), the estimate value is 0.3182 and significant at 1% high significant level. Based on the above analysis we understand that the day (t-1) U.S. stock market

<Table 7> GARCH Analysis of the Influence of Day (t-1) U.S. Market Returns on Time Sectionalized Rate of Returns of Shanghai Stock Market on Day t

CSH_i	CSH1 (Day)	CSH2 (Night)	CSH3 (Open+10)	CSH4 (Open+30)	CSH5 (Open+60)	CSH6 (Open+120)	CSH7 (Afternoon)	CSH8 (Morning)
α	0.0006	-0.0014*	0.0006	0.0000	0.0009	0.0013	-0.0003	0.0023
β	-0.1348	0.3182**	-0.0485**	-0.0182	-0.0231	0.0316	-0.0915	-0.0953*
θ	-0.1875	-0.3114	-0.0371	-0.0647	0.0356	-0.1182	-0.2619**	-0.0186
γ_0	0.000061	0.000079**	0.000021	0.000006	0.000020*	0.000028	0.000048	0.000025*
γ_1	-0.0154	0.6701	-0.0897	0.2133	0.3796	0.1891	-0.1046	-0.1450**
γ_2	0.9098**	-0.0118**	0.4641	0.6595*	0.1732	0.5190	0.9109**	0.9879**
R^2	0.0811	0.5241	0.0823	0.0261	0.0421	0.0264	0.1248	0.0522

*and **indicate coefficient is significant at 5%, or 1% significant level, respectively.
CSH_i (i-1, 2 ⋯, 8) represents Shanghai Component Index. CSH1 represents day return, CSH2 represents night return, CSH3 represents(opening+10 minutes) yield, CSH4 represents (opening+10 minutes-opening+30 minutes) yield, CSH5 represents (opening+30 minutes-opening+60 minutes) yield, CSH6 represents (opening+60 minutes-morning closing price) yield, CSH7 represents afternoon yield, CSH8 represents morning yield.

<Table 8> GARCH Analysis of the Influence of Day (t-1) U.S. Market Returns on Time Sectionalized Rate of Returns of Shenzhen Stock Market on Day t

CSZ_i	CSZ1 (Day)	CSZ2 (Night)	CSZ3 (Open+10)	CSZ4 (Open+30)	CSZ5 (Open+60)	CSZ6 (Open+120)	CSZ7 (Afternoon)	CSZ8 (Morning)
π	0.0023	-0.0015	0.0013	0.0004	0.0015	0.0008	-0.0008	0.0032*
ϕ	-0.1004	0.2912**	-0.0574**	-0.0200	-0.0226	0.0493	-0.0502	-0.0594*
ω	-0.1313	-0.1460*	0.1168	-0.1892	0.0633	-0.0468	-0.2471**	-0.0401
γ_0	0.000414	0.000049	0.000006	0.000009	0.000024**	0.000033	0.000031	0.000020
γ_1	0.2513	-0.0243	-0.0267	0.2744	0.5026*	0.1171	-0.1249	-0.0910*
γ_2	0.0847	0.6004	0.8395**	0.4694	0.1583	0.5576	1.0136**	1.0123**
R^2	0.0170	0.5165	0.1156	0.0485	0.0295	0.0311	0.0925	0.0300

*and **indicate coefficient is significant at 5%, or 1% significant level, respectively.
CSZi (i-1, 2⋯, 8) represents Shenzhen Component Index. CSZ1 represents day return, CSZ2 represents night return, CSZ3 represents(opening+10 minutes) yield, CSZ4 represents (opening+10 minutes-opening+30 minutes) yield, CSZ5 represents (opening+30 minutes-opening+60 minutes) yield, CSZ6 represents (opening+60 minutes-morning closing price) yield, CSZ7 represents afternoon yield, CSZ8 represents morning yield.

rate of returns have a significant impact on the overnight returns of Shanghai Component stock market.

If the Shanghai stock market is efficient market, in that way the U.S. stock market variation does not have influence on the other time sectionalized rate of returns of Shanghai stock market except overnight rate. However, CSH3 (opening plus 10 minutes) and CSH8 (morning return) estimates β are -0.0485 and -0.095331 respectively, and both of them are significant at different significant level of 1% and 5%. It indicates that day (t-1) U.S. stock market influence on day t Shanghai stock market for "opening plus 10 minutes" and morning rate of returns.

The results for Shenzhen Index time sectionalized rate of returns are shown in <Table 10>. The daytime return estimate of Shenzhen stock market is -0.1004, which is not significant value. The estimate value of overnight return is 0.2912 and significant at 1% level. Day (t-1) U.S. stock market has the significant impact on the overnight returns of Shenzhen Component stock market. It means the opening stock price of Shenzhen Component Index response to day (t-1) S&P 500 stock price variation. Also if the Shenzhen stock market is efficient market, the U.S. stock market variation do not influence on the other time sectionalized rate of returns of Shenzhen stock market except overnight returns. However, CSZ3 (opening plus 10 minutes return) and CSZ8 (morning return) estimates β_s are -0.0573 and -0.0593, respectively, andthey are significant at different significant level of 1% and 5%. This result indicates that day (t-1) stock variation of U.S. stock market has some impact on day t "opening plus 10 minutes" rate of return of Shenzhen stock market, just influence "opening plus 10 minutes" rate of return after opening.

3. Usefulness of the U.S. Stock Market Variation Information

Now we come to examine the usefulness of the U.S. stock market movement information for the investment performance in the Chinese stock market. To achieve this goal, we now sort the U.S. stock market return into positive and negative rates of return, and then calculate the time sectionalized excess rates of return in the Chinesestock market. If the movement information is useful, along with the positive returns of U.S. stock market the excess rate of return will have a positive significant value. In

contrast, along with the negative returns of U.S. stock market the excess rate of return will to be significant negative value.

For Shanghai stock market shown in <Table 9>, we find that "opening+10 minutes" rate of returns exhibit positive value of 0.00389 at 1% significant level, but the other time sectionalized returns value are not significant. Thus based on day (t-1) positive rate of return in the U.S. stock market, making long position on opening price of Shanghai stock market is a useful investment strategy. However, the results of negative rate of return in the U.S. stock market exhibit that all the time sectionalized rates of return are not significant. Thus, day (t-1) negative U.S. stock return does not provide any useful information to day t Shanghai stock market short position.

The results for Shenzhen stock market are shown in <Table 10>. For the positive rates of return in the U.S. stock market, "opening+10 minutes" return and

<Table 9> Conditional Time Sectionalized Excess Returns of Shanghai Market with Positive or Negative Day (t-1) S&P 500 Rate of Returns

S&P 500 rate of returns	Shanghai time sectionalization rate of returns	Excess rate of return
r > 0	day return	0.00627
	night return	-0.00358
	(opening+10 minutes) return	0.00389**
	(opening+10 minutes-opening+30 minutes) return	-0.00062
	(opening+30 minutes-opening+60 minutes) return	0.00212
	(opening+60 minutes-morning closing price) return	-0.00064
	afternoon return	0.00658
	morning return	0.00637
r < 0	day return	-0.00512
	night return	0.00080
	(opening+10 minutes) return	-0.00091
	(opening+10 minutes-opening+30 minutes) return	-0.00056
	(opening+30 minutes-opening+60 minutes) return	-0.00123
	(opening+60 minutes-morning closing price) return	0.00173
	afternoon return	-0.00279
	morning return	-0.00154

*and **indicate coefficient is significant at 5%, or 1% significant level, respectively.

<Table 10> Conditional Time Sectionalized Excess Returns of Shenzhen Market with Positive or Negative Day (t-1) S&P 500 Rate of Returns

S&P 500 rate of returns	Shenzhen time sectionalization rate of returns	Excess rate of return
r > 0	day return	0.01239**
	night return	-0.00176**
	(opening+10 minutes) return	0.00441**
	(opening +10 minutes-opening+30 minutes) return	-0.00065
	(opening+30 minutes-opening+60 minutes) return	0.00280
	(opening+60 minutes-morning closing price) return	-0.00205
	afternoon return	0.00922*
	morning return	0.00502
r < 0	day return	-0.00717
	night return	0.00099
	(opening+10 minutes) return	-0.00045
	(opening +10 minutes-opening+30 minutes) return	0.00117
	(opening+30 minutes-opening+60 minutes) return	-0.00283
	(opening+60 minutes-morning closing price) return	0.00087
	afternoon return	-0.00366
	morning return	0.00039

*and **indicate coefficient is significant at 5%, or 1% significant level, respectively.

daytime rate of return have positive value 0.0044 and 0.0123 respectively at a significant level of 1%. The other time sectionalized rate of returnsvalue are not significant. In conclusion day (t-1) positive day rate of return of U.S. stock market information is useful for making long position on opening price of Shenzhen stock market. The result of negative day rate of return of U.S. stock market, all the time sectionalized return values are not significant. Thus day (t-1) negative U.S. stock return also does not supply any useful information to day t short position of Shenzhen stock market.

Ⅳ. Conclusion

This paper investigated the spillover effect of day (t-1) U.S. stock market on day t time sectionalized Chinese Shanghai and Shenzhen stock markets, and also examined the comovement among these

stock markets. This paper used quantitative methods to analyze 87 days trading data from September 1, 2008 to February 27, 2009. Using GARCH (1, 1) model we investigated the impact of the volatility of U.S. stock yield rate on the Chinese stock yield rate.

For Shanghai stock market, the results show significant correlation between lagged U.S. stock market and night (close-to-open) Shanghai stock markets, while the lagged U.S. stock market has limited impact on the morning rate of returns of Chinese stock market (more precisely, the first ten minutes of Chinese market opening). This evidence suggests that the price information in the U.S. market is useful only by trading at the opening prices. For Shenzhen stock market, we find the similar empirical results as Shanghai stock market. Significant correlation between lagged U.S. stock market and night (close-to-open) Shenzhen stock markets, and lagged U.S. stock return has limited impact on the first ten minutes of Shenzhen stock market opening.

We also find asymmetric response patterns of the Chinese market to the positive and negative U.S. influence. If the day (t-1) U.S. stock market return is positive, making long position on opening price of Chinese stock market yields significant abnormal return; on contrary, if the day (t-1) U.S. stock market return is negative, there is no significant abnormal return from making short position on opening price of Chinese stock market. These results are common for both Shanghai and Shenzhen stock markets.

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