Relationship between Rational Speculative Bubbles in Stock Market and Gross Domestic Product

Nurharyanti Borhan [1] and Nurfadhlina Abdul Halim [2]
[1] *Faculty of Science and Technology, Universiti Sains Islam Malaysia,71800 Nilai, Negeri Sembilan, Malaysia*
[2] *Faculty of Science and Technology, Universiti Sains Islam Malaysia,71800 Nilai, Negeri Sembilan, Malaysia*
[1]nurharyantihusna@gmail.com, [2] nurfadhlina@usim.edu.my

ABSTRACT
This paper discusses about the relationship between Gross Domestic Product with the size of speculative rational bubbles in stock market. The stock market chosen in this study are Hang Seng, Nikkei 225 and S&P 500. This is because China, Japan and United States are countries that pioneers the world economy. This paper presents analysis that have been done in order to view the relationship between GDP and the size of speculative rational bubbles in stock market.

Keywords: Financial Bubble, GDP, Economic downturn

INTRODUCTION

Economic bubbles are also known as speculative bubbles, market bubbles, price bubbles, financial bubbles or speculative mania which leads to very high prices and very different from intrinsic values. The cause of the bubble remains a challenge of economic theory but according to Stasys et al. (2009), the main idea behind the formation of the economic bubble is weak monetary policy and excessive financial liquidity in the financial system.

There are several major types of economic bubbles namely stock market bubbles, real estate bubbles and bubbles in other markets, including precious metals, energy resources and other commodities. A popular example of an ever-occurring bubble collapse is the tulip mania that occurred in 1634-37 as shown in figure 1. The financial bubble relates to each other and also the impact of its fall will affect each of them. The impact of the collapse of the bubble for one country will also affect other countries, especially developing countries.

According to Pengfei and Yi Wen (2009), the presence of the bubble was cheered on and the death of the bubble was mourned by the entire economy. The parody given by Pengfei and Yi Wen (2009), is very interesting. The statement of the presence of bubble was cheered leads to the meaning of the bubble itself. According to Nurfadhlina et al. (2009), a bubble is formed by an increase in the price of an asset that exceeds its intrinsic price. Why mourns its death? This death refers to the collapse or rupture of a bubble that leads to an economic collapse. When the financial bubble bursts, it will disrupt a country's GDP performance. Especially developing countries. figure 2 shows the phase of bubbles formation and how it can be burst.

In this study, only financial markets were tested. This research aims to look at the current economic situation by looking at the relationship of GDP with rational speculative bubble size in selected financial markets using the General Johansen-Ledoit-Sornette (JLSU) model. The selected financial markets are stock market indices from the United States, China and Japan namely the S&P 500, Nikkei 225 and Hang Seng. This is because the three countries are the major powers that dominate the world economy. Stock index data were selected from 1965 to 2018 and divided into five cycles. Only Hang Seng stock index data is taken from 1969 to 2018 because the stock index for China was first introduced in 1969. The first cycle for each stock index is from 1965 to 1975 (1969 to 1975 for Hang Seng), the second cycle is from 1976 to 1985, the third cycle is from 1986 to 1997, the fourth cycle from 1998 to 2008 and finally the fifth

cycle from 2009 to 2018. In the previous paper, the discussion about the size of financial bubble and the forecasting on the collapse of rational speculative bubble already been discussed. So, in this study, the discussion will only focus on the relationship between rational speculative bubbles in stock market and gross domestic product.
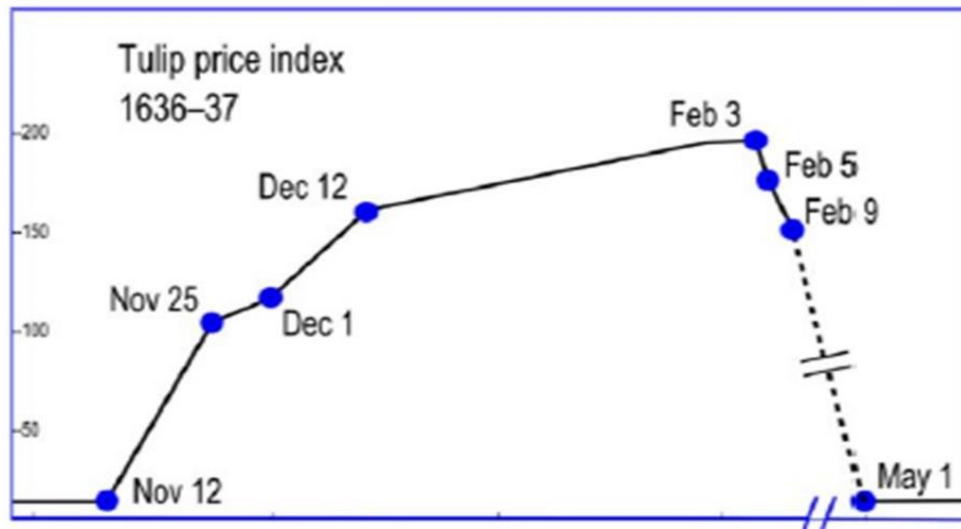

Figure 1: Tulip Mania Bubble.
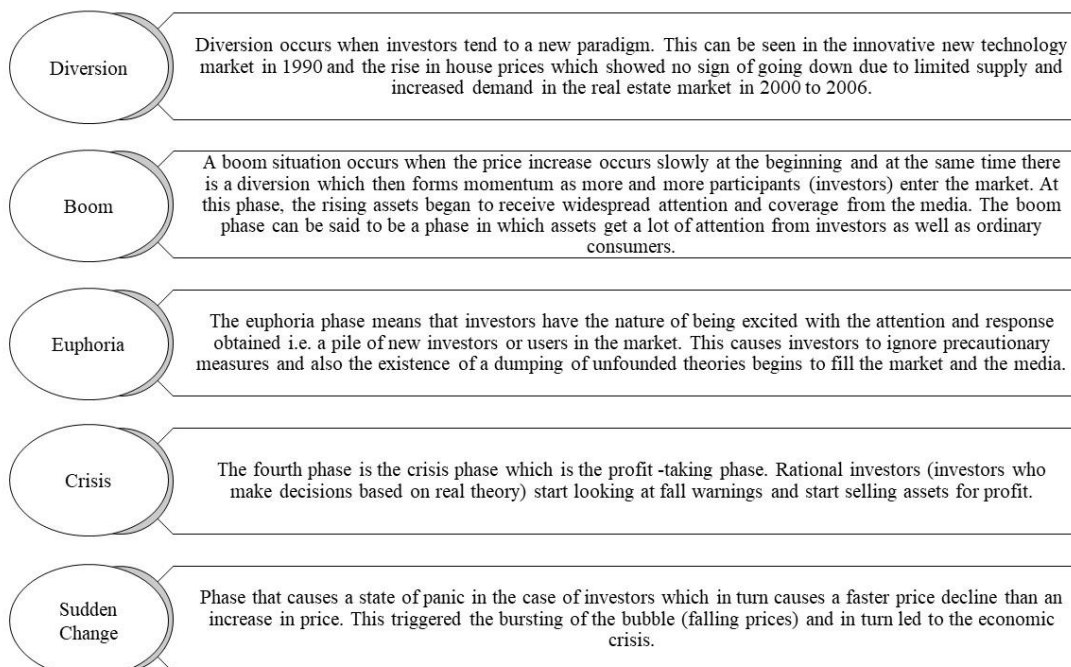Source : Pengfei and Yi Wen (2009).

Figure 2: Five General Stages of Bubbles.
Source : Alexandru Balasescu and Apurv Jain (2018).

In this study, only financial markets were tested. This research aims to look at the current economic situation by looking at the relationship of GDP with rational speculative bubble size in selected financial markets using the General Johansen-Ledoit-Sornette (JLSU) model. The selected financial markets are stock market indices from the United States, China and Japan namely the S&P 500, Nikkei 225 and Hang Seng. This is because the three countries are the major powers that dominate the world economy. Stock index data were selected from 1965 to 2018 and divided into five cycles. Only Hang Seng stock index data is taken from 1969 to 2018 because the stock index for China was first introduced in 1969.

The first cycle for each stock index is from 1965 to 1975 (1969 to 1975 for Hang Seng), the second cycle is from 1976 to 1985, the third cycle is from 1986 to 1997, the fourth cycle from 1998 to 2008 and finally the fifth cycle from 2009 to 2018. In the previous paper, the discussion about the size of financial bubble and the forecasting on the collapse of rational speculative bubble already been discussed. So in this study, the discussion will only focus on the relationship between rational speculative bubbles in the stock market and gross domestic product.

Analysis of the relationship between GDP and the size of the bubble is conducted to find the relationship that exists between the GDP and the financial bubble. The impact of the presence of the bubble in a country's economy is explained by looking at the ability of the financial bubble to influence a country's GDP performance. In this study, GDP is the benchmark for assessing the current economic situation. According to Abd Aziz and Nurfadhlina (2018), GDP reflects the current state of the economy for a country.

Thus, the important role of GDP in a country's economy makes this study to choose the GDP as a reflection of the economic situation by looking at the relationship between the financial bubble and the GDP of the selected country. In this study, GDP data is collected annually and collected in a cycle. That is, from 1965 to 2017. This data is used to test the economic performance of selected countries, which are United States, China and Japan. Subsequently, these data were analyzed together with rational speculative bubble sizes. The results of this analysis led to the discussion of GDP relations and the rational speculative bubble size discussed from the economic standpoint.

PEARSON CORRELATION COEFFICIENT (PCC)

According to Richard (1990), correlation is a way to evaluate the variable relationship. This method measures the compatibility between two random variables. The Pearson Correlation Coefficient (PCC) is used to express the strength of the relationship. This method is commonly used when variables are quantitative, which is the ratio or variable of interval. PCC is also known as R correlation is defined as equation 1.

$$r = \frac{(n \sum xy - \sum x \sum y)}{\sqrt{(n \sum x^2 - (\sum x)^2)(n \sum y^2 - (\sum y)^2)}} \tag{1}$$

With $-1 \leq r \leq 1$. If the value of y increases with the value of x, then there is a positive correlation between the variables x and y and if the value of y increases and the value of x decreases, then there is a negative correlation between the variables x and y. The extreme values of r are +1 and -1 indicating that there is a perfect correlation between the variables x and y. If the value of r is zero, then there is no correlation or also called zero correlation between variables. The guidelines for the interpretation of the correlation coefficient is shown in figure 3. Figure 3 is used as a guideline for the correlation coefficient.

In this study, the correlation between GDP and stock market was tested to see if the correlation that exists is a negative correlation or a positive correlation. PCC test was conducted to see the situation or the performance of the world economy at present.
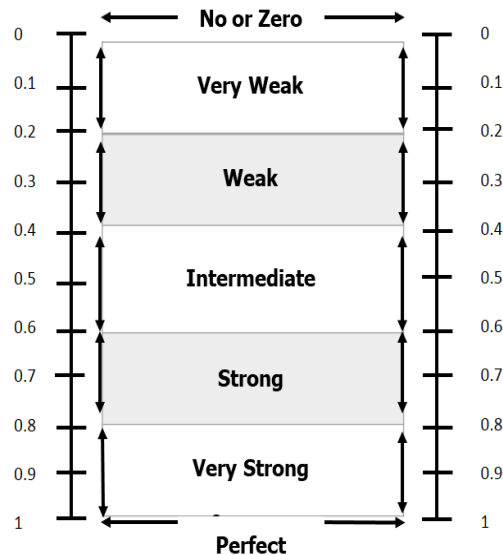

Figure 3: Interpretation of correlation coefficient values.
Source : Gogtay and Thatte (2017).

CORRELATION

An analysis of the rational speculative bubble size and GDP was conducted to see the relationship between these two data. These relationships were analyzed using the Pearson Correlation Coefficient (PCC) using SPSS software. The results of the analysis are shown through the table 1 through the table 3.

Table 1: Pearson correlation coefficient, Empirical Test Results for Hang Seng Market.

Correlation

		Bubble Size	GDP of Hong Kong
Bubble Size	Pearson Correlation	1	.520**
	Sig. (2-tails)		.000
	N	49	49
GDP Hong Kong	Pearson Correlation	.520**	1
	Sig. (2-tails)	.000	
	N	49	49

**. Correlation is significant at the 0.01 level (2-tails)

Table 2: Pearson correlation coefficient, Empirical Test Results for Nikkei 225 Market.

Correlation

		Bubble Size	GDP of Japan
Bubble Size	Pearson Correlation	1	.466**
	Sig. (2-tails)		.000
	N	52	52
GDP Japan	Pearson Correlation	.466**	1
	Sig. (2-tails)	.000	
	N	52	52

**. Correlation is significant at the 0.01 level (2-tails)

From the table 1 and table 2, the correlation coefficient, *r*, for the Hang Seng market is 0.520 and the Nikkei 225 market is 0.466. Both markets show a strong moderate relationship between GDP and rational speculative bubble size. This shows that, although the relationship between the two stock index markets is not strong, it is still a positive relationship. Table 3, correlation coefficient, *r*, for the S&P 500 market was 0.808, indicating that strong and positive relationships exist between bubble size and GDP. Therefore, empirical testing results of correlation coefficients for all three markets prove that positive relationships lead to an increase in bubble size in tandem with rising GDP.

Table 3: Pearson correlation coefficient, Empirical Test Results for S&P 500 Market.

Correlation

		Bubble Size	GDP of United States
Bubble Size	Pearson Correlation	1	.808**
	Sig. (2-tails)		.000
	N	53	53
GDP United States	Pearson Correlation	.808**	1
	Sig. (2-tails)	.000	
	N	53	53

**. Correlation is significant at the 0.01 level (2-tails)

RATIO ANALYSIS

The second analysis was performed which is to analyze the ratio between GDP and bubble size. The analysis is divided into two, namely, the ratio of critical time data for rational speculative bubble size to GDP and the second is the ratio of rational speculative bubble size to GDP. Table 4 and table 5 show the results of the empirical study for both analyzes. The test results show only the fifth cycle as for the ratio of critical time, the result shows are for 2008. This is because the results for all analyzes shows the same trend.

Table 4: Analysis on average ratio of GDP and the size of rational speculative bubble.

Market	Bubble Size	GDP	Ratio GDP : Bubble Size
Hang Seng	52795.08	1767888889	33485.87 : 1

Nikkei 225	3433.14	5278888888888.89	1537625545 : 1
S&P 500	315.6589	2668888888888.89	84549777771.36 : 1

Table 5: Analysis on critical time ratio of GDP and the size of rational speculative bubble.

Market	Bubble Size	GDP	Ratio GDP : Bubble Size
Hang Seng	2638.8105	12237701000000	4637582279.78 : 1
Nikkei 225	3652.78	4872137000000	1333823550.44 : 1
S&P 500	349.75	20500600000000	58615010721.94 : 1

Through table 4 and table 5, the analysis results show that the GDP ratio of each country is a million times greater than the ratio of one bubble size. This means that the growth in the production and services market, which is GDP, is greater than the growth of one bubble size. While GDP growth outpaced the size of the bubble, but the presence of one unit of a rational speculative bubble in the stock index capable on eliminating millions of developments in the production and services markets for each country. This indicates that the presence of rational speculative bubble size in the stock market could negatively impact GDP growth.
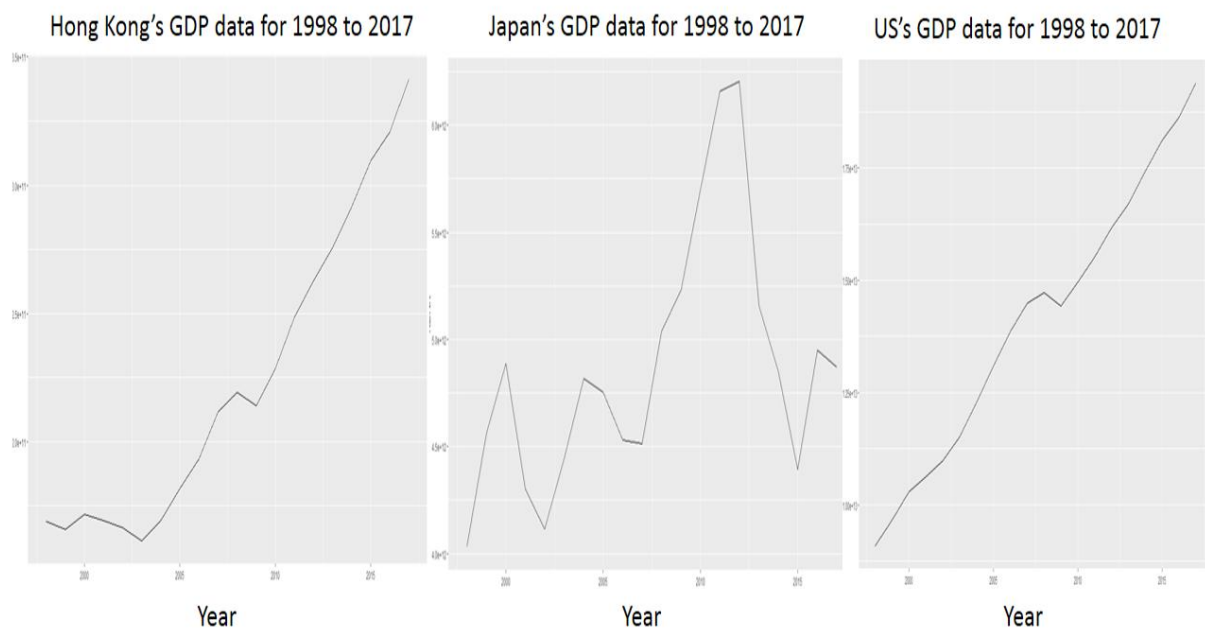

Figure 4: Illustration of GDP for China, Japan and US from 1998 to 2017.
Source : Nurharyanti et al. (2020)

Figure 4 shows the graph of real GDP data for each country and GDP growth for 2008 is focused, as in 2008, the economic downturn occurred (which indicates the breakdown of rational speculative bubbles.). Through figure 4, shows that, the growth of GDP for each country in 2008 is slower than the year before.

CONCLUSION

The result shows that the strong correlation between GDP and rational speculative bubble sizes, and the development of rational speculative bubble sizes which are in line with the GDP growth makes the presence of bubbles is extremely difficult to detect. The impact of the eruption of rational speculative bubbles is so big that it can adversely affect a country's economic performance.

Moreover, this study shows that the presence of rational speculative bubbles can lead to a decline in GDP performance. This has led to the collapse and recession. The economic downturn caused by the financial crisis of 2008 should serve as an example and lesson to a country's financial system.

This proves that rational speculative bubble breakdown can negatively impact a country's economic situation, especially for developing countries. According to Bruno (2010), the cause of the global financial crisis in 2008 was due to the financial and economic policies of developed countries, especially the United States (US). However, developing countries are also affected even though developing countries are not the cause of the economic crisis. Julia (2001) says that the decline in foreign investment, trade and remittances has a positive impact on developing countries when the crisis strikes.

On the whole, rational speculative bubble breakdowns not only negatively impact a country's GDP growth but also adversely affect the world economy. The breakdown of the financial bubble had a different effect on the economic growth of each country. If the burst of financial bubbles (the economic crisis) have occurred in developing countries, this may not provide any impact on the economies of developed countries, but, if otherwise, the economic situation in other developed countries were also affected, but the impact is not as big as the developing country faces. Therefore, studies on the size of the bubble in a particular country and especially developed countries are crucial in ensuring that issues related to economic growth (GDP) and global economic stability can be addressed.

ACKNOWLEDGEMENT

REFERENCES

Abd Aziz Arrashid Abd Rajak and Nurfadhlina Abdul Halim 2016 *Pemodelan Matematik Instrumen Bai Bithaman Ajil (BBA) Terubahsuai Dengan Konsep Qardhul Hassan dan Musharakah Mutanaqisah* (Malaysia: Universiti Malaysia Terengganu)

Alexandru Balasescu and Apurv Jain 2018 *Financial bubbles and their magic: asset price as a heroic journey in the financial markets* (The Journal of Philosophical Economics XII) **1**: 1 – 37

Bruno Gurtner 2010 *The Financial and Economic Crisis and Developing Countries* (International Development Policy) pp 189—213

Julia Pham 2001 *How did the GFC affect developing countries?* (Australia: The Economics Student Society of Australia)

Nurfadhlina Abdul Halim, Nurharyanti Borhan, Nadhirah Gazali and Wan Muhammad Amir W. Ahmad 2019 *Forecasting on the Collapse of Rational Speculative Bubble in Hang Seng, Nikkei 225 and S&P 500 in 2018* (ASM Science Journal) , **12(6)**

Nurharyanti Borhan, Nurfadhlina Abdul Halim and Nor Azlida Aleng 2020 *Penganggaran Saiz*

Gelembung Spekulatif Rasional Menggunakan Pendekatan Johansen-Ledoit-Sornette Umum (JLSU) (Malaysia: Universiti Malaysia Terengganu)

N.J Gogtay and U.M Thatte 2017 *Principles of Correlation Analysis* (Journal of the Association of Physicians of India) **65** : 78-79

Pengfei Wang and Yi Wen 2009 *Speculative Bubbles and Financial Crisis* (Federal Reserve Bank of St. Louis : Working Paper Series)

Richard Taylor 1990 *Interpration of the Correlation Coefficient : A Basic Review* Journal of Diagnostic Medical Sonography pp 35 – 39

Stasys Girdzijauskas, Dalia Štreimikienė, Jonas Čepinskis, Vera Moskaliova, Edita Jurkonytė and Ramūnas Mackevičius 2009 *Formation Of Economic Bubbles: Causes And Possible Preventions* (Baltic Journal on Sustainability : Technological and Economic Development of Economy) vol **15(2):** 267 – 280