

## DETERMINANTS OF MONETARY VARIABLES AND PHILIPS CURVE TESTING OF INFLATION IN ASIAN COUNTRIES

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### ABSTRAK

*Penelitian ini bertujuan untuk melihat pengaruh variabel moneter terhadap inflasi dan membuktikan apakah kurva philips bekerja di Asia. Penelitian ini menggunakan metode kuantitatif dengan pendekatan deskriptif, sumber data yang digunakan diambil dari world bank tahun 2013-2022 dan teknik analisis menggunakan regresi data panel. Hasil penelitian menunjukkan bahwa secara parsial variabel uang beredar (M3) tidak berpengaruh terhadap inflasi, sedangkan GDP dan suku bunga pinjaman berpengaruh signifikan terhadap inflasi sedangkan secara simultan variabel uang beredar (M3), GDP, pengangguran laki-laki, suku bunga pinjaman berpengaruh terhadap inflasi di negara Asia. Hasil penelitian ini juga menunjukkan bahwa pengangguran tidak berpengaruh negatif signifikan terhadap inflasi hal ini membuktikan bahwa kurva philips tidak bekerja di negara-negara Asia. Masing-masing negara ASEAN memiliki beberapa kebijakan beragam dalam menjaga tingkat inflasi. Hong Kong dapat menerapkan kebijakan pengawasan harga untuk mencegah manipulasi pasar. Vietnam dapat memperkuat kebijakan perdagangan untuk memitigasi dampak inflasi impor. Korea dapat mempertahankan suku bunga pada tingkat yang moderat. Indonesia dapat mengoordinasikan kebijakan moneter dan fiskal untuk mengendalikan inflasi.*

*Kata kunci: inflasi, uang beredar, GDP, pengangguran, suku bunga.*

### ABSTRACT

This study examined the impact of monetary variables on inflation and determined the validity of the Phillips curve in the Asian context. It applied a quantitative methodology with a descriptive orientation. The data source utilized was the World Bank from 2013 to 2022, and the analysis approach employed was panel data regression. The research findings indicate that the money supply variable (M3) has a limited impact on inflation. Simultaneously, both GDP and loan interest rates substantially impact inflation. Conversely, money supply (M3), GDP, male unemployment, and loan interest rates simultaneously influence inflation in Asian countries. The study's findings indicate that unemployment does not exert a noteworthy detrimental impact on inflation, demonstrating the ineffectiveness of the Phillips curve for non-Asian nations. Each ASEAN member state implements diverse policies to manage and control the inflation rate. Hong Kong can enforce price monitoring measures to deter market manipulation. Vietnam could enhance its trade policy to alleviate the consequences of imported inflation. Korea can sustain interest rates at a moderate level. Indonesia can synchronize monetary and fiscal policies in order to manage inflation.

Key words: inflation, money supply, GDP, unemployment, interest rates.

### INTRODUCTION

The government consistently prioritizes macroeconomic factors, particularly the inflation rate, when focusing on economic development. Inflation serves as a metric for assessing the economic stability of a nation

(Girdzijauskas et al., 2022). The presence of low inflation in Asian countries can indicate a state of economic stability and the successful implementation of monetary policy. Minimal inflation can bolster consistent economic expansion and alleviate price

pressures on products and services. Furthermore, the presence of low inflation rates can also impact the monetary and financial policies implemented by countries in the Asian region. Maintaining a consistently low and steady inflation rate will be a standard for measuring economic growth. The societal upheaval in terms of social, economic, and political dimensions, both domestically and internationally, will be linked to the issue of inflation (Sihotang and Nopeline, 2020).

Inflation cannot be defined as an increase in the price of one or two goods unless the increase is significant or causes most other commodities to increase (Fuadi et al., 2022). Inflation can be considered an economic disease that cannot be ignored because it can have a vast impact. Inflation has a negative impact as well as a positive impact on the economy. One of the negative impacts that can occur if the inflation increase is inappropriate is the decline in the currency's value, which can reduce people's purchasing power, especially people with a fixed income. An inflation rate that is too high will have the power to reduce people's welfare and can also affect the distribution of income and the allocation of production factors in a country (Khatir et al., 2020). Asian countries have several countries with low inflation rates, such as Hong Kong, Qatar, Korea, Indonesia, and Vietnam. The country had the lowest inflation rate in September 2022, with the Hong Kong inflation rate at 2% and the Qatar inflation rate at 1.8%. Then, the Korean inflation rate was 3.7%, the Indonesian inflation rate was 2.28%, and the Vietnam inflation rate was 3.66% (Trading Economics, 2023).

Monetary policy has a vital role in controlling the inflation rate. The importance of monetary policy in controlling the country's inflation can be seen in regulating the money supply to achieve specific goals, such as containing inflation, achieving full employment, or being more prosperous. Monetary policy is one of the main tools for the government's active role in the economy.

This policy was implemented to overcome and prevent the global crisis in Asian countries. Monetary policy is set by the central bank's monetary authority, which changes the monetary amount, and the monetary authority and financial institutions implement it. The Quantity Theory of Money explains the relationship between money supply, GDP, and interest rates. This theory states that the amount of money circulating in an economy will influence the price level of goods and services (GDP) and interest rates (Kunwar, 2020).

One of the monetary variables is the money supply. Money supply can be indicated by economic activities that impact the increase in the community's demand for money. Money offered to the public must be based on the community's needs and demands. Excess money beyond the community's needs and desires will increase prices (Joshi, 2021).

The inflation rate can also be influenced by other factors, such as Gross Domestic Product (GDP), because when GDP increases, inflation will also increase. GDP is used to describe the aggregate demand in a country because one of the methods of calculating GDP is through the expenditure side, which is a description of the amount of consumption or demand in a country. When demand increases, the increase in demand will push the price level. Thus, GDP as a proxy for aggregate demand is suspected to influence inflation (Kankpeyeng et al., 2021).

Interest rates can also determine the inflation rate; they are used as a benchmark for economic activities in a country. Interest rates are an indicator that can affect the flow of banking finance, investment, currency movements, and inflation in a country. If the inflation rate is high, the central bank will also reduce interest rates to reduce the inflation rate, and vice versa (Hamdar et al., 2022).

The Philip Curve also shows the relationship between unemployment and inflation. According to the Philip Curve theory, unemployment will be low when

inflation is high (Yayar and Tekgün, 2022). The assumption that inflation reflects an increase in aggregate demand means the demand theory about rising prices results in inflation. Producers hire more labor to increase production capacity to meet the increase in demand, so the unemployment rate decreases (Suharti et al., 2021).

Based on several studies conducted by other researchers who have similar discussions with this study, namely research conducted by Tahir et al., (2023) in China, the money supply positively impacts inflation. In research, Milenković et al., (2020) show that GDP and unemployment variables impact inflation. Nguyen et al., (2022) also explained that the money supply and interest rates positively influence Vietnamese inflation.

The difference between the current research and previous research is that the current research specifically focuses on using inflation data from countries with low inflation rates, whereas previous research tends to use data with high inflation rates. In addition, the current research focuses more on male unemployment data than previous research, which did not specifically differentiate between male and female unemployment. This selection of male unemployment is generally in Asian countries, where men are expected to work more (Mills, 2017). Therefore, this study aims to determine the effect of monetary variables on inflation and prove whether the Philips curve worked in Asian countries in 2013-2022.

## **THEORETICAL REVIEW**

### **Inflation**

Inflation is a condition in which prices increase in a society's economy. The increase usually occurs in goods or services (Olusola et al., 2022). Inflation is related to prices to consumers and prices agreed upon globally. So, inflation significantly impacts the economy, but it can be overcome if adequately predicted. Thus, each individual has considered the possibility of high prices in the future. However, inflation cannot be

predicted with certainty (Adaramola and Dada, 2020). Such inflation can reduce economic efficiency because everyone will likely have minimal risk in reducing losses or buying goods (Amhimmid et al., 2021).

### **Money Supply**

The amount of money supply is the amount of cash and demand deposits and quasi-money circulating in the community issued by the Central Bank (Yuniasih et al., 2022). In circulation in a society during a specific period, all forms of money held by individuals and institutions vary according to economic and social developments and banking practices (Gubanov, 2021). Total money in circulation (JUB) is also called the general money supply. The more money is in circulation, the weaker the exchange rate is, and the higher the prices of necessities are. In other words, the more money in circulation, the higher the inflation rate (Sinah, 2018).

The quantity theory says that inflation usually occurs when the volume of money increases (Mustifa et al., 2022). Inflation will stop if the money supply does not increase, so inflation control comes from controlling the money supply. Prices will rise as the money supply increases (Esumanba et al., 2019). The inflation rate is determined by the increased amount of money in circulation and people's expectations about future price increases. If people already think so, there is no tendency to save cash anymore, and they prefer to store wealth in the form of goods (Idisi et al., 2023).

Dekkiche (2022) examined the impact of money supply on inflation in Egypt from 1990 to 2019 using the VECM regression model. It was found that money supply has a significant positive effect on inflation. Ujkani and Gara (2023) Analyzed the relationship between macroeconomic factors affecting several countries' inflation rates. The study showed that countries with an increasing money supply will also face an increase in inflation, so the impact of money supply on the inflation rate is positive. The money supply significantly affected inflation

in Indonesia in 2006-2007 (Zulfikar and AF, 2023).

### Gross Domestic Product (GDP)

The Keynesian theory (demand-pull theory) explains that inflation is caused by excess demand that cannot be met by the available production capacity at any given time (Schwarzer, 2018). GDP is a commonly used indicator in describing a country's aggregate demand. One of the methods of calculating GDP is through the expenditure side, which describes the amount of consumption or demand in a country (Mariati et al., 2022). This theory also states how demand can affect the price level. When demand increases, the increase in demand will push the price level. Thus, it is expected that GDP as a proxy for aggregate demand has a positive influence on inflation (Xiong, 2023).

Kryeziu and Durguti (2019) using a linear regression model, we examined fiscal deficits' impact on Eurozone countries' inflation rates from 1997 to 2017. The study shows that GDP has a significant positive effect on inflation.

### Interest Rate

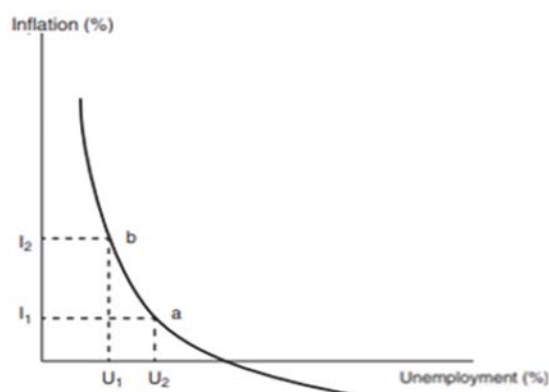
Interest Rates are usually expressed as a percentage and are the cost of borrowing or the price paid for borrowing. Therefore, interest can also be considered money earned on a loan (Alafif, 2023). According to the review, interest rates have two words: for banks and entrepreneurs. Entrepreneurs see interest as a cost of production or capital, but banks see it as revenue or profit when they lend money to customers or business owners (Haryadi and Ilhami, 2019).

Rahmayani et al., (2021), Sihotang and Nopeline (2020), and Silaban et al., (2021) state that interest rates and money supply influence inflation in Indonesia. Research by Bourainy et al., (2021) Shows that interest rates positively affect inflation rates in developing countries.

### Unemployment

Unemployment occurs when a person of working age is not working or looking for work at a particular time. Unemployment is essential to pay attention to because the unemployed do not have income, so they have difficulty meeting their basic daily needs (Ramzan, 2021). An increase in employment leads to an increase in wage income, therefore, an increase in consumer spending and, ultimately, an increase in overall demand in the economy. Generally, unemployment is caused by the number of job seekers being more significant than the number of jobs available (Michael and Geetha, 2020). Unemployment is a problem for a country's economy, security, and stability. With a higher unemployment rate in a region, the productivity and income of a region in general will also decrease, leading to poverty, high crime rates, and other social problems (Kuznetsov and Sokolov, 2023).

The impact of unemployment and interest rates on inflation in Sri Lanka from 1953 to 2015 was analyzed (Selvanayagam and Mustafa, 2019). The results show that unemployment has a significant negative effect on inflation.



**Figure 1**  
**Philips Curve**

Source: Dorn (2020)

### Philips Curve

The Phillips curve in figure 1 was first proposed by A.W. Phillips in 1958. Phillips concluded that there is a negative relation-

ship between unemployment and changes in the wage rate. Phillips used the change in wage rate because wages will affect the price of goods and services and eventually affect inflation (Kurmanova et al., 2022). In its development, the Phillips curve used by economists today differs in explaining the relationship contained in the curve. Phillips states that changes in the unemployment rate can explain changes in the wage rate (Kruľický et al., 2022).

## RESEARCH METHODS

The method used in this research is quantitative with a descriptive approach. Quantitative research aims to test a theory or hypothesis to strengthen or reject a previous theory or hypothesis (Kittur, 2023). Descriptive analysis describes a symptom or problem that is happening now.

### Population and Research Sample

This study's population comprises five Asian countries with the lowest inflation rates: Hong Kong, Qatar, Korea, Indonesia, and Vietnam. It covers ten years, from 2013 to 2022. Sampling is based on criteria: the inflation rate of Asian countries below 5%, which has complete data based on the variables to be tested.

### Sampling Technique

The method used to select samples in this study is purposive sampling combined with non-probability sampling. A sampling method in which not all components or members of the population have the same opportunity to be selected as a sample. They used a purposive sampling method based on specific criteria based on the problems and research objectives. With the criteria used, Asian countries that have low inflation rates obtained a sample of 5 countries from a population of 48 countries.

### Data Collection Technique

This study collects secondary data from the object of research in written form or other sources through institutions or agencies. The

data includes M3 money supply, GDP, lending interest rates, male unemployment, and inflation obtained from the World Bank.

### Operationalization of Research Variables

Variable operationalization presents the concept of variables in general and other information about indicators, sizes, and variable measurement scales. In this study, the variables used consist of independent and dependent variables.

### Independent Variable (X)

The M3 money supply is the sum of money in circulation outside banks, demand deposits from sources other than the central government, time deposits, savings, and foreign currency deposits in the domestic sector other than the government, bank checks and traveler's checks, and other securities such as certificates of deposit and commercial paper.

*Gross Domestic Product* (GDP) is the total gross value added to the economy by all producers, plus product taxes and minus subsidies that are not part of the product value. This calculation does not consider the depletion and degradation of natural resources and the depreciation of newly created assets.

Lending interest rates are bank interest rates that typically cover the private sector's short-and medium-term financing needs. These rates vary based on the purpose of the financing and the borrower's credit worthiness. Comparing these interest rates is hampered by each country's different terms and conditions.

Unemployment describes the number of workers who are available for work but currently do not have a job. Each country has its definition of the labor force and unemployment.

### Dependent Variable (Y)

Inflation is the annual percentage change in the average cost to consumers of buying a basket of goods and services that can be fixed or modified at specific intervals,

such as annually, which is what the consumer price index measures inflation. A frequently used formula is the Laspeyres formula.

**Data Analysis Technique**

This study's data analysis technique uses descriptive and associative analysis.

**Descriptive Analysis**

This study uses descriptive analysis to analyze data by describing the development of inflation rates, M3 money supply, GDP, male unemployment, and lending interest rates.

**Associative Analysis**

Associative or relationship hypothesis testing in this study uses panel data regression analysis, which combines time series and cross-section data as shown in the following analysis model:

$$Y = \beta_0 + \beta_1 M3\_X1 + \beta_2 GDP\_X2 + \beta_3 LIR\_X3 - \beta_4 PL\_X4 + e$$

Where:

- Y = inflation
- $\beta_0$  = constant
- M3\_X1 = money supply M3
- GDP\_X2 = Gross Domestic Product
- LIR\_X3 = Lending interest rate
- PL\_X4 = Male unemployment
- e = estimation error

**Procedures Used for Data Analysis:**

The regression model selected the best panel data model. This model uses three model approaches, namely CEM, FEM, and REM. After these tests, the Chow and Hausman tests are carried out to select the best model.

After finding the best model, continue to test the hypothesis so that the level of significance of all variables is measured using statistical tests, including the T-test (partial test), F-test (simultaneous test), and the coefficient of determination (R-square).

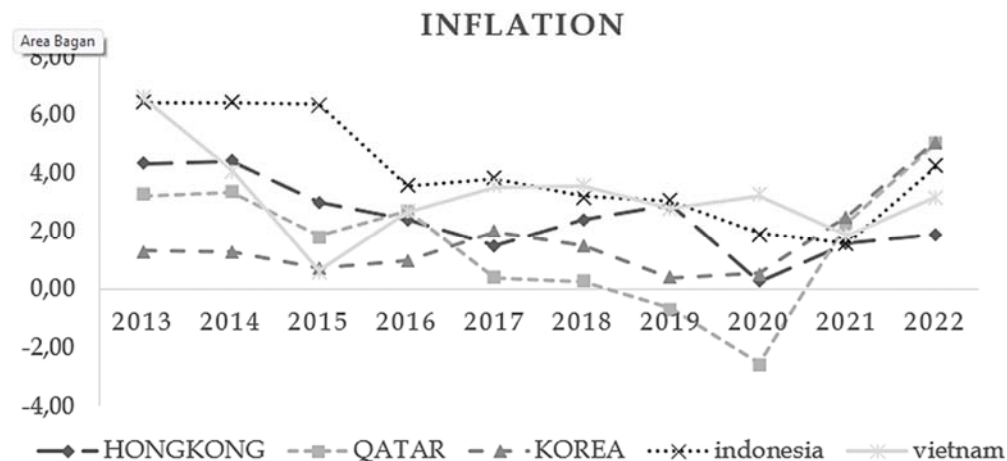
**ANALYSIS AND DISCUSSION**

**Descriptive Analysis**

**Development of Inflation Rate in Five Asian Countries**

Inflation is a monetary event often occurring in developed and developing countries. An economy always experiences inflation that changes to achieve faster development.

Figure 2 shows inflation rates in five Asian countries fluctuate every year. The highest inflation in Vietnam occurred in 2013, at 6.59%. It was due to the full impact of the fuel price adjustment, which was accompanied by increased health, education, household water, and public transportation costs (Maitah et al., 2020).



**Figure 2**  
Average Inflation Rate Per Year (in percent)

Source: World Bank, 2023

The inflation rate in Hong Kong was highest in 2014 at 4.42%. The sharp increase primarily influenced real estate values, which increased living costs such as property prices and rents. The high inflation rate is directly attributable to this growth (Hesary et al., 2020).

Qatar reached its highest inflation rate of 5% in 2022 due to its dependence on oil and gas. The decline in global oil prices has affected Qatar's economy, which is heavily dependent on natural resources. Rising oil prices could sharply increase the country's inflation rate (Ben Hassen, 2022).

Indonesia's inflation rate was highest in 2013, at 6.41%. Given the fiscal pressure faced by the government from large energy subsidies, especially for fuel oil (BBM), which directly impacts people's cost of living, policies that reduce subsidies or increase domestic energy prices can significantly impact the inflation rate (Al Fajrin et al., 2023).

Korea has the highest inflation rate in 2022, at 5.09%. Increased production costs, especially in the manufacturing or industrial sector, can cause the rise. Rising wages, rising raw material prices, and other factors that impact the production process can all

lead to higher production costs (Kim et al., 2021).

### Development of M3 Money Supply Level in Five Asian Countries

Figure 3 is based on the average level of M3 money supply per year in Asia.

It can be concluded that from 2013 to 2022, the M3 money supply in five Asian countries fluctuated annually. The highest M3 money supply occurred in 2013 in Vietnam, by 21.40%, because the need for money for public consumption increases annually, which increases the price of goods in the market, so the money supply must be fulfilled (Nguyen et al., 2022).

In 2021, Indonesia reached the highest level of M3 money supply at 13.97%. This significant increase may be related to the central bank's relatively loose monetary policy implementation. Policies that can increase the money supply include fiscal incentives, bank-driven credit expansion, or government spending stimulus. The measures mentioned are geared towards promoting economic growth and mitigating the financial consequences of certain circumstances, such as a pandemic or worldwide economic recession (Wijaya et al., 2022).

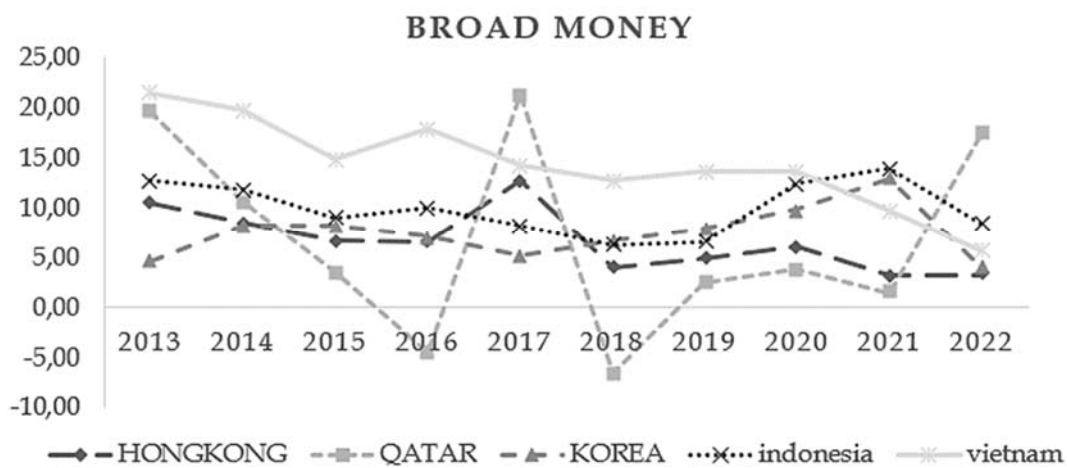


Figure 3  
Average Money Supply Rate M3 Per Year (in percent)

Source: World Bank, 2023

Korea achieved the highest level of M3 money supply in 2021 at 12.93%. This achievement is due to the tremendous increase in credit in the country. An increase in the volume of loans from financial institutions can directly increase the money supply. Initiatives to encourage specific industries or policies that support economic expansion may cause this increase in credit activity (Hwang, 2020).

In 2017, Qatar achieved the highest M3 money supply rate of 21.26%. This achievement may be related to the increase in infrastructure projects that require massive spending. Due to these significant investments, Qatar's economy could see an increase in money circulation, consistent with the explosive growth of the infrastructure sector (Irshad, 2019).

Hong Kong achieved the highest M3 money supply rate in 2017, at 12.80%. This achievement may be attributed to the country's influential position as an international financial center. The high volume of financial activities, such as stock and derivatives trading, can significantly increase money flow through Hong Kong's financial

system, reflecting Hong Kong's significant influence in the global financial market (Zhao, 2022).

**Development of Gross Domestic Product (GDP) Level in Five Asian Countries**

Figure 4 is based on the average level of GDP per year in Asia.

It concluded that the Gross Domestic Product (GDP) fluctuates from year to year. Vietnam's highest GDP in five Asian countries occurred in 2013-2022, at 8.02% due to economic recovery after the COVID-19 pandemic, which no longer limited people's activities in purchasing goods and services as they wished. An increase in textile exports to the United States also supported it.

Hong Kong had the highest GDP in 2021, at 6.44%. The high growth of the investment sector and financial activities are the main drivers of the outstanding economic performance. Rapid investment, financial services, and stock trading growth have significantly contributed to Hong Kong's success as a global financial center (Tsui et al., 2021).

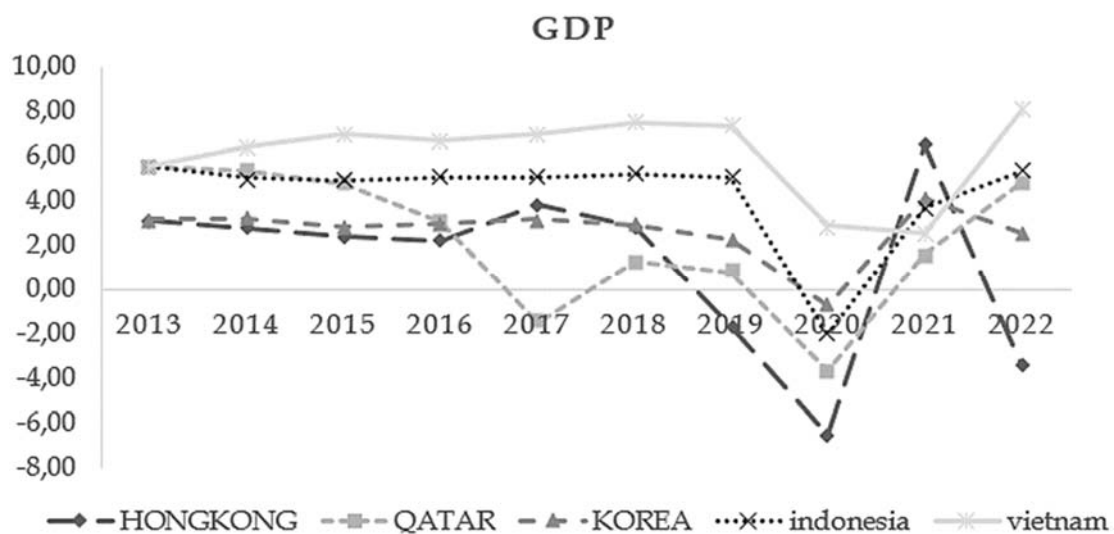


Figure 4  
Average GDP Rate Per Year (in percent)

Source: World Bank, 2023



In 2013, Qatar had the highest GDP rate of 5.56%. This success was mainly due to the contribution of a strong energy sector. As a leading producer and exporter of natural gas and oil, Qatar's economy grew much faster during the rising oil prices. Dependence on the energy sector, particularly oil and gas, was a significant factor in the outstanding economic performance during that period (Al-Noaimi et al., 2023).

South Korea achieved the highest GDP rate of 4.15% in 2021. The good economic performance predicts that efforts are being made to revive the economy after the COVID-19 pandemic. Some potential contributing factors are the growth rate of exports, the stimulus policies enacted, and the rapid expansion of the technology sector (He and Wang, 2022).

Indonesia's highest GDP rate in 2013 was 5.56%. The solid economic performance in that year was mainly due to important industries such as manufacturing, services, and agriculture. Supportive fiscal policies, significant investments in infrastructure, and strong domestic consumption growth may have contributed to this success (Adityara, 2020).

### Development of Loan Interest Rates in Five Asian Countries

Figure 5 is based on average annual loan interest rates in Asia.

This study identified that from 2013-2022, lending rates in five Asian countries fluctuated every year. The highest loan interest rate occurred in 2015, at 12.66% in Indonesia. This was due to the banking industry choosing to be cautious in an economic situation that has not yet recovered. With relatively low economic growth and rising inflation, accompanied by a somewhat declining purchasing power, banks prefer to maintain the quality of their credit growth (Jumono et al., 2019).

From 2013-2022, lending rates in Hong Kong averaged 5%. Interest rates in Hong Kong usually reflect U.S. monetary policy due to the policy of tying Hong Kong to the U.S. dollar. In this case, Hong Kong may raise domestic interest rates in response to a rise in U.S. interest rates. This action aims to maintain the exchange rate of the Hong Kong currency against the U.S. dollar, which is crucial to Hong Kong's monetary system and economy (Chen and Tsang, 2020).

In 2013, Qatar's highest lending rate stood at 5.11%. The country is a significant producer of natural gas and oil, so changes in commodity prices can have a significant impact. The monetary policy implemented to mitigate the impact of oil price fluctuations, which significantly affected Qatar's economy, may have contributed to the high interest rates during that period.

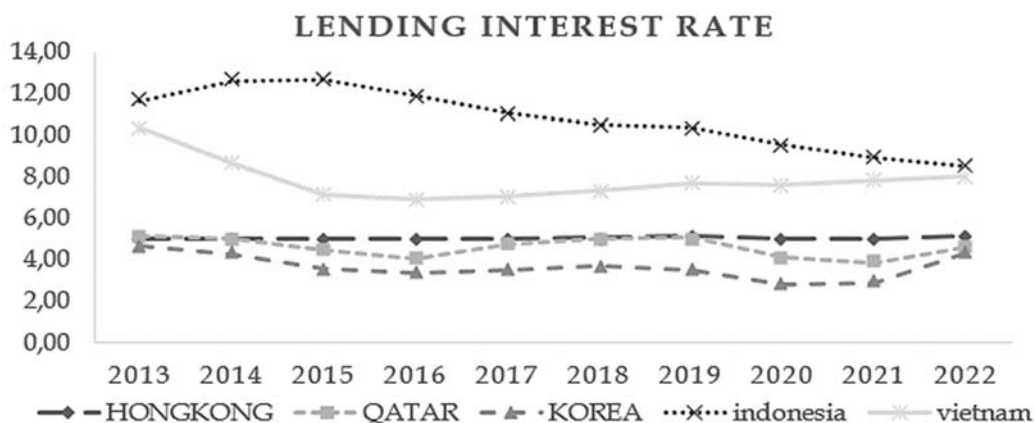


Figure 5  
Average Loan Interest Rate Per Year (in percent)

Source: World Bank, 202

The highest lending rate in South Korea reached 4.64% in 2013. Monetary policies implemented by the central bank, which aim to address specific economic challenges or control inflation, can impact interest rates. The central bank seeks to maintain economic stability and adjusts monetary policy to existing economic conditions, which is reflected in relatively high lending rates (Yi-Wei, 2020).

In 2013, Vietnam's highest lending rate was 10.37%. An increase in interest rates may be necessary to mitigate the negative impact of the severe economic instability that some countries experienced after the 2008 global financial crisis. The high lending rates in 2013 may have been due to the efforts of Vietnam's central bank and government to address post-crisis global economic issues (Minh et al., 2022).

**Development of Male Unemployment Rate in Five Asian Countries**

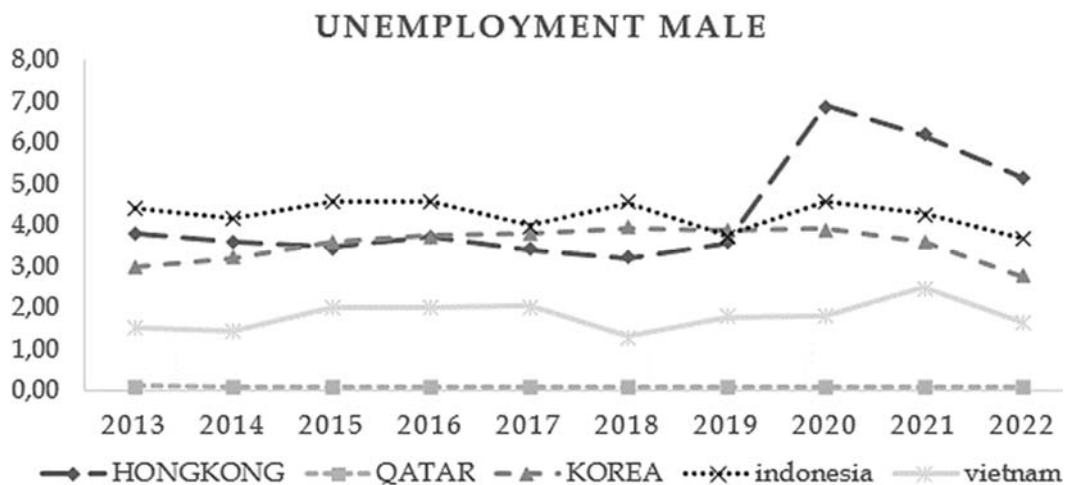
Figure 6 shows the average annual male unemployment rate in Asia.

It can be concluded that the male unemployment rate in five Asian countries fluctuates from year to year. The highest male unemployment rate occurred in Hong Kong in 2020, at 6.88%, due to the COVID-19

pandemic that year. With unstable economic conditions affecting unemployment, many workers are terminated from their jobs to reduce social interaction to prevent the coronavirus; many companies have also gone out of business, so many people are unemployed due to termination of employment (PHK) (Yuk, 2023).

Between 2013 and 2022, the male unemployment rate in Qatar averaged 0.1%. It highlights the characteristics of Qatar's economy, which is highly dependent on the energy sector, mainly as it produces natural gas and petroleum. Qatar's success in improving its inflation rate may be related to the increased economic stability caused by the high income from the energy sector (Alsamara et al., 2019).

Korea had the highest male unemployment rate of 3.92% in 2018. Economic structure and worker skill requirements are two factors that can contribute to higher unemployment rates. One reason is the mismatch between workers' skills and the demands of the labor market. For example, a mismatch between the skills possessed by workers and the demands of industry can lead to an increase in the unemployment rate (Jang, 2018).



**Figure 6**  
Average Male Unemployment Rate Per Year (in percent)

Source: World Bank, 2023.

In 2015, 2016, and 2020, the male unemployment rate reached its highest level of 4.57%. Although Indonesia's economy is growing, it may only be able to accommodate some of the labor force, especially in some industries where there may be a mismatch between workers' skills and labor market demand. The high unemployment rate during this period may reflect the difficulty in generating enough jobs (Amalia et al., 2023).

In 2021, the male unemployment rate in Vietnam was the highest at 2.47%. The COVID-19 pandemic may have impacted some industries more than others, leading to labor market imbalances, especially regarding unemployment. The global health crisis affected some sectors of the economy more than others, leading to a rise in the unemployment rate for men throughout the year (Lan, 2023).

#### Associative Analysis

This research uses associative analysis, where the associative hypothesis is whether there is a significant relationship between monetary variables and inflation in five Asian countries in 2013-2014.

#### Panel Data Regression Analysis

Data analysis methods can use three methods in panel data regression: Common

Effects, Fixed Effects, and Random Effects, as follows: Panel Data Regression Model Estimation.

The Common Effect Model approach results in table 1 show that GDP and lending rates significantly affect probability values of 0.0093 and 0.0028. M3 money supply and male unemployment have no significant effect because the probability value is more than 0.05.

The Fixed Effect Model approach results in table 2 show that GDP and loan interest rates have significant effects, with probability values of 0.0054 and 0.0008. Money supply M3 male unemployment has no significant effect because the probability value is more than 0.05.

The results of the Random Effect Model approach in table 3 show that GDP and lending interest rates have significant effects, with probability values of 0.0041 and 0.0010. M3 money supply and male unemployment have no significant effect because the probability value is more than 0.05.

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**Table 1**  
**Panel Data Regression Analysis Results - Common Effect Model**

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.408931	0.595499	-0.686704	0.4958
M3_X1	0.034229	0.037620	0.909873	0.3677
GDP_X2	0.209021	0.076889	2.718487	0.0093
LIR_X3	0.275784	0.087322	3.158236	0.0028
PL_X4	0.085325	0.125252	0.681228	0.4992
R-squared	0.470115	Mean dependent var		2.581600
Adjusted R-squared	0.423014	S.D. dS.D.dent var		1.871943
S.E. oS.E.gression	1.421920	Akaike info criterion		3.636533
Sum squared resid	90.98357	Schwarz criterion		3.827735
Log-likelihood	-85.91332	Hannan-Quinn criteria.		3.709344
F-statistic	9.981010	Durbin-Watson stat		1.194571
Prob(F-statistic)	0.000007			

Source: Processed Data EViews 12, 2023.

**Table 2**  
**Results of Panel Data Regression Analysis - Fixed Effect Model**

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-2.548169	1.728850	-1.473910	0.1481
M3_X1	0.052127	0.035970	1.449158	0.1549
GDP_X2	0.227116	0.077262	2.939549	0.0054
LIR_X3	0.803831	0.223029	3.604155	0.0008
PL_X4	-0.436953	0.311740	-1.401662	0.1685
Effects Specification				
Cross-section fixed (dummy variables)				
R-squared	0.609739	Mean dependent var		2.581600
Adjusted R-squared	0.533591	S.D. dS.D. dent var		1.871943
S.E. oS.E.gression	1.278427	Akaike info criterion		3.490687
Sum squared resid	67.00941	Schwarz criterion		3.834851
Log-likelihood	-78.26718	Hannan-Quinn criteria.		3.621747
F-statistic	8.007252	Durbin-Watson stat		1.443652
Prob(F-statistic)	0.000002			

Source: Processed Data EViews 12, 2023.

**Table 3**  
**Results of Panel Data Regression Analysis - Random Effect Model**

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.408931	0.535404	-0.763781	0.4490
M3_X1	0.034229	0.033823	1.011999	0.3169
GDP_X2	0.209021	0.069129	3.023616	0.0041
LIR_X3	0.275784	0.078510	3.512722	0.0010
PL_X4	0.085325	0.112612	0.757691	0.4526
Effects Specification				
			S.D.	S.Do
Cross-section random			6.46E-08	0.0000
Idiosyncratic random			1.278427	1.0000
Weighted Statistics				
R-squared	0.470115	Mean dependent var		2.581600
Adjusted R-squared	0.423014	S.D. dS.D.dent var		1.871943
S.E. oS.E.gression	1.421920	Sum squared resid		90.98357
F-statistic	9.981010	Durbin-Watson stat		1.194571
Prob(F-statistic)	0.000007			
Unweighted Statistics				
R-squared	0.470115	Mean dependent var		2.581600
Sum squared resid	90.98357	Durbin-Watson stat		1.194571

Source: Processed Data EViews 12, 2023

### Selection of the Best Model

After the panel data model approach has been estimated, the best panel data model selection is conducted to determine the fixed effect model or common effect model that is best used in research. There are three tests for

selecting the best model in panel data: the Chow test, the Hausman test, and the Lagrange Multiplier (L.M.). This study did not conduct the L.M. tesL.M. because the Chow and Hausman tests selected the best model.

Model Selection Using the Chow Test. The Chow test is a test used to choose between the Common Effect Model (CEM) or the Fixed Effect Model (FEM), which is most appropriate to use in estimating panel data. Based on the processed data results on table 4, it obtained Prob. Cross-section F = 0.0121, the value is smaller than  $\alpha$  (0.05), so it is decided to accept  $H_1$  and reject  $H_0$ . Thus, it can be said that the FEM model is more appropriate to us.

Model Selection Using the Hausman Test. The Hausman test is used in comparing which model is the best the Random Effect Model (REM) and the Fixed Effect Model (FEM)—based on the results of the data processing on table 5, obtained Prob. Cross-section random = 0.0054, the value is smaller than  $\alpha$  (0.05), so it is decided to accept  $H_0$  and reject  $H_1$ . Thus, it can be said that the fixed effect model is more appropriate to use.

### Hypothesis Testing

Hypothesis testing is used to determine the significance of regression coefficients. If the regression coefficient value is equal to zero, it is said to be significant. However, if the regression coefficient is not equal to zero,

the predictor variable does not have sufficient evidence to influence the response variable. The t-test (partial regression test), F-test (simultaneous regression test), and coefficient of determination (R-Square) should be used in assessing regression coefficients.

The t-test is used to see the significance level of the independent variables individually in influencing the dependent variable. This study uses a significance level of 5% to see how much significance is in rejecting or accepting variables. Based on Table 2, tested using the EViews 12 program, The money supply variable M3 does not positively influence inflation, which is indicated by the t-statistic value of 1.449158 and a probability value of 0.1549 > 0.05.

The GDP variable correlates positively with inflation with a t-statistic value of 2.939549 and a probability value of 0.0054 < 0.05. The lending rate variable has a significant positive impact on inflation, as indicated by the t-statistic value of 3.604155 and the probability value of 0.0008 < 0.05. The male unemployment variable has no significant negative impact on inflation, as indicated by the t-statistic value of -1.401662 and the probability value of 0.1685 > 0.05.

**Table 4**  
**Chow Test Results**

Redundant Fixed Effects Tests			
Equation: FE			
F.E.st cross-section fixed effects			
Effects Test	Statistic	d.f.	Prob.
Cross-section F	3.667174	(4,41)	0.0121
Cross-section Chi-square	15.292297	4	0.0041

Source: Processed Data EViews 12, 2023

**Table 5**  
**Hausman Test Results**

Correlated Random Effects - Hausman Test			
Equation: RE			
Test cross-section random effects			
Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random	14.668697	4	0.0054

Source: Processed Data EViews 12, 2023

The f test (*Goodness of fit*) is calculated based on the significance level with the prob value. F statistics. Its significance determines the criteria for accepting or rejecting it. This research uses a significance of 5%. Based on Table 2, the results of the F test in this study obtained a prob (F-statistic) value of 0.000002, which has a significance value smaller than 0.05, indicating that there is no significant difference between the model and the data so that the regression model in this study is feasibly used to explain the influence of the variables M3 money supply, GDP, loan interest rates and male unemployment on inflation.

The coefficient of determination (R-Square) is a test to see how much the independent variable can explain the dependent variable. Based on Table 2, the R-Square is 0.609739 or 60.97%, which means that the variables of money supply M3, GDP, lending rates, and male unemployment influence inflation by 60.97%. The remaining 39.03% is explained by other variables outside the mode studied.

## Discussion

### The Effect of M3 Money in Circulation on Inflation

Based on the test results of this study, the effect of monetary variables using the M3 money supply variable on inflation proves that in this study, the M3 money supply variable does not have a significant positive effect on inflation because the probability value is greater than 0.05, which is 0.1549. If the money supply increases, inflation in 5 Asia countries will decrease. An increase in money supply can be seen from the number of people holding money, so they tend to consume, which can increase demand in the market. However, in this study, an increase in the money supply caused inflation to decline because the M3 money supply did not consider how quickly the money changed hands when measuring the total amount of money in circulation. The money supply may not impact the inflation rate if there is little money velocity. In other words,

money velocity is the frequency with which a currency unit is used over time to purchase goods and services. Therefore, money velocity is essential when analyzing the relationship between money supply M3 and inflation.

These results are in line with research conducted by Putra (2022). The negative impact is due to COVID-19, which causes people to prefer to save assets rather than spend their money. Another research by Sultana et al., (2019) found that the results did not affect inflation in Bangladesh.

### The Effect of Gross Domestic Product (GDP) on Inflation

Based on the test results of this study, the effect of monetary variables using the GDP variable on inflation proves that in this study, the GDP variable has a significant positive effect on inflation because the probability value is less than 0.05, equal to 0.0054. From these results, when GDP increases, the purchasing power of the people also increases. The increase in people's purchasing power will cause an increase in 5-inflation Asia countries because economic growth is high, supported by increased domestic demand, which leads to higher household consumption and positive growth in all sectors of the economy. An increase in GDP in each of 5 Asian countries can cause inflation in 5 Asian countries due to increased demand, but this does not always happen and depends on various economic factors.

The finding is supported by the research of Zhu (2023) and Tolasa et al., (2022), which state that GDP significantly affects inflation. The positive relationship between inflation and GDP can be explained by households' tendency to save, the redistribution of money ownership in the economic system, and an increase in the investment portion.

### The Effect of Lending Interest Rate on Inflation

Based on the test results of this study, the effect of monetary variables using the

loan interest rate variable on inflation proves that in this study, the loan interest rate variable has a significant positive effect on inflation because the probability value is less than 0.05, which is 0.0008. After all, higher borrowing rates have a considerable positive impact on inflation. Higher borrowing rates can also increase production costs for firms, increasing the prices of goods and services and leading to inflation in 5 Asian countries. Higher lending rates can sometimes be a reaction to rising inflation. Central banks may increase interest rates to curb inflation and keep it from spiraling out of control when inflation rises. However, this may also result in lower economic growth. The study results align with Bourainy et al., (2021) and Ali et al., (2023).

#### **The Effect of Male Unemployment on Inflation**

Based on the test results of this study, male unemployment does not have a significant adverse effect on inflation because the probability value is greater than 0.05, which is 0.1685. So, it can be said that if male unemployment is low, then inflation in 5 Asian countries also decreases. When people are unemployed, they have less money to spend, decreasing demand for goods and services. This decrease in demand leads to decreased prices, which can cause deflation. For example, during the COVID-19 pandemic, many people lost their jobs, so the decrease in demand led to deflation in some sectors of the economy. Similarly, during the economic crisis 1998, the high unemployment rate caused a decrease in demand, leading to deflation. Therefore, when there is a decrease in demand for goods and services due to unemployment, it can cause deflation rather than inflation because a decrease in demand causes a decrease in prices.

This study's results are based on research conducted by Nasir et al., (2021) and Daniel et al., (2021), which shows that unemployment has no significant adverse effect on inflation.

#### **The Effect of M3 Money in Circulation, GDP, Lending Interest Rates, and Male Unemployment on Inflation**

This study is conducted with variables of money supply M3, GDP, lending interest rates, and male unemployment are related. The higher the money supply in society, the more people's purchasing power will increase. So people will tend to increase their consumption through shopping, which can cause prices to rise due to increased demand from the community. Then, this will trigger inflation. When GDP rises, the community often increases the demand for goods and services. The increasing demand will lead to price increases, which can cause inflation. When interest rates decrease, the availability of money increases, and if demand growth exceeds output growth, inflation can occur. High unemployment can create a surplus of labor, which in turn can suppress wage demands. If companies have many potential workers ready to work for lower wages, they may feel free to raise wages to help control production costs and reduce inflationary pressures from the cost side.

#### **Testing the Phillips Curve in Asian Countries**

The downward slope of the Phillips curve indicates a negative correlation between changes in the unemployment rate and the wage rate: when wages rise, unemployment falls, or vice versa. The Phillips curve shows that price stability and a high unemployment rate cannot coexist (Kurmanova et al., 2022). Achieving high employment or low unemployment will inevitably result in high inflation, and one must be prepared to deal with it. In other words, this curve shows the trade-off between inflation and the unemployment rate, meaning that it is always possible to reduce the unemployment rate by raising it and reducing it by allowing it to rise (Angelov, 2023).

This study shows that unemployment does not affect inflation, so the Philips curve does not impact Asian countries. The Philips

curve does not apply in Asian countries because unemployment in Asia is caused by the large number of companies that use modern technology rather than human labor, so job growth is smaller than the growth of the labor force. In addition, the price increase is generally caused by increased production costs; for example, the increase in fuel oil is not due to aggregate demand. The increase in fuel prices can ultimately increase prices due to supply shortages and distribution disruptions in various regions.

### CONCLUSIONS AND SUGGESTIONS

Based on the analysis and discussion results, this study concluded that from the determination of monetary variables, the M3 money supply does not have a significant positive effect on inflation; the Gross Domestic Product (GDP) and lending interest rates have a significant positive effect on inflation. However, the M3 money supply, gross domestic product (GDP), lending rates, and male unemployment significantly affected inflation in five Asian countries in 2013-2022. In this study, the Philips curve in Asian countries does not work because male labor has no impact on fluctuations in inflation in Asia.

Furthermore, the recommendation can be given is that in maintaining the inflation rate, the government is expected to create stable and quality economic growth. Hong Kong can implement price surveillance policies to prevent market manipulation. Vietnam also streng then trade policies to mitigate the impact of imported inflation. Besides, Korea can keep interest rates at a moderate level. Therefore, Indonesia can coordinate monetary and fiscal policies to control inflation.

Further research into the causes of inflation is needed to deepen our understanding of the factors that influence it. The fact includes an in-depth study of supply and demand dynamics in the economy, the impact of fiscal and monetary policies, structural factors such as political instability, and changes in global trade relations. With more

comprehensive research, we can identify the causes of inflation and formulate more effective policies to control it, maintain economic stability, and improve people's welfare.

This research is limited because it only uses five countries in a relatively short period, 2013-2022. Further research can add other countries' objects and extend the research year with the latest data so that future researchers can find maximum results.

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