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Relationship between inflation rate and economic growth rate of Southeast Asian countries

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ABSTRACT

This paper analyses the Panel Granger-causality relationship between GDP growth rate and inflation rate. Using Quaterly data for 5 South-East Asian Countries from 2nd quarter in 1997- 4th quarter in 2011, we conclude that there is clear Granger causality between GDP growth rate and inflation rate and it is one-directional. In addition, Our finding point to positive relationship between GDP growth rate and inflation rate. This result has important policy implications GDP growth rate influences the evolution of inflation rate.

Keywords: Granger causality; panel data; inflation rate and GDP growth rate

JEL Classification: C23, E31, O40

1. Introduction

Nowadays, the economy of many countries is complex and full of the linkage both within and between the country. This relationship is the result of many economic factors of each country according to the economic volatility of the global market. Many essential production factors need to be imported because of the shortage of those products or no capacity to produce within their own country. For this reason, the cost control of domestic enterprises affects the price of product since there is a need to set prices according to the increase of costs which is the important reason leading to inflation in the country excluding there has the excessive money supply in the economic system.

Effects of inflation caused by higher demand for goods and services will affect the price of goods and services increasingly. If domestic manufactures unable to produce goods and services to meet this increasing demand, it imports goods from abroad in order to sell to their consumers. If the import increases steadily, the country will have a deficit in balance of trade. If the ability to export falls due to rising of product price, the current account deficit will continue which contributes to the economic problem starting from the decline in economic confidence to the economic slowdown as investors delay to invest. Finally, the economic will be in the recession and it will not create an economic growth in the country, especially in Asian countries, which mostly are developing countries. The government takes a key role in developing countries by using funds for building or developing infrastructure such as road, high speed train, and etc. The investment from government will result to the increase in money supply in the economic system that lead to inflation in the future, so the government needs to control the cost. The inflation is a key factor that will affect the overall economy of the country and also the confidence for consumption.

Countries that maintain low inflation rate is likely to have the ability to the higher economic growth rate and longer than other countries with high inflation rate due to following reasons. (Sunisa Kamkaew, 2006)

1. Countries with very high inflation rate are often experience an economic disruption.
2. High inflation rate is consistent with the speedy expansion of the financial system. It causes liquidity management and the higher cost of price tracking, and the risk of financial crisis.
3. Efficiency of goods and labor market are reduced because of the confusion that the price does not reflect the true value (shadow price) of goods and services. Fischer (1994) calculated that the inflation rate at 10 % per year would cause the social cost that caused by distortion of the tax system (Tax related distortion) approximately 2-3 % of gross national product.
4. Influence on the distribution of income, especially from the creditor (the saving) to a debtor who has a direct impact on society.

From those mentioned above, it demonstrates the importance of the inflation and the economic growth rates. This paper is interested in relationship between the economic growth and inflation rates in Southeast Asia countries and we employed Panel Granger Causality method to test of relationship between the inflation rate and GDP growth rate of countries in South-East Asia.

2. Theory

2.1 Theoretical concepts about the relationship between inflation and economic growth

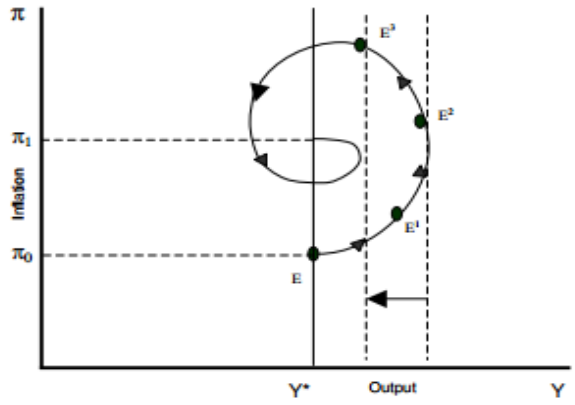
Economic theory has different conclusion in term of economic growth on inflation but these theories are useful because they are derived from an observation in actual environment. In the past, there was no definition of "Constant inflation". The theory of the economic growth and the inflation in the early stage came from an observer. The continuing inflation was a determined phenomenon after World War II while the inflation occurred periodically before World War II. The condition is caused by a period of deflation as well. When there is no trend up or down, inflation has been likened to "Lazy Dog" because inflation will be in one of these levels until there is the interference causing inflation to move to another level. So the theory is to search for a positive correlation between economic growth and inflation.

The aggregate demand and supply concept has shown a positive relationship between inflation and economic growth that if the economy has been growing, inflation will increase as well. However, the Stagflation concept began to have an important role in 1970 and there was question about the positive relationship of inflation and economic growth to provide a clear picture. Herein, it will refer to the various theories of economic growth such as the Keynesian, Neo-Keynesian, Monetarist, Neo-classical, and Endogenous Growth theories. (Pijit Inta, 2008)

2.1.1 Keynesian Theory

The traditional Keynesian model consists of the aggregate demand and supply lines, which shows the relationship between economic growth and inflation. This model in short, the aggregate supply is a bias line rather than a straight line perpendicular to the horizontal that is the main feature of the aggregate supply. If the aggregate supply line is perpendicular to the horizontal, a change in aggregate demand will affect the price only. However, if the aggregate supply line is a bias line, the aggregate supply line will affect both in price and the national income. There are many factors determined the inflation level and the national income rate in the short term, including the expectation, labor force, cost for other factors in the production, and monetary and fiscal policies.

In moving from the short term to the long term, it does not happen instantaneously. In the first phase, the aggregate demand and supply will adapt and show a positive relationship between economic growth and inflation. After that it will be changed to a negative relationship in the last phase of the adaptation which is determined from Figure 1.



Source: Vikesh Gokal and Subrina Hanif (2004)

Figure 1. The adaptation process between the inflation and the economic growth

Moving from point E to point E1 as shown in Figure 1 shows the positive relationship between the national income and the inflation. It means if the price rises, manufacturers will produce products increasingly that results to an increase in the productivity or the national income. Normally, it happens when there has the time's inconsistency problem (time in - consistency problem).

Blanchard and Kiyotaki (1987) believed that a positive relationship might come from the companies' agreement that agreed to buy and sell in advance. Therefore, although the price of goods in the economy system would increase but productivity would not be reduced because the manufacturer met the customer need from agreement that was done in advance. The other two important aspects of a change process are firstly, when the output is reduced while the inflation rate is increased. For example, a moving from point E2 to E3 is a negative relationship between inflation and economic growth. It is called 'Stagflation', when inflation is rising, but output is declined or remained. Secondly, the economic system, which will adjust to the equilibrium with the first stage of inflation, will increase and then decrease until the inflation is remained at one point, where the production equals to the natural rate (Y *).

2.1.2 Money & Monetarism

Monetarist has several important features but it will focus on the long-term supply of the economy system, which is in contrast to changes in short-term. Milton Friedman was a person who provided the definition of 'Monetarist' word. It will focus on several long-term economies, including the Quality Theory of Money and Neutrality of Money. The first will show the relationship between the inflation and the economic growth with a simple equation by the sum of all expenses in the economic system, which is a total amount of existing money. Friedman suggested that inflation was caused by an increase in supply or rotation of money (velocity of money) than the economic growth rate.

Friedman also challenged the concept of the Phillips curve, which said that if prices of all products were doubled; people would pay double for goods and services as well. However, people did not concern because the revenue would be increased in double too. In other words, people were predicting the inflation by plus a rise of inflation in spending money from own behavior. For this reason, the employment and the productivity were not affected. Economists called 'neutrality of money' for this concept. The financial neutrality would occur when there is the balance of real variable. The super neutrality would occur when a real variable and growth rate of domestic products were independent from the growth rate of money supply in the long term. If inflation was occurred by this term, it would not harm the economy system. In fact, the inflation had an impact on macro-economic variable, which affected economic growth rate of the country.

In summary, the monetarist explained that the price would be affected by the money growth in long term. If the growth rate of money supply was higher than the economic growth rate, inflation would be occurred.

2.1.3 Neo-Classical Theory

Neo-classical model was started from a model of Solow (1956) and Swan (1956). This model represented the diminishing return to labor and capital and the constant return to both factors. Technological change was the main factor explaining the economic growth in the long term.

Mundell (1963): An increase in inflation or inflation expectation would reduce the individual wealth by decreasing the return rate of actual money. If people wanted to increase the wealth, they had to accumulate savings in the form of assets, instead of holding cash. More saving leads to the increase in the capital and the productivity growth.

Tobin Effect was a neo-classical economist, who developed a Mundell model following to approach of Solow (1956) and Swan (1956) by making money as a tool to accumulate value (store of value). People in this model would save the current consumption to be consumed in the future by holding cash or capital accumulation.

Stockman (1981) developed a model which said that the rising inflation rate would also result in the low level of the steady state of output and people welfare. In Stockman's

model, money was a capital supporter which would lead to a negative relationship between the constant level of output and the inflation.

Stockmans' thought originated from the idea that company used money for investment. Cash sometimes could be part of the investment while some banks would need to offset the outstanding amount. Stockman created a model for investment by using cash that was restricted to cash-in advance either for purchasing capital and consumer goods. When inflation decreases the purchasing power, people would reduce the purchasing of goods by cash and capital, so the steady state level of output would be lower caused by an increased inflation.

2.1.4 Neo-Keynesian Theory

Neo-Keynesian economists developed the concept from original Keynesian economists. The main development is the potential output concept, which referred to the output at the natural rate. The output level was consistent with the unemployment rate by nature, which was the non - accelerating inflation rate of unemployment. By this concept, built - in inflation was determined from inside. According to this theory, inflation would depend on the output level and employment rate by nature.

Firstly, if the output was higher than the potential output and the unemployment rate was lower than unemployment rate by nature in the same level, inflation would be increased because the manufacturer increased goods price resulting to inflation (built - in inflation). In this situation, it would cause the Phillips line to move into the direction of stagflation, this will increase inflation and unemployment.

Secondly, if the output was lower than a potential output and unemployment was higher than unemployment rate by nature, with other factors constant. Inflation would decrease because the manufacturer tried to increase production capacity and reduced goods price and inflation rate (built - in inflation). This will not cause inflation and the Phillips line would shift to the point where there was low inflation and unemployment.

Finally, if the output was equal to unemployment rate, or NAIRU. Inflation rate would not change because there were not supply shock in long-term. The Neo-Keynesian economists believed that a Phillip line would be perpendicular to the horizontal because the unemployment rate was set to be equal to unemployment rate by nature while inflation would be offset by unemployment rate.

2.1.5 Endogenous Growth Theory

This theory explained about economic growth. It was formed by a factor of production process such as the economy level, increase of return, which was contrast to external factor such as the population increase. The economic growth was based on a single variable, the rate of return on capital. Other variables such as inflation would reduce the rate of return and capital accumulation, and economic growth rate.

The difference between this model and Neo-Classical model was that the return on capital would decrease as more capital was accumulated for Neo-Classical model while output per person would increase because the return on capital did not decrease in this model. This concept was that if the return on capital is high enough, people will

accumulate more capital. In this model, the rate of return will increase in mass production.

This model described the economic growth in relation with the human capital and developed this theory by stating that the economic growth rate depended on the rate of return on human capital as well as physical capital. The rate of return on all forms of capital must be equal to economic growth. When this model was set up under the exchange concept of Lucas (1980), Lucus and Stokey (1987), or McCallum and Goodfriend (1987), inflation would reduce the return from all capital types and economic growth rate.

2.2 Dynamic of Aggregate Demand and Aggregate Supply

In conclusion, the relationship between inflation and economic growth rates is a positive correlation. Higher inflation will result in the increase in the national income. But this point is not the long-term equilibrium. The system has to adapt to long-term equilibrium. The inflation rate and the national income will gradually decline together into long-term equilibrium. (Pijit Inta, 2008)

3. Literature review

Sunisa Kamkaew (2006) The purpose of this study was to examine the relationship between inflation in Thailand and economic growth by using the Co-integration Method. Two economic variables were chosen in this study, CPI and GDP.

Results of the Granger Causality test showed that both CPI and GDP had a bi-directional causality relationship. Pijit Inta(2008) The purpose of study was to examine the relationship between inflation in Thailand and economic growth by using the Bivariate GARCH model. Two economic variables were chosen in this study, real GDP and CPI. The relationship between 2 variables had positive and negative relationship. Thus, the volatility of inflation in Thailand had negative effects to the volatility of economic growth while the volatility of economic growth had positive effects to the volatility of inflation in Thailand. Fountas, Karanasos and Kim (2001) The purpose of study was to examine the relationship between inflation in Japan and economic growth by using the Bivariate GARCH model. The resulte show that The increase in inflation is not uniform. The inflation increase is not uniform, it will result in lower rates of economic growth. The results have important policy. The price stability that will affect the rate of economic growth. Mallik and Chowdnury (2001) The purpose of study was to examine the relationship between inflation in South-East Asia and economic growth by using the cointegration and error –correction model. The result show that the relationship between inflation rateand economic growth is positive in long term in four country and significant feedback between inflation and economic growth. The results have important policy. it have affect to the economic growth rate. But The growth rate is too fast to affect inflation. Gokal and Hanif (2004) The purpose of study was to examine the relationship between inflation in Fiji Island and economic growth by using the correlation model. the result show that inflation rate and economic growth have

positive relationship while The changes in the output gap has a significant relationship. The relationship between two variables is one of the rate of economic growth to inflation.

4. Methodology

4.1 Data

This study uses panel data, which contains a cross-section data and the time series data. The data are the inflation and economic growth rates in Thailand, Malaysia, Indonesia, Philippines and Singapore. It is used quarterly data from 2nd quarter in 1997- 4th quarter in 2011 totaled 59 quarters. It is a secondary data which is collected online data of the Bank of Thailand, Ministry of Finance and Commerce, and Finance and Investment Center of Chiang Mai University.

4.2 Model

$$I_{i,t} = a_0 + a_1 Y_{it} + a_2 Y_{it}^2 + e_{it} \quad (1)$$

$$Y_{i,t} = b_0 + b_1 I_{it} + b_2 I_{it}^2 + u_{it} \quad (2)$$

Where $I_{i,t}$ = Inflation Rate

$Y_{i.t}$ = Economic Growth Rate

$e_{i,t}, u_{i,t}$ = Error term

$a_0, a_1, a_2, b_0, b_1, b_2$ = Parameters

The $I_{i,t}$ is calculated from the change rate in comparison between the contiguous time of Consumer Price Index (CPI) = $\left(\frac{CPI_t}{CPI_{t-1}}\right)_{it}$ and inflation rate is shown.

a_1, a_2, b_1, b_2 are The parameters, which is assumed to represent the percentage change when the independent variable affects to inflation rate and the economic growth rate as a percentage.

4.3 Analysis of data

To find the relationship between inflation rate and economic growth rates of countries in Asia, we use a panel data analysis method, which are Panel Unit Root, Panel Equation, and Panel Granger Causality tests.

4.3.1 Panel Unit Root Test

The Panel Unit Root test or the stability test of all variables used in the model by Levin, Lin, and Chu (LLC) (2002), Breitung (2000), Hadri (1999), Im, Pesaran and Shin (2003) and Fisher Type Test. After we tested the panel unit root for each variable, then we compared the result of such tests by selecting the data which were given the test

result when variables had the relationship of data (Order of Integration) in the same level.

If the data was I (0), it would be put to the panel test immediately, but if it was I (1), it was required to analyze the relationship between variables by co-integration panel before doing a Panel Equation Testing.

4.3.2 Panel Equation Testing

The estimation of model which has the assumption of constant stability and differential coefficient is divided into a Constant Coefficient Model (Pooled Estimator), Fixed - Effects Model, and Random Effects Model. The estimation method is based on the model and data used in the appropriate study. It follows the test method of Breusch and Pagan (Lagrange multiplier test), Moulton and Randolph method (Anova F - test), and Huasman Test.

4.3.3 Panel Granger Causality Test

It is a rationality test between the economic growth rate (Y) and inflation rate (I) which is determined by the following equations:

$$I = f(Y)$$

$$Y = f(I)$$

$$I_{i,t} = a_0 + a_1 Y_{it} + a_2 Y_{it}^2 + e_{it} \quad (3)$$

$$Y_{i,t} = b_0 + b_1 I_{it} + b_2 I_{it}^2 + u_{it} \quad (4)$$

We use F-tests to test Granger non-causality and we begin by testing the following hypothesis:

For equation (3) $\mathrm{H}_0 : a_1 = a_2 = 0$

$\mathrm{H}_1 : a_1 \neq a_2 \neq 0$

For equation (4) $\mathrm{H}_0 : b_1 = b_2 = 0$

$\mathrm{H}_1 : b_1 = b_2 \neq 0$

It uses the F-test to test Granger Causality under the assumption of "no causility" between variable. If the F-test is greater than the value from F table, it means 'reject the hypothesis' by means the economic growth rate determines the inflation rate (equation 3) and the inflation rate determines the economic growth rate (equation 4).

5. Results

The Granger causality tests require data to be stationary. As we can see in Table 1, the unit root tests for inflation rate (INF) and GDP growth rate (GDP) indicate that at $\alpha = 0.1$ inflation rate (INF) and GDP growth rate (GDP) have no unit root thus is stationary at level.

TABLE 1. Result of unit root test at level or I(0)

The result of unit root test at level or I(0)						
Variable	LLC Test	Breitung Test	IPS Test	Fisher-Type Test		Hadri Test
				ADF	PP	
GDP	-5.02001*** (0.0000)	-0.61207 (0.2702)	-6.70503*** (0.0000)	62.4960*** (0.0000)	121.703*** (0.0000)	2.61697*** (0.0044)
INF	-2.88848*** (0.0019)	-5.71335*** (0.0000)	-5.30957*** (0.0000)	46.5022*** (0.0000)	21.7944** (0.0162)	1.39959* (0.0808)

Note: Probability values in parenthesis
*** is significant at 0.01
** is significant at0 .05
* is significant at0 .1

Following the methodology presented in Section 3, we use Random effect model estimates to test Granger causality between GDP growth rate and Inflation rate with the model defined by equations [1] and [2]. The F-test of model[1] (Dependent variable = INF) presented in Table 2 allow us to accept the null hypotheses, at 5% level significant. There is causality direct from GDP growth rate to inflation rate. The F- tests of model[2] (Dependent variable = GDP) presented in Table 2 allow us to reject the defined null hypotheses, at 10% level significant. There is no causality direct from Inflation rate to GDP growth rate. Moreover, it clear that this causality is always one-directional.

TABLE 2 : Result of Panel Granger Causality Test

Dependent variable	Independent variable	F- tests (without the lags of the dependent variables)
Inflation Rate (INF)	GDP Growth Rate (GDP)	F(1,292) = 5.131102 Prob > F =0.0242
GDP Growth Rate (GDP)	Inflation Rate (INF)	F(1,292) =1.218442 Prob > F =0.2706

*The model defined with the equations [1] and [2], which were presented in Section 3.

$$INF = 3.562302 – 0.033320(GDP) + 0.001212(GDP)^2$$

Table 3, shows estimate result when inflation rate is dependent variable. The coefficient of GDP growth rate is negative implied that increase in 1% of GDP growth rate will lead to decrease in inflation rate about 0.033320% at 10% level significant and the coefficient of $(GDP)^2$ have 1% level significant, it shows that the relationship between inflation rate and GDP growth rate is parabola . R-square equal to 0.037549 which means that GDP growth rate can be explain change in inflation rate at 3.7549 percent.

TABLE 3. Estimate Result of Inflation Rate (INF)

Dependent variable : Inflation Rate (INF)				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	3.562302	0.555564	6.412051	0.0000
GDP	-0.033320	0.014710	-2.265194	0.0242
$(GDP)^2$	0.001212	0.000430	2.819733	0.0051
F-statistic (Prob)	5.695978			
R^2	0.037549			

5. Conclusion

This paper empirically explores the Granger-causality relationship between economic Growth rate and inflation rate of South-East Asian Countries from 2nd quarter in 1997-4th quarter in 2011. We confirm the existence of Granger causality between GDP growth rate and Inflation rate. However, there is clear evidence that this causality is always one-directional. The result shows negative relationship between GDP growth rate to Inflation rate and this relationship is non-linear. The coefficient of GDP growth rate to inflation rate is negative means that increase in GDP growth rate will decrease in inflation rate.. This result has important policy implications GDP growth rate influences the evolution of inflation rate

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