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First and Second Order Instability of the Shanghai and Shenzhen Share Price Indices

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1. Introduction

The instability of share price indices is an important characteristic of share markets for investors, speculators and forecasters. Stable share prices series provide a sounder basis for the purposes of prediction and for the portfolio choices of agents. This applies particularly to emerging markets, such as the Chinese markets which are the focus of so much international investment attention at present.

Our purpose in this paper is to assess the instability of the Shanghai and Shenzhen market on daily data from January 2nd 1992 to July 16th 2004. Our tests for instability are based on Harvey's (1981) argument that a non stationary time series is explosive and therefore is unstable. Following the argument of Felmingham and Mansfield (2003), a stationary time series exhibits stable properties having a time invariant, finite variance while random innovations which have a transitory affect on the stationary series. The series is mean reverting and its autocorrelation function declines with lag length. So a stationary series is stable in this context. We deem the two series studied in this paper to be stable if they are stationary, we call this first order stability.

However, an analysis of stability does not rest on the stationarity issue alone. We also test the Shanghai and Shenzhen share price indices for structural breaks. It is one thing to have a smooth, stationary and therefore stable series, it is another altogether to have a series which is stable subject to a structural break in that series. This second order test for instability involves some basic questions as to the cause of break, and the role of domestic or foreign influences.

The present analysis augments the research conducted by Groenewold, Tang and Wu (2004) who find stable linkages between the time series of the Shanghai and Shenzhen markets. Test for interdependence are not the issue in this study, rather the concern is about instability (first and second order) and the stability of the price signals emitted by the two mainland Chinese share price indices.

What are the probabilities of discovering a stable pattern of behavior of Chinese share prices through time? There are many events which might be the cause of instability. Some of these will impact on China from the rest of the world, and others will be uniquely Chinese. Included among the world events of note are September 11 and the Asian financial crisis, while exclusively Chinese event are exemplified by the return of Hong Kong to Chinese administration and China's entry to the World Trade Organization. Just as these events may have caused some instability in the developing Chinese stock exchanges, so it follows that in any analysis of the time series of Chinese stock price behavior, structural instability should be accommodated.

Tests for the presence of a unit root in share price time series is the subject of a voluminous study in economics and finance over the past decade. The time series properties of economic variables have important implications for economic theory. In a well known paper Nelson and Plosser (1982) could not reject the null hypothesis of a unit root in most US macroeconomic time series. However, Perron (1989) argues that if there is a break in a deterministic trend, then unit root tests will lead to a misleading conclusion that there is a unit root, even in fact if there is not. Furthermore, Perron and Vogelsang

(1992), Perron (1997) and Zivot and Andrews (1992) structured their models by allowing stationarity around an endogenously estimated structural break point under the alternative hypothesis.

The main objective of this paper is to investigate if the methodologies developed by Perron (1997) and Zivot and Andrews(1992) are employed to test for unit roots in share price time series subject to a structural break.

2. An Overview of China's Share Markets

Before conducting an empirical analysis, it may be useful to review the development of China's stock markets. China's stock exchanges in Shanghai and Shenzhen are relatively new players in the Chinese economy and on the world financial markets. The Shanghai stock Exchange (SHSE) was established on December 19,1990 and the Shenzhen Stock Exchange (SZSE) was founded on July 3,1991. Following the establishment of China's share markets, the market capitalization of each exchange has grown rapidly. Table 1 shows the world's largest equity markets at year-end 2001. China is ranked eight with an official capitalization of Rmb4.3 trillion ($524bn). This is an extraordinary achievement for a market which is only 12 years old.

Table 1: The world's largest stock markets (year-end 2001)

Country Market	Capitalization ($bn)
United States	13,810
Japan	2,52
UK	2,217
France	1,174
Germany	1,072
Canada	701
Italy	527
China	524
Switzerland	521
Hong Kong	506

Source: *Standard and Poor's* (cited by Stephen Green, 02,2003)

At the moment China's share market is the second largest in Asia behind only Japan. It is possible that China's share market will become Asia's largest over the next few years (Peterson et al.2003). Companies in China list two types of shares – domestic shares (A shares), which are quoted and traded only among domestic Chinese investors and foreign shares (shares B) which are traded in RMB but quoted in foreign currencies. Moreover some Chinese companies are allowed to go beyond traditional domestic equity financing channels to raise capital by listing in oversea capital markets in Hong Kong and New York stock exchanges which are called Share H and Share N. These have different degrees of interdependence with international capital markets. In terms of avoiding the impact of adverse international market movements on the stock market, the segmentation of share A and share B markets appears effective **(**Xiangmei Fan, Yanrui Wu, Nicolaas Groenewold, 2004). Of course, this can be expected to change because of recent policy

changes involving the opening of share B markets to domestic investors and opening share A markets to qualified foreign institutional investors.

While China has been moving towards the solution of various problems associated with emerging share markets, it must be acknowledged that China's stock market is still relatively underdeveloped in comparison with other countries. There is reason for optimism, however, the government is moving to privatize industry and encourage the public to buy more shares. As a result, the government will become more interested in the quality of existing regulations and of the performance of listed companies. As these trends take root – and there are already signs that they are taking root, there is reason to believe that China's stock market will grow in size, allocate capital more efficiently, help finance China's economy and it may become a market worthy of foreign investors.

3. Empirical Methodology

Perron (1997) and Zivot and Andrews (1992) emphasize that the date of any break point in a time series should be endogenously estimated. The null hypothesis of a unit root without an exogenous structural break is tested against the alternative that the series is trend-stationary with a one-time break. Perron's (1997) structural break test consists of estimating the following regression:

$$y_t = \mu + \theta DU_t + \beta t + \gamma DT_t + \delta D(T_B)_t + \alpha y_{t-1} + \sum_{i=1}^{k} c_i \Delta y_{t-i} + \varepsilon_t \qquad (1)$$

Where $DUt = 1$ if $t > T_B$, $DT_t = t - T_B$ if $t > T_B$ and $D(T_B) = 1$ if $t = T_B + 1$. T_B denotes the time at which a structural break occurs. In order to determine the date of a structural break endogenously, it is necessary first to select the date which minimizes the Dickey

Fuller t-statistic for testing the null hypothesis of a unit root (a = 1). Secondly, the date of the structural break is chosen such that the value of $\left| t_{\gamma} \right|$ is maximized. We will select the breakpoint using the maximum of the absolute value of t_{γ}. From general to specific procedures suggested by Perron (1997) is adopted to determine the value of the lag truncation parameter k.

The structural break tests developed by Zivot and Andrews (1992) involve the following regressions:

$$y_t = \mu + \theta DU_t + \beta t + \gamma DT_t^* + \alpha y_{t-1} + \sum_{i=1}^{k} c_i \Delta y_{t-i} + \varepsilon_t \qquad (2)$$

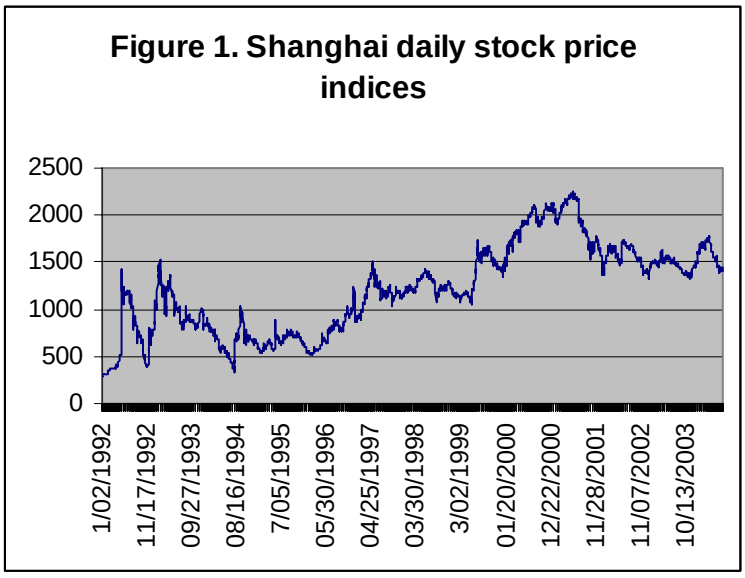
Where $DUt = 1$ if t>T_B, 0 otherwise DT_t^*=t-T_B if t>T_B, 0 otherwise. The break point is chosen as the value maximizing the absolute value of t_{θ}. Unlike Perron (1997),the one-time break dummy, D(T_B), is not included in Zivot and Andrews(1992) model. In equation (2), we estimate Zivot and Andrews' model which allows a change in both the level and the trend. The testing procedure in Zivot and Andrews (1992) is similar to that of Perron(1997) described above. Perron has simulated critical values for a finite sample size which is quite different from the asymptotic critical value derived from Zivot and Andrews models.

4. Data and Empirical Results

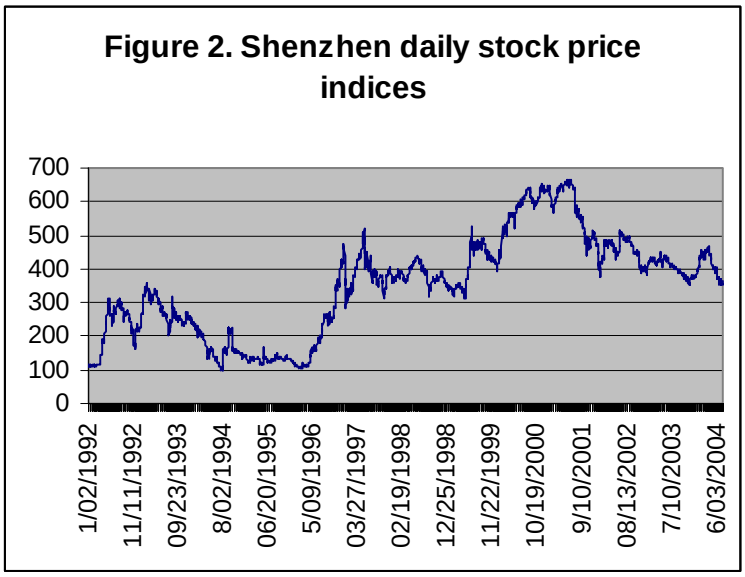
Sample data included in these studies is comprised of daily stock prices over January 6,1992 to July 16, 2004 at Shanghai stock exchange and Shenzhen stock exchanges. The data used in this study are purchased from Global Financial Data.

Table 2: Basic Statistics of the 2 Stock Indices

	Shanghai	Shenzhen
Mean	1212.846	351.7335
Median	1213.66	371.42
Maximum	2242.42	664.85
Minimum	293.75	96.56
Std. Dev.	470.7168	150.1
Skewness	0.097904	0.054914
Kurtosis	2.136662	2.205134
Jarque-Bera	100.3128	81.98657
Probability	0	0
Observations	3072	3056

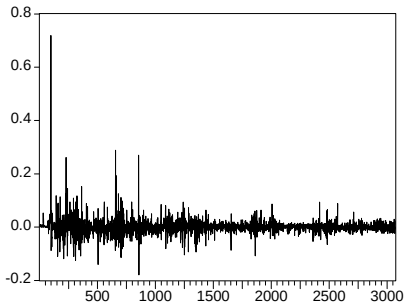


Source: *Global Financial Data*

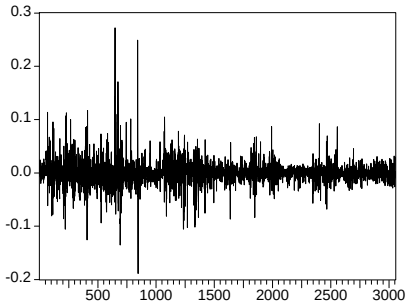


Source: *Global Financial Data*

Figure 3: Volatility of China's Daily Share Market Returns



(a) Shanghai Composite Index (SSECD)
Source: *Global Financial Data*



(b) Shenzhen Composite Index (SZSCD)
Source: *Global Financial Data*

Table 2 provides summary statistics of the share price. As can be seen, the price level series are positively skewed. The Shanghai stock market has a relatively higher standard deviation in comparison with the Shenzhen stock market. This to some extent indicates that the Shanghai stock market is more volatile than the Shenzhen market. The Jarque-Bera test for joint normal kurtosis and skrewness rejects the normality hypothesis, this is a common feature of all financial data. The Shanghai share market and the Shenzhen share market experienced similar trends and have high contemporaneous relationships (Figure1).

Figure 3 and Figure 4 present time series plots of the returns for the two stock markets used in the study. For both indices, there were more variations in the early stage of the sample than the later stage. This is perhaps due to the implementation of a 10% band limit on daily stock price changes with a T+1 settlement rule after 12/16/1996. Of particular note, is the absence of high volatility of the market returns series associated with the October 1997 Asian financial crisis. Both China stock markets appeared to be relatively stable over this time compared with the stock markets in other countries. It is important to understand the unique characteristic of the two segmented stock markets in China. The government secures the ownership of the companies listed through domestic institutional investors using A shares and attracts foreign capital using B shares. Most international shocks are expected to be mainly absorbed in share B markets and their impact on share markets will diminish as a result. This may explain why China could have escaped the Asian financial crisis during 1997-1998.

A preliminary step in our analysis is concerned with examining the integration properties of the series. The results of augmented Dickey-Fuller tests portrayed in Table 3 indicates that both series are integrated of I(1).

However, Perron (1989) suggests that conventional unit root tests such as ADF tests are biased towards the non-rejection of the unit root null in the case of a structural change. Perron and Vogelsang (1992), Zivot and Andrews (1992), and Perron (1997) have developed tests which account for structural breaks in order to avoid bias in favor of a unit root hypothesis.

Table 3. Unit Root Test Results for Daily Series

	ADF		**Perron (1997)**			**Zivot and Andres (1992)**		
	Levels	**Return**	$\mathbf{T_B}$	**k**	$\mathbf{t_r}$	$\mathbf{T_B}$	**k**	$\mathbf{t_r}$
SES	-3.04	-52.03***	1999.5	1	-4.4254	1999.5	1	-4.4254
SZS	-2.10	-53.44***	1999.12	2	-3.6515	1999.12	2	-3.6523

T_B denotes the break date suggested by t_γ and t_θ respectively. The critical values for the 1, 5 and 10 percent significant levels of the t statistics are –5.57, -5.08 and –4.82 for Zivot and Andrews' test and -5.57, -4.91 and -4.59 for Perron's test. *** significant at 1 percent.

The relevant test statistics for the ADF, and Perron (1997) analyses of stationarity are also shown on Table 3.

According to the estimated t_γ test statistics based on Perron, the break point was occurred in 1999, May 1999 for Shanghai index and December 1999 for the Shenzhen index. This finding is not surprising because the Shanghai stock market and the Shenzhen stock market are both influenced by domestic policy changes, government intervention and macroeconomic factors in China.

The results of Zivot and Andrews (1992) tests reported in Table 3 suggest that both stock series are non-stationary allowing for a break in the level and trend of the function. Similarly, the break point suggested by Zivot and Andrews is May 1999 and December of the same year for Shanghai and Shenzhen share markets.

The estimated break point marks a significant year in the share market history of China because the late 1990s was a turning point for the Chinese economy. Exports increased compared with two years earlier when Asian financial crisis broke. Share prices in China have picked up since 19 May 1999 and pushed prices up nearly 40 percent in a little over a month. This recovery followed a number of stimulatory measures. For example, state-owned enterprises were allowed to enter the securities market, as well 25 insurance companies were allowed to hold of their total asset in shares up to 5 percent of the assets they had. Besides, the Securities Law also took effect on 1 July 1999 which affected share market sentimental favorite. Most importantly, China and the US finalized their trade agreement on China's WTO entry on 16 Nov.1999. All these developments created a sound basis for the long term strength of the stock market.

5. Conclusions

The unit root tests developed by Perron (1997) and Zivot and Andrews (1992) are used to assess the first order and second order instability of the Shanghai and Shenzhen market. We conclude that the empirical evidence based on these data suggest that share market series are non stationary even if the structural break points are taken into account. It appears that the China's share market is relatively isolated. The causes of instability of China's share markets may not be influenced by outside shocks. The cause of instability during January 1992 to July 2004 may be unique Chinese economic motivations and entry to world trade organization at the end of the 1999. World events such as September 11 and the Asian financial crisis have little impact on China's share markets in comparison with Chinese domestic influences. The reason why China could have escaped the foreign shocks may be explained by the segmented share markets of China (Share A and Share B). International shocks are expected to be mainly absorbed in share B markets and risks can't transmit across markets in segmented markets. This explanation need further test.

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