2004

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Gary Gang Tian
University of Western Sydney, gtian@uow.edu.au

Guang Hua Wan
University of Sydney

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Abstract

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Keywords

test, procedure, interacting, china, among, related, stocks, evidence, causality

Disciplines

Business | Social and Behavioral Sciences

Publication Details

Tian, G. G. & Wan, G. (2004). Interacting among China-related stocks: evidence from a causality test with a new procedure. Applied Financial Economics, 14 (1), 67-72.

Interactions among China-Related Stocks: Evidence from a Causality Test with a New Procedure

Gary Gang Tian*
School of Economics
The University of Western Sydney, Australia

Guang Hua Wan
Department of Agricultural Economics
The University of Sydney

ABSTRACT: The purpose of this study is to investigate a causal relationship among five different indices of shares issued by Chinese firms, A-, B- and H-shares listed in China and Hong Kong. This paper re-examines the interactions among these China-related stocks using daily time series data by constructing a vector autoregresion (VAR) model. A new Granger no-causality testing procedure developed by Toda and Yamamoto (1995) was applied to test the causality link among these five stock indices. The results emerging from our research indicate that there are "closed" relations within A-share (as well as within B-share) between Shanghai and Shenzhen markets and by contrast there is no any significant relations between A- and B-share within each market over the same period. These results suggest that Chinese A- and B-share remain separate and generally speaking Chinese market is not efficient. The evidence of unilateral Granger causality running from Hong Kong H-shares to B-shares in Shanghai also suggest that Hong Kong traders have better information than these foreign institutional investors in Shanghai B-share markets.

* Gary Gang Tian is the corresponding author, his email address is g.tian@uws.edu.au and his mailing address is School of Economics and Finance, Parramatta Campus, University of Western Sydney, Lack Bag 1797, Penrith South DC NSW 1797 Australia. Telephone number is 61 2 9687 5812.

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I. INTRODUCTION

Given the continued state of uncertainty in its banking system, China's reliance on foreign equity capital will continue to grow more serious in the future. To attract and maintain foreign capital, the importance of efficient financial markets will increase correspondingly. Traditionally, equity markets that are characterized by market segmentation have not been known for efficient pricing mechanisms, especially in the critical area of information transmission. The Chinese stock markets have been purposely segmented in following three respects.

First, dual listing is not allowed, i.e., a company officially listed in one exchange cannot be listed in the other exchange. In addition, the companies listed in the Shenzhen Stock Exchange (SZSE) tend to be smaller export-oriented companies, many of them joint ventures, while those listed in the Shanghai Stock Exchange (SHSE) are likely to be state-owned enterprises, many of them monopoly supplies to the domestic market (Kim and Shin, 2000). Although cross listing is not permitted, both Chinese exchanges are subject to the same macroeconomic and policy influence, particularly the political and policy decisions made by the Central Government. Nevertheless, depending on the nature of the companies listed in each exchange, the sensitivities of stock price movements caused by the common market factors might be different between the two stock exchanges (Kim and Shin, 2000).

Second, a listed company in either exchange can issue three types of shares: A-shares are restricted to Chinese nationals only, while B-shares are for foreign investors only. H-shares are issued to Hong Kong residents and the shares are listed in the Stock Exchange of Hong Kong (SEHK). All these three types of shares are identical, except that domestic investors can only hold A-shares and foreign investors can hold B-shares as well as H-shares. Although starting from February 19 2001 domestic investors were allowed to open foreign exchange account for trading B-shares, our study only focuses on the period between 1992 and 1999.

Bailey (1994) documented a significant premium of A-share prices over B-share prices. Such a premium has still been maintained so far, suggesting that the A- and B-share markets remain separate.

Since both A- and B-shares are issued by the same underlying company, in an ideal environment where markets are efficient, and information regarding firm-specific and common market factors should be reflected in the prices of both A- and B-shares, causing the same degree of price changes simultaneously. However, because of the A-B-share regime, shares issued by the same company would be traded by two distinctive groups of investors in Chinese markets. Although investors trading A-shares outnumber those trading B-shares, the former group is composed mostly of individual investors without much experience or many resources to obtain and analyze new information, while the latter group is dominated by foreign institutional investors more capable of processing information and quickly executing transactions accordingly. In addition, since the Chinese yuan is not yet convertible and the SEHK provides a stable and established system of stock market, many overseas investors prefer trading the H-shares in Hong Kong than investing directly in B-shares in Chinese markets (Kim and Shin, 2000).

The last but not the least importance, the amount of both outstanding B- and H-shares is always smaller within the limit set by the central government, making foreign investors minority shareholders. Given the growing importance of the equity markets in China, the segmentation and its impact on market efficiency deserve more attention.

This article explores the issue of causality or lead-lag relations among the five different stock indices of Chinese firms listed in the two stock exchanges of China and one in the SEHK. The objective is to learn more about the role of foreign investors in emerging stock markets and to investigate where price information is produced. The causality relations among these five different stock indices could be ended up as the following four scenarios:

Firstly, the foreign investors in China are mainly big and more experienced financial institutions. The presence of foreign investments can be a buy signal for the relative uninformed domestic investor. In this situation, the prices of B-shares would lead those A-shares. Secondly, the domestic investors can have the information advantages. They might be better in acquiring relevant news from local sources. In addition, A-share prices might reflect more information collectively through the active trading of A-share investors. In this case, the prices of A-shares would lead the prices of B-shares. Thirdly, it follows from this discussion that price information can flow in both directions. Different investor groups can have different comparative advantages in acquiring information. Finally, the markets for A- and B-shares might be completely segmented, showing no correlation among prices, even though the share prices reflect the expected cash flow of the same firm. Besides, a similar hypothesis can be established as if H-share traders receive better information than A- and/or B-share traders, then the return of H-shares should Granger causality lead the return of A- and/or B-shares or visa verse.

A Granger causality test can be used to find out which group of investors is more efficient in obtaining and processing relevant information and trading upon it. This paper, therefore, re-examines the information diffusion issue in five China-related markets by constructing a vector autoregresion (VAR) model. A new Granger no-causality testing procedure developed by Toda and Yamamoto (1995) was applied to test the causality link between Shanghai A-, B-shares and Shenzhen A- and B-shares and Hong Kong H-shares. The procedure improves the reliability of the F-statistic on which the causality test is based. A possible causal linkage between variables in a five-variable VAR model is investigated.

This paper progresses as follows: in the following section we provide the reader with a review of some of the empirical literature; Section III sets out the data and model specification, Section IV demonstrates empirical results, and finally, in Section V conclusions are presented.

II. REVIEW

Broadly, empirical studies on the lead-lag nexus can be categorised into two groups: first, those that use cross-autocorrelation method; and second, in recent years a few studies have taken a time-series approach by applying Granger no-causality test.

Some studies on Chinese A- and B-shares have dealt with the lead-lag structure by examining their cross-autocorrelation structure of A- and B-share returns. Among these studies, Chui and Kwok (1998) show that A-share traders condition much of their trading on the more informative B-share returns. These results, however, are based on an implicit assumption of a complete long-run segmentation between A- and B-shares. This is no ground for making such assumption about the relationship between the prices of A- and B-shares (Sjoo and Zhang, 2000).

Recently, several groups have studied the interactions between these China-related stock indices by doing Granger causality tests. Laurence *et al* (1997) examine causality among the four Chinese markets by doing bivariate causality tests. Their results suggest a causal relationship from Shanghai B-share market to all other Chinese markets and from Shanghai A and Shenzhen B back to Shanghai B. They argue that the causal relationships from the B-share markets to the A-share markets imply that foreign investors in B-share markets exert a significant influence on the markets open only to Chinese nationals.

Based on the returns of portfolios of individual stocks, Sjoo and Zhang (1999) found that in the SHSE, information flows from foreign to domestic investors, while in the smaller and less liquid SZSE, the information diffusion does in the opposite way. They argued that there is a general information advantage of foreign investors, even though they are faced with political risk. Based on stock indices, Kim and Shin (2000) found that the causality relationships among the five China-related indices went through significant changes after early 1996; B-shares became more influential relative to the other shares. B-shares in China have tended to lead H-shares in Hong Kong since 1996. Although A-shares tended to lead B-shares before 1996, such relationships either disappeared or were reversed after 1996 (Kim and Shin, 2000, p. 97).

It is arguable that all these existing studies have been deficient in several respects: first, the F-test statistics used in causality test may be invalid if the time-series are integrated of order 1 (or greater); second, a simple two-variable models are sensitive to model selection and functional form, which results in a fundamental deficiency. This paper seeks to overcome these problems by using a VAR framework and accommodate potential difficulties associated with using integrated time-series data.

We have applied the Granger no-causality methodology, developed by Toda and Yamamoto (1995), and further extended and interpreted by Zapata & Rambaldi (1997) and Rambaldi & Doran (1996). Although several procedures (other than the normal F-test) have been developed to improve the size and power of the Granger no-causality test, they are cumbersome and ‘the simplicity and ease of application have been largely lost’ (Rambaldi & Doran, 1996). The alternative procedure developed by Toda and Yamamoto (1995) utilises a modified WALD test for restrictions on the parameters of a VAR (k), or MWALD procedure (where k is the lag length in the system). This test has an asymptotic χ^2 distribution when a VAR (k + $d_{max, a}$X) is estimated, where d_{max} is the maximal order of integration suspected to occur in the system. Monte Carlo experiments presented in Zapata and Rambaldi (1997) provides evidence that the MWALD test has a comparable performance in size and power to the likelihood and WALD tests. The advantage of this procedure is that it does not require precise knowledge of the integration properties of the system. It can be applied even when there is no integration and/or stability and rank conditions are not satisfied 'so long as the order of integration of the process does not exceed the true lag length of the model' (Toda and Yamamoto, 1995). Rambaldi and Doran (1996) have proved that this method can use a seemingly unrelated regression (SUR) form.

III. DATA AND THE MODEL SPECIFICATION

A. Data

The data include 1702 daily observations for each of these China-related stock indices. The indices collected are Shanghai A (ShA), Shanghai B (ShB), Shenzhen A (SzA), Shenzhen B (SzB), Hong Kong H (Hang Seng China Enterprise, HSCE). All of these indices are based on closing prices. The data are obtained from Datastream International and cover the period from October 6, 1992 to December 29, 1999 for ShA, ShB, SzA and SzB. HSCE data are covered for the period from July 15, 1993 to December 29, 1999. Stock index returns are calculated using the continuously compounded formula.

To identify possible time structural changes in the behavior of the data, the sample is divided into two sub-samples covering the periods from October 6, 1992 to December 29, 1995 and from January 2, 1996 to December 29, 1999.

As shown in Table 1, average returns of A-shares are generally higher than those of B-shares. The average returns of both classes of shares in the SHSE are higher than their counterparts in the SZSE. The performance of both B- and H-shares has been very disappointing with negative average returns during the full sample period. Furthermore, all these shares have consistently exhibited extraordinarily high volatility compared with those of Hang Kong Hang Seng index and S&P 500 during the same period (Fernald and Rogers, 2002).

[INSERT Table 1 HERE]

In addition to high volatility in China-related stock indices, a time structure change can also be observed in terms of the pattern of volatility. As we can see from the standard deviations of daily returns in Table 1, A-shares tended to have a higher volatility than B-shares, and Shanghai A-shares showed a higher volatility than those in the SZSE until 1996. H-shares have also shown high volatility, but not as serve as seen in the A-shares. However, during the post-1996 period, B-shares actually have a higher volatility than A-shares, and meanwhile Shenzhen A-shares showed a higher volatility than these in the SHSE. H-shares have a highest volatility among these five indices after 1996. The change in volatility among different class shares might indicate a time structure changes at the beginning of 1996.

B. The Model Specification

As explained, the existing studies have been so far limited to test causality hypothesis by using a two-variable model (i.e., causality between A- and B-shares in the same Exchange). Controlling the effect of causality of A- and B-shares between the different markets is so important. We found that actual causality of A- and B-shares between different Exchanges are quite significant, compared with the fact that there is no causality running between A- and B-shares in Shenzhen before 1996 when market is quite information inefficient.

Our study follows this path and reduces the risk of specification bias by not restricting itself to the use of a two-variable model. The A- and B-share lead-lag hypothesis is tested according to a five-variable VAR model which is built upon the following function:

$$ShA_t = f(ShB_t, SzA_t, SzB_t, HSCE_t) \qquad \ldots\ldots\ldots \qquad (1)$$

where ShA is daily return of Shanghai A-shares; ShB_t, SzA_t, SzB_t, and $HSCE_t$, respectively are daily return of Shanghai B-shares, Shenzhen A-shares, Shenzhen B-shares and Hong Kong H-shares, where the lower-case letter denote average daily rate of return over a period.

$$\begin{bmatrix} ShA_t \\ ShB_t \\ SzA_t \\ SzB_t \end{bmatrix} = A_0 + A_1 \begin{bmatrix} ShA_{t-1} \\ ShB_{t-1} \\ SzA_{t-1} \\ SzB_{t-1} \end{bmatrix} + A_2 \begin{bmatrix} ShA_{t-2} \\ ShB_{t-2} \\ SzA_{t-2} \\ SzB_{t-2} \end{bmatrix} + A_3 \begin{bmatrix} ShA_{t-3} \\ ShB_{t-3} \\ SzA_{t-3} \\ SzB_{t-3} \end{bmatrix}$$

$$HSCE_t \qquad HSCE_{t-1} \qquad HSCE_{t-2} \qquad HSCE_{t-3}$$

$$+ A_4 \begin{bmatrix} ShA_{t-4} \\ ShB_{t-4} \\ SzA_{t-4} \\ SzB_{t-4} \\ HSCE_{t-4} \end{bmatrix} + A_5 \begin{bmatrix} ShA_{t-5} \\ ShB_{t-5} \\ SzA_{t-5} \\ SzB_{t-5} \\ HSCE_{t-5} \end{bmatrix} + A_6 \begin{bmatrix} ShA_{t-6} \\ ShB_{t-6} \\ SzA_{t-6} \\ SzB_{t-6} \\ HSCE_{t-6} \end{bmatrix} + \begin{bmatrix} \varepsilon_{ShA} \\ \varepsilon_{ShB} \\ \varepsilon_{SzA} \\ \varepsilon_{SzB} \\ \varepsilon_{HSCE} \end{bmatrix} \quad \cdots\cdots (2)$$

Where: A_1-A_6 are six by six matrices of coefficients with A_0 as an identity matrix.

To test the hypothesis that "no Granger causality from ShB to ShA", we test H_0: $\alpha_1^{(12)} = \alpha_2^{(12)}$,...,= $\alpha_5^{(12)} = 0$, where $\alpha_i^{(12)}$ are the coefficients of ShB_{t-1}, $ShB_{t-2,...,}$ ShB_{t-5} respectively in the first equation of system (2) where the system is being estimated as a VAR(6).

The existence of a causality from ShB to ShA can be established through rejecting the above null hypothesis which requires finding the significance of the MWALD statistic for the *group* of the lagged independent variables identified above. A similar testing procedure can be applied to the alternative hypothesis that "no Granger causality from ShA to ShB", i.e., to test H_0: $\alpha_1^{(21)} = \alpha_2^{(21)}$,..., = $\alpha_5^{(21)} = 0$, where $\alpha_i^{(21)}$ are the coefficients of ShA_{t-1}, $ShA_{t-2,...,}$ ShA_{t-5} respectively in the second equation of system (2) where the system is being estimated as a VAR(6).

IV. ESTIMATION RESULTS:

Prior to testing for causality relations between the time series, it is necessary to establish the order of integration present. Augmented Dickey-Fuller (ADF) tests were carried out on the time series in levels and differenced forms. The results of the ADF tests on the time series, expressed in natural logarithms, reject the null hypothesis of a unit root in all the daily return series at any of the reported significance levels. Therefore, the orders of integration for all these time series are *I*(o).

Results of the Granger no causality are presented in Tables 2 and Figure 1. The results can be summarized as follows.

[INSERT Table 2 HERE]
[INSERT Figure 1 HERE]
[both from a separate file]

1. We can see there are unilateral causality relations within A-shares as well as within B-shares. Shenzhen A-share exerts significant influence on its counter-part in Shanghai. Shanghai B-share has strong influence on the Shenzhen B-share during the early period, while Shanghai B was influenced by Shenzhen B in the later period. This result is similar to the one from Kim and Shin (2000), in which they found that it is B-shares in Shenzhen became more influential after 1996.

2. Chinese stocks listed in Hong Kong leads Shanghai B-shares during the entire period. This unilateral causality indicates that Hong Kong traders have better market-wide and company-wide information than foreign institutional investors within Mainland China.

3. There is no any significant causality relations between A- and B-share either in unilateral or two-way direction. The information transmission between A- and B-share is very weak. Theoretically there would be more strong information transmission between A- and B-share rather than within A-share or within B-share.

V. CONCLUDING REMARKS.

This paper has applied the methodology of Granger no-causality test developed by Toda and Yamamoto (1995) to examine the causality linkage among five different indices of shares issued by Chinese firms, A- and B-shares listed in the SHSE and SZSE, and H-shares listed in the SEHK.

The results emerging from our research indicate that the “closed” relations within A-share as well as within B-share markets suggest that Chinese A- and B-share remain separate and generally speaking Chinese market is not efficient. The evidence of unilateral Granger causality running from Hong Kong H-shares to B-shares in Shanghai also suggest that Hong

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ACKNOWLEDGEMENT

The authors gratefully acknowledge the help from the work by Jordon Shan in the VAR model.

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Table 1 Descriptive Statistics of daily percentage returns (Mean, standard deviation, minimum and maximum (October 6, 1992 to December 29, 1999)

Market	Mean	Minimum	Maximum	Standard deviation	Standard deviation First period*	Standard deviation Second period**
Shanghai A	0.041	-18.4	30.9	3.37	4.43	2.22
Shanghai B	-0.029	-13.1	12.4	2.32	1.88	2.66
Shenzhen A	0.022	-19.7	27.2	2.89	3.36	2.50
Shenzhen B	-0.073	-22.2	14.8	2.63	2.04	3.11
Hong Kong H	-0.047	-25.6	41.7	3.11	2.39	3.58

Notes: All percentages calculated as 100 times the change in the log of the index.
* denotes that the first period covers the period between October 6, 1992 and December 29, 1995; ** denotes that the second period covers the period between January 2, 1996 and December 29, 1999.

Table 2 and Figure 1 See a separate file.