Did a Rational Bubble Exist in the Vietnam Stock Market?

Hiroshi Gunji[*]

Faculty of Economics, Daito Bunka University
1-9-1 Takashimadaira, Itabashi, Tokyo, Japan

Kazuki Miura

Graduate School of Economics, Hosei University.

Email: kazuki.miura.47@gs-eco.hosei.ac.jp

Abstract: In this paper, we investigated whether or not the movement in Vietnam's stock prices was the result of rational bubbles during the July 2000-July 2008 period. The stock market experienced some boom and burst cycles during this period. Although these seem to be stock market bubbles, no studies tested this fact statistically. Based on Fukuta's (1996) proposition, we used some popular unit-root tests to check for the existence of rational bubbles in Vietnam's stock market. All of these tests supported the hypothesis that the series of real stock prices was stationary. From these results, we conclude that there were no rational bubbles in Vietnam's stock market.

1.   Introduction

In the Vietnam stock market, legal system reform and financing mechanism building have been enhanced. The government has facilitated the privatization of many state-owned enterprises (SOEs). In July of 2000, Vietnam's first stock market was established in Ho Chi Minh City. Most of the listings are companies formed by the equitization of SOEs. We see from Figure 1 that the number of listed companies rose steadily, and a total of 156 companies were listed on the Ho Chi Minh Stock Exchange (HOSE) as of July 2008.

Over eight years have now passed since the establishment of HOSE, and Vietnam's market has attracted attention from investors around the world. Figure 1 also displays time series behavior of the VN Index. From 2000 to the first half of 2006, it fluctuates between 200 and 300 points, with the exception of a temporary movement beyond 400 points in mid-2001. From the latter half of 2006, the VNI rises dramatically, recording 1,113 points at its peak in March 2007.

The Economist (2007) compares the sharp rise in the VN Index to the "South China Sea bubble" and suggests the existence of a bubble in that period. Furthermore, IMF (2007)

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* Corresponding author: Email: hgunji@ic.daito.ac.jp

reports that the price-earnings (P/E) ratio of the market's top 30 Vietnamese firms was 53.6% in 2006, and 32.4% in mid-2007. They point out that the Vietnamese P/E ratio is overvalued compared to other emerging markets such as China and India. Soon after the release of that report, the VN Index, a representative stock price index of Vietnam, plunged by approximately 400 points.

Figure 1: Nominal VN Index
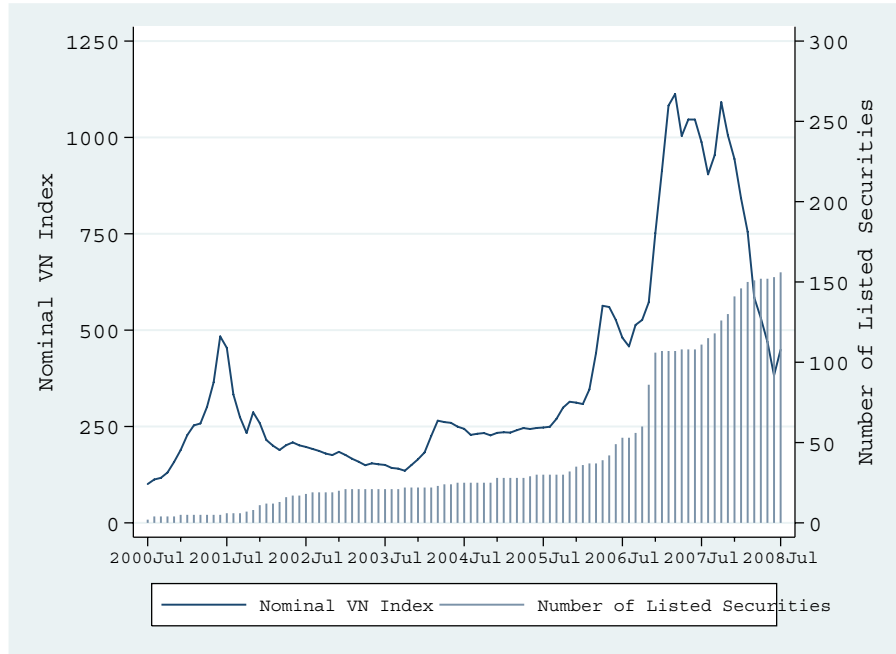
The movement of Vietnam stock market prices appears to be similar to the bursting of a rational bubble. However, there is no previous work investigating whether a stock market bubble occurred based on the rational expectation of the investors. In this paper, we investigate the existence of rational bubbles in the recent Vietnam stock market using time series analysis.

2. Methodology and Data

According to Blanchard and Watson (1982), rationality of behavior or expectation often does not imply that the asset price will be equal to its fundamental value. They use the concept of rational bubbles to signify rational deviations of an asset price from its fundamental value.

The objective of this paper is to verify whether bubbles occurred in the Vietnam stock

market based on the rational expectation of the investors. It is not easy to test the existence of rational bubbles, but from some earlier empirical studies using time series methods, there are approaches available for testing for rational bubbles.

As typical examples, Diba and Grossman (1988) present methodologies using cointegration tests of real stock prices and real dividends with U.S. annual data. The theoretical background for these tests is the idea that if the first differences of the stock price and dividends are stationary, rational bubbles do not exist. In other words, these approaches propose necessary conditions for the absence of rational bubbles under the assumption of risk neutral investors and a constant real interest rate.

In contrast to these studies, Fukuta (1996) considers a sufficient condition for the absence of rational bubbles. Under the condition that investors are not risk neutral and that both the real interest rate and risk premium are time varying and stationary, Fukuta (1996, p. 463) proposes:

Proposition: *Suppose that the real interest rate and the risk premium are stationary and that the sum of unconditional means of them is strictly larger than zero. If the first difference of a real stock prices movement is stationary, then the stock price behavior does not contain rational bubbles*.

Intuitively speaking, "[a] stock price which is consistent with rational bubble behavior keeps on diverging from its fundamental price level" (Fukuta, 1996, p. 459). Following this proposition, we conduct some unit-root tests for the *first difference* of real stock prices in Vietnam.

Before doing so, however, we should test the condition of stationarity for the real interest rate and the risk premium. Let r_t denote the real interest rate at time t, ρ_t the risk premium, d_t the dividend, and p_t the stock price. The non-arbitrage condition is: $1 + r_t + \rho_t = \dfrac{E_t(d_{t+1} + p_{t+1})}{p_t}$, where $E_t(\cdot)$ is the expectation under the information set at time t. From this equation, we have $r_t + \rho_t = \dfrac{d_{t+1} + p_{t+1} - p_t}{p_t} + u_{t+1}$, where $u_{t+1} = [E_t(d_{t+1} + p_{t+1}) - d_{t+1} - p_{t+1}] / p_t$ is the forcast error. The left hand side of this equation is stationary if and only if the right hand side is stationary. Provided that u_{t+1} is stationary, we should test the stationarity of holding return, $(d_{t+1} + p_{t+1} - p_t) / p_t$. Since the data of d_t is not available for Vietnam, however, we assume that d_{t+1} / p_t is stationary and investigate whether or not $(p_{t+1} - p_t) / p_t$ is stationary in order to check the condition.[1]

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[1] In practice, most previous researches reject the unit-root null of dividends. See, for example, Diba and Grossman (1988).

We use the VN Index to represent stock prices during the July 2000-July 2008 period. Table 1 shows descriptive statistics on the holding return and real stock prices, and Figure 2 presents the time series of the real stock prices. We use the consumer price index as the deflator. The movement of the real stock price is quite similar to that shown in Figure 1. It seems that, in 2000, bubbles quickly expanded and bursted. Following that, the stock prices rose gradually and finally fell sharply in late 2007.

Table 1: Basic Statistics

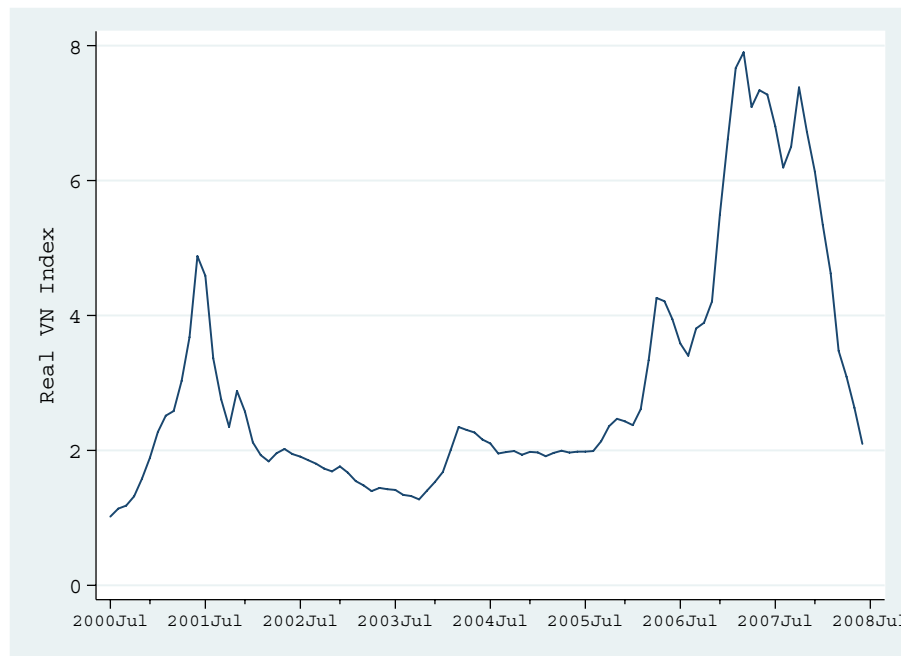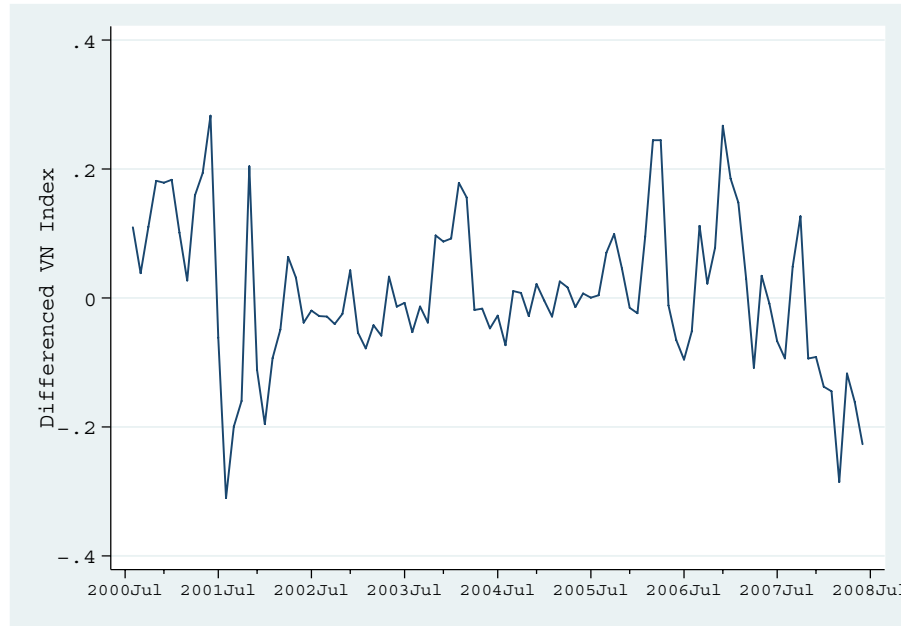| Statistics	First-differenced real stock prices	Holding return	Statistics	First-differenced real stock prices	Holding return
Mean	0.011	0.014	Std. Dev.	0.435	0.118
Median	-0.018	-0.009	Skewness	0.284	0.422
Maximum	1.288	0.327	Kurtosis	4.650	3.244
Minimum	-1.224	-0.267	Observations	95	95

Figure 2: Real VN Index

Figure 3 demonstrates the differenced series of the real VN Index. It moves around zero as if it is an autoregressive process with a low order and without a drift. So, we conjecture that it is stationary.

Figure 3: Differenced Real VN Index

3. Unit-Root Tests

Following Fukuta's (1996) proposition, we conduct some unit-root tests for holding return and the first difference of real stock prices. First of all, we check the condition of Fukuta's (1996) proposition, the stationarity for holding return. Table 2 shows the result. We first conduct the Augmented Dickey-Fuller test (ADF, hereafter), and select the lag length using the Schwartz Bayes Information Criteria (SBIC). Regardless of the time trend, the test statistics reject the null of non-stationarity at the 1 percent level. This suggests that the condition of Fukuta's (1996) proposition is satisfied.

Although we have the stationary result from the ADF test, which tends to outperform in small samples, we also use another unit-root test to check the robustness. Table 2 also shows the results from the DF-GLS test of Elliot et al. (1996). This test is widely used to improve the small sample property of ADF. The null hypothesis is that the series is non-stationary. Like ADF, the test statistics reject the null of non-stationarity.

Next, we adopt two other tests: Phillips and Perron's (1988) Z_t test (PP) and Ng and Perron's (2001) MZ_t^{GLS} test (NP). The relationship between these tests is analogous to that between ADF and DF-GLS. We choose the bandwidth of Newey and West's (1987) nonparametric estimator of the long-run variance by the Bartlett kernel. Both of these tests also reject the non-stationarity null at the 1 percent level.

Table 2: Unit-Root Tests for Holding Return

Test	Intercept	Trend	Lags/ Bandwidth	Statistic	
ADF	Yes	No	0	-4.840	***
	Yes	Yes	0	-4.927	***
DF-GLS	Yes	No	0	-4.217	***
	Yes	Yes	0	-4.822	***
PP	Yes	No	7	-4.717	***
	Yes	Yes	7	-4.831	***
NP	Yes	No	7	-3.241	***
	Yes	Yes	7	-3.714	***
KPSS	Yes	No	4	0.177	
	Yes	Yes	4	0.125	*

Moreover, we conduct a different test, the Kwiatkowski et al. (1992) LM test (KPSS), which has the null of stationarity. In the case of the model without time trend, the null cannot be rejected even at the 10 percent significance level. On the other hand, with time trend, the null is rejected at the 10 percent significance level. Although we have the result of non-stationarity in the latter case, the significance level is relatively high. Furthermore, all other tests suggest that the holding return is stationary. Therefore, it is reasonable to say that the condition of the proposition is satisfied.

Next, we investigate whether or not the first-differenced real stock prices are stationary. Table 3 presents the results. The ADF, DF-GLS, PP, and NP tests reject the null of non-stationarity at the 1 percent significance level. In addition, the KPSS test cannot reject the null of stationarity even at the 10 percent significance level. The mean of this result is the same as the former four tests.

Table 3: Unit-Root Tests for the First-Differenced Real Stock Prices

Test	Intercept	Trend	Lags/ Bandwidth	Statistic	
ADF	Yes	No	0	-5.245	***
	Yes	Yes	0	-5.280	***
DF-GLS	Yes	No	0	-5.231	***
	Yes	Yes	0	-5.318	***
PP	Yes	No	7	-5.050	***
	Yes	Yes	7	-5.085	***
NP	Yes	No	7	-3.750	***
	Yes	Yes	7	-3.810	***
KPSS	Yes	No	4	0.130	
	Yes	Yes	4	0.113	

Hence, we find that the VNI was not based on rational bubbles. This result is quite robust since all of the tests we conducted support the stationarity of the first-differenced real stock prices.

4. Robustness

To check the sensitivity, we investigate the other period of our sample. The government has taken a step-by-step approach to provide for the necessary regulations on and securities market, and to relax unnecessary regulations. In particular, some important laws went into effect in the Vietnamese stock market in 2003.

For instance, on July 2003 the government promulgated Decree 146/2003/QD/TTg. With the Decree, the percentage of listed shares that foreign investors could held in a listed company was raised from 20% or less to 30% or less. In addition, the percentage of shares that foreign securities companies could hold in domestic investment fund management companies was increased from 30% to 49%. In November 2003, moreover, the government issued Decree 144/2003/ND/CP. The Decree provides a comprehensive framework including efforts to help the securities market operate organizationally, safely, publicly, fairly and efficiently, and protect the interests of investors. These decree-laws played an important role in the development of the Vietnamese stock market. Therefore, it is possible that after 2003, the results of the unit-root tests may change.

Table 4 presents the unit root tests for holding returns in the subsample between July 2003 and July 2008. The first four test statistics reject the null of non-stationarity, whereas the result of the KPSS test is ambiguous. However, almost all tests suggest that the series are stationary.

Table 4: Unit-Root Tests for Holding Return, Subsample

Test	Intercept	Trend	Lags/ Bandwidth	Statistic	
ADF	Yes	No	0	-3.316	**
	Yes	Yes	0	-3.535	**
DF-GLS	Yes	No	0	-3.295	***
	Yes	Yes	0	-3.535	**
PP	Yes	No	2	-3.390	**
	Yes	Yes	3	-3.530	**
NP	Yes	No	1	-2.752	***
	Yes	Yes	1	-2.891	*
KPSS	Yes	No	4	0.259	
	Yes	Yes	4	0.157	

Table 5 shows the unit root tests for the first-differenced real stock prices from July 2003 to July 2008. As in the last section, we see from all the test statistics that the the series are stationary. Therefore, the VPN does not contain rational bubbles.

Table 5: Unit-Root Tests for the First-Differenced Real Stock Prices, Subsample

Test	Intercept	Trend	Lags/ Bandwidth	Statistic	
ADF	Yes	No	0	-3.908	***
	Yes	Yes	0	-4.041	**
DF-GLS	Yes	No	0	-3.931	***
	Yes	Yes	0	-4.074	***
PP	Yes	No	2	-3.918	***
	Yes	Yes	3	-3.990	**
NP	Yes	No	0	-3.097	***
	Yes	Yes	0	-3.170	**
KPSS	Yes	No	4	0.223	
	Yes	Yes	4	0.153	**

5. Concluding Remarks

In this paper, we investigated whether or not the movement in the Vietnam's stock prices was due to rational bubbles during the July 2000-July 2008 period. The stock market experienced some boom and burst cycles during this period. Although these seemed to be stock market bubbles, no studies have tested this fact statistically.

Based on Fukuta's (1996) proposition, we used some popular unit-root tests to check for the existence of rational bubbles in Vietnam's stock market. All of these tests supported the hypothesis that the series of the real stock prices was stationary. From these results, we conclude that there were no rational bubbles in Vietnam's stock market.

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