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The Dynamics of Income, Money Supply and Inflation Rate: The Case of The Philippines and China

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Abstract: ***The primary objective of government intervention in the market through monetary and fiscal policy of the central bank any state, like Philippines and China, is to promote stable rate of prices that will result in balanced and sustainable economic growth and economic activities of both consumers and producers. However, even though these policies were made focusing on price stability, high levels of inflation rate persist in the Philippines. For the year 2023, countries in Southeast Asia recorded an alarming inflation figures and rapidly depreciating currency due to economic recession brought by the Covid-19 pandemic as well as the conflict between Russia and Ukraine which resulted in a volatile global fuel market and food shortages. Compared to other ASEAN countries such as Philippines, China still manage to lower its inflation rate despite of the pandemic situation. In the model 1, the statistical result revealed that gross domestic product significantly affect the inflation rate. Simultaneously, the lagged of GDP and interest rate affects the gross domestic product while money supply affects the interest rates. In model 2, the results of the analysis revealed that Percentage Change in Money Supply and Gross Domestic Product has significant relationship with inflation rate. Simultaneously, the lagged of GDP and interest rate affects the gross domestic product while money supply affects the interest rates. Between the two models, the Model 2 is more feasible model to be used since the R2 is higher compared to Model 1 which means that collectively the fiscal and monetary policy affects the inflation rate of the Philippines.***

Keywords: Inflation Rate; Money Supply; Gross Domestic Product; Monetary Policy.

1. INTRODUCTION

The primary objective of government intervention in the market through monetary and fiscal policy of the central bank any state, like Philippines and China, is to promote stable rate of prices that will result in balanced and sustainable economic growth and economic activities for both consumers and producers. However, even though these policies were made focusing on price stability, high levels of inflation rate persist in the Philippines. For the year 2023, countries in Southeast Asia recorded an alarming inflation figures and rapidly depreciating currency due to economic recession brought by the Covid-19 pandemic as well as the conflict between Russia and Ukraine which resulted in a volatile global fuel market and food shortages. Compared to other ASEAN countries such as Philippines, China still manage to lower its inflation rate despite of the pandemic situation.

In particular, as reported by the Philippines Statistic Authority (2023), the headline inflation of the Philippines continues to increase as it accelerated further from 8.1 percent in December to 8.7 percent in January 2023 – the highest annual rate posted since November 2008. Although it slowed down to 8.6% in February 2023, this rate still exceeds the BSP's two (2) to four (4) percent initial target (BSP, 2018). Meanwhile, the inflation rate in the China still manage to decrease ranging from 2.10 percent in January 31, 2023 to deflation of 30 percent.

In inflation rate of China from 1953 to 1984 is considered as most stable East Asia countries due to effective monetary policy. The stable prices of China had changed in 1984 due to liberalization of several price at the time when credit was expanding rapidly. The prices of goods increase by 7.4 percent, and it soared in 1988 with 18.50 percent. With this situation, the government of China was forced to tightened monetary conditions, reduced investment, thereby, its resulted to a decline in inflation by 1.4 percent in 1990 and 5.1 percent in 1991. In 1991, the economy of China heated up experiencing a 13.6 percent economic growth. This economic condition had cost a resumption of increase in inflation recording an alarming 24.1 percent inflation rate in 1994. This has caused the government of China to implement a reduction in credit expansion and investment was curtailed which resulted to a stabilization of inflation in China.

With this disparity between the price performance of the Philippines and other countries in SouthEast Asian Countries, this paper to seek a comparative on different Monetary and Fiscal Policy being implemented by Selected South East Asian Countries such as Philippines, Vietnam, Singapore, Malaysia, and Thailand and compared it to

China.

2. THEORETICAL FRAMEWORK

The foundation of this study is based on Static Stochastic Model using the Hicksian IS-LM Model. The HIcksian IS-LM Model depicted in figure 1 represented by series of equation were $Y = a_0 + a_1 r$ and $M = b_0 + b_1 Y + b_2 r$.

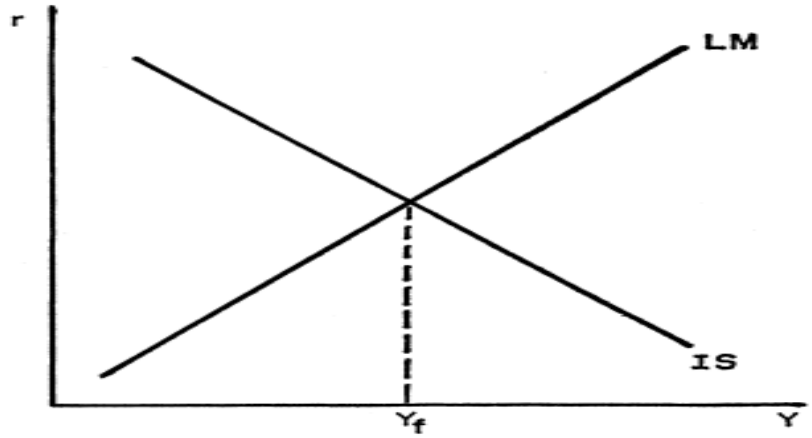

Figure 1: The Hicksian IS-LM Mode

The study used three important variables such as Y, M, and r. A country uses monetary policy by using Money (M) or Interest Rate (r) which serves as an instrument. This can be represented by the following equations:

$$Y = a_0 + a_1 r$$

$$M = b_0 + a_0 b_1 + (a_1 b_1 + b_2) r.$$

$$Y = (a_1 b_1 + b_2)^{-1} [a_0 b_2 + a_1 (M - b_0)]$$

$$r = (a_1 b_1 + b_2)^{-1} [M - b_0 - a_0 b_1].$$

The model also emphasizes that the increase in money demand results to lower money stock policy

Considerations involving an investment accelerator or a dependence of consumption on lagged income may produce a model such as

$$Y_t = a_0 + a_1 r_t + S_1 Y_{t-1} + S_2 Y_{t-2} + u_t$$

The Friedman model has argued that a successful active policy is can not be attained given enough knowledge of the current status. It also emphasized that a country would better off to have steady state money growth in different conditions and its is called "passive" policy.

Moreover, the quantity theory of money emphasizes that if we obtained increasing output and keeping the velocity on constant, a country should increase supply of money to maintain the lower price level. Moreover, the money supply increase should be compensated with the increase in output.

If the quantity of money can be prevented from increasing significantly them inflation can be prevented (Eatwell, J., Milgate, M. and Newman, P., 1987).

Further, if the growth rate of real GDP varies is coupled with the same rate of money supply then means that price level will remain constant. However, if a country allows money supply growth more than the increase in output growth then inflation will occur (Ajuzie et.al, 2008)

Since there is the tendency for money supply to grow faster than output growth rate, there would remain the perception of inflationary pressure and a hawkish pursuit of remedial measure(s) to stem its attendant economic "woes."

Meanwhile, Hall (1978), Flavin (1981), Mankiw and Shapiro (1986) resolved that Hall and Flavin's assumption of trend stationary at first difference that means that the current gross domestic product is positively related to the

lagged of gross domestic product.

Further, the McKinnon-Shaw hypothesis stated that the growth of the economy is dependent on the liberalization of domestic financial system, that is to allow banks to raise real interest rate to plausible market-clearing levels. This will result to positive relationship between real interest rate and GDP growth (Pill, 1997).

In terms of the relationship between interest rates and money supply, the Fisher equation views the relationship either negative or positive relationship. According to liquidity effect view of Fisher equation, demand for money has a decreasing function to that of nominal r since r is treated to liquidity of the company

The interest rate causes the decrease in the money supply so that to sustain equilibrium in money market. The Fisher equation view stipulated that the money and interest rates are positively related, that is, the increase in interest rates requires an increase growth of money supply(Fisher 1896). The increase in inflation is associated with with increase in nominal interest rates and in the long run the increase in money supply causes higher inflation rate. The Fisher equation suggest to increase the growth rate of money to compensate the increase in interest rates (Monnet, 2001)

3. RESEARCH METHODOLOGY

3.1 Research Design

This study is quantitative in nature and used both univariate and multivariate analyses of quantitative research design. The univariate analysis of quantitative research design has the sole purpose of describing characteristics and behavior of a given variable using frequency distributions and averages (Babbie, 2011).

On the other hand, the simultaneous equation to determine the simultaneity between Money Supply, Interest Rate, Lag of Real Income, Real Income and Inflation Rate

3.2 Sources of Data

This study uses secondary data from different agencies and international institutions and organizations. The data will be from the government offices and departments where the needed data are readily available or to be requested if needed. The data to be collected will be during the years 2000-2022 to reflect enough the different to

This study will be collecting the documentary data of money supply, interest rate, gross domestic product, and inflation rate from Bangko Sentral ng Pilipinas, National Economic Development Authority, and Philippine Statistical Authority.

3.3 Statistical Treatment

The Regression Models

To find out the simultaneity between the fiscal and monetary policy in inflation targeting, this study utilized two models. One model anticipating that the real gross domestic product only can inflation in inflation while other model anticipate that there is strong linkage between monetary and fiscal policy and inflation rate.

Test for Instrument Validity

To test if the instrument is valid, it must pass two conditions: instrument is exogenous and instrument is relevant. The two conditions for a valid instrument are vital for instrument variables (IVs) regression. The F-test and Hausman Test were used to test if the instruments were valid. If the F-statistic is greater than 10, the variable is exogenous, which means that the error is not dependent on the instrument.

To test whether Y2 is uncorrelated with E1, the equation was estimated by ordinary least square (OLS). Hausman suggested comparing directly the OLS and two-stage least squares (TSLS) estimates to determine if the differences were statistically significant. Let the regression equation be

$$Y_1 = \beta_0 + \beta_1 Y_2 + \beta_2 X_1 + \beta_3 X_2 + \varepsilon_1$$

where X1 and X2 are exogenous and Y2 is suspected to be endogenous. If the OLS and TSLS estimates differ significantly, it is concluded that Y2 must be exogenous.

If the instrument satisfies the conditions of instrument relevance and exogeneity, then the coefficient β1 can be estimated using an IV estimator called two-stage least squares.

Test of Overidentification

In addition to the requirement that instrumental variables be correlated with the endogenous regressors, the instruments must also be uncorrelated with the structural error term. The Sargan Test of Overidentifying Restrictions is applied to check the validity of the instruments used in simultaneous equation model. If the model is overidentified, meaning that the number of additional instruments exceeds the number of endogenous regressors, then we can test whether the instruments are uncorrelated with the error term. If the model is just identified, then we cannot perform a test of overidentifying restrictions.

The Chi-square value can be used to test the null hypothesis that the instruments are valid and correctly excluded from the function. If the Chi-square test gives us a significant p-value, the study will reject the null hypothesis and conclude that the instruments are invalid. Otherwise, the study do not reject the null hypothesis.

Test of Endogeneity

To test the endogeneity of the model the Durbin-Wu-Hausman test was used. The null hypothesis of the Durbin-Wu-Hausman test is that the independent variables are exogenous in nature. The rejection of the null hypothesis indicates the presence of endogeneity.

Three-Stage Least Squares Model

Model 1: Gross Domestic Product and Inflation Rate

The three-stage least squares model uses instrument variables uncorrelated with the error term to estimate the model parameters. These IVs are correlated to the endogenous variables but not with the error term of the model.

In order to determine the effect of Monetary Policy to the inflation of the Philippines, the study used the Friedman-Meiselman model on monetary policy. Mathematically, the model is represented by the following:

$$\prod = \beta_0 + \beta_1 Y \quad (1)$$

$$Y_t = a_0 + a_1 r_t + SY_{t-1} + S_2 Y_{t-2} + u_t \quad (2)$$

$$M = b_0 + a_0 b_1 + (b_0 + a_0 b_1) r \quad (3)$$

The effect of the monetary policy to the level of price can be measured through simultaneous equations as represented by equation (1), (2), (3). In equation (1), the "tolerable" rate of price increase is dependent on the desired level of National income (Yt). This study extended the analysis to more complicated models in which there are lagged responses to the disturbances and policy actions in considerations involving an investment accelerator which represents the dependence of consumption on lagged income $SY_{t-1} + S_2 Y_{t-2}$ as shown in equation (2). The lagged income represent the active policy where it includes both predictable income changes through the influence of the lagged income terms and unpredictable income changes through the influence of the random terms, and so does represent, at least in part.

In this model the level of income is a random variable, and in general its probability distribution will depend on whether the money stock (Equation 3) or the interest rate (r in equation 2) is selected as the policy instrument. The model taken into account the relationship between turning points in money and income is variable due to the random terms u and v even though the partial effect of money on income does not have a variable lag.

Model 2: Gross Domestic Product, Money Supply and Inflation Rate

The three-stage least squares model uses instrument variables uncorrelated with the error term to estimate the model parameters. These IVs are correlated to the endogenous variables but not with the error term of the model.

In order to determine the effect of Monetary Policy and Fiscal Policy to the inflation of the Philippines, the study used the Friedman-Meiselman model on monetary policy. Mathematically, the model is represented by the following:

$$\prod = \beta_0 + \beta_1 Y + \beta_2 MS \quad (4)$$

$$Y_t = a_0 + a_1 r_t + SY_{t-1} + S_2 Y_{t-2} + u_t \quad (5)$$

$$M = b_0 + a_0 b_1 + (b_0 + a_0 b_1) r \quad (6)$$

Model 3: Gross Domestic Product, Interest Rate and Inflation Rate

The Instrumental Variable model uses instrument variables uncorrelated with the error term to estimate the model parameters. These IVs are correlated to the endogenous variables but not with the error term of the model.

In order to determine the effect of Monetary Policy and Fiscal Policy to the inflation of the Philippines, the study used the Friedman-Meiselman model on monetary policy. Mathematically, the model is represented by the following:

$$\prod = \beta_0 + \beta_1 LNY + \beta_2 r \quad (7)$$

$$r = b_0 + a_0 b_1 MS \quad (8)$$

Other Statistical Tests

Test of Correlation

To measure the correlation between variables, the Pearson Correlation Coefficient was employed. The formula is:

$$r = \frac{S_{xy}}{\sqrt{S_{xx} S_{yy}}}$$

The value of r close to unity in magnitude implies a good correlation or linear association between X and Y, whereas values near zero indicate little or no correlation.

Test of Significance of the Parameter Estimates

To test for the statistical significant of each regression coefficient, the t-ratio was used. If the computed t value exceeds the critical t-value at the chosen level of significance, reject the null hypothesis; otherwise, accept it.

$$t = \frac{\hat{\beta}}{se(\hat{\beta}_1)}$$

where:

t = Value of statistic
$\hat{\beta}_1$ = Standard error of the estimate
$\hat{\beta}$ = Estimated slope coefficient

Test for the Overall Significance of the Model: F – test

To test for the significance of the coefficients collectively, that is, testing the hypothesis of no relationship between Y and X, the F-statistic was employed. The formula is:

$$F_{k-1,n-k} = \frac{R^2/(k-1)}{(1-R^2)/(n-k)}$$

If the F-computed value exceeds the F-critical value, reject the null hypothesis; otherwise, accept it.

To test for the stationarity of panel unit root, the Levin, Lin, and Chu procedure was used. The test allows two-way fixed effects such as from unit specific fixed effect and unit specific time trend (Baltagi, 2005).

$$Yit = \alpha i + \rho Yi,t\text{-}1 + \Sigma\varphi\Delta Y\ i,t\text{-}1 + \delta t + \phi t + vit$$

Where the model allows two-way effects, one coming from unit specific fixed effects, αi, and the other from unit

specific time trends, ϕt.

To determine which model is appropriate, the pooled regression or the fixed effect model, the restricted F-test was used. The equation is:

$$F = \frac{(R^2_{UR} - R^2_R)/m}{(1 - R^2_{UR})/(n-k)}$$

dwhere:

R^2_{UR} = R^2 obtained from the unrestricted regression
R^2_R = R^2 obtained from the restricted regression
m = number of linear restrictions
k = number of parameters in the unrestricted regression
n = number of observations

If the F-value is significant, therefore, the restricted regression seems to be invalid.

Test of Overidentification

In addition to the requirement that instrumental variables be correlated with the endogenous regressors, the instruments must also be uncorrelated with the structural error term. If the model is overidentified, meaning that the number of additional instruments exceeds the number of endogenous regressors, then we can test whether the instruments are uncorrelated with the error term. If the model is just identified, then we cannot perform a test of overidentifying restrictions.

Test of Endogeneity

To test the endogeneity of the model the Durbin-Wu-Hausman test was used. The null hypothesis of the Durbin-Wu-Hausman test is that the independent variables are exogenous in nature. The rejection of the null hypothesis indicates the presence of endogeneity.

4. RESULTS AND DISCUSSIONS

4.1 Behavior of Philippine and China Inflation Rate

The Philippines emerged as a marginal exporter given the strong growth in the local economy that was driven primarily by the recovery of the agricultural and mining industry during the same period. The results of these events on the general price level were also mixed. Century-long deflation came to a halt during the trade shocks as a result of the increase in overall prices due to the pressures of a robust recovery.

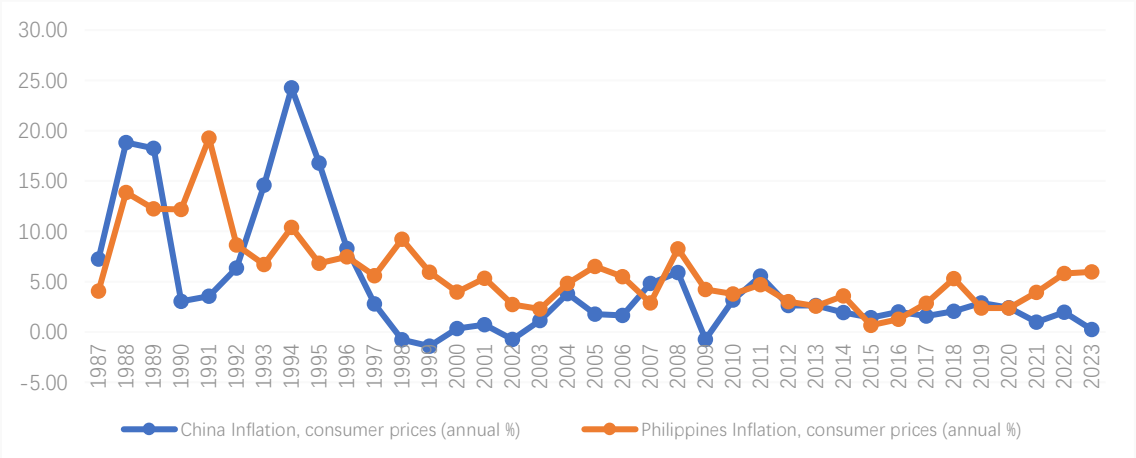

Figure 1: The Philippine Inflation Rate Versus China's Inflation Rate

4.2 The Relationship Between Philippine Real GDP and Inflation Rate

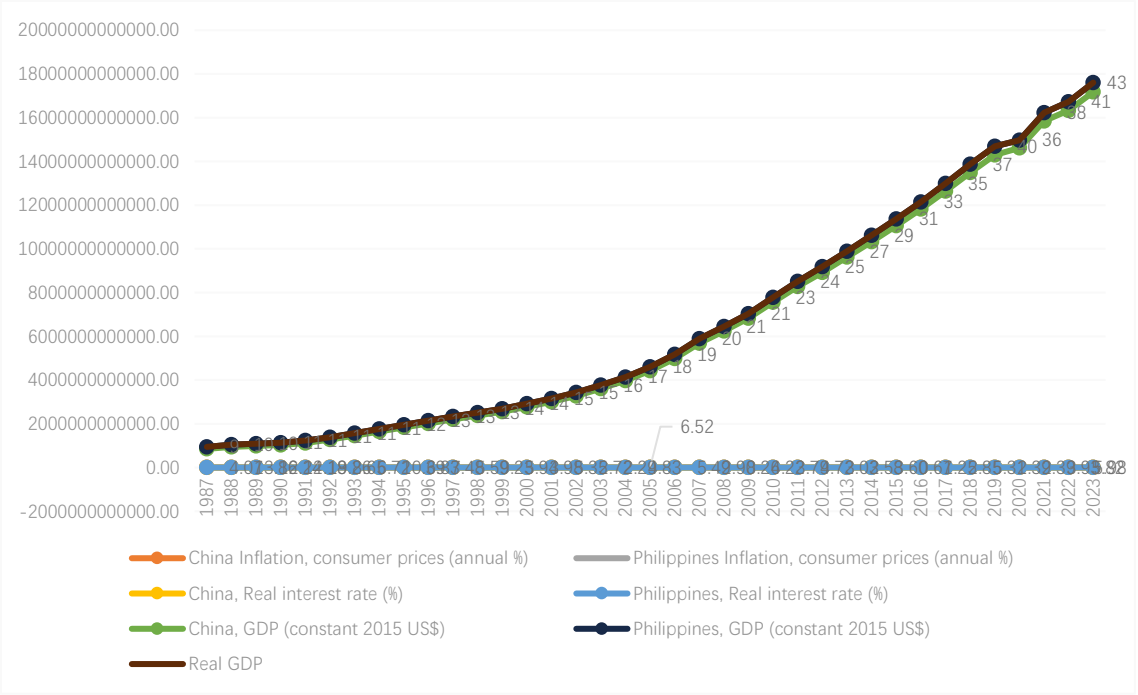

Figure 2: The Philippine Real GDP and Inflation Rate

Some simple arithmetic will help clarify. Start with the famous equation of exchange, MV = Pq, where M is the money supply; V is the velocity of money, that is, the speed at which money circulates; P is the price level; and q is the real output of the economy. If the growth rate of the economy increases, that is, if the growth rate of q increases, then, if the growth rates of M and V are held constant, the growth rate of the price level must fall. Since the growth rate of the price level is just another term for the inflation rate, the inflation rate must fall. An increase in the rate of economic growth means more goods for money to "chase," which puts downward pressure on the inflation rate. Assume, for illustrative purposes, that the money supply grows at 6 percent a year and velocity is constant. Then, if annual economic growth is 3 percent, inflation must be 3 percent. (Actually, inflation must be 2.9 percent, which is approximately 3 percent). If, however, economic growth rises to 4 percent, inflation falls to 2 percent. (Actually, it falls to 1.9 percent.)

4.3 The Relationship Between China's Real GDP and Inflation Rate

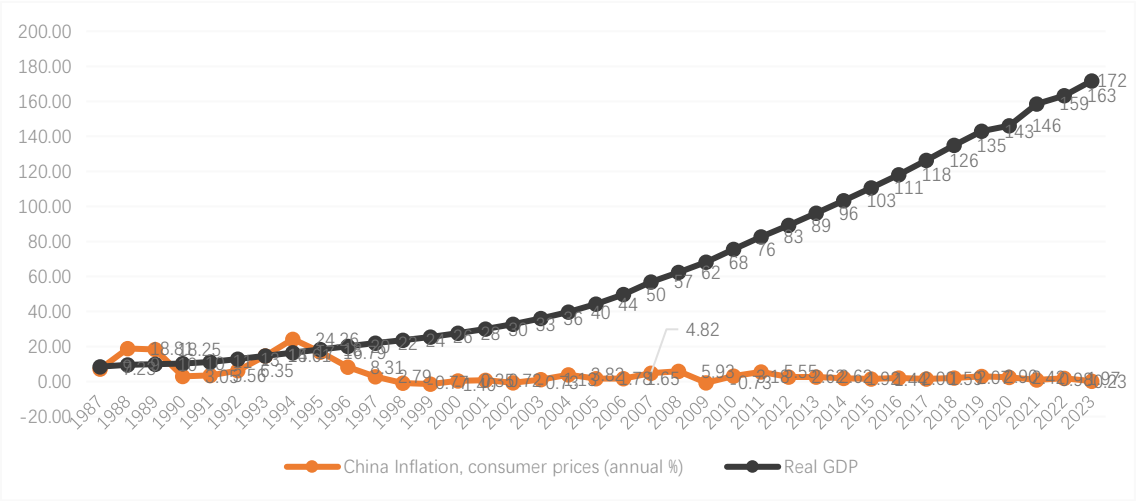

Figure 3: China's Real GDP and Inflation Rate

Over the past few decades, China's rapid economic expansion has often been accompanied by fluctuating inflationary pressures, influenced by both domestic factors and global trends. In a booming economy with rising real GDP, increased demand typically drives prices up, leading to higher inflation. However, China's experience

has shown a different pattern. While inflationary pressures were notable in the 19th century, the 20th century saw the country achieve both economic growth and price stability simultaneously, this is because of the effective implementation of monetary and fiscal policies (Figure 8).

From 1987 to 2023, the inflation and interest rates in the Philippines experienced significant fluctuations, while its Gross Domestic Product (GDP) steadily grew, apart from the downturn during the global pandemic. Price stability remains one of the country's challenges which is closely linked to volatility in interest rates.

4.4 The Simultaneity Relationship Between Philippine Interest Rate, Real RGDP and Inflation Rate

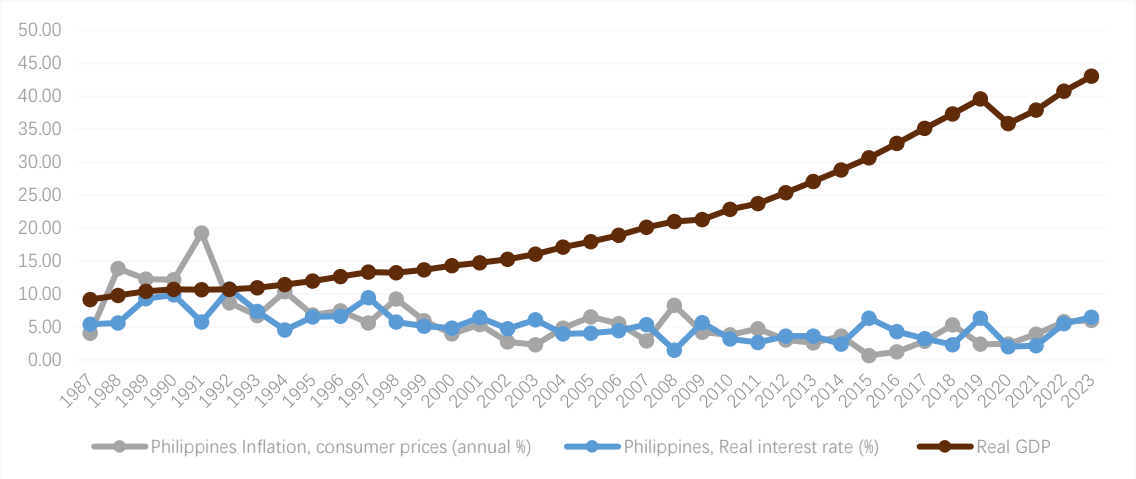

Figure 4: China's Real GDP and Inflation Rate

Based on the graph, a noticeable increase in inflation was recorded in year 1991 which is mainly attributed to challenges related to economic recovery of Aquino's administration that focuses on rebuilding democratic institutions after the fall of Ferdinand Marcos in 1986.

Over the years, the Philippines has experienced instability in inflation and interest rates due to several interconnected factors. These include external shocks, domestic economic policies, market conditions, and structural challenges within the economy. Interest rates, set by the Bangko Sentral ng Pilipinas (BSP), play a crucial role in influencing inflation and overall economic activity.

During the COVID-19 pandemic, inflation and interest rates in the Philippines were significantly influenced by the economic disruptions caused by the crisis. Early in the pandemic, inflation rates decreased due to reduced consumer demand and supply chain disruptions, although some sectors, particularly food, saw price increases. In response to the economic downturn, BSP implemented an expansionary monetary policy by cutting interest rates to stimulate economic activity. As the economy began to recover, inflationary pressures mounted due to increased demand and ongoing supply chain issues, prompting the BSP to carefully adjust interest rates to balance growth with inflation control. By 2023, the BSP began gradually increasing rates to address persistent inflation concerns while supporting continued economic recovery.

4.5 The Simultaneity Relationship Between China's Interest Rate, Real RGDP and Inflation Rate

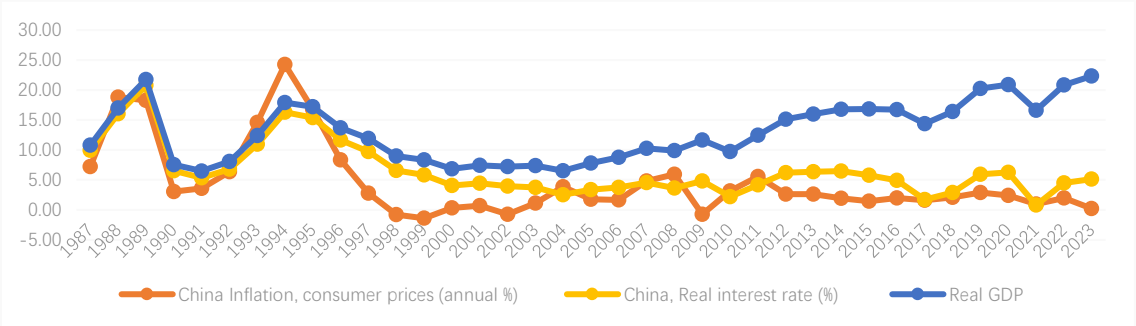

Figure 5: China's Real GDP and Inflation Rate

For instance, during the economic slowdown of 2015-2016, the People's Bank of China (PBOC) lowered interest rates to stimulate growth by making borrowing cheaper for businesses and consumers. In contrast, to control rising inflation in 2010-2011, particularly from increasing food and commodity prices, the PBOC raised interest rates to reduce consumer spending and borrowing, thereby easing inflationary pressures. In response to trade tensions with the United States in 2018-2019, the PBOC adjusted monetary policy by employing measures like targeted reserve requirement ratio reductions and liquidity injections, although it did not change benchmark rates directly. During the COVID-19 pandemic in 2020, the PBOC cut the one-year loan prime rate and reduced reserve requirement ratios to support economic recovery and lower borrowing costs amidst the pandemic's impact. Additionally, the PBOC's interest rate adjustments align with long-term structural goals, such as transitioning to a more consumption-driven economy and managing financial market risks, reflecting a strategic approach to maintaining macroeconomic stability and supporting economic development.

4.6 Comparison of Rate of Growth

This study further validate the quantity theory of money which emphasize that if output is increasing and velocity is constant, the money supply will have to increase to keep the price level from decreasing; and an increase in the money supply without an increase in output causes the price level to change by the same change in the money supply. In other words, output does not change, but when the money supply doubles, the price level also doubles.

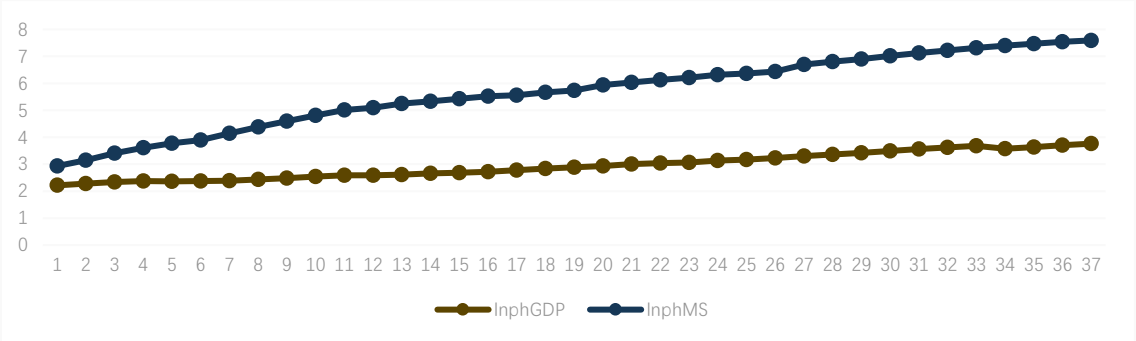

Figure 6: Philippine Growth of GDP versus Growth of Money Supply

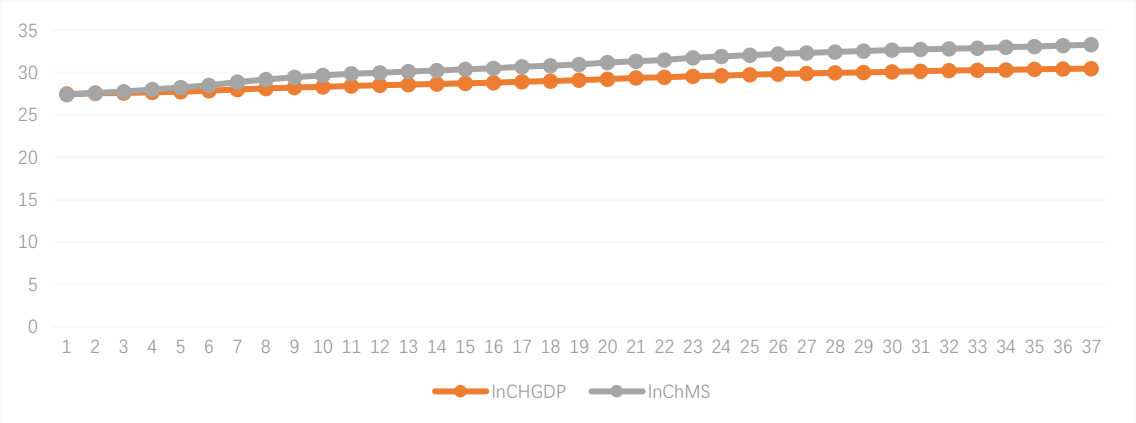

Figure 7: China's Growth of GDP versus Growth of Money Supply

5. RESULTS

5.1 Statistical Results

5.1.1 Correlation Between Money Supply, Inflation Rate and GDP

Figure shows the correlation matrix between the Real gross Domestic Product, Interest Rate, Money Supply and lagged of GDP. The statistical result shows that there is moderate significant negative linear relationship between GDP and inflation rate as reflect in correlation coefficient of -0.53 with p-value of 0.0007.

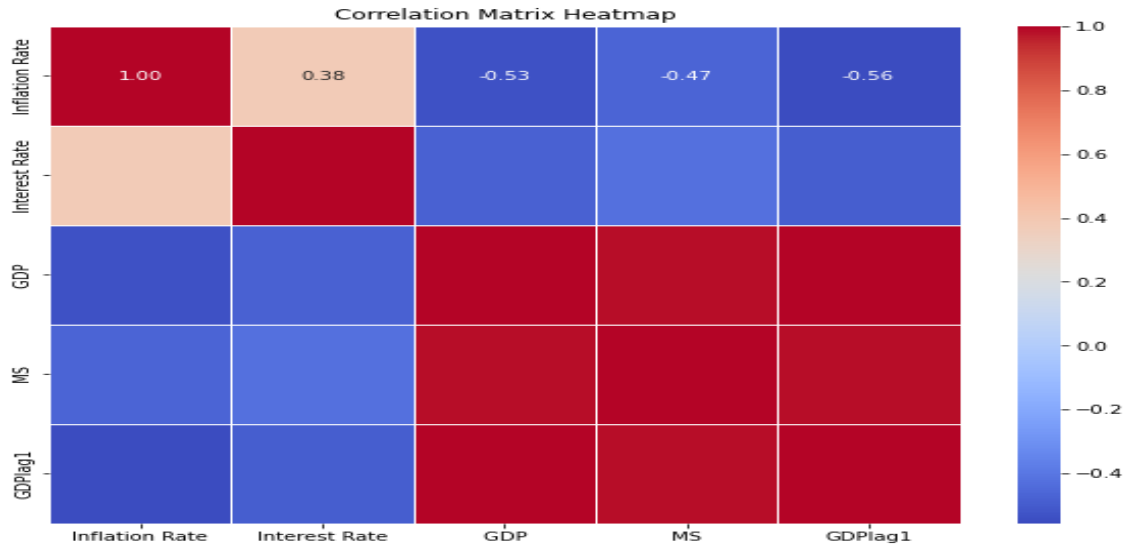

Figure 8: Correlation Matrix between Inflation Rate in the Case of the Philippines

Table 1: The Correlation Matrix

	GDP	Money Supply	Interest Rate	GDP Lag1
	p-values			
Inflation Rate	0.0007	0.0036	0.0218	0.0004

Moreover, the correlation matrix also shows that a moderate negative correlation between Money Supply and Inflation rate as reflected in the correlation coefficient of -0.47 with p-value of 0.0036.

Further, there is weak positive significant correlation between Interest Rate and Inflation rate as reflected in the correlation coefficient of 0.38 with p-value of 0.0218. Meanwhile, the correlation between lagged of GDP and Inflation rate is negative and significant. Thus, the Statement of Hypothesis Number 1 that there is no significant relationship between GDP and Money Supply is rejected

5.1.2 Correlation Between Money Supply, Inflation Rate and GDP in the case of China

Figure below shows the correlation matrix between the Real gross Domestic Product, Interest Rate, Money Supply and lagged of GDP. The statistical result shows that there is moderate significant negative linear relationship between GDP and inflation rate as reflect in correlation coefficient of -0.53 with p-value of 0.0007.

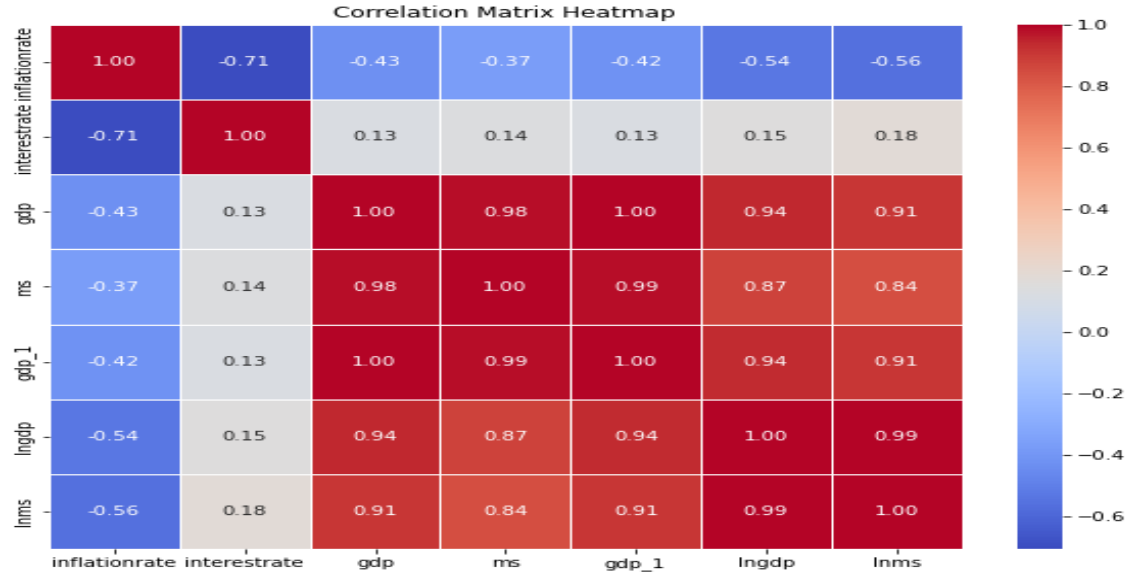

Figure 9: Correlation Matrix between Inflation Rate in the Case of the China

Table 2: The Correlation Matrix

	LNGDP	Money Supply	Interest Rate	GDP Lag1
	p-values			
Inflation Rate	0.0006	0.0003	0.0000	0.0115

Further the correlation matrix in the case of China also shows that a strong negative correlation between LN Money Supply and Inflation rate as reflected in the correlation coefficient of -0.71 with p-value of 0.0036. This means as interest rate increases the inflation decreases

Further, there is moderate significant negative correlation between lnGDP and Inflation rate as reflected in the correlation coefficient of 0.54 with p-value of 0.0006. Meanwhile, the correlation between lagged of GDP and Inflation rate is negative and significant. Thus, the Statement of Hypothesis Number 1 that there is no significant relationship between GDP and Interest rate is rejected

5.2 Regression Results

5.2.1 Instrument Validity Test

To test if the instrument is valid, it must pass two conditions: instrument is exogenous and instrument is relevant. The two conditions for a valid instrument are vital for instrument variables (IVs) regression. The F-test and Hausman Test were used to test if the instruments were valid. If the F-statistic is greater than 10, the variable is exogenous, which means that the error is not dependent on the instrument.

Table 3: The First Stage Regression

```
First-stage regressions
-----------------------

      Source |       SS       df       MS              Number of obs =      36
-------------+------------------------------           F(  2,    33) =   37.82
       Model |  367.74543      2  183.872715            Prob > F      =  0.0000
    Residual |  160.439571    33  4.86180519            R-squared     =  0.6962
-------------+------------------------------           Adj R-squared =  0.6778
       Total |  528.185001    35      15.091            Root MSE      =   2.205
```

Since the computed F-value of 37.82 is greater than 10 then the chosen instrument is exogenous and valid. This means that the identified instrument can be used as exogenous variable of endogenous variables.

Test of Overidentification

In addition to the requirement that instrumental variables be correlated with the endogenous regressors, the instruments must also be uncorrelated with the structural error term. If the model is overidentified, meaning that the number of additional instruments exceeds the number of endogenous regressors, then we can test whether the instruments are uncorrelated with the error term. If the model is just identified, then we cannot perform a test of overidentifying restrictions

Table 4: The Test of Overidentification

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. estat overid

  Tests of overidentifying restrictions:

  Sargan (score) chi2(1) =  1.10105  (p = 0.2940)
  Basmann chi2(1)        =  1.00959  (p = 0.3150)
```

The statistical results revealed that this study reject do not reject the null hypothesis that the instrument is valid, thus, we can use the instrument in estimating the simultaneous relationship between variables.

Test of Endogeneity

To test the endogeneity of the model the Durbin-Wu-Hausman test was used. The null hypothesis of the Durbin-Wu-Hausman test is that the independent variables are exogenous in nature. The rejection of the null hypothesis indicates the presence of endogeneity.

```
Tests of endogeneity
Ho: variables are exogenous

Durbin (score) chi2(1)          =  1.67877  (p = 0.1951)
Wu-Hausman F(1,32)              =  1.56523  (p = 0.2200)
```

The statistical result revealed that this study do not reject the null hypothesis the independent variables are exogenous in nature

5.2.2 The Two Models of Inflation rate

To answer the Statement of the Problem Number 2, Is there a significant relationship between the percentage change in GDP and inflation rate, as conditioned by the lagged of GDP and Interest Rate and Money Supply, the Two Stage Least Square was employed.

The study made a comparison of two models which are as follows: (1) The factor that consider as determinant of inflation is solely the expansionary fiscal policy implemented through expansion of GDP measured through GDP growth. Simultaneously, the GDP growth which is dependent on previous economic performance represented by the lagged of GDP, and Interest Rate simultaneously Money Supply as determinant of Interest Rate; (2) The second model is the combination of fiscal and monetary policy through GDP growth and Money Supply as factor that influences the inflation rate. In this model, it also assumed that the GDP growth is endogenous to the lagged of GDP and interest rate, while the interest is considered is being affected by the Money Supply.

In model 1, the regression results revealed that there is significant relationship between inflation rate and percentage change of GDP. Thus, one percentage change in the GDP results to a decrease in inflation rate by 5.34 percentage point. The result of the study is consistent with the findings of the study of Mallik and Chowburry (2011), Ramazan , E., Tuzun, O., and Fatih, C. (2020), Barro (1991), Fischer (1993), Bullard and Keating (1995), Ghosh and Philips (1998), Fabayo and Ajilore (2006), and Wang (2008) indicates that there is strong positive relationship between economic growth and inflation rate. Thus, the null hypothesis which state that there is no significant relationship between inflation rate and gross domestic product is rejected.

In model 2, the regression result revealed that there is significant relationship between inflation rate and percentage change of GDP and percentage of Money Supply. Thus, one percentage change in the GDP results in an increase in inflation rate by 12.91664 percentage point. The findings of the study is back up by the result of the studies of Nguyen and Hoang (2022), Madurapperuma (2023), Maune et.al (202), Beja (2007), Ali (2016), He (2017), and Sultana et. Al (2019) where their studies found out that there a strong evidence of the relationship between money supply and inflation rate. Their studies found that money supply does not affect the inflation in short-run and this is not true in vice-versa.

Table 5: Regression Results of Philippine Inflation Model

Model 1: Inflation Rate - LNGDP			
	Coefficient	p-value	R2
Third Stage: Dependent Variable – Inflation Rate			
LNGDP	-5.34227	0.000	
Second Stage: Dependent Variable - LnGDP			
Lagged GDP	1.0127	0.000	0.4267
Interest Rate	0.00103	0.000	
Third Stage: Dependent Variable- Interest Rate			
Ln Money Supply	-1.1199	0.000	
Model 2: Inflation Rate- LNGDP and LNMS			
	z-value	p-value	R2
Third Stage: Dependent Variable – Inflation Rate			

LNGDP	12.9166	0.000	
LNMS	-6.90558	0.000	
Second Stage: Dependent Variable – LnGDP			
Lagged GDP	1.0133	0.000	
Interest Rate	0.0072	0.764	0.6784
Third Stage: Dependent Variable- Interest Rate			
Ln Money Supply	11.502	0.000	
Model 3: Inflation Rate- LNGDP and INTEREST			
	z-value	p-value	R2
Third Stage: Dependent Variable – Inflation Rate			.57
LNGDP	4.98	0.000	
Interest Rate	4.28	0.000	
Third Stage: Dependent Variable- Interest Rate			
Ln Money Supply	-0.0015	0.000	

In addition, an increase in inflation rate by one percent will result to a decrease in inflation by 6.90 percentage point. Simultaneously, the percentage change in GDP is being affected by the lagged of GDP and interest as reflected in the p-value of 0.000. This means that an increase in the lagged of GDP by one million results to an increase in GDP by 1.01 percent. Moreover, an increase in interest rate results to an increase in the GDP by 0.000727 percent. In addition, the Money Supply simultaneously affects the interest rate as reflected in the p-value of 0.000. This means that an increase in Money Supply in one percent results to a decrease in interest rate by 1.09 percentage point.

5.2.3 The comparison between the three Models of Inflation Rate

The study revealed that the model 2 is more preferred compared to model 1 since the R2 of 0.67 is higher compared to Model 1 R2 of 0.4267. This means that both the monetary and fiscal policy affect the inflation targeting. In the quantity theory of money, an economy's money supply and price level are inversely correlated (Friedman 1989). Friedman's stated that proposed a solution to the problems of inflation and short-run fluctuations in employment and real GNP was a so-called money-supply rule. If a country intend to lessen inflation, a county has to increase the money supply at the same rate as real GNP increased. The same result was yield by the study of Amisano and Fagan (2010) where they found out the impact of money supply on inflation in the case of United State of America. Furthermore, the study of Hassan (2012) found out that there is negative relationship between the money supply of Nigeria and inflation rate.

China's Inflation Model

The study revealed that the model 3 the most preferred model of inflation targeting which has the higher R2 of 0.7243. The coefficient also is higher compared to Model 1 R2 of 0.4267. This means that both the monetary as represented by interest rate and GDP growth affect the inflation targeting. In the quantity theory of money, an economy's money supply and price level are inversely correlated (Friedman 1989). Friedman's stated that proposed a solution to the problems of inflation and short-run fluctuations in employment and real GNP was a so-called money-supply rule.

Table 6: Regression Results of China's Inflation Model

Model 1: Inflation Rate - LNGDP			
	Coefficient	p-value	R2
Third Stage: Dependent Variable – Inflation Rate			
LNGDP	-3.53	0.000	
Second Stage: Dependent Variable - LnGDP			
Lagged GDP	0.00000000000087	0.000	0.2916
Interest Rate	0.9243	0.000	
Third Stage: Dependent Variable- Interest Rate			
Ln Money Supply	0.31584	0.000	
Model 2: Inflation Rate- LNGDP and LNMS			
	z-value	p-value	R2
Third Stage: Dependent Variable – Inflation Rate			0.34

LNGDP	17.93676	0.000	
LNMS	-11.75675	0.000	
Second Stage: Dependent Variable – LnGDP			
Lagged GDP	0.000000000000072	0.000	
Interest Rate	0.9229099	0.764	0.6784
Third Stage: Dependent Variable- Interest Rate			
Ln Money Supply	0.379485	0.000	
Model 3: Inflation Rate- LNGDP and Interest Rate			
	z-value	p-value	R2
Second Stage: Dependent Variable – Inflation Rate			
LNGDP	-1.5283	0.000	
LNMS	-3.4697	0.000	
First Stage: Dependent Variable – Interest Rate			-0.7243
Ln Money Supply	0.3160	0.000	

If a country intend to lessen inflation, a county has to increase the money supply at the same rate as real GNP increased. The same result was yield by the study of Amisano and Fagan (2010) where they found out the impact of money supply on inflation in the case of United State of America. Furthermore, the study of Hassan (2012) found out that there is negative relationship between the money supply of Nigeria and inflation rate.

6. CONCLUSIONS

Based on the findings generated from the data gathered, the study have come up with the following conclusions:

1) There is an existing linear relationship between inflation rate, gross domestic product, and money supply

2) The gross domestic product and money supply combinedly and significantly affects the inflation rate of the Philippines simultaneously with other variables such as lagged of gross domestic product, interest rates, and money supply.

3) The rate of increase in the money supply in the Philippines as not as much as the rate of increase in gross domestic product to offset the inflation rate in the Philippines

7. RECOMMENDATIONS

Based on the findings of the study, the paper recommends the following:

Inflation may eat into the spending power of income earners in the Philippines, which can cause a reduction in the demand for goods and services. Firms may also experience an increase in the cost of production, which they might pass on to consumers by selling products and providing services at a high price level. There are those who can afford inflation only until a certain threshold, after which further increases cause them to experience financial difficulties. Although it is difficult and costly to avoid inflation, individuals, firms, or the whole economy can adopt some strategies to protect themselves from the further impacts of inflation.

Short-term strategies: For individuals, inflation will generally result in a reduced standard of living. Proper budgeting can help individuals cope with inflation. It can outline what the individual or family will spend and what, therefore, must be earned to maintain the ongoing consumption level and lifestyle. For firms, rising costs will generally be imposed. Inflation hedging will provide firms with some protection from the rising costs associated with purchasing power.

Long-term strategies: In the long run, the performance of the economy is related to its potential output. The essence of the long-term strategy should be aimed at increasing the capacity or productivity of available resources. Diversification and innovation in the agricultural and non-agricultural sectors are long-term strategies that could increase output and dampen inflationary pressures. Increased coordination between different sectors and agencies will contribute to the implementation of an effective pricing strategy to increase output.

Policymakers should balance the development of non-agricultural sectors with the production of the agricultural

sector. More attention needs to be given to promoting import substitution industries that are less dependent on imported commodities to prevent cost-push inflation. The strategies should produce new productivity, increase efficiency, and enhance the inherent productivity of the economy, as well as increase employment.

The awareness, knowledge, and orientation of stakeholders could be key components of an effective inflation mitigation program. Therefore, reducing misconceptions through consumer education and public awareness campaigns is very important to foster informed decision-making. However, informing the public may not have an immediate impact on the cost of production and inflation rate; policy interventions need to be made to stabilize and eventually reduce the inflation rate through other policy mixes at the macro level. It is the responsibility of policymakers to manage the overall economy.

The Philippines is composed of a class CDE population that, when taken together, constitutes a "poverty trap"; the collapse of any one of these groups will act recessionary, as the damage to just one will suffice to produce low growth rates. Analysis of the Inflation Rate and Causes of Low Growth Rates in the Philippine Economy: To tackle this country crisis, effective collaboration among stakeholders is essentially needed to collect and analyze data and unify performance around terms of results.

The Philippines should increase the amount of money circulating in the economy as the same with the amount of increase in gross domes products in the Philippines.

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