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The Impact of Monetary Policy on Systemic Risk in Vietnam

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Abstract

This study examines the impact of monetary policy on controlling inflation (2010–2012), economic stability, and development (2013-2020) on the systemic risk of Vietnamese financial institutions. The data was retrieved from the Vietnamese stock market, specifically relating to 29 listed financial firms (commercial banks, insurance firms, and securities companies) for 11 years (2010–2020). The analysis consists of two steps, including a systemic risk measurement in Vietnam based on the Marginal Expected Shortfall (MES) method and employing a Vector Autoregressive model (VAR Model) for investigating the effect of monetary policy and Vietnam's systemic risk. We find the impact of monetary policy on systemic risk when the combination of money supply and interest rates leads to a more pronounced effect than when only one of two measures is implemented. On the other hand, the impact of an expansionary monetary policy on systemic risk is almost negligible in the average period.

Keywords: financial firms, monetary policy, systemic risk

1. Introduction

Studies in macroeconomics and the financial system have made significant progress over the years in explaining financial system vulnerability. Specific mention can be made of a series of studies related to the 2008 financial crisis and studies on the potential role of monetary policy in causing an undesirable accumulation of systemic risk. The 2008 financial crisis showed several outstanding issues: the global imbalances in trade and capital flows, the interconnection of institutions in the financial system, and gaps in macroeconomic regulations.

The relationship between imbalances and the financial crisis has received particular attention from scholars. Bernanke (2009) states, "It is impossible to understand this crisis without reference to the global imbalances in trade and capital flows that began in the latter half of the 1990s." Obstfeld and Rogoff (2009), Borio and Disyatat (2010), and Acharya and Schnabl (2010) provide the following similar explanations: these imbalances were the result of a chronic lack of saving relative to investment in the United States and other industrialized nations and an exceptional surge in saving relative to investment in certain emerging market nations. Rapid economic growth in East Asian economies with high rates of saving, accompanied, outside of China, by declining investment rates, significant accumulations of foreign exchange reserves in some emerging markets, and substantial increases in revenues from oil and other commodity exporters all contributed to excess saving in the emerging world. Finally, both the rise in global saving and the growth of global imbalances in the late 2000s were caused by monetary easing (Obstfeld & Rogoff, 2009).

The collapse of Lehman Brothers caused a severe financial crisis in the United States, which quickly spread to global financial markets and impacted most other economies. Acharya et al. (2017) showed a link between institutions in the financial system and the impact of the financial crisis on the economy. Adrian and Brunnermeier (2016) make a similar point, the authors argue that the increased risk of spillovers through the network of institutions is due to the linkage between the assets of financial institutions created by the development of the financial system and globalization. Zhou et al. (2020) demonstrate that a single financial institution's failure can destabilize the financial system. Linkages between financial institutions can increase the efficiency of the financial system because they facilitate the efficient distribution of system liquidity and risk sharing. However, linkages are a significant source of systemic externalities.

The crisis showed shortcomings in traditional macroeconomic regulations, which failed to recognize and avoid crises promptly. Reality shows financial system hazards can still exist when finance firms meet safety standards. Given that microprudential restrictions for individual firms are required but insufficient for financial stability or credit risk response, the financial crisis has necessitated macroprudential regulations by the central bank to execute monetary policy following the economic situation. Microsafety regulations like the Basel I, II, and III capital accords focus on individual financial institutions, ignoring systemic concerns and some micro-security regulations. Macroprudential rules aim to reduce externalities or assure system security. According to De Nicoló et al. (2012, p. 10), macroprudential regulations should be seen "as a tool to correct externalities that create systemic risk."

The European Central Bank (ECB, 2009, p. 134) defines systemic risk broadly as risk "that financial instability becomes so widespread that it impairs the functioning of a financial system to the point where economic growth and welfare suffer materially." According to Acharya et al. (2017), the external factor that creates risk is the tendency of financial institutions to be undercapitalized when the entire financial system is undercapitalized. Systemic risk can be examined from a variety of perspectives. Some studies examine systemic risk at the level of the market (e.g., Bhansali et al., 2008; Rodriguez-Moreno & Peña, 2013), while the majority of studies examine individual institutions (e.g., Adrian & Brunnermeier, 2016; Brownlees & Engle, 2017; Acharya et al., 2017). In the context of the current unstable economy and financial system, these two matters require extensive consideration. This study aims to contribute to the empirical evidence on systemic risk, taking into account the systemic risk of the financial system as a whole.

After the 2008 financial crisis, systemic risk in the form of a severe economic crisis and spillover effects on the real economy could adversely affect countries' central banks in pursuing objectives; meanwhile, the main objective of monetary policy is price stability. However, supposing that macroprudential regulations fail to reduce the formation of systemic risk and its undesirable effects on prices and the economy's stability, the systemic risk can affect the objective of monetary policy.

Taylor (2009) states that the Federal Reserve has kept interest rates "too low for too long," thus contributing to the formation of the US housing bubble in 2007–2009. On the other hand, Bernanke (2010) and Greenspan (2010) defend the US policy stance in the run-up to the crisis as justified by downside risks to inflation. The role of monetary policy in ensuring financial stability is again the subject of hot debate. Borio and Zhu (2012) proposed the transmission of the monetary policy–

risk-taking channel, arguing that low-interest rates enhance risk-taking in the financial sector through the following mechanisms: the "seeking profit," low-interest rates can encourage investors to accept higher risks; the way banks measure risk; the behavior of banks and investors when interest rates are maintained at low levels for a long time; and when banks expand credit and increase investment, consequently promoting the relationship between monetary policy and the increases in systemic risk.

In Vietnam, several studies have recently related to systemic risk (e.g., Nguyen et al., 2019; Van & Tran, 2019). However, these studies approach systemic risk for the banking system or listed companies. No studies approach systemic risk from the perspective of the risk of the organizations that make up the system. Regarding the critical role of monetary policy, many studies have been carried out, such as Le and Pfau (2009), Bhattacharya (2014), Van Hai and Trang (2015), and Ha and Quyen (2018). Studies show that monetary policy plays a vital role in Vietnam's economy. General research on the impact of monetary policy on systemic risk in Vietnam still needs to be undertaken.

According to the Report of the Economic Committee of the National Assembly (2012), the financial system of Vietnam after the crisis period was assessed as underdeveloped and containing many risks. History shows that the financial crisis from 2008 and internal problems caused inflation to spiral to nearly 20% in 2008 and remained in double digits in 2010 and 2011. The government has now implemented measures to control inflation and maintain macroeconomic stability. This study aims to examine the impact of monetary policy on controlling inflation (2010–2012), economic stability, and development (2013–2020) and the systemic risk of financial institutions in Vietnam. Some papers (Blommestein et al., 2011; Taylor, 2013) indicate that monetary policies aimed at reducing the damage of the current crisis can "seed" a future financial crisis. The question arises as to whether central bank interventions can effectively limit systemic risk in Vietnam. This study will supplement empirical evidence on the impact of monetary policy on the systemic risk of financial institutions in Vietnam after the financial crisis.

Researchers believe that monetary policy plays a vital role in the economy and stabilizes the financial system. Specifically, central banks use monetary policy interventions to stimulate the economy during a recession or to control inflation during periods of high economic growth. Meanwhile, credit risk takes the form of a severe financial crisis and spillover effects on the real economy that could adversely affect the ability of central banks to pursue their goals. If macroprudential regulations do not reduce risk formation, then prices and output risks will undoubtedly become a concern of monetary policy. On the other hand, if monetary policy is successful in curbing macroeconomic volatility, it may lead financial market participants to accept unsustainable risks, thus increasing systemic risk even though it has stabilized (Borio & Lowe, 2002; Borio & White, 2004). Therefore, the objectives and strategies of monetary policy can affect the risk of loss. In some cases, a central bank may be forced to accept higher macroeconomic volatility in the short term operating for medium-term financial market stability.

1. Theoretical Background

According to Taylor (2009), expansionary monetary policy was one of the reasons for the increase in systemic risk leading to the 2008 financial crisis. He argued that the Federal Reserve kept interest rates "too low for too long," thus contributing to the formation of the US housing bubble. Rajan (2006) proposed the theory of a "risk-taking channel" of monetary policy, through which lower interest rates led to higher risk-taking by financial institutions. Borio and Zhu (2012) elucidate the link between monetary policy and systemic risk in financial markets. The authors define the risk-taking channel as "the link between monetary policy and the perception and pricing of risk by economic agents." On the other hand, Mishkin (1994) proposed the theory of information asymmetry of a financial crisis, which argues that rising interest rates are one of the leading causes of the financial crisis; asymmetric information and, in particular, the problem of adverse selection can lead to credit constraints, and a higher interest rate exacerbates the problem of adverse selection; financial markets are therefore unable to efficiently allocate funds to individuals and businesses with the most productive investment opportunities. Economists argue that high interest rates mean tight monetary policy in the short run (McCallum, 1999) and assert that tight monetary policy inevitably leads to macroeconomic risks and can lead to a recession (Mishkin, 2009).

The impact of monetary policy on systemic risk has been discussed through several studies, such as Altunbasa et al. (2014), Jiménez et al. (2014), Buch et al. (2014), Angeloni et al. (2015), Gang and Qian (2015), Deev and Hodula (2016), Neuenkirch and Nöckel (2018), Colletaz et al. (2018), Sabri et al. (2019), Laséen et al. (2017), Zhang et al. (2020), and Kabundi and De Simone (2020). These studies support the view that continuous loosening of the monetary policy may be at the expense of financial instability. As such, central banks may need to account for the impact of their policy stance on systemic risk. On the other hand, the effect of systemic risk on monetary policy is rejected. Colletaz et al. (2018) reject the impact of systemic risk on the monetary policy of the European Central Bank (ECB) during the global financial crisis, which confirms that before the crisis, the systemic risk did not affect the stance of the ECB.

Empirical studies on the impact of monetary policy on systemic risk focus on two main aspects: firstly, the effect of monetary policy on systemic risk through the risk-taking channel of monetary policy (Altunbasa et al., 2014; Jiménez et al., 2014; Buch et al., 2014; Angeloni et al., 2015; Neuenkirch & Nöckel, 2018) and secondly, they analyse the impact of the monetary policy on systemic risk through an interest rate shock (Deev & Hodula, 2016; Sabri et al., 2019; Laséen et al., 2017; Zhang et al., 2020) or the change of money supply M2 (Gang & Qian, 2015).

In regard to the Eurozone countries, Deev and Hodula (2016) find that lowering the interest rates increases the systemic risk of the financial system while pointing out that the current expansionary monetary policy does increase systemic risk but not inflation. On the other hand, tightening the monetary policy does not necessarily reduce systemic risk, applicable to both pre- and post-crisis periods.

When looking at the US, Laséen et al. (2017) argue that tightening monetary policy does not reduce systemic risk, especially when the financial system is vulnerable. At the same time, the unexpected tightening of monetary policy has adverse effects on output, inflation, and asset prices. Sabri et al. (2019) indicate that high short-term interest rates can increase the risk of a crisis.

Studying monetary policy in China, Gang and Qian (2015) show that monetary expansion does not increase inflation or output but significantly increases the risk of loss in the financial sector. Therefore, a prudent monetary policy should be implemented to prevent the accumulation of financial risks, which could eventually lead to a financial crisis in China. Zhang et al. (2020) suggest that the

Chinese government should focus on a short-term monetary policy and long-term macroprudential policy to prevent systemic risks. In the short term, a tightening monetary shock would increase systemic risk, but a similar tightening macroprudential policy shock would reduce systemic risk over the medium term.

In Vietnam, based on the state budget and economic growth objectives, the National Assembly sets the targeted inflation rate. The government is responsible for implementing the monetary policy and developing the amount of liquidity injected into the economy. The National Assembly supervises the implementation of monetary policy, and the government must report periodically to a standing committee of the National Assembly. The State Bank is an integral part of the Vietnamese government, a ministerial-level agency of the Government, the Central Bank of the Socialist Republic of Vietnam. The State Bank implements monetary policy control mainly through the interest rate, the exchange rate, and the reserve requirement ratio. Therefore, Vietnam's monetary policy is the responsibility of the National Assembly and the government.

3. Methodology

To study the impact of Vietnamese monetary policy on systemic risk, we employ the vector autoregressive modeling framework; however, we have to measure the systemic risk first.

3.1 Measuring the Systemic Risk

Acharya et al. (2017) proposed the Systemic Expected Shortfall (SES) method for measuring systemic risk and suggested that the systemic risk of a financial institution consists of two components: an institution-risk component and a systemic-risk component.

Financial institutions' contribution to the marginal risk of the system during a crisis can be predicted by the leverage ratio (LVG) and the marginal expected loss (MES) over a period without a crisis. To calculate LVG (the institution-risk component), collecting data from institutions' financial statements is necessary. However, financial statement information can only be collected quarterly or annually. However, we wish to analyze the impact of monetary policy on systemic risk on time, particularly in times of economic instability. It is impossible to capture and clarify this impact using quarterly or annual data.

On the contrary, MES (the systemic-risk component) is very simple to estimate, as "one can simply calculate each firm's average return during the 5% worst days for the market." Acharya et al. (2017) show that the average return on equity of financial institutions during "bad" days (during regular periods) can be a good predictor of returns in a financial crisis. Such an average return on equity is referred to as "marginal expected shortfall – MES." One of the unique features of MES is that it reflects a financial institution's marginal contribution to the financial sector's systemic risk.

The MES method has been applied in many national studies. Battaglia (2013) applies it to Italian banks from 2000–2009 to measure the contribution of each bank to the risk system; Idier (2014) applies this model to 65 US banks from 1996–2010 to estimate the cost of condition owner failure for a crisis and rationalize a near-reasonable standard of balance accounting for the soundness of the bank and the importance of the system; Yun and Moon (2014) apply MES to measure the risk of the banking system in the Korean market from July 2002 to March 2013; Gang and Qian (2015) study the influence of policy currency on China's financial risk, measuring the risk system by the MES method; and Zhou et al. (2020) also apply the MES to the Chinese economy, showing an unusual rise at the outbreak of the 2008 global financial crisis.

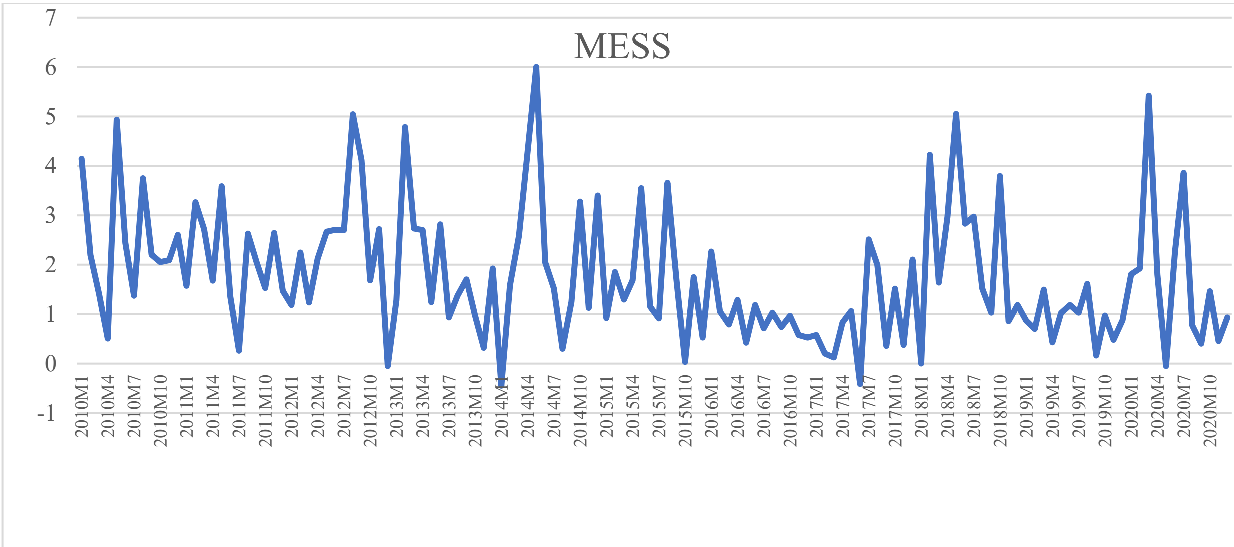
Using frequent market returns results, we measure the marginal potential MES loss at a typical risk level of α = 5%. This implies, in any given period, taking the 5% lowest days for the average returns *R* and then measuring the equal-weighted average return on any given institution R^i for these days:

$$MES_{5\%}^{i} = \frac{1}{\#days} \sum R_t^i \quad (1)$$

Where: *t* is the system in its 5% tail, $MES_{5\%}^{i}$ is the MES of institution *i*, and R_t^i is the stock market return of institution *i*.

In general, the MES of individual institutions would not be sufficient to estimate systemic risk because each institution's share during the crisis has yet to be determined. However, the MES serves as a predictor of systemic risk since the systemic risk increases if the MES contributions of all individual institutions increase with the allocation of returns. Tram and Nguyen (2021) show that the MES is essential for the systemic risk of Vietnamese financial institutions. This means we can measure systemic risk using individual institutions' common marginal expected shortfall (MESS). MESS is calculated from the sampled institutions' average monthly MES. In our research model (Figure 1), examining how monetary policy influences systemic risk, this index will represent the systemic risk of Vietnamese financial institutions.

Figure 1: Common Marginal Expected Shortage (MESS).



Source: Own research.

3.2 Model Settings and Data

3.2.1 Research Model

The vector autoregression (VAR) model is a statistical model used to measure the dependence and linear correlation between many variables in time series. The VAR model generalizes to the univariate autoregression (AR) model by enabling the involvement of more than one variable. All variables in an autoregressive vector are treated structurally equal (although the estimated response coefficients may not be identical), and each variable will have an equation explaining its evolution based on the lag of the research variable itself and the lags of other variables in the model. The VAR model only requires a little knowledge about the forces acting on a variable, such as modeling a structure or an equation. Still, knowledge is necessary regarding a list of variables with the hypothesis that they affect each other. Therefore, the VAR model is highly suitable for measuring the interaction between macro variables according to time series data.

The VAR model, introduced by Sims (1980), quantifies the dynamic response of a group of many macro variables that do not require strong conditions to identify macro shocks. Since then, VAR has gradually become one of the models most commonly used for time series data. VAR measures the linear dependence and correlation between multiple variables in a time series. VAR is well-suited for measuring interactions between macro variables based on time series data. Because macro data over time is special, as macro factors are often self-correlated, the value of the previous period usually affects the value of that period. Autocorrelation causes macro variables to fluctuate with trends and lag frequently. Additionally, macro variables often interact with each other depending on the network model. That is, all variables interact with each other on a network. Consequently, all macro-macro variables can be affected by other macro-macro variables. The opposite is true, too.

With the above advantages, the author applies the three-equation VAR model (Dufour et al., 2013) to analyze the impact of interest rates on the systemic risk of financial firms in Vietnam. The VAR model has the following form:

$$Y_t = \mu + A_1 Y_{t-1} + A_2 Y_{t-2} + \dots + A_p Y_{t-p} + \varepsilon_t \qquad (2)$$

Where: Y_t, …, Y_{t-p} are $n \times 1$ vectors of endogenous variables and their respective lagged realizations, μ is an $n \times 1$ vector of constants, and $A(1), \dots, A(p)$ are $n \times n$ coefficient matrices. Thus, any endogenous variable depends on its lags and the lagged realizations of all other variables. Estimation can be conducted separately for each equation using ordinary least squares (OLS).

The output gap GAP_t is the difference between the growth in real output and the growth in potential output. Since it is impossible to collect monthly data on real output, we use the industry output growth rate monthly and the Hodrick-Prescott filter to estimate potential output growth.

Many additional variables are relevant to macroeconomic dynamics, such as the exchange rate, wages, and measures for the fiscal policy stance. However, including several other variables would reduce the remaining degrees of freedom to a prohibitive extent. This is because a VAR model with n variables and a lag length of p requires that $(n \times p) + n$ parameters must be estimated. Given the naturally small sample size in macro-econometric applications, VAR models should thus be kept as economical as possible.

Applying a VAR setup for monetary policy analysis goes hand in hand with making an implicit assumption about the structure of the central bank's reaction function. In a VAR, the policy rate depends on its lags and lags of any other endogenous variable.

Some studies use the VAR model to study the monetary policy transmission on systemic risk, such as Angeloni et al. (2015) and Buch et al. (2014). In addition, in the Vietnamese market, several studies have applied the VAR model to study the transmission of monetary policy, such as Vo and Nguyen (2017) and Nguyen et al. (2019).

3.2.2 Variables That Present Monetary Policy

The interest rate of monetary policy. According to traditional economic theory, the central bank changes the money supply to affect interest rates and other economic variables. Today, central banks often change the policy rate directly to implement monetary policy, so the policy rate is usually considered the most suitable proxy for monetary policy.

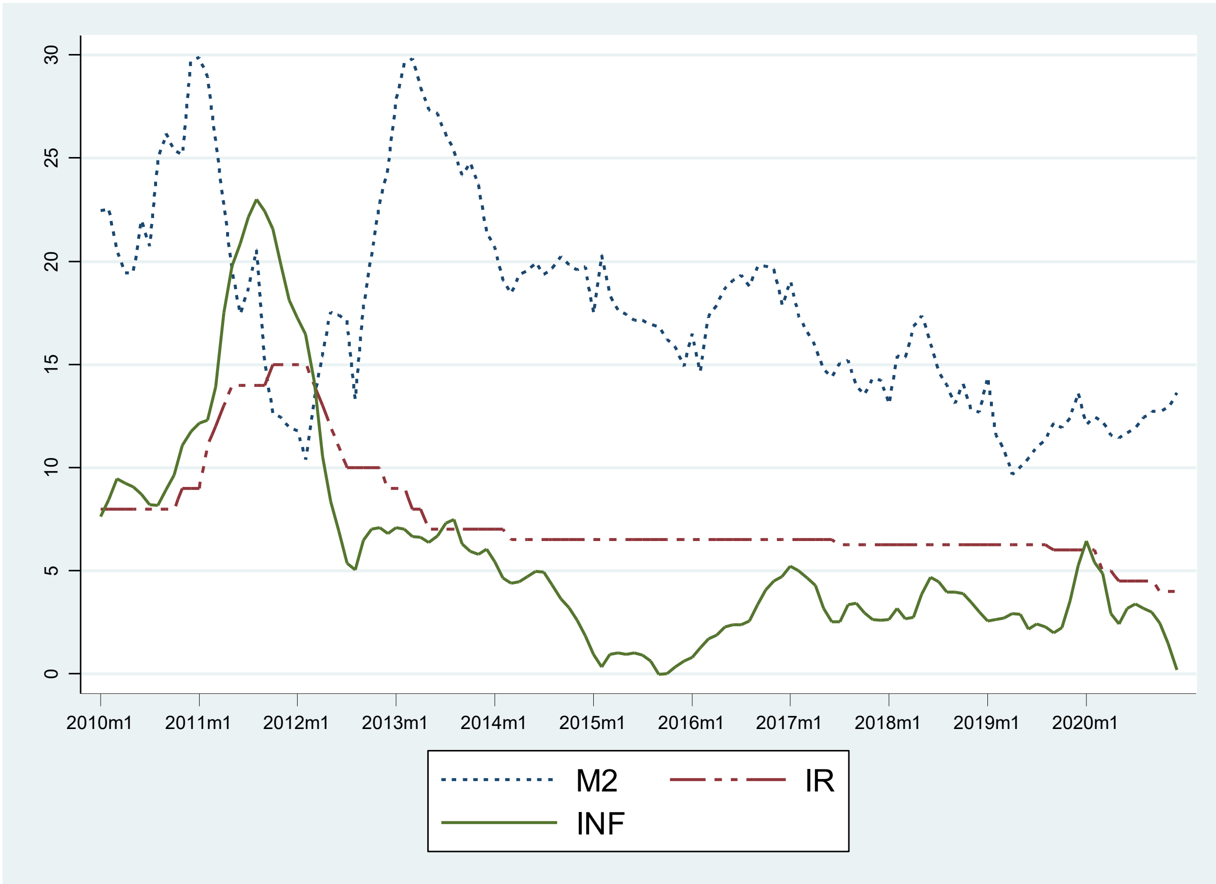
Money supply. Besides the policy interest rate, the money supply is, of course, an important proxy variable for the government currency book and an intermediate target that the central bank aims at when implementing monetary policy.

To analyze the impact of monetary policy on systemic risk, we establish the following research models: First, we set up a research model including the variables of inflation, output gap, monetary policy interest rate, and systemic risk—the first VAR model. The second VAR model includes inflation, output gap, money supply, and systemic risk; the monetary policy shock is now represented by the money supply M2. The third VAR model comprises inflation, output gap, monetary policy interest rate, money supply, and systemic risk; the impact of the monetary policy on systemic risk is now considered in terms of the combination of the monetary policy interest rate with the expansion of the money supply M2.

3.2.3 Data

The VAR is estimated with monthly data from M1 2010 to M12 2020; inflation (INF), interest rates (IR), the monthly M2 growth rate, and output growth are collected from the Asian Development Bank (ADB). For Vietnam's systemic risk measurement, the author uses the MESS; the data for measuring systemic risk was collected from the Vietnamese stock market. We collected daily closing prices of shares of twenty-nine financial institutions (Appendix I) listed on the stock market in Vietnam from 2010–2020 from the Hanoi Stock Exchange and Ho Chi Minh Stock Exchange.

Figure 2: Inflation (INF), interest rates (IR), M2 growth rate.



Source: Own research.

Figure 2 shows that inflation touched record levels from 2011–2012. To control inflation, the State Bank of Vietnam implemented a tight monetary policy by reducing the money supply and increasing the monetary policy interest rate in a strong measure. Inflation has been stable since mid-2012. The next section will show how monetary policy limiting inflation and stabilizing the economy affects systemic risk.

4. Results and Discussion

From 2010–2012 (when the economy was strongly affected by the global economic crisis), the interest rate of monetary policy and inflation variables showed a significant difference between the maximum and minimum values. During this period, the government pursued a tight, prudent monetary policy with the initial aim of reviving the economy after the crisis, then reducing the inflation and interest rate, with inflation stabilizing the macroeconomy. The values of the interest rate, inflation, and systemic risk variables over 2010–2012 are all higher than 2013–2020 (the period of macroeconomic stability and economic development) (Table 1).

Table 1**.** Descriptive statistics of the variables.

Variable	**MESS**	**INF**	**M2**	**IR**	**GAP**
2010M1–2012M12					
Mean	2.302	12.370	19.902	11.028	0.011
Std. Dev.	1.167	5.594	5.311	2.699	4.993
Min	-0.048	5.035	10.393	8.000	-12.539
Max	5.044	23.015	29.911	15.000	16.226
Obs	36	36	36	36	36
2013M1–2020M12					
Mean	1.579	3.387	16.922	6.323	-0.004
Std. Dev.	1.295	1.845	4.653	0.813	4.681
Min	-0.448	-0.011	9.680	4.000	-16.853
Max	6.002	7.497	29.816	9.000	15.944
Obs	96	96	96	96	96

Source: Own calculation.

The unit root test considers the static and non-stationary nature of the time series of variables in the real model test to avoid spurious regression when analyzing the data. The Augmented Dickey-Fuller (ADF) test is commonly used to consider the stability or non-anomaly of a time series (Table 2).

Table 2**.** The result of checking the stationarity of the data.

Variable	Dickey-Fuller rank 0		Dickey-Fuller rank 1		Dickey-Fuller rank 2		Results
	T - statistic	P - value	T - statistic	P - value	T - statistic	P - value	
2010M1–2012M12							
INF	-0.544	0.982	-2.055	0.571	-4.730	0.001	Rank 2
GAP	-12.070	0.000					Rank 0
IR	0.389	0.997	-3.267	0.072	-7.459	0.000	Rank 2
M2	-0.880	0.958	-4.571	0.001			Rank 1
MESS	-5.664	0.000					Rank 0
2013M1–2020M12							
INF	-1.750	0.728	-5.359	0.000			Rank 1
GAP	-11.395	0.000					Rank 0
IR	-2.546	0.305	-10.286	0.000			Rank 1
M2	-2.399	0.380	-11.882	0.000			Rank 1
MESS	-7.941	0.000					Rank 0

Source: Own calculation.

ADF results show that from 2010–2012, GAP and MESS are stationary at level; M2 is stationary at the 1^{st} difference; INF and IR are stationary at the 2^{nd} difference; from 2013–2020, GAP and MESS are stationary at level; while INF, IR, and M2 are stationary at the 1^{st} difference. Variables that are stationary at the level are retained as origin, while variables that are stationary at the 1^{st} difference and the 2^{nd} difference are taken at the 1^{st} and 2^{nd} difference, respectively (Table 3).

Table 3. VAR model results.

2010M1–2012M12

VARIABLES	VAR1	VAR2	VAR3
L.GAP	-0.0218	0.0305	-0.0334
L2.GAP	0.152***	0.123*	0.0848
L3.GAP	0.113*	0.0775	0.0575
L4.GAP	0.0720*	0.0903**	0.0800**
L.d2_INF	0.390**	0.568***	0.344**
L2.d2_INF	0.27	-0.00317	0.00921
L3.d2_INF	0.317**	0.426**	0.375**
L4.d2_INF	-0.138	-0.128	-0.259*
L.d2_IR	0.464*		0.356
L2.d2_IR	-0.37		-0.726**
L3.d2_IR	-0.04		-0.221
L4.d2_IR	-0.557*		-0.474*
L.MESS	0.3	0.317*	0.340*
L2.MESS	-0.244*	-0.378**	-0.225
L3.MESS	0.271**	0.289**	0.339***
L4.MESS	-0.442***	-0.640***	-0.482***
L.d_M2		0.015	0.0663
L2.d_M2		0.0807	-0.00326
L3.d_M2		-0.0907	-0.0943*
L4.d_M2		0.110*	0.186***
Constant	2.458***	3.178***	2.299***
Observations	30	30	30

2013M1–2020M12

VARIABLES	VAR1	VAR2	VAR3
L.GAP	0.102***	0.0798***	0.107***

L2.GAP	-0.0510*		-0.0630**
L.d_INF	0.327	0.068	0.434*
L2.d_INF	-0.26		-0.276
L.d_IR	-0.784		-0.802
L2.d_IR	-0.0198		0.00199
L.d_M2		0.0941	0.0949
L2.d_M2			-0.211*
L.MESS	0.205**	0.238**	0.200*
L2.MESS	0.122		0.173*
Constant	0.975***	1.205***	0.887***
Observations	93	94	93

Note: Marginal significance levels: (***), (**), and (*) indicate significance at 1%, 5%, and 10%.
Source: Own calculation.

The results of the VAR models show that monetary policy and inflation affect systemic risk from 2010–2012. However, they do not seem to have a significant impact on systemic risk from 2013–2020; the output gap affects systemic risk in both periods. This shows that monetary policy played an important role in the period strongly influenced by the financial crisis (2010–2012); from 2013 to 2020, when the economy and financial system were relatively stable, only the output gap affected the systemic risk.

To explain this result, from 2010–2012, the government took a series of solid and continuous measures to control the galloping inflation; the State Bank adjusted the interest rate from 9% in January 2011 and quickly changed it to 15% in November 2011, which had a partial impact on systemic risk of financial institutions in Vietnam. While entering a period of stable economic development, when the target of the monetary policy in this period is to strengthen macroeconomic stability simultaneously with economic growth, one of the most apparent measures is to keep interest rates stable—showing that the systemic risk of financial institutions is affected by the cycle of the economy. The output gap provides signals about what stage of the business cycle the economy is in.

From 2010–2012, the output gap has the same effect as the systemic risk; Vietnam's GDP in this period always reached a high level compared to other countries in the region and the world, accompanied by double-digit inflation. This shows that the economy is reflecting an economy in the overheating phase of the economy, and the potential output gap has a positive impact on the risk of financial institutions. This result is consistent with Festić et al. (2011), which states that solid economic growth can be interpreted as a signal for economic overheating and, thus, a potential threat to the financial system.

From 2013–2020, the output gap has a positive effect on the systemic risk in the first lag to the second lag; the effect is in the opposite direction, showing the stable and growing trend of the economy during this period, contributing to limiting the general systemic risks for the financial system. The durability test of both models satisfies the durability condition because all the eigenvalues lie inside the unit circle (Appendix III). Checking the autocorrelation criteria through the LM test shows that the VAR model is no longer autocorrelated, so it is suitable .

The results of Granger's causality test (Table 4) on the causal relationship of monetary policy to systemic risk are interesting. That is, during the economic crisis from 2010–2012, the VAR 1 model finds that the monetary policy interest rate has a causal relationship with systematic risk (significance level 5%), while the VAR 2 model reveals that the causal relationship of the money supply to systematic risk is not statistically significant. In VAR 3, when combining the monetary policy interest rates and money supply, this relationship is stronger when interest rates have Granger causality with systematic risk at a 1% significance level, where money supply has a significant level of 10%.

Table 4. Granger Test

Model	Equation	Excluded	chi2	df	Prob > chi2
2010–2012					
VAR1	MESS	d2_IR	10.895	4	0.028
VAR2	MESS	d_M2	6.502	4	0.165
VAR3	MESS	d2_IR	18.588	4	0.001
	MESS	d_M2	13.369	4	0.010
2013–2020					
VAR1	MESS	d_IR	1.523	2	0.467
VAR2	MESS	d_M2	0.592	1	0.442
VAR3	MESS	d_IR	1.684	2	0.431
	MESS	d_M2	4.345	2	0.114

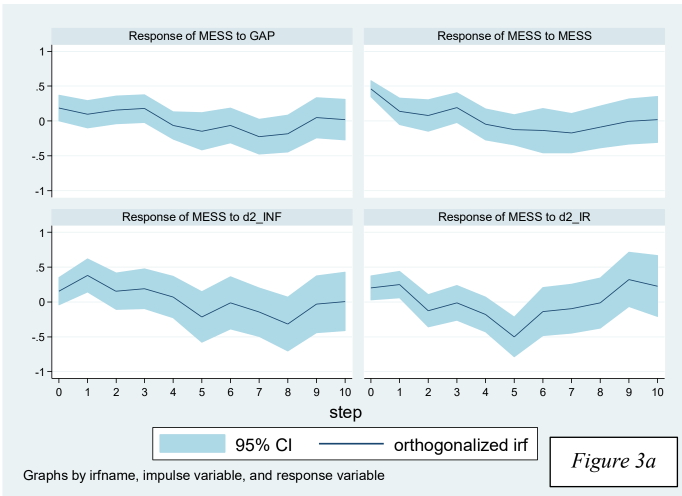
Source: Own calculation.

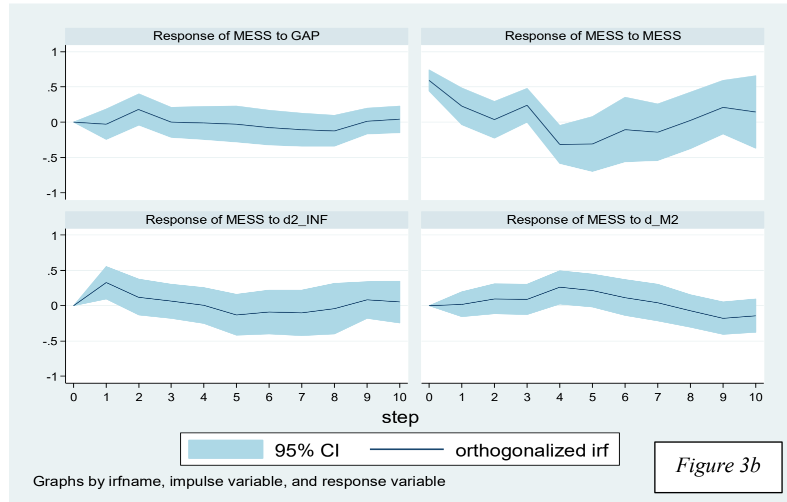
From 2013–2020, the Granger causality relationship of monetary policy to systematic risk is not statistically significant. This can be explained by the relatively stable monetary policy interest rates and money supply during this period, while the systemic risk in Vietnam depended on other variables (Tram & Nguyen, 2021).

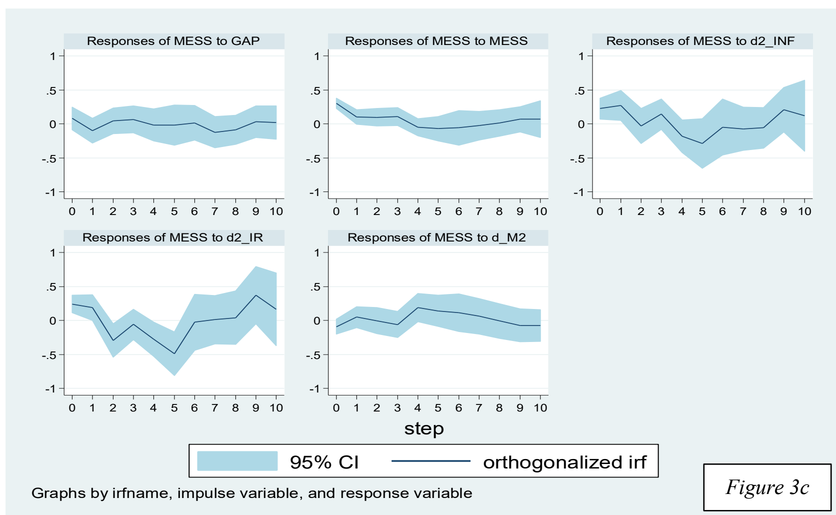
Impulse Responses of the VAR Model

To clarify the level of impact, the study continues to analyze the impulse response function in the next ten months (x-axis: month). The impulse response function helps us measure responses of systemic risk (y-axis: unit) to one unit of monetary policy shock/output gap shock/inflation shock. Impulse responses of systemic risk to the variables have been shown in Figure 3 (2010–2012) and Figure 4 (2013–2020).

Figure 3. Impulse responses of systemic risk during 2010–2012.







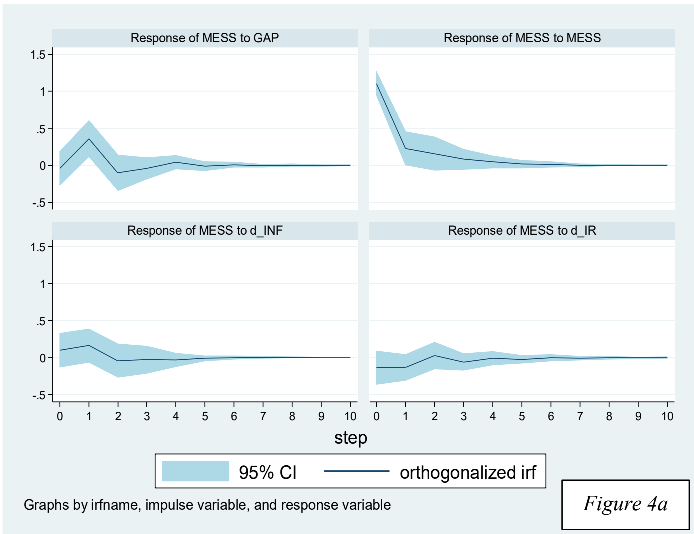
Monetary policy interest rates have the opposite effect on systemic risk in the first five months and the most substantial impact in the fifth month; however, after that, the trend of influence is in the same direction (Figure 3a). It means that the tightening of the monetary policy by raising the interest rates will help limit the systemic risk for the financial system in the first period; however, this trend is not stable, and from the fifth month onward, the reaction of systemic risk with monetary policy shock is in the same direction. This result is consistent with most previous studies' results (Sabri et al., 2019; Laséen et al., 2017; Ramos-Tallada, 2015). The response of systemic risk to inflation and output gap is in the same direction, but this trend is also unstable.

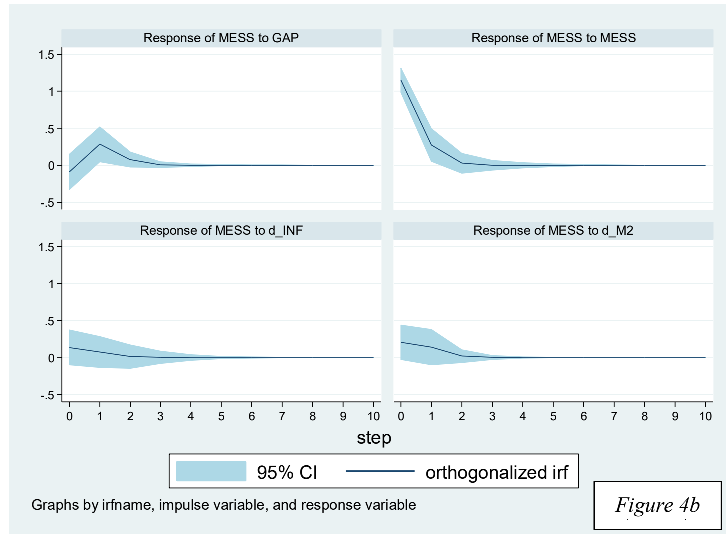
Systemic risk has a positive response to the money supply shock and peaks at month 4. This trend is not strong and quickly decreases to zero. The reaction of systemic risk to inflation and output gap is in the same direction, but this trend is also unstable (Figure 3b).

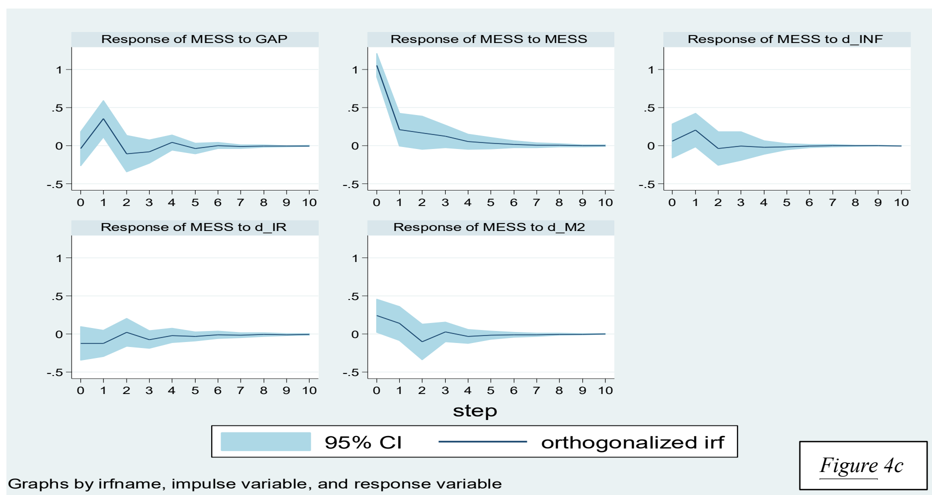
Combining the effects of interest rates and money supply on systemic risk produces interesting results, with the Granger causality test (Table 4) giving evidence of the causal relationship of money supply M2 with systemic risk; the impact of money supply on systemic risk seems to be amplified under the strong influence of interest rates during this period (Figure 3c). It can be seen that interest rates play an important role in economic development and have the most substantial and direct impact on the stability of the Vietnamese financial system.

During this period, high inflation forced the State Bank of Vietnam to implement tightening measures to push back inflation; hence, policy interest rates continuously increased. However, the increase in the policy interest rates comes at the expense of increased systemic risk during this period.

Figure 4: Impulse responses of systemic risk during 2013-2020.







In 2013–2020, the shock in monetary policy has an impact on reducing systemic risk but is not large; this impact is immediately apparent in the first month; from the third month, the trend gradually decreases to zero. Similarly, the output gap and the amount of impact are in the same direction as the systemic risk; this effect is also shown immediately in the second month; from the second month, the trend gradually decreases to zero. The systemic risk response rate to inflation is relatively weak and later than the monetary policy and output gap.

5. Conclusions

This study adds empirical evidence to the critical role of monetary policy in limiting the systemic risk of financial institutions in Vietnam. Using the VAR model estimation, the MES represents the overall risk of the Vietnamese financial system. The author seeks to answer the question, "*What is the impact of monetary policy on the systemic risk of financial institutions in Vietnam?*" Specifically, monetary policy impacts the systemic risk of financial institutions in Vietnam, and the response of systematic risk to monetary policy shocks differs in each research period. In addition, the output gap also impacts the risk of loss in both periods, while inflation only affects the deposit risk from 2010–2012.

In the period strongly affected by the financial crisis of 2010–2012, the tightening monetary policy partly contributed to the reduction of the collateral risk in the first stage; however, in the long term, the tightening monetary policy increased the risk of the financial institutions. In Vietnam, this result is similar to Sabri et al. (2019) and Gang and Qian (2015) but slightly different from the research results of Zhang (2020) in that tight monetary policy increases the systemic risk in the short term but contributes to limiting the systemic risk in a long time. When the economy is stable, the Vietnamese Government implements an expansionary monetary policy to develop the economy to stabilize the economy (Bui et al., 2022). The impact of monetary policy on systemic risks is almost negligible. Therefore, the State Bank and the Government must accurately assess the current economy and financial system to develop appropriate measures and policies in each period. Our study also draws some implications for Southeast Asian countries, which aligns with the existing literature (Chotewattanakul et al., 2019; Ngo et al., 2019; Wongchoti et al., 2021; Huynh et al., 2022).

Although monetary policy affects the systemic risk of financial institutions in Vietnam, the impact of monetary policy on systemic risk varies with the economic stage. However, the effect of monetary policy on the systemic risk of the financial system remains minimal. Therefore, when systemic risk increases, there will be no tools or measures that are both specific and powerful enough to limit its effects on the economy.

The SBV must accurately evaluate the current state of the economy and financial system and identify erratic macroeconomic factors that will lead to the emergence of financial shocks, particularly during times of crisis. When the economy and financial system are unstable, monetary policy tightening or easing can increase systemic risk in undesirable ways.

Should the mandate of monetary policy be expanded to include the objective of financial stability? Even though this objective should belong to macroprudential regulations, regulations are compared to a shield in the following two directions: first, systemic risk is not a concern of monetary policy, and second, there are minimal diverse effects of monetary policy on systemic risk. Systemic risk will not increase, for instance, when macroeconomic conditions require the government to employ an expansionary monetary policy or a tight monetary policy for an extended period.

This study explores the impact of monetary policy on systemic risk; accompanied by monetary policy, the government implements fiscal policies in each stage of the economy. Future studies may combine the impact of monetary policy and fiscal policy on the systemic risk of financial institutions in Vietnam and, at the same time, consider whether the effects of fiscal policy in limiting the risk of financial institutions in Vietnam are more effective than monetary policy.

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Appendices

Appendix I

List of Vietnam financial institutions that were used in the study.

Stock Code	Name	Stock Exchange
ACB	Asia Commercial Bank	HNX
AGR	Agribank Securities Corporation	HOSE
APG	APG Securities Joint Stock Company	HOSE
API	Asia - Pacific Investment Joint Stock Company	HNX
APS	Asia - Pacific Securities Joint Stock Company	HNX
BMI	Bao Minh Insurance Corporation	HOSE
BVH	Bao Viet Holdings	HOSE
BVS	Baoviet Securities Company	HNX
CTG	Vietnam Joint Stock Commercial Bank for Industry and Trade	HOSE
CTS	Viet Nam Bank For Industry & Trade Securities JSC	HOSE
EIB	Vietnam Commercial Joint Stock Export Import Bank	HOSE
HAC	Hai Phong Securities Joint Stock Company	UPCoM
HCM	Ho Chi Minh City Securities Corporation	HOSE
OGC	Ocean Group Joint Stock Company	HOSE
PSI	Petrovietnam Securities Incorporated	HNX
PVI	PVI Holdings	HNX
PVR	Hanoi PVR Investment JSC	UPCoM
SBS	Sacombank Securities Joint Stock Company	UPCoM
SHB	Saigon Hanoi Commercial Joint Stock Bank	HNX
SHS	Saigon - Hanoi Securities JSC	HNX
SSI	SSI Securities Corporation	HOSE
STB	Sai Gon Thuong Tin Commercial Joint Stock Bank	HOSE
VCB	Bank for Foreign Trade of Vietnam	HOSE
VDS	Viet Dragon Securities Corporation	HOSE

VIG	Viet Nam Industrial & Commercial Securities Corporation	HNX
VIX	IB Securities Joint Stock Company	HNX
VND	VNDirect Securities Corporation	HOSE
VNR	Vietnam National Reinsurance Corporation	HNX
WSS	Wall Street Securities Company	HNX

Source: Our compilation (Hanoi Stock Exchange–HNX and Ho Chi Minh Stock Exchange–HOSE).

Appendix II

Lag length selection for VAR model.

2010-2012

lag	LL	LR	df	p	FPE	AIC	HQIC	SBIC
0	-194.784				6.69167	13.2523	13.312*	13.4391*
1	-179.37	30.829	16	0.014	7.04522	13.2913	13.5901	14.2254
2	-159.789	39.162	16	0.001	5.91341*	13.0526	13.5905	14.734
3	-145.18	29.217	16	0.023	7.68386	13.1453	13.9223	15.5741
4	-124.462	41.437*	16	0.000	8.05853	12.8308*	13.8468	16.0068

lag	LL	LR	df	p	FPE	AIC	HQIC	SBIC
0	-236.899				110.886*	16.0599	16.1197*	16.2467*
1	-225.494	22.81	16	0.119	152.519	16.3662	16.6651	17.3004
2	-210.389	30.21	16	0.017	172.529	16.4259	16.9638	18.1074
3	-194.751	31.275	16	0.012	209.32	16.4501	17.2271	18.8788
4	-171.616	46.271*	16	0.000	186.857	15.9744*	16.9904	19.1504

lag	LL	LR	df	p	FPE	AIC	HQIC	SBIC
0	-263.702				41.4387*	17.9135	17.9882*	18.147*
1	-244.113	39.177	25	0.035	61.0792	18.2742	18.7225	19.6754
2	-217.016	54.195	25	0.001	61.8062	18.1344	18.9562	20.7033
3	-187.62	58.792	25	0.000	71.2733	17.8413	19.0367	21.5778
4	-150.08	75.08*	25	0.000	89.0257	17.0053*	18.5742	21.9095

Source: Own research.

2013-2020

lag	LL	LR	df	p	FPE	AIC	HQIC	SBIC
0	-434.116				.178606	9.62893	9.67346	9.7393*
1	-403.006	62.22	16	0.000	.128193	9.29684	9.51948*	9.84868
2	-380.874	44.264	16	0.000	.11227*	9.16207*	9.56281	10.1554
3	-371.236	19.276	16	0.255	.129802	9.30189	9.88073	10.7367
4	-357.604	27.263*	16	0.039	.138096	9.35394	10.1109	11.2302

lag	LL	LR	df	p	FPE	AIC	HQIC	SBIC
0	-617.428				10.0368	13.6578	13.7023	13.7681*
1	-588.891	57.074	16	0.000	7.62292*	13.3822*	13.6049*	13.9341
2	-575.173	27.437*	16	0.037	8.0322	13.4324	13.8331	14.4257
3	-565.03	20.285	16	0.208	9.18407	13.5611	14.14	14.9959
4	-556.195	17.671	16	0.344	10.8571	13.7186	14.4755	15.5948

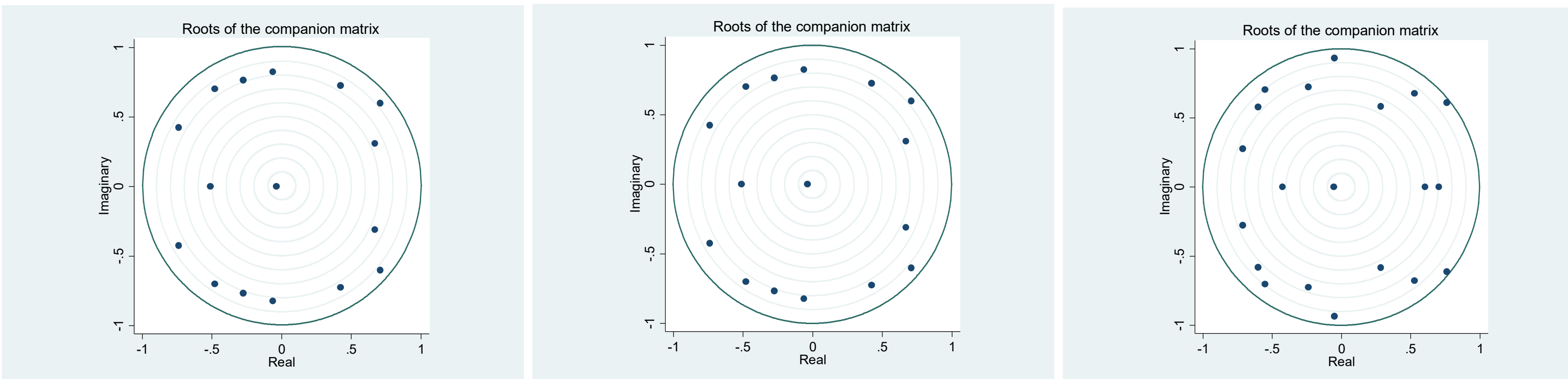
lag	LL	LR	df	p	FPE	AIC	HQIC	SBIC
0	-563.272				.182705	12.4895	12.5452	12.6275*
1	-524.341	77.862	25	0.000	.134647	12.1833	12.5173*	13.0111
2	-496.526	55.63*	25	0.000	.127201*	12.1215*	12.7337	13.639
3	-480.845	31.363	25	0.177	.158079	12.3263	13.2168	14.5336
4	-465.365	30.96	25	0.190	.199575	12.5355	13.7043	15.4326

Source: Own research.

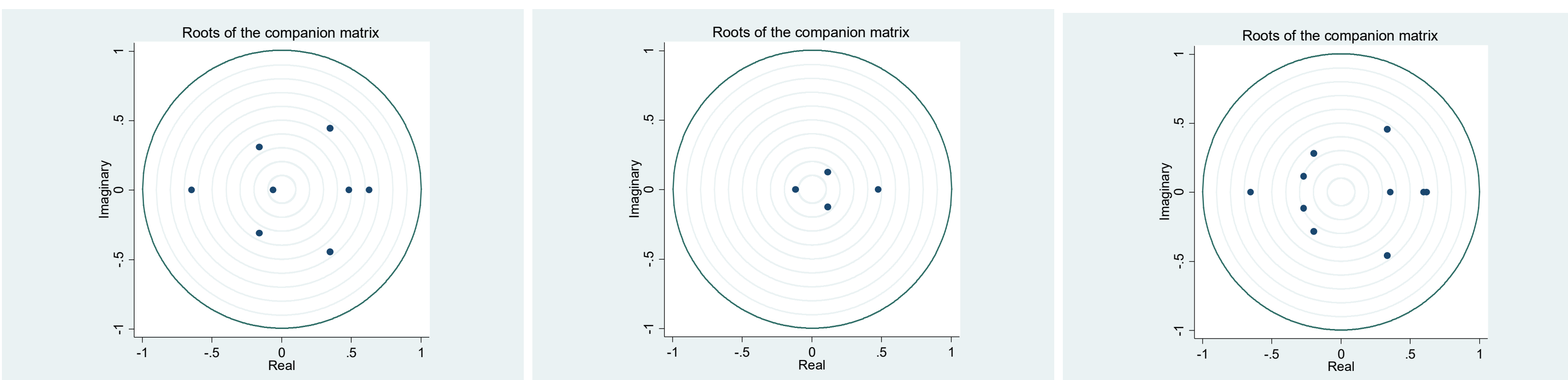
Appendix III

Durability test: All the eigenvalues lie inside the unit circle. VAR satisfies stability conditions.

2010–2012



2013–2020



Source: Own research.