Inflation, Interest Rate and Wage Trade-offs in Southeast Asia Countries

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Abstract. This paper focused on the factors that give impacts to the inflation in Southeast Asia countries, including Brunei, Cambodia, Indonesia, Loas, Malaysia, Myanmar, the Philippines, Singapore, Thailand, and Vietnam. This paper has analysed the relationship between inflation and factors that influence inflation in Southeast Asia. The hypothesised factors are crude oil, interest rate, money supply, nominal wage, and unemployment rate. The panel data analysis was tested using the panel unit root test. Then, the Pooled Ordinary Least Square (POLS), Fixed Effects Model (FEM), and Random Effects Model (REM) were caried-out. Hausman Test, Poolability F-Test, and Breusch-Pegan Lagrange Multiplier Test (LM) were applied to select the best estimated model. The diagnostic checking performed as well in order to detect any underlying economic problems under the model. Crude oil was found to be significant, and positively relate to inflation. Interest rate and nominal wage are found significant and negative relate to inflation. Variable that are found insignificant to inflation are money supply, and unemployment rate. To mitigate the oil shock suffered during the 1970s oil crisis and high crude oil price, Southeast Asia countries are recommended to accelerate the use of more renewable energy as a substitution of crude oil, so that they are easily be affected by the increases in oil price. Based on the study, when the interest rate is high, it is recommended that the central bank can increase the interest rate when confronting inflation. This is due to when the interest rate is high, bank loans will become more expensive because the borrower will pay more by the maturity date. Thus, the borrower will reduce applying to loan as well as spending lesser. When the inflation is getting higher, the Government will consider increase of the minimum wage, while promoting the adoption of digital technology to improve productivity.

Keywords: Crude Oil Price, Inflation, Interest Rate, Money Supply, Unemployment Wage.

1   Introduction

Inflation can be known as the price of goods and services are keeping rising over time, the trend of the price is upward. It means that the price is increasing continuously.

Undoubtedly, it is burdening people as living cost increase to spend more on a same basket of goods or services. Even worse is the pace of inflation faster than the pace of increasing salary.

Notably, this study is discussing a union, Association of Southeast Asian Nations (ASEAN) ASEAN is a political and economic union which established since 8 August 1967 [1]. It is formed by ten countries which are Thailand Indonesia, Malaysia, Philippines, Singapore, Brunei, Vietnam, Lao PDR, Myanmar and Cambodia.

Based on Figure 1, starting from the mid-1970s, the price of goods and services in US increased nearly doubled in 1974 as compared to 1973. In 1974, the oil price is increased by 307.41% and its inflation rate was 11.05% due to an energy crisis [2].
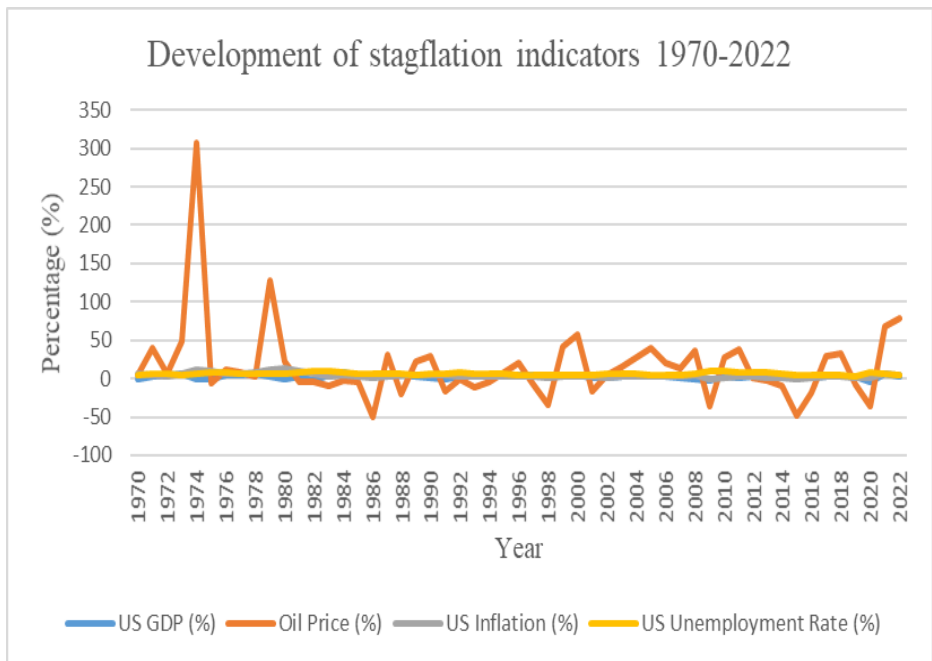

Fig. 1. Development of stagflation indicators 1970-2022. Adapted from Comparison of stagflation indicators from 1970 to 2022. (2002). *Statista.*

In the 1980s, US and ASEAN are having high inflation rate in the early 1980 and the rate is decreasing over years till the end of this decade. ASEAN inflation rate is lower than the western countries. Malaysian inflation rate is less than 1% for 3 years which is from 1985 to 1987. However, there is an exception, the inflation rate in the Philippines is fluctuated and it reached the peak point in 1984 which is 50.34% (Refer to Figure 2). It leads the terms of trade in agriculture industry to increase because the devaluation of PESO moved up the agricultural prices [3].
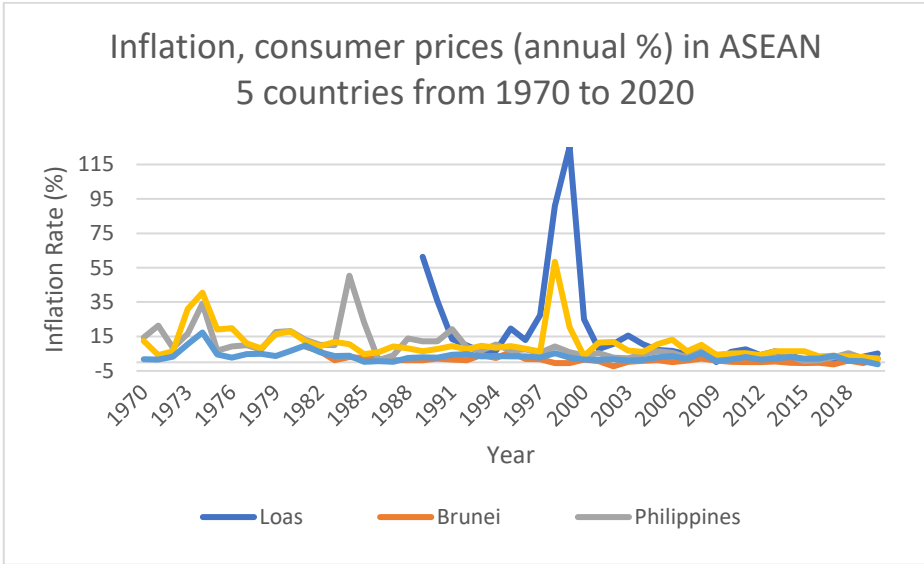
Fig. 2. Inflation, consumer prices (annual %) in ASEAN countries from 1970 to 2020. Adapted from World Bank Databank.

In the 2020s, there are two significant events which are Covid-19 pandemic and Russia-Ukrainian War. Covid-19 pandemic considered as demand shock. In 2021, the inflation rate in Thailand, Malaysia and Singapore were dropping to negative value, which are -0.86%, -1.14% and -0.18%, respectively. For the rest of ASEAN countries, the inflation rate was decreased but still having positive value. Russo-Ukrainian War is a supply shock because they boycott Russia in global trade. It caused the entire global supply chain being affected because Russia is the main exporter of natural gas and petroleum producer, while Ukraine is the main exporters of agricultural products. The inflation rate of Eurozone is reached 8.6% and consumers' purchasing power decrease because oil price increased by 40% [4]. ASEAN countries are affected which are Thailand, Singapore and Vietnam because they are importers of wheat, corns, nickel and oil. With that, Thailand inflation rate increased to 7.66 % in June 2022 [5]. It is the highest inflation rate in Thailand since 2011.

Inflation is a multifactorial macroeconomic problem. Central banks pursue macroeconomic objectives including unemployment objective aside the usually explicitly specified inflation objectives. Unemployment and inflation have welfare implications, and these are key considerations in policy formulations. In this study, we will examine the relationship between inflation and another five independent variables which are crude oil price, money supply, interest rate, unemployment rate and nominal wage. We will investigate which independent variable will bring impact to ASEAN's inflation.

2   Literature Review

Before showing the research result of this paper, let us understand the theories of this paper and how the independent variables impact the dependent variable. For this research, there are two implied theories which are the monetary policy theory and the interest rate theory.

Monetary policy is the set of action that the Central Bank modifies the supply of money in the market either to increase the money supply or to reduce the money supply in order to palliate the burden of higher commodity prices and influences the circulation of country's economy. The modification of money supply can be implemented in several ways which are adjustment in interest rate, changes in reserve requirements and through the open market operations. However, government is required to implement the precise policy either are expansionary policy or contractionary policy depends on the situation since the application of incorrect monetary policy will further increase the inflation condition. The relationship between monetary policy and inflation is irresistible. More than the selection of policy, the transparency of central bank matters to managing the inflation to ensure the effectiveness of monetary policy.

The second theory is the interest rate theory. The relationship between interest rate and inflation rate are always inverse. For example, if a country is experiencing a high inflation rate, the Central Bank will impose a higher interest rate. As a result, the inflation rate will become lower. Likewise, if the country is experiencing the low inflation rate, the Central Bank will decrease the interest rate in order to increase the inflation rate, so that the level of economy development can be boosted.

After we have discussed the two theories, and I will introduce the dependent variable which is the inflation and the five independent variables which are interest rate, nominal wage, unemployment rate, money supply and crude oil price. The five independent variables having huge impacts to the countries' inflation and their relationship can be proven by the past studies. From some research paper, the interest rate and money supply are negatively correlated with inflation where there is increase one percent in independent variable, the rate of inflation will be decrease, vice versa. However, there is research shows that the interest rate is positively correlated with inflation. Research conducted by Fumikata and Munir in 2009 found that there is no trade-off relationship between unemployment and inflation. The same result also can be found in the research of Puzon [6].

Now, let us understand how each of the independent variables correlated with the inflation. Interest rate can be described as a compensation paid by creditors to debtors. Hence, if the interest rate increases, firms tend to borrow more loans to purchase the raw materials and intermediate goods for production. It indicates that the cost of borrowing increase which leads firms bear higher cost of production. Eventually, inflation take place since the commodity prices are higher. Nominal wage is measured as in money as opposed to actual purchasing power. If the speed of wages increase do not keep pace with rising costs, purchasing power will decline, and the money value will also decrease.

According to the study conducted by Tang and Lean [7], they found that there is a stable negative relationship between unemployment rate and inflation. This result

accord with the fundamental theory of the relationship between these two variables. Based on several studies regarding the money supply and inflation, there are different result obtained by the researchers. For the crude oil price, research indicates that there is a long-run pass-through effect of oil on CPI inflation in the majority of Asia countries, but the findings were not statistically significant in the short run.

In this paper, we aim to discover the relationship between interest rate, unemployment rate, nominal wage, money supply and crude oil price. By looking the past studies, they showed the evidence of significant relationship between dependent variable and independent variables.

3   Methodology

The data for this paper consists of interest rate, unemployment rate, nominal wage, money supply and the crude oil price from the World Development Indicators (World Bank). In this model, we use the basic model and the logarithm of all variables. We used panel data analysis to measure the determinants of inflation on the economy of ASEAN. The analysis is implemented for 10 Southeast Asia countries covers the 15 years' period 2006 to 2020 with total 150 observations. The panel analysis utilises the annual series. Furthermore, the panel unit root test is required before beginning panel data to ensure the data series is stationary. The augmented dickey -fuller (ADF) test and Philips-Perron unit root tests will be performed. Moreover, there are three tests that used in model selection which are Hausman test, poolability F-test, and Breusch-Pegan Lagrange Multiplies Test (BP-LM). Besides, we use heteroscedasticity, auto-correlation and multicollinearity to detect the presence of economic problems.

4   Data Analysis

Panel unit root tests are performed to investigate the time series stationary properties of the variables. The stationary properties of the variables are examined via Augmented Dickey-Fuller Test (ADF) and Philips-Perron Test (PP) panel unit root tests (Table 1).

Table 1: Panel unit toot tests

Variables	Constant with trend		Constant without trend	
Inflation	186.151	0.0000***	227.010	0.0000***
Log Crude Oil Price	118.774	0.0000***	161.933	0.0000***
Interest Rate	183.000	0.0000***	226.343	0.0000***
Log Money Supply	149.513	0.0000***	179.493	0.0000***
Log Nominal Wage	79.3733	0.0000***	84.6134	0.0000***
Unemployment Rate	114.898	0.0000***	139.780	0.0000***

Note. *** indicates significance level of 1%.

Based on decision rules, we reject H_0 as the p-value of inflation, the crude oil price, interest rate, money supply, nominal wage, and unemployment rate in second

differentiating with and without trends are lower than significant level at 5%. Thus, we have enough evidence to make a decision that inflation, the crude oil price, interest rate, money supply, nominal wage, and unemployment rate are stationary and do not have a unit root. According to Table 2, the ADF test and the PP test at 1% significant levels for both tests indicate that all variables are stationary, and that no unit root exists at second differentiating with trends and without trends.

Table 2: Test results for selection of best model

Tests	Pooled OLS	REM	FEM
Poolability F-Test	15.3429 (0.0000)***		
BP-LM Test		26.0170 (0.0000)***	
Hausman Test			9.8693 (0.0000)***

Note. *, **, ***, indicates significance level of 10%, 5% and 1% respectively.

This test is applied to choose whether POLS or FEM will be used to estimate the model in this study. The null hypothesis specified that POLS is recommended in this study and alternative hypothesis specified FEM is recommended in this study. Since the probability value (0.0000) smaller than the significance value at 1%. It is indicating FEM is more recommended in comparison to POLS.

The Hausman test further proved that FEM is more recommended in comparison to REM as the probability value (0.0000) less than the value of significant of 0.01. Lastly, BP-LM test proved that REM is more recommended in comparison to POLS as the probability value (0.0000) less than the value of significant 0.01.

Table 3. Results of fixed effect model (FEM)

Variable	Coefficient	Probability
C	38.07640	0.0057
Crude Oil Price	2.547613	0.0491**
Interest Rate	-0.230572	0.0041***
Money Supply	-2.853035	0.1641
Nominal Wage	-8.078493	0.0264**
Unemployment	-0.080073	0.8849

Note. *, **, ***, indicates significance level of 10%, 5% and 1% respectively.

Hausman test further proved that FEM is more recommended in comparison to REM as the probability value (0.0000) less than the value of significant 0.01. Lastly, BP-LM test proved that REM is more recommended in comparison to POLS as the probability value (0.0000) less than the value of significant 0.01.

Table 4. Test Results for diagnostic checking

Tests	Heteroscedasticity	Autocorrelation	Multicollinearity
ARCH	0.9650 (0.5107)		
LM		1.6520 (0.0647)	
VIF			All values less than 10

Note. *, **, ***, indicates significance level of 10%, 5% and 1% respectively.

5   Discussion

Crude oil price was found to be significant and positively affect the inflation. It indicates that when the crude oil price increase, the inflation will increase. According to [8-9], the findings are in line with our findings. In the findings of Ran and Voon [8], when the linear model is applied, Indonesia and Malaysia are having positive relationship with oil price shocks, while Pakistan and Thailand are having negative relation. All countries are insignificant with the impact of oil price shocks. They concluded that oil price shocks will have greater impact on macroeconomic variables when a non-linear model is applied in contrast to the linear model. The result became significant when non-linear model is applied.

Interest rate was found to be significant in the model, it implies that interest rate does affect inflation. The study outcome stated that the interest rate has a negative relationship with inflation. It indicates that when the interest rate increase, the inflation will decrease. Pennacchi [10] in line with the findings, the results shown an inverse relationship between real interest rate and expected inflation [10]. Other than that, according to Sari et al. [11], the result is also a line with our findings because the study shown there is an inverse relationship between interest rate and inflation in the five ASEAN countries. They stated that if the inflation expectation moves quickly, it is difficult to assess the real interest rate. When a country faces high inflation, central bank will reduce the inflation by raising the interest rate, it will lead the price of loan increase. It will suppress public demand for loans and the demand of loan will decrease. In this case, the money supply in economy will decrease and people tend to reduce consumption because of low purchasing power [12]. When people demand less on goods and services, with a fixed supply or consistent supply, the price of good and services will decrease [13]. Thus, it automatically reduces the inflation. This is as indicated in the theory of interest rate, that the relationship between interest rate and inflation rate are always inverse.

Money supply was found to be insignificant in the model, it implies that money supply does not affect inflation. Furthermore, the study outcome stated that the money supply has a negative relationship with inflation. It is in line with findings of Amassoa et al. [14], which indicate that there is no causality relationship between money supply and inflation in Nigerian country and the result is likely due to the recession. There is excess capacity in the economy during a recession. An increase in the money supply merely aids in the utilisations of unemployed resources in the general economy. As a

result, in the event of recession, inflation is unlikely will increase even though increasing in money supply.

Nominal wage was found to be significant in the model, it implies that nominal wage does affect inflation. Furthermore, the study outcome stated that the nominal wage has a negative relationship with inflation. According to Easterly and Fischer [15], high inflation tax rate is significantly correlated with negative percentage change in real wage. The implied effect is strong when it applied on the impact of inflation on the minimum real wage: when the inflation tax rate increases from zero to 20%, the real wage will decrease by eight percentage point. The strong result due to a large outlier Nicaragua in 1987. The inflation is near 1000 percent, yet, the nominal wage just increased on 22 percent. Even though the outlier is excluded, real minimum wage change-inflation tax relation still significant.

Unemployment was found to be insignificant in the model, it implies that unemployment does not affect inflation. Besides that, the study outcome stated that the unemployment has a negative relationship with inflation. It is in line with the findings of Puzon [6], which indicate that there are no stable one-to-one negative relationships between the unemployment and inflation. There are several scenarios in which inflation can lead to unemployment. However, unemployment is not having a direct relationship with inflation.

Table 5. Comparison between hypotheses and empirical results

Hypotheses of the study	Results (from e-view)
Crude oil price is significantly impact inflation of ASEAN countries.	Supported
Interest rate is significantly impact inflation of ASEAN countries.	Supported
Money supply is significant impact inflation of ASEAN countries.	Not Supported
Nominal wage is significantly impact inflation of ASEAN countries.	Supported
Unemployment is significantly impact inflation of ASEAN countries.	Not supported

6   Practical Implications of the Study

For crude oil price, based on the findings, crude oil price is positively and significantly affecting the ASEAN countries' inflation. It indicates that ASEAN will be affected if there is oil price shock like oil crisis in 1973, and it will bring economic shock to ASEAN. Hence, ASEAN should rely on renewable energy as a substitution of oil. ASEAN should introduce, promote and implement renewable energy project, and it is better to be one of the energy supply. Singapore would be a best example in implementing and supplying the renewable energy in ASEAN. Bluenergy Solutions has introduced a new project offshore Singapore, the project is regarding tidal energy

generation, storage and generation [16]. So that, they will not easily be affected by the changes in oil price, the risk of high inflation can be reduced.

For interest rate, according to the findings, inflation is significantly and negatively influenced by interest rate. This result is in line with most of the findings, most of it is supporting negative relationship. Since the result shows negative relationship in ASEAN countries, therefore policymakers could increase the interest rate when facing inflation [11]. When the interest rate is high, loan will become expensive because people need to pay more in the maturity date. Hence, they will reduce the application of loan and spend lesser. When consumption decreases, the money supply will decrease as well. For example, the CPI of Malaysia is increased 4.5% from a year earlier in September 2021 [17]. The target inflation in 2022 set by central bank is 3.3%, so they made a decision on a rising overnight policy rate (OPR) by 25 basis point to 2.75% [17].

For nominal wage, according to the findings, nominal wage is significantly negatively in influencing inflation. One policy could be proposed to policymakers to increase the nominal wage is promoting digital technology. Due to the fact that, the inflation is high, but the nominal wage is low is because of the low productivity. The examples of digital technology are cloud computing, blockchain and big data analytics, according to Ganatra [18], when advanced technology is applied, the productivity will increase. Thus, promoting digital technology in ASEAN will bring positive impact to nominal wage. This alternative is essential for less developing ASEAN countries such as Cambodia and Laos.

7   Conclusion

For this paper, the research objectives are to determine how the money supply, interest rate, unemployment, crude oil price and nominal wage affect the inflation rate in ten ASEAN countries within the sample period from 2006 to 2020. By referring to the models, the crude oil price, interest rate and nominal wage are significant to the inflation while the money supply and the unemployment are insignificant to the inflation. The results indicate that economic policy faces the trade-off of stabilising wage and inflation. Conclusion drawn from this study is that policymakers must endure interest rate to minimise price distortions, however there are wage gains from price stability. Thus, economic policy should prioritise stabilisation of price inflation, even if this choice entails destabilising wage. The estimates show that inflation declines with increase in interest rate. This suggests that the gains are also translated into increased wage. On the other hand, there is an insignificant link between the money supply and inflation. Based on findings, the money supply is not the primary factor in determining inflation. In other words, it does not show changes in the money supply affect the economy significantly. There is insufficient evidence to prove that faster money supply growth causes faster inflation.

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