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A study on the relationship between money supply and inflation in Vietnam from 2005 to 2021

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A B S T R A C T

The study examines the relationship between money supply and inflation in Vietnam in the period of 2005-2021. The relationship between money supply and inflation is addressed in economic theories and models and has been studied by many experts in different economies in different periods. To examine the relationship between money supply and inflation in Vietnam in the period of 2005-2021, the research team collected data on money supply and inflation rate, then analyzed this relationship during three periods of 2005-2011, 2012-2019 and 2019-2021. Next, the research team collected data on money supply (MS - total means of payment) and consumer price index (CPI), quarterly data from the first quarter of 2005 to the fourth quarter of 2021 and uses Eviews 8 software for analyzing. The research team uses a linear regression model to evaluate the impact of money supply growth (GMS) on consumer price index (CPI), a variable representing the inflation rate, of Vietnam during the research period. The model results support the view that money supply growth and past inflation are among the factors affecting inflation in Vietnam. From the research results and the actual money supply, the money supply growth rate as well as the inflation rate in Vietnam during the research period, the research team makes some policy recommendations to achieve the targets of supporting economic recovery, controlling inflation, stabilizing the macro-economy in Vietnam after the Covid-19 pandemic.

1. Introduction

The relationship between money supply and inflation is addressed in economic theories and models and has been studied by many experts in different economies in different periods. In Vietnam, during the period of 2005 - 2011, inflation tended to increase and fluctuate unpredictably. Inflation increased from single-digit to double-digit in 2008, 2011. In 2006, the inflation rate decreased slightly (Wilcox & Mishkin, 1990). Compared to 2005, however, when the State Bank of Vietnam implemented a loose monetary policy, the inflation expectations and a strong increase in the money supply in 2007 caused the inflation rate to grow at nearly 23.1% in 2008. In the following two years, 2009 and 2010, many macro policies were implemented to push the inflation rate down below 10%, however, the money supply was at a high level leading to an increase of inflation to 18.7% in 2011. The main reason for the escalating inflation in 2008, 2011 was the overheating growth of the money supply. From 2012 to now, the flexible management of monetary policy of the State Bank of Vietnam as well as the close coordination with fiscal policy have made an important contribution to realizing the goal of stabilizing the macro-economy, controlling inflation, and supporting economic growth. To examine the relationship between money supply and inflation in Vietnam for the period 2005 - 2021, the research team collects data on money supply (MS - total means of payment) and consumer price index (CPI) of Vietnam in the period of 2005 - 2021, with data series aggregated quarterly and analysed using Eviews 8. The research team uses a linear regression model to find empirical evidence on the relationship between money supply and inflation in Vietnam in the period of 2005-2021. In addition, because the collected data shows that the period 2008-2011 is marked with strong fluctuations in the data series, the research team adds 2 dummy

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variables to the model, and due to the effect of the lag of policy, the money supply growth rate is measured with a lag of 1. CPI of the previous quarter is also included in the model because the literature review shows that current inflation is dominated by past inflation. Research results show that money supply growth and past inflation are among the factors affecting inflation in Vietnam. From the analysis results, the research team proposes a number of recommendations to the State Bank of Vietnam in order to achieve the goals of stabilizing the macro-economy, controlling inflation, supporting economic growth and ensuring social security in the context that the Vietnamese economy and the world economy are facing difficulties caused by the Covid-19 pandemic.

2. Theoretical background on the relationship between money supply and inflation

Monetary theory is the most convincing explanation of the underlying origins of inflation. The basic idea of monetarist economists is that inflation is essentially a monetary phenomenon. Friedman and other modern monetarists have indicated a direct causal relationship between money supply and inflation: *"Inflation is always and everywhere a monetary phenomenon, in the sense that it is and can be produced only by a more rapid increase in the quantity of money than in output"* (Friedman, 1963, 1968, 1970). This conclusion is based on two things: First, economists argue that inflation is caused by an excess of aggregate demand relative to aggregate supply, and that the cause of this excess is too much money in circulation. Second, economists assume that the causal relationship stems from the effect of the money supply on the price level, not conversely. To understand that relationship, it is necessary to look at the domino effect. With the assumption of market equilibrium and starting from the equilibrium in the money market, an increase in the money supply will lead to an imbalance between the money supply and demand in the market. To re-establish the equilibrium, part of the excess is used to purchase goods and services. However, because the quantity of goods and services produced is limited due to the scarcity of resources in the economy, the aggregate supply is limited and cannot meet the aggregate demand, so there is an excessive demand in the commodity market. This will push prices up to establish a new equilibrium in the commodity market. In the aggregate demand and supply model, an increase in the money supply will lead to a rightward shift of the aggregate demand curve and an increase in the price level since the aggregate supply curve is vertical in the long run. (Vinh, 2015).

In Irving Fisher's equation of exchange, the relationship between money and prices is presented in the equation of the quantity of money M.V = P.Y, where M is the volume of currency traded, and V is the velocity of currency, P is the price level of the selected goods basket, and Y is the level of real income (output). According to monetarists, the velocity of money (V) is relatively stable over time. Therefore, when the money supply (M) grows faster than output (Y) inflation (P) occurs, the higher the growth of the money supply, the higher the inflation rate. In this view, monetary policy is the key to control inflation, the implementation of tight monetary policy will control the money supply, thereby controlling prices and inflation rate in the economy. Besides, a loose fiscal policy also affects inflation as it can cause a budget deficit and one of the measures to finance the budget deficit is to borrow money from central banks, leading to an increase in the money supply (Tung & Duong, 2019). However, empirical studies on the relationship between money supply and inflation have controversial results. While the study by Hung and Wade (2008) did not find a strong relation between money supply and prices, the research by Phu (2008) showed that an increase in money supply within four quarters has a great impact on price increase and although the effect varies from quarter to quarter, all results indicate that an increase in the money supply has an effect on an increase in price. The research by Gambetti et al. (2008) indicated the role of monetary policy in price stability and output volatility over time. Vo Tri Thanh (2000) found that the nominal money supply growth rate is highly significant in explaining volatility and forecasting inflation. Lan (2010) proved that when tight monetary policy is implemented, CPI is relatively sensitive and strongly responds to this move.

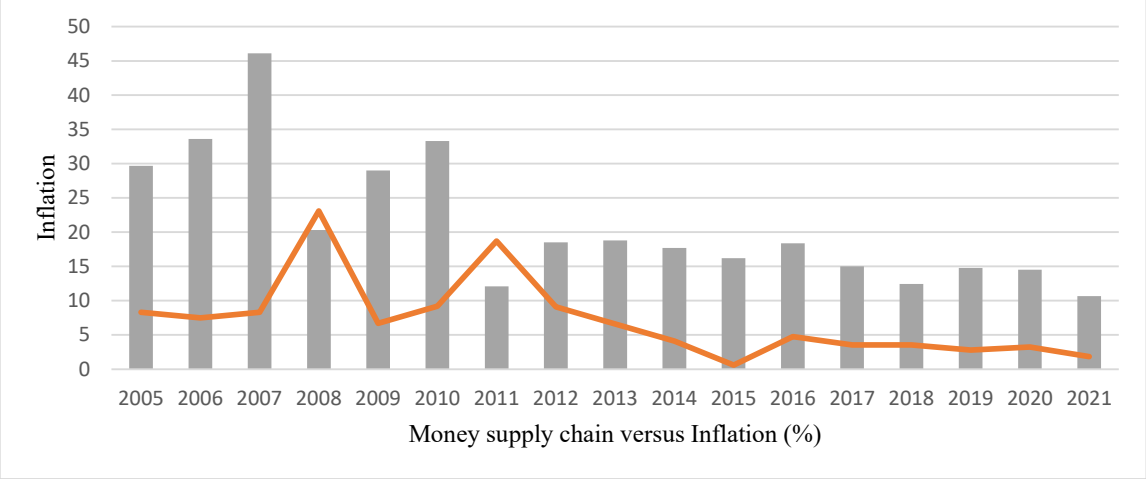
According to the monetary policy transmission mechanism of the European Central Bank (ECB) to the Eurozone, when the ECB tightens monetary policy, it will increase interest rates in the money market, reduce the amount of credit granted to the economy, push down asset prices (causing wealth effects and income effects), decrease domestic demand for goods and ease inflationary pressures. On the other hand, the price of imported goods during this period will decrease due to the appreciation of the domestic currency. Through the channel of inflation expectations, the rate of price increase will slow down and workers tend not to ask for a pay rise. Thus, with the decrease in prices and wages, the price of imported goods decreases, easing inflationary pressure in the economy. Some studies of Hang & Thanh (2010) and Anh (2019) indicated the relationship between past inflation and current inflation. In addition, the effect of money supply increase on the economy is not immediate, but policy lag. Policy lag is divided into inside and outside lags. Inside lag is the time for gathering information, processing information, and making decisions. The outside lag is the time for policy dissemination, implementation and for the policy to take effect (Tung & Duong, 2019). Therefore, many studies have considered the lag of variables affecting the dependent variable in the model.

3. Money supply and inflation in Vietnam

3.1 Period 2005-2011

In the Vietnamese economy, after a period of low and relatively stable inflation, in 2004 inflation increased to 9.5% for a number of reasons including the impact of rapid money supply increase and credit growth rate in the period of 1999-2003.

In 2006, inflation decreased slightly compared to 2004-2005. However, when the State Bank of Vietnam implemented the loose monetary policy along with inflation expectations, it led to an increase in real inflation in the next stage of the economic cycle. The loose monetary policy during this period is considered the main cause of high inflation. The average growth of money supply in the period of 2005 - 2011 was 29.2% while the average inflation rate was 11.7%. With a strong increase in money supply and credit growth in 2007, the inflation rate increased to nearly 23.1% in 2008. In 2009 and 2010, by the tight fiscal policy, the inflation rate fell below 10%, however, the money supply and credit growth were high, leading to an increase in inflation in 2011 at 18.7% (Fig. 1). The main cause leading to the escalating inflation in 2008, 2011 was the overheating growth of the currency.



Source: GSO, SBV

Fig. 1. Growth of total means of payment (Money Supply – MS) and inflation rate in Vietnam in the period 2005 - 2021

3.2 Period of 2012-2019

When inflation was controlled and gradually reduced, to support production and business, the State Bank of Vietnam adjusted down the operating interest rates, combined with money supply management to regulate liquidity, creating conditions for credit institutions to reduce interest rates. In the period of 2012-2019, with the flexible management of monetary policy by the State Bank of Vietnam towards macroeconomic stability, money supply growth was under control. On average during this period, money supply growth was at 16.5%/year, inflation was controlled at an average rate of 4.4%/year, the economic growth in this period saw signs of recovery, especially in 2018 and 2019, Vietnam's economic growth reached over 7%/year.

3.3 Period of 2020-2021

Covid-19 affects all socio-economic aspects, with negative impacts on economic growth, business activities, labour, employment and income. The government implemented the initiative, flexible monetary policy management solutions and banking activities to control inflation, stabilize the macro-economy; actively monitor the situation, focus all resources on removing difficulties for production and business, support people and businesses affected by the Covid-19 pandemic, thereby promoting economic recovery. The growth of money supply in 2020 reached 14.53% and 10.66% in 2021. The State Bank of Vietnam successfully controlled inflation at 3.23% in 2020, and 1.84% in 2021 with the economic growth of 2.12% and 2.58% respectively.

4. Data set series and research methodology

4.1 Data set series

To examine the relationship between money supply and inflation in Vietnam in the period of 2005 - 2021, the research team collects data on money supply (MS - total means of payment) and consumer price index (CPI). Data is collected quarterly from the first quarter of 2005 to the fourth quarter of 2021 with the number of observations of 68. Next, MS is seasonally adjusted according to the moving average method to ensure that it reflects the long-term trend of that variable. With the collected data and after adjusting according to the moving average method, the research team calculates the growth rate of money supply (GMS).

$$GMS^t = \frac{MS^t - MS^{t-1}}{MS^{t-1}} x100\%$$

In which:

GMS^t: Growth of money supply in the period *t*

MS^t: Money supply in the period *t*

MS^{t-1}: Money supply in the period *t-1*

In addition, the model uses two dummy variables, D1 and D2, because during the period of 2005-2021, before 2012, the economy witnessed macroeconomic instability, especially in 2008 and 20011.The variables D1 and D2 are set as follows:

$$D_1 = \begin{cases} 1 \; if \; observed \; before \; 2009 \\ 0 \; if \; observed \; in \; other \; period \end{cases}$$

$$D_2 = \begin{cases} 1 \; if \; observed \; in \; the \; period \; from \; 2009 \; to \; the \; end \; of \; 2012 \\ 0 \; if \; observed \; in \; other \; periods \end{cases}$$

GMS is logarithmized and coded LGMS. The collected, adjusted and logarithmized data is described in Table 1 using Eview8.

Table 1
Descriptive statistics of variables

	CPI	GMS	LGMS	D1	D2
Mean	128.1897	4.889308	1.519783	0.187500	0.250000
Median	141.8388	4.300015	1.458618	0.000000	0.000000
Maximum	172.8896	9.969123	2.299493	1.000000	1.000000
Minimum	63.22481	2.583646	0.949202	0.000000	0.000000
Std. Dev.	34.75707	1.918243	0.360469	0.393398	0.436436
Skewness	-0.541503	1.035479	0.516759	1.601282	1.154701
Kurtosis	1.945852	3.048147	2.277351	3.564103	2.333333
Jarque-Bera	6.091012	11.44316	4.241022	28.19899	15.40741
Probability	0.047572	0.003275	0.119970	0.000001	0.000451
Sum	8204.138	312.9157	97.26608	12.00000	16.00000
Sum Sq. Dev.	76107.41	231.8184	8.186084	9.750000	12.00000
Observations	64	64	64	64	64

4.2. Research methodology

The research team uses a linear regression model to assess the impact of money supply growth (GMS) on CPI (a representative variable of inflation rate) in Vietnam in the period 2005 – 2021 as follows:

$$CPI = C(1) + C(2) \times LGMS(-1) + C(3) \times CPI(-1) + C(4) \times D1 + C(5) \times D2 + e$$

with *e* as random noise.

The procedure is taken as follows:

Step 1: Use Eviews 8 software to run the model with collected secondary data.

Step 2: Check the statistical significance of the regression coefficients with the explanatory variables and the statistical significance of the regression model with significance level α=5%.

A regression coefficient is statistically significant if:

- Prob < α=5%

- Prob(F-statistic) < α=5%

Step 3: Check the explainability of the model through the coefficients R–squared and Adjusted R–squared

A model is explanatory (fit) if:

- R–squared > 0.6

- Adjusted R–squared > 0.6

Step 4: Check the model's defects with α=5%.

A model is good (*can be used for analysis*) when the regression coefficients in the model are statistically significant, and the R–squared, Adjusted R–squared should not have autocorrelation and heteroskedasticity. At the same time, the residuals of the model should follow the standard normal distribution.

In the study, the authors used tools on Eviews 8 to check for these defects. Specifically:

- Breusch-Godfrey test to check autocorrelation. The model does not have an autocorrelation defect at some level p if Prob (F-statistic) and Prob (Obs *R-squared) > α=5%.
- Breusch-Pagan-Godfrey to test heteroskedasticity. The model is not subject to heteroskedasticity if Prob (F-statistic) and Prob (Obs*Chi-squared) > α=5%.
- Jarque - Bera to check if the residuals of the model follow the standard normal distribution. The residuals of the model are normally distributed if Prob (Jarque - Bera) > 5%.

When the above conditions are satisfied, the model results are estimated and analyzed.

5. Testing the relationship between money supply chain and inflation

The econometric model is used to examine the impact of MS on inflation in Vietnam during the period of 2005-2021, the data is collected quarterly and adjusted and logarithmized, and the results are shown in Table 2.

Table 2
Impact of money supply growth on CPI in Vietnam during 2005 – 2021

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LGMS(-1)	5.057072	1.426838	3.54425	0.0008
CPI(-1)	1.081573	0.027128	39.86867	0.0000
D1	4.334174	1.648186	2.629664	0.0109
D2	3.840744	1.066665	3.600702	0.0007
C	-18.13317	5.771452	-3.141874	0.0026
R-squared	0.997914	Mean dependent var		129.2208
Adjusted R-squared	0.997771	S.D. dependent var		34.03508
S.E. of regression	1.607007	Akaike info criterion		3.862663
Sum squared resid	149.7834	Schwarz criterion		4.032753
Log likelihood	-116.6739	Hannan-Quinn criteria		3.92956
F-statistic	6938.138	Durbin-Watson stat		1.520448
Prob(F-statistic)	0.0000			

4.3 Testing model fit

The results in Table 2 show that the regression coefficients are all statistically significant because Prob(C(i)) = 0.00026 < 0.05; The regression model is fit because Prob (F-statistic) = 0.000000 < 0.05;

The coefficient of determination R-squared = 0.997914 > 0.6; Adjusted R–squared =0.997771> 0.6

The model does not have autocorrelation defects.

Table 3
Breusch–Godfrey Serial Correlation LM Test with lags = 2

F-statistic	2.295740	Prob. F(2,56)	0.1101
Obs×R-squared	4.773992	Prob. Chi-Square (2)	0.0919

Source: Model results

According to the results of Table 3, Prob.F (2.56) = 0.1101 > 0.05; Prob. Chi–Square (2) = 0.0919 > 0.05.

The model does not have heteroskedasticity.

Table 4
Heteroskedasticity Test: Breusch-Pagan-Godfrey

F-statistic	2.130187	Prob. F(4,58)	0.0885
Obs×R-squared	8.069769	Prob. Chi-Square(4)	0.0891

Source: Model results

According to Table 4, Prob. F (2.58) = 0.0885 > 0.05; Prob. Chi–Square(4) = 0.0891 > 0.05.

- Model residuals follow the standard normal distribution Prob (Jarque - Bera) = 0.349145 > 0.05 (Fig. 2).

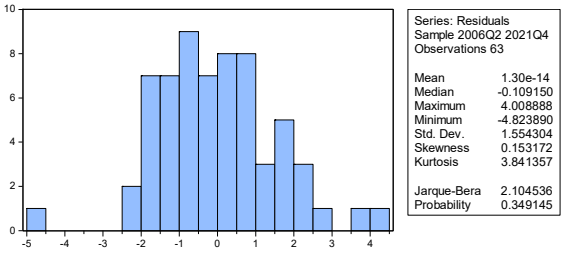


Fig. 2. Normal distribution residuals

4.4 Regression model and analysis of the model's results

The results of data analysis using Eviews 8 in Table 2 show the impact of money supply growth on inflation in Vietnam in the period of 2005 - 2021 with quarterly data series with the following regression model:

*CPI = -18.1331739069 + 5.05707168886*LGMS (-1) + 1.08157288546*CPI (-1) + 4.33417367755*D1 + 3.84074440045*D2*

The results of the regression model present

+ Inflation is affected by the growth rate of money supply over time, specifically C(2) = 5.05707168886 > 0. Thus, while other factors remain constant; an increase in money supply will make inflation increase. When money supply increases by 1% in the previous quarter, CPI will increase by 5.0571%. Thus, the growth rate of money supply and inflation have a positive relationship, which is consistent with economic theory and the results of many empirical studies that have been reviewed by the research team and the case of the economy in Vietnam.

+ Current CPI is affected by past CPI, specifically C(3) = 1.08157288546 > 0. Thus, while other factors remain constant, an increase in past CPI will lead to a rise in the current CPI. When the previous quarter's CPI increases by 1%, the current CPI will increase by 1.0816%. Thus, once inflation occurs, it will create a tendency to increase prices over time, which is consistent with the theory of expected inflation and the results of some previous empirical studies.

+ C(4) = 4.334174 is the difference of CPI in the period 2005Q1-2008Q4 compared with the period 2009Q1-2021Q4 when other factors remain constant.

+ C(5) = 3.840744 is the difference of CPI in the period 2009Q1-2012Q4 compared with the period 2005Q1-2008Q4 and period 2013Q1-2021Q4 when other factors remain constant.

+ R-squared = 0.997914, so the model explains 99.7914% of the variation of CPI.

5. Conclusion and discussion

The researchers use a linear regression model to assess the impact of money supply growth on Vietnam's inflation in the period of 2005 - 2021. Quarterly data from the first quarter of 2005 to the fourth quarter of 2021 is collected for analysis. The model results support the view that money supply growth and past inflation are the determinants of inflation in Vietnam.

Vietnam and the world have just experienced a difficult period when the Covid-19 pandemic caused a global economic shock. The world economic outlook in 2022 is mixed with opportunities and challenges; IMF (October 2021) forecasted that the world economy will recover at a rate of 4.9%. Accompanying the economic recovery are risks of inflation, increase in prices of essential commodities, complicated fluctuations of the global financial and monetary markets; therefore, the money supply reduction and interest rate increase will be the main trends of 2022. The IMF warns of the risk of global inflation in 2022 and recommends countries be cautious, not losing their price stability results. (Monetary Policy Department, 2022). Vietnam is a modest economy with great openness, and strong dependence on the world economy, so it may be affected by the above global trends. Currently, the factors that increase the pressure on the price level are mainly fluctuations in the prices of raw materials and inputs in the world, high transportation and logistics costs, which have affected the prices of animal feed and fertilizer, building materials (iron, steel); especially fuel such as gasoline, liquefied petroleum gas, due to high prices when the general demand in the world increases. Cost-push inflation is the major concern in the near future in Vietnam. Therefore, managers need to pay attention to the management of monetary indicators to control inflation at a reasonable level, and the achievement of the target inflation is not only beneficial in the current year but also the following year. The increase in money supply also needs examining, as the money supply growth rate should be stable so as not to trigger inflation. These are the difficulties facing the monetary policy management in the current period of the State Bank of Vietnam. Therefore, it is essential to maintain solutions and policies to support economic recovery but also monitor inflation risks. In 2022, the State Bank of Vietnam should manage the monetary policy proactively and flexibly with close coordination with fiscal policy and other macro policies to assist economic recovery, as well as inflation control and macroeconomic stability.

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